Discussion Paper
Review of Horizon Power's Service Standards

July 2008

Economic Regulation Authority
WESTERN AUSTRALIA

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Foreword

The Economic Regulation Authority (*Authority*) is required under section 39A of the *Electricity Industry Act 2004* (*Act*) to review the standards relating to power quality and reliability (*service standards*) that apply to Horizon Power under the *Electricity Industry (Network Quality and Reliability of Supply) Code 2005*[1] (*Reliability Code*). The *Reliability Code* was first issued by the Minister for Energy in December 2005.

The purpose of the *Reliability Code* is to require Western Australian electricity suppliers, licensed under the Act, to meet more stringent standards of electricity reliability and quality compared to those that applied prior to the introduction of the *Reliability Code*[2]. The *Reliability Code* is customer focussed and places clear minimum standards on electricity suppliers and, by including public reporting obligations, makes suppliers more accountable for their performance against the standards. Under the *Reliability Code*, electricity suppliers who cannot meet the standards may be required to take action to meet the standards.

Under section 39A(5) of the *Act*, the *Authority* is required to review Horizon Power's *service standards* under the *Reliability Code* having regard for the *service standards* that apply to Western Power in their *Access Arrangement*[3]. The current Western Power *Access Arrangement* was approved by the *Authority* in April 2007.

Section 39A(6) of the *Act* requires the *Authority* to give members of the public an opportunity to comment on matters relevant to the review.

This Discussion Paper examines issues relevant to the operation and effect of Horizon Power's *service standards*, having regard for those that apply to Western Power under the *Access Arrangement*, and invites interested parties' views on the *Authority's* proposed recommendations for amending the current *service standards* applying to Horizon Power under the *Reliability Code,* and any other matters that are considered relevant to the review. Submissions should be in both printed and electronic form and be received by **4:00pm WST on Friday 15 August 2008**, addressed to:

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Section 2.4 of this paper provides further information regarding the process for making a submission.

Following its consideration of the public submissions that it receives, the *Authority* will give a report to the Minister for Energy under section 39A(7) of the *Act*. The report will detail the changes that the *Authority* recommends should be made to the current *service standards* in the *Reliability Code*, and any other matters that it considers relevant to the *service standards* framework for electricity distribution and transmission networks.

LYNDON ROWE
CHAIRMAN

[1] This includes the amendments to the Code that were published in the *Government Gazette* on 20 September 2007.

[2] Media Statement from the Minister for Energy on the release of the *Reliability Code*, 14 December 2005.

[3] Amended Proposed Access Arrangement for the South West Interconnected Network owned by Western Power, April 2007, which is available on the *Authority's* web site: http://www.era.wa.gov.au/3/584/48/amended_propose.pm

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Glossary

Term	Definition
Access Arrangement	Amended Proposed Access Arrangement for the South West Interconnected Network owned by Western Power (April 2007).
Access Code	Electricity Network Access Code 2004
Act	Electricity Industry Act 2004
Authority	Economic Regulation Authority
Benchmark	In this document benchmark is used to define the value that has been assigned to a *standard*.
CAIDI	Customer Average Interruption Duration Index
CBD	Central Business District
Distributor	Holder of a distribution licence, or the holder of an integrated regional licence that authorises distribution activities.
Reliability Code	Electricity Industry (Network Quality and Reliability of Supply) Code 2005 (including 2007 Amendment Code)
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCONRRR	Steering Committee on National Regulatory Reporting
Service Standards	Power quality and reliability standards that apply to Horizon Power under the *Reliability Code* or Western Power under the *Access Arrangement.*
Service Standard Benchmarks	Reliability *benchmarks* that apply to the *service standards* that are defined in the *Access Arrangement.*
Small Use Customer	A customer who consumes less than 160MWh of electricity annually.
Standard	In this document standard is used to define what is being measured, i.e. voltage frequency, *SAIDI*.
SWIS/SWIN	South West Interconnected System/Network
Technical Rules	Western Power's Technical Rules for the South West Interconnected Network (April 2007)
Transmitter	Holder of a transmission licence, or the holder of an integrated regional licence that authorises transmission activities.

1 Executive Summary

Section 39A of the *Electricity Industry Act 2004* (*Act*) establishes the requirement for the Economic Regulation Authority (*Authority*) to conduct a review of Horizon Power's power quality and reliability standards (*service standards*), and sets out the process for that review. In particular:

- Section 39A(2) of the *Act* requires the *Authority* to review the operation and effect of the RPC standards. RPC standards are standards referred to in section 39(2)(d) of the Act that are to be observed by the Regional Power Corporation (Horizon Power)[4]; and
- Section 39A(5) of the *Act* states that the purpose of the review is to consider whether the RPC standards are appropriate for each of the transmission systems and distribution systems to which they apply when assessed against the standards relating to the quality and reliability of the supply of electricity that are provided for in an access arrangement that applies to the South West interconnected system[5].

In undertaking this review, the *Authority* has, where it is considered relevant, given consideration to the operation of the regulatory frameworks that define *service standards* applying to *distributors* and *transmitters* in other States. The Authority has also given consideration to matters relevant to the reliability, quality and reliability of supply in regional areas, that are serviced by Horizon Power, put forward by the Government when the *Electricity Corporations Bill 2005* was considered by Parliament[6]. When the *Reliability Code* was first released by the Minister for Energy, he said that the purpose of the Code is to place "*clear minimum service standards on electricity suppliers*". The Minister went on to say that the *Reliability Code* would require "*electricity suppliers to meet more stringent standards of electricity reliability and quality*"[7].

The *Authority* notes that the *Access Arrangement* does not include any standards relating to power quality. The power quality standards applying to Western Power under the *Electricity Network Access Code 2004* (*Access Code*) are found in Western Power's *Technical Rules for the South West Interconnected Network* (*Technical Rules*), which were approved by the *Authority* at the same time as the *Access Arrangement*. The *Authority* has taken the view that, by comparing the power quality standards in the *Technical Rules* with the power quality standards in the *Reliability Code*, it is acting consistent with the intention of section 39A of the *Act*.

The following paragraphs outline the issues that the *Authority* identified during the course of the review and detail the *Authority's* proposed approach to addressing these issues through amendments to the *Reliability Code*. The *Authority* proposes that, in the interests of defining consistent regulatory obligations for all distributors and transmitters licensed by the *Authority*, the amended *service standards* applying to Horizon Power in the *Reliability Code* should also be extended, where practicable, to apply to other *distributors* and *transmitters*.

Power Quality Standards

The suite of power quality standards in the *Technical Rules* is much more comprehensive than those in the *Reliability Code*. Also, where the same standard is present in both documents, the definition of the standard in the *Technical Rules* is more detailed, as consideration is given to

[4] The standards referred to in section 39(2)(d) of the Act are those in the *Electricity Industry (Network Quality and Reliability of Supply) Code 2005*[4] (*Reliability Code*) first issued by the Minister for Energy in December 2005.

[5] *Amended Proposed Access Arrangement for the South West Interconnected Network owned by Western Power* (*Access Arrangement*) that was approved by the *Authority* in April 2007 that is available on the *Authority's* web site: http://www.era.wa.gov.au/3/584/48/amended_propose.pm

[6] The second reading speech for the *Electricity Corporations Bill 2005* (Hansard 2005, pp1401-1402), which created Regional Power Corporation, states that the Corporation will be subject to technical and safety regulations to ensure adequate reliability, quality and security of supply in regional areas and that the establishment of the Network Quality and Reliability Code is intended to strengthen customer protection.

[7] The *Reliability Code* replaced network standards that were in other legislative instruments, such as the *Electricity (Supply Standards and System Safety) Regulations 2001*.

different network operating conditions. The *Authority* has recommended amending the *Reliability Code* to align the power quality standards in the *Reliability Code* with those in the *Technical Rules*.

Transmission Reliability Standards

The *Reliability Code* defines transmission reliability standards in terms of interruptions to customer premises in prescribed areas of the State. The *Access Arrangement* defines transmission reliability standards based on transmission Circuit Availability and System Minutes Lost, which are consistent with the reliability measures used in the electricity markets in other States.

It is also relevant to note that Horizon Power only owns and operates a total of 464km of transmission network across the whole business[8]. Implementing a system to record and report against Circuit Availability and System Minutes Lost will impose additional costs on Horizon Power that are only justified if the benefits of implementing the systems exceed the costs incurred. The Authority has recommended that a more suitable alternative is to define appropriate distribution reliability *benchmarks* for interruptions to customer premises caused by outages on the transmission network.

Distribution Reliability Standards

The *Reliability Code* includes standards for the interruption of supply to individual customers. Similar standards are not included in the *Access Arrangement*. The *Authority* proposes these standards remain unchanged.

The *Reliability Code* distribution reliability standards are defined in terms of the total duration of interruptions to customer premises in specified areas of the State, which is equivalent to *SAIDI*. The *Access Arrangement* defines reliability in terms of both *SAIDI* and *SAIFI*. The *Authority* recommends amending the *Reliability Code* to include both *SAIDI* and *SAIFI* standards[9].

The *Reliability Code* applies distribution reliability standards to specified areas of the State, whereas the *Access Arrangement* defines reliability standards applied to distribution feeder classifications (e.g. CBD, Urban, Rural Short and Rural Long)[10], as defined by the *SCONRRR*.

The *Authority* recommends an assessment is undertaken to determine whether there is scope to increase the number of geographic areas in the *Reliability Code* to better align the areas with the discrete communities that are served by *distributors*. The *Authority* also recommends reliability standards based on feeder classifications and the whole of network are included in the *Reliability Code*. This will make it possible to compare and set the feeder reliability *benchmarks* applying to *distributors* under the *Reliability Code* with the *benchmarks* for similar distribution businesses in other States.

The *Reliability Code* does not mention any method for excluding interruptions from the calculation of *SAIDI*. The distribution *service standard benchmarks* applying to Western Power under the *Access Arrangement* prescribe *SAIDI* and *SAIFI benchmarks* based on the *SCONRRR* Normalised Distribution Network – Unplanned data set (see Table 11), which excludes all outages that have been caused by factors that are considered to be beyond the reasonable control of the *distributor*. This approach has been adopted in a number of other States[11]. In most of these States, *distributors* are also required, consistent with the *SCONRRR* framework, to separately detail all interruption events that have been excluded from the calculation of the Normalised Distribution Network – Unplanned data set. The *Authority* recommends that the definition of the *SAIDI* and *SAIFI* standards in amended *Reliability Code* are consistent with the *SCONRRR* Normalised

[8] See section 4.1 for more information.

[9] Including SAIDI and SAIFI standards enables the average time to restore service to a customer, CAIDI, to be calculated for a distribution network.

[10] See section 8.3 for the definition of each class of feeder

[11] some States additionally require reporting against the Overall, Distribution Network – Unplanned and Distribution Network – Planned data sets defined by the *SCONRRR* (Table 11)

Distribution Network – Unplanned data set, and that *distributors* are required to separately report on any interruptions that have been excluded from the calculation of *SAIDI* and *SAIFI*.

The *Authority* recommends including a *SAIDI* and *SAIFI* reliability standard in the *Reliability Code* that measure interruptions caused by unplanned outages on the transmission network.

Should the service standards in the Reliability Code be Compulsory?

The *Reliability Code* requires *distributors* and *transmitters* to use best endeavours to comply with the prescribed *service standards*. The *service standard benchmarks* in the *Access Arrangement* are considered to be compulsory because the *Access Code* requires that Western Power must provide services at a standard at least equivalent to the *service standard benchmarks* set out in the *Access Arrangement*. Similarly, the *Authority* considers the *service standards* in the *Technical Rules* to be compulsory because they set out the minimum requirements for the *SWIN* and equipment connected to it by users.

The *Authority* recommends that consideration be given to making the *service standards* in the *Reliability Code* compulsory. The *Authority* also recommends that an assessment is undertaken to determine what the appropriate *service standard benchmarks* should be.

Service Standard Performance Reporting Arrangements

The *Authority* recommends that the reporting obligations in the *Access Code* and the *Reliability Code* are retained, subject to the reporting obligations in Schedule 1 of the *Reliability Code* being amended to align with any amendments to the *service standards* in Part 2 of the *Reliability Code* resulting from this review.

Timing of the Current and Future Reviews

The *Authority* notes that the current *Access Arrangement* expires in June 2009. Negotiations on a new *Access Arrangement* and the associated *Technical Rules* are scheduled to commence in October 2008. It is possible that the new *Access Arrangement* and *Technical Rules* may include new or revised *service standards*. The *Authority* recommends that the implementation of the recommendations in the report on the current review be delayed until after the 2009 *Access Arrangement* and *Technical Rules* are approved by the *Authority*.

The *Authority* recommends that reviews beyond 2009 commence as soon as practicable after the date that the *Authority* has approved an *Access Arrangement* for the South West Interconnected System operated by Western Power.

Summary of the Review Recommendations

This section summarises the 27 recommendations that the Authority is seeking comments on:

1) The structure of the voltage fluctuation standards applying to Horizon Power under the Reliability Code should be aligned with the structure applying to Western Power under the Technical Rules (Table 2).

2) Undertake an assessment of what the appropriate voltage fluctuation benchmarks applying to Horizon Power should be. Note that this recommendation recognises that it may be appropriate to set different benchmarks applying to Horizon Power compared to the benchmarks applying to Western Power under the Technical Rules.

3) Amend the Reliability Code to define separate voltage harmonic compatibility standards for distribution networks and transmission networks.

4) Undertake an assessment of what the appropriate voltage harmonic benchmarks applying to Horizon Power under the Reliability Code should be.

5) Amend the *Reliability Code* to include voltage frequency standards applying to Horizon Power based on the standards applying to Western Power under the *Technical Rules*.

6) Undertake an assessment of what the appropriate voltage frequency *benchmarks* applying to Horizon Power under the *Reliability Code* should be.

7) Amend the *Reliability Code* to include steady state voltage standards applying to Horizon Power.

8) The steady state voltage standards in the *Reliability Code* applying to Horizon Power should prescribe different *benchmarks* for distribution and transmission networks.

9) Amend the Reliability Code negative to include phase sequence voltage standards applying to Horizon Power.

10) Undertake an assessment of what the appropriate negative phase sequence voltage benchmarks applying to Horizon Power under the Reliability Code should be.Give consideration to including in the *Reliability Code* temporary overvoltage standards applying to Horizon Power.

11) Amend the Reliability Code to include temporary overvoltage standards applying to Horizon Power.

12) Undertake an assessment of what the appropriate temporary overvoltage benchmarks applying to Horizon Power under the Reliability Code should be.

13) The Reliability Code should not define transmission reliability benchmarks applying to Horizon Power. Note transmission network reliability will be measured through the implementation of appropriate distribution reliability standards.

14) The reliability standards in relation to the interruption of supply to individual customers that apply to Horizon Power under the *Reliability Code* should remain unchanged.

15) Amend the distribution reliability standards applying to Horizon Power in the *Reliability Code* to include both *SAIDI* and *SAIFI* standards.

16) The *Reliability Code* continue to define distribution reliability standards for particular areas of the State.

17) Undertake an assessment to determine whether the number of areas of the State prescribed in the *Reliability Code* could be usefully expanded to align the distribution networks operated by Horizon Power with the discrete communities that they serve.

18) Amend the *Reliability Code* to include distribution reliability standards based on the *SCONRRR* feeder classifications, and a separate reliability *standard* for the whole of each distribution network operated by Horizon Power.

19) The definition of *SAIDI* and *SAIFI* in the *Reliability Code* applying to Horizon Power is to be consistent with the definition of the *SCONRRR* Normalised Distribution Network – Unplanned data set.

20) Amend the *Reliability Code* to require Horizon Power to provide details of each excluded interruption excluded from the calculation of the Normalised Distribution Network – Unplanned data set, including a description of the event and the amount of *SAIDI* and *SAIFI*.

21) Amend the *Reliability Code* to include two reliability standards applying to Horizon Power that measure interruptions in the distribution network caused by unplanned outages in the transmission networks that supply those distribution networks:

- *SAIDI* – unplanned transmission outages; and
- *SAIFI* – unplanned transmission outages.

22) Amend the *Reliability Code* to include compulsory *service standard benchmarks* applying to Horizon Power.

23) Undertake an assessment of what the appropriate value of power quality and distribution reliability *benchmarks* in the *Reliability Code* applying to Horizon Power should be.

24) The requirement for *distributors* and *transmitters* to publish reliability reports complying with Schedule 1 of the *Reliability Code* is to be retained.

25) Amend Schedule 1 of the *Reliability Code* to align with the amended service standards in Part 2 of the Code resulting from this review.

26) The implementation of the recommendations in the report on the current review is to take place as soon as practicable after the date that the *Authority* approves an *Access Arrangement* and *Technical Rules* for the South West Interconnected System operated by Western Power for the period commencing July 2009.

27) The Minister publish a notice in the *Government Gazette* fixing the date to commence future reviews of the standards that apply to Horizon Power beyond 2009 to commence as soon as practicable after the date that the *Authority* has approved an *Access Arrangement* for the South West Interconnected System operated by Western Power. This is subject to the period between the approval of future *Access Arrangements* being less than five years.

2 Introduction

Consistent with its obligations under the *Act*, the *Authority* has commenced its review of the operation and effect of the standards applicable to Horizon Power under the *Reliability Code*. This Discussion Paper identifies issues that the *Authority* considers relevant to the review and forms the basis of the public consultation phase of the review process.

2.1 Background

Section 39A(2) of the *Act* requires the *Authority* to carry out a review of the operation and effect of the standards applicable to Horizon Power under the *Reliability Code*. The *Reliability Code* includes the following:

- Quality standards in Division 1 of Part 2;
- Standards for the interruption of supply to individual customers in Division 2 of Part 2;
- Standards for the duration of interruption of supply in particular areas in Division 3 of Part 2; and
- Payments to customers for failure to meet certain standards in Part 3.

Section 39A(5) of the *Act* requires the *Authority* to review whether Horizon Power's standards are appropriate when assessed against the *service standards* that apply to the South West Interconnected System (*SWIS*). The *service standards* that apply to the *SWIS* are the "*service standard benchmarks*" specified in the *Access Arrangement* that was approved by the *Authority* in April 2007.

2.2 Structure of Discussion Paper

The structure of this Discussion Paper is as follows:

- chapter 3 provides an overview of the legislative and regulatory framework in relation to service and reliability standards provided by Horizon Power and Western Power;
- chapter 4 provides an overview of the networks operated by Horizon Power and Western Power;
- chapter 5 examines the power quality standards applying to Horizon Power under the *Reliability Code* with the standards applying to Western Power under the *Technical Rules*;
- chapter 6 examines the transmission network reliability standards applying to Horizon Power under the *Reliability Code* with the standards applying to Western Power under the *Access Arrangement*;
- chapter 7 examines the interruption of supply to individual customer standards applying to Horizon Power under the *Reliability Code*;
- chapter 8 examines the distribution network reliability standards applying to Horizon Power under the *Reliability Code* with the standards applying to Western Power under the *Access Arrangement*;
- chapter 9 considers whether the standards in the *Reliability Code* should be compulsory or aspriational;
- chapter 10 considers the performance reporting arrangements under the *Reliability Code* and the *Access Arrangement*;
- chapter 11 considers the impact on the performance reporting obligations in the *Reliability Code,* arising from this review; and

- chapter 12 considers the timing of implementing the recommendations in the current review, and the timing of future reviews.

2.3 Review Process

Section 39A(6) of the Act requires the *Authority* to invite public comment on its review of Horizon Power's *service standards*.

Public submissions are invited on the proposed recommendations in this Discussion Paper. Respondents are also encouraged to comment on any other matters that they consider relevant to the review.

Following its consideration of public submissions, the *Authority* will give a report to the Minister for Energy under section 39A(7) of the Act that details the changes it recommends should be made to the current *service standard*s in the *Reliability Code*.

Under section 39A(10) of the Act, the *Authority* is required to make the report to the Minister available for public inspection in such manner as the *Authority* considers appropriate, and publish on the *Authority's* web site and in a daily newspaper circulating in the State, a notice giving details of where copies of the report can be obtained.

2.4 How to Make a Submission

Submissions in relation to this review should be in written form and electronic form (where possible) and addressed to:

Mr Paul Reid
Assistant Director, Monitoring
Economic Regulation Authority
PO Box 8469
Perth Business Centre
PERTH WA 6849
Email: electricity.licensing@era.wa.gov.au

Fax: (08) 9213 1999

Submissions should be received by **4:00pm WST on Friday 15 August 2008**.

In general, submissions from interested parties will be treated as in the public domain and placed on the *Authority's* web site. Where an interested party wishes to make a submission in confidence, it should clearly indicate the parts of the submission for which confidentiality is claimed, and specify in reasonable detail the basis for the claim.

The receipt and publication of any submission on the *Authority's* web site shall not be taken as indicating that the *Authority* has knowledge, either actual or constructive, of the contents of a particular submission and, in particular, whether the submission in whole or in part contains information of a confidential nature and no duty of confidence will arise for the *Authority* in these circumstances.

Further information regarding this review can be obtained from:

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3 Current Legislative and Regulatory Framework

Horizon Power and Western Power are subject to service *standard* obligations that derive from a number of legislative and regulatory instruments. Any assessment of Horizon Power's *service standards* needs to address the interactions between these various instruments. This chapter provides an overview of the current legislative and regulatory framework relating to Horizon Power and Western Power's *service standards*.

3.1 Electricity Industry Act 2004

Section 39A of the Act establishes the requirement for the *Authority* to conduct a review of Horizon Power's *service standards* and sets out the process for that review:

- section 39A(2) of the Act requires the *Authority* to conduct a review of the operation and effect of the standards that apply to Horizon Power under the *Reliability Code*;
- section 39A(3) provides that the *Authority* is required to undertake this review as soon as practicable after Western Power's *Access Arrangement* was approved in April 2007;
- section 39A(5) provides that the *Authority* must consider whether the standards that apply to Horizon Power are appropriate when assessed against the *service standards* for Western Power under its *Access Arrangement*;
- section 39A(6) requires the *Authority* to provide the opportunity for public comment on its review;
- section 39A(7) requires the *Authority* to give the Minister a report based on its review;
- section 39A(9) provides that the *Authority's* report to the Minister may recommend changes to the *service standards* that apply to Horizon Power under the *Reliability Code*.
- section 39A(10) requires the *Authority* to make the review report available for public inspection within 28 days after the report is given to the Minister for Energy;
- section 39A(11) provides that the Minister, by order published in the Government Gazette, is to fix a period for subsequent reviews; and
- section 39A(12) requires the period between reviews to be no longer than 5 years from the date that the previous review report was published in accordance with section 39A(10).

3.2 Electricity Industry (Network Quality and Reliability of Supply) Code 2005 (2007 Amendment)

The *Reliability Code* sets out the network supply and reliability of supply obligations relevant to Horizon Power and Western Power:

- section 5(1) of the *Reliability Code* requires *distributors* and *transmitters* to comply with the quality of supply standards set out in section 6(2) and section 7 of the *Reliability Code*;
- section 6(2) sets out voltage fluctuation standards for electricity supplied by *distributors* and *transmitters*;
- section 7 sets out standards for the harmonic voltage distortion level of electricity supplied by;

- section 9 requires that *distributors* and *transmitters* "*…must, so far as is reasonably practicable, ensure that the supply of electricity to a customer is maintained and the occurrence and duration of interruptions is kept to a minimum*";
- section 11 sets out the allowed duration of planned interruptions and conditions under which these interruptions are permitted;
- section 12 sets out the actions that *distributors* and *transmitters* must take in the event of significant interruptions to *small use customers*;
- section 13 sets out standards for *distributors* and *transmitters* (as applicable) for the duration of interruptions of supply in the Perth *CBD*, Urban areas and other areas of the State;
- section 18 details payments to be made by *distributors* and *transmitters* for failing to give the required notice of planned interruptions;
- section 19 sets out payments to be made by *distributors* and *transmitters* for supply interruptions exceeding 12 hours;
- section 21 requires *distributors* and *transmitters* to provide eligible customers with the information necessary to make an application under section 18 and section 19;
- section 26 requires *distributors* and *transmitters* to arrange for an independent expert to audit and report on the systems used to monitor compliance with Part 2;
- section 27 sets out an obligation for *distributors* and *transmitters* to prepare and publish an annual report setting out performance information as detailed in Schedule 1; and
- Schedule 1 prescribes the performance information that *distributors* and *transmitters* are required to publish.

The provisions of the *Reliability Code* apply to both Horizon Power and Western Power.

3.3 Electricity Networks Access Code 2004

The *Electricity Network Access Code 2004* (*Access Code*) sets out the requirements for the *Access Arrangement* and the *Technical Rules*:

- section 5.1(c) of the *Access Code* requires an *Access Arrangement* to include *service standard benchmarks* for each reference service;
- section 5.6 requires that a service standard *benchmark* must be:
  - reasonable; and
  - sufficiently detailed and complete to enable a user or applicant to determine the value represented by the reference service at the reference tariff.
- section 11.1 requires a service provider to provide reference services at a service standard at least equivalent to the *service standard benchmarks*;
- section 11.2 requires the *Authority* to monitor and, at least once each year, publish a service provider's actual service standard performance against the *service standard benchmarks*;
- section 11.6 sets out the basis for imposing penalties on service providers for failure to comply with *service standard benchmarks*;
- section 12.4 obliges the service provider and users of a network that is subject to *Technical Rules* to comply with those rules;
- section 12.6 requires the following networks to have *Technical Rules*:
  - a covered network; and

  - a non-covered network that is part of an interconnected system which contains one or more covered networks.

- section 12.11 sets out the approval process for *Technical Rules* submitted by the service provider of a covered network; and
- section 12.32 indicates that unless a different form of *Technical Rules* will better achieve the *Access Code* objective or the objectives set out in section 12.1, the *Technical Rules* must address the matters listed in Appendix 6 of the *Access Code*.

The *Access Code* currently applies to Western Power, but does not currently apply to Horizon Power.

3.4 Western Power's Access Arrangement

The *Access Arrangement* approved by the *Authority* in April 2007[12], sets out the terms and conditions under which Western Power will provide users and applicants with access to the South West Interconnected Network (*SWIN*):

- section 3.16 of the *Access Arrangement* defines the *SAIDI* for distribution services, which is a measure of the average interruptions in minutes a customer will experience each year attributable to the distribution system;
- section 3.17 defines the *SAIFI* for distribution services, which is a measure of the average number of times a customer will experience an interruption each year attributable to the distribution system;
- section 3.18 sets out the *service standard benchmarks* expressed in terms of *SAIDI* for distribution services for the financial years 2007 to 2009;
- section 3.19 sets out the *service standard benchmarks* expressed in terms of *SAIFI* for distribution services for the financial years 2007 to 2009;
- section 3.20 provides that definitions of *CBD*, Urban, Rural Short and Rural Long feeder classification are consistent with those applied by the *SCONRRR*[13];
- section 3.21 provides that *service standard benchmarks* for transmission services for users directly connected to the transmission network are expressed in terms of Circuit Availability and System Minutes Interrupted;
- section 3.22 sets out the *service standard benchmarks* for transmission services for users directly connected to the transmission network expressed in terms of Circuit Availability and System Minutes Interrupted for the financial years 2007 to 2009; and

Western Power's *Access Arrangement* does not apply to Horizon Power.

3.5 Western Power's Technical Rules for the South West Interconnected Network

Western Power's *Technical Rules* (*Technical Rules*), approved by the *Authority* in April 2007, detail the technical requirements to be met by Western Power on the transmission and distribution systems and by users who connect facilities to the transmission and distribution systems:

- section 2.2.1 of the *Technical Rules* prescribes standards for system frequency applying to the *SWIN*;

[12] The current Access Arrangement is available on the *Authority's* web site: http://www.era.wa.gov.au/3/584/48/amended_propose.pm

[13] Table 3, National Regulatory Reporting for Electricity Distribution and Retailing Businesses, Utility Regulators Forum, Steering Committee on National Regulatory Reporting Requirements, March 2002 describes the feeder classifications. A copy of the document is available on the *Authority's* web site: http://www.era.wa.gov.au/2/281/51/regulatory_guid.pm

- section 2.2.2 prescribes standards for steady state power frequency voltage;
- section 2.2.3 prescribes standards for rapid voltage fluctuations (flicker);
- section 2.2.4 prescribes standards for harmonic voltage;
- section 2.2.5 sets out the limits for the negative phase sequence component of voltage; and
- section 2.2.10 sets out the temporary overvoltage limits in the presence of a contingency event (fault).

4 The Horizon Power and Western Power Networks

This section provides a brief overview of the distribution and transmission networks that are owned and operated by Horizon Power and Western Power. Figure 1 is a map of the electricity networks that are licensed by the *Authority*, including those networks operated by Horizon Power and Western Power.

4.1 Horizon Power

Horizon Power is a vertically integrated electricity business that provides generation, distribution, transmission and retail services to the areas of the State outside of the *SWIS* and holds an Integrated Regional operating licence issued by the Authority.

In the North West of the State, Horizon Power manages the North West Interconnected System (NWIS), which includes the communities of Cape Lambert, Dampier, Karratha, Newman, Paraburdoo, Port Hedland and Shay Gap. The NWIS contains 1,200km of transmission lines operating at voltages of 66kV, 132kV and 220kV and 30 sub-stations. Horizon Power owns and operates 464km of the NWIS transmission lines and 9 sub-stations. Horizon Power also owns and operates the distribution networks in Karratha, Point Samson, Port Hedland, Roebourne and South Hedland that are supplied from the NWIS.

By June 2007, Horizon Power supplied electricity to 32 non-interconnected systems covering townships and remote communities throughout regional Western Australia. Horizon Power owns and operates the distribution assets in each of these communities and either owns, or contracts a third party to provide, the generation capacity in each community.

The distribution networks operated by Horizon Power comprise high voltage and low voltage distribution networks. The high voltage network operates at voltages of 11kV, 22kV and 33kV and mainly connects distribution substations to low voltage distribution transformers and some large demand business customers. The low voltage network operates at 415V 3-phase or 240V single-phase to provide power to residential and small business customers.

4.2 Western Power

Western Power is the networks business that provides distribution and transmission network services in the *SWIS*. The *SWIS* covers an area from Albany to Kalbarri and eastwards across to Kalgoorlie.

The *SWIS* contains more than 140 major substations, 6,000km of transmission lines and 64,000km of high voltage distribution lines[14]. The transmission network is divided into the:

- bulk transmission network that operates at voltages of 132kV and 330kV with a mesh configuration designed to provide a high degree of security against a single unplanned outage;
- sub-transmission network that operates at voltages of 66kV and 132kV used to connect from the transmission network to zone sub-stations (which supply the distribution networks); and
- radial networks that operates at 66kV, 132kV and 220kV mainly used to supply regional townships.

The distribution networks operated by Western Power can be separated into three types of network:

[14] Page 15, 2008 Transmission and Distribution Annual Planning Report, Western Power.

- *CBD* that supplies the Perth *CBD* area. This network is designed to provide high levels of protection against network outages;
- Metropolitan that supplies suburban areas with high load densities. This network is designed to provide fast restoration when network outages occur; and
- Rural that supplies rural and fringe of metropolitan areas. This network comprises longer feeders in a radial configuration, which are prone to longer restoration times when outages occur.

The distribution network comprises both high voltage and low voltage distribution networks. The high voltage network operates at voltages of 6.6kV, 11kV, 22kV and 33kV and mainly connects zone substations to low voltage distribution transformers and some large demand business customers. The low voltage network operates at 415V 3-phase or 240V single-phase to provide power to residential and small business customers.

Figure 1: Map of Electricity Licensing Areas in Western Australia

5 Power Quality Standards

Section 39A(5) of the *Act* requires the *Authority* to review whether the power quality standards applying to Horizon Power under the *Reliability Code* are appropriate when assessed against the power quality standards applying to Western Power under the *Access Arrangement*. When the *Electricity Corporations Bill 2005,* that created Horizon Power, was considered by Parliament, the Government stated that "*the new Regional Power Corporation {Horizon Power}… will be subject to technical … regulations to ensure adequate reliability quality and security of supply in regional areas*". When the *Reliability Code* was first released by the Minister for Energy, he said that the purpose of the Code is to place "*clear minimum service standards on electricity suppliers*". The Minister went on to say that the *Reliability Code* would require "*electricity suppliers to meet more stringent standards of electricity reliability and quality*"[15].

The current *Access Arrangement* does not include any power quality *service standards*. However, Chapter 12 of the *Access Code* required Western Power to submit to the *Authority* for it's approval *Technical Rules* for the *SWIN* at the same time as the *Access Arrangement*. The *Technical Rules* do not form part of the *Access Arrangement*[16] but, in effect, the Rules detail the technical power quality standards to be met by Western Power for the transmission and distribution systems within the *SWIN*, and by the users who connect their facilities to the *SWIN*. The *Authority* approved the *Technical Rules* at the same time as it approved the *Access Arrangement* in April 2007.

It has already been noted that the *Access Arrangement* is silent on power quality standards. However, the *Authority* has taken the view that, by comparing the power quality standards in the *Technical Rules* with the power quality standards in the *Reliability Code*, it is acting consistent with the intention of section 39A of the *Act*. This is because the power quality standards in the *Technical Rules,* that are binding on Western Power and third parties who connect to the *SWIN* under an access agreement, are, in effect, can be interpreted as *de facto* power quality standards under the *Access Arrangement*.

The remainder of this section discusses and evaluates the power quality standards that apply to Horizon Power under the *Reliability Code* and the power quality standards that apply to Western Power under the *Technical Rules*. The *Authority* proposes a number of amendments to the power quality standards applying to Horizon Power under the *Reliability Code*.

5.1 Overview of Power Quality Standards in the *Reliability Code* and the Technical Rules

5.1.1 Power Quality Standards in the Reliability Code

Division 1 of Part 2 of the *Reliability Code* sets out quality of supply standards. Section 5(1) of Division 1 obliges *distributors* and *transmitters*, so far as is reasonably practicable, to comply with the quality of supply standards set out in section 6(2) and section 7 of the *Reliability Code*:

- section 6(2) prescribes standards for voltage fluctuations in terms of flicker severity measured over short-term (P_{st}) and long-term (P_{lt}) intervals of time; and
- section 7 prescribes standards for harmonic voltage distortion levels.

5.1.2 Power Quality Standards in the Technical Rules

Section 2.2 of the *Technical Rules* include a number of transmission and distribution system power quality standards:

[15] The *Reliability Code* replaced network standards that were in other legislative instruments, such as the *Electricity (Supply Standards and System Safety) Regulations 2001*.

[16] Section 1.8 of the Access Arrangement states that the *Technical Rules* do not form part of the Access Arrangement.

- section 2.2.1 - frequency variations, including values for normal operating range, isolated networks, single contingency and multiple contingency events (failure or removal from service of a network element);
- section 2.2.2 – steady state power voltage ranges for normal operation, maintenance conditions, emergency conditions and step changes due to routine or infrequent switching activities;
- section 2.2.3 – flicker severity (P_{st} and P_{lt}) values for low voltage, medium voltage and high voltage networks;
- section 2.2.4 – harmonic voltage levels in networks operating at a nominal voltage of up to 35kV or nominal voltage above 35kV;
- section 2.2.5 – negative phase sequence voltage expressed as a percentage of the positive phase sequence voltage, for networks operating at nominal voltages of <10kV, 10-100kV and >100kV;
- section 2.2.10 – temporary overvoltage in the presence of a contingency event (fault).

When we compare the power quality standards applying to Horizon Power under the *Reliability Code* (section 5.1.1) with the *service standard benchmarks* applying to Western Power under the *Technical Rules* (section 5.1.2) the following differences can be identified:

- The *Reliability Code* defines a single voltage fluctuation *standard* for distribution and transmission networks whereas the *Access Arrangement* defines separate voltage fluctuation standards for low, medium and high voltage networks. This is discussed further in section 5.2;
- The *Reliability Code* defines a single voltage harmonic *standard* for distribution and transmission networks whereas the *Technical Rules* defines separate voltage harmonic standards for distribution and transmission networks. This is discussed further in section 5.3;
- The *Reliability Code* does not include standards relating to voltage frequency whereas the *Technical Rules* defines voltage frequency standards for distribution and transmission networks operating under different network conditions. This is discussed further in section 5.4;
- The *Reliability Code* does not include standards relating to steady state voltage whereas the *Technical Rules* defines separate steady state voltage standards for distribution and transmission networks, with the former varying depending on network conditions. This is discussed further in section 5.5;
- The *Reliability Code* does not include standards relating to negative phase sequence voltages whereas the *Technical Rules* defines separate negative phase sequence voltage standards for distribution and transmission networks. This is discussed further in section 5.6; and
- The *Reliability Code* does not include standards relating to temporary overvoltage whereas the *Technical Rules* defines a temporary overvoltage *standard* for distribution and transmission networks. This is discussed further in section 5.7.

5.2 Voltage Fluctuation (Flicker) Standards

5.2.1 Reliability Code

Section 6(2) of the *Reliability Code* requires the voltage fluctuation of electricity supplied by a *distributor* or *transmitter* is at a level of fluctuation less than the compatibility levels set out in

Table 1. The P_{st} and P_{lt} terms[17] in Table 1 represent the short term (10 minute interval) and long term (2 hour interval) evaluations respectively as measured by the measuring device (flickermeter).

Table 1: *Reliability Code* Voltage Fluctuation Compatibility Levels

Interval	Compatibility levels
P_{st}	1.0
P_{lt}	0.8

5.2.2 Technical Rules

Section 2.2.3 of the *Technical Rules* set planning levels for P_{st} and P_{lt} depending on the system voltage as described in Table 2.

Table 2: Technical Rules - Flicker Planning Levels

Flicker Severity Quantity	Low Voltage (415V)	Medium Voltage (≤ 35kV)	High to Extra High Voltage (>35kV)
P_{st}	1.0	0.9	0.8
P_{lt}	0.65	0.7	0.6

The *Technical Rules* define different planning levels of flicker for transmission (>35kV) and distribution networks (<35kV).

5.2.3 Discussion and Recommendations

Comparing Table 2 with Table 3, we can see that the definition of the voltage fluctuation standards in the *Technical Rules* and the definition of the standards in the *Reliability Code* are based on the same measures, P_{st} and P_{lt}. However, the *Technical Rules* define different voltage fluctuation *benchmarks* for distribution networks (≤35kV) and transmission networks (>35kV).

The *Authority* considers that it is appropriate to amend the structure of the voltage fluctuation *benchmarks* applying to Horizon Power under the *Reliability Code* to align with structure applying to Western Power under the *Technical Rules* (Table 2). The *Reliability Code* applies a uniform *standard* to both distribution and transmission networks. The structure of the voltage fluctuation *standard* in the *Technical Rules* recognises that the impact of voltage fluctuations on the end user is a function of the network operating voltage.

The *Authority* recognises that the voltage fluctuation *benchmarks* prescribed in Table 2 may not be appropriate for Horizon Power under the *Reliability Code*. It will be necessary to undertake further research to determine what the appropriate voltage fluctuation *benchmarks* applying to Horizon Power should be.

[17] P_{st} and P_{lt} are defined in Part 3.7 of standard AS/NZS 61000:2001

Recommendations

The *Authority* is seeking comments on the following proposed recommendations:

1) The structure of the voltage fluctuation standards applying to Horizon Power under the *Reliability Code* should be aligned with the structure applying to Western Power under the *Technical Rules* (Table 2).

2) Undertake an assessment of what the appropriate voltage fluctuation *benchmarks* applying to Horizon Power should be. Note that this recommendation recognises that it may be appropriate to set different *benchmarks* applying to Horizon Power compared to the benchmarks applying to Western Power under the *Technical Rules*.

5.3 Voltage Harmonics

Harmonic voltages can be generated in electricity supply networks as a result of switching, faults and non-linear loads in the network. If they are not controlled, harmonic voltages can create voltage distortions that may cause unwanted interference to customer equipment. Electricity supply networks set standards for the maximum level of an individual harmonic voltage and the total harmonic distortion (the sum of all the harmonic voltages), both of which are defined as a percentage of the nominal operating voltage of the system.

5.3.1 Reliability Code

Section 7 of the *Reliability Code* prescribes standards for the harmonic voltage distortion level of electricity supplied by a *distributor* or *transmitter*. The *standard* defines harmonic voltage distortion compatibility levels set out in Table 3.

Table 3: *Reliability Code* Compatibility Levels for Harmonic Voltages

Odd harmonics non multiple of 3		Odd harmonics multiple of 3		Even harmonics	
Order h	Harmonic voltage %	Order h	Harmonic voltage %	Order h	Harmonic voltage %
5	6	3	5	2	2
7	5	9	1.5	4	1
11	3.5	15	0.3	6	0.5
13	3	21	0.2	8	0.5
17	2	>21	0.2	10	0.5
19	1.5			12	0.2
23	1.5			>12	0.2
23	1.5				
>25	0.2+1.3(25/h)				

Note — Total harmonic distortion (THD): 8%

5.3.2 Technical Rules

The *Technical Rules* define different *benchmarks* for harmonic voltage levels in distribution and transmission networks. Table 4 details the compatibility levels for distribution networks (<35kV) and Table 5 details the compatibility levels for transmission networks (>35kV).

Table 4: Technical Rules Compatibility Levels for Harmonic Voltage (≤35kV nominal)

Odd harmonics non multiple of 3		Odd harmonics multiple of 3		Even harmonics	
Order h	Harmonic voltage %	Order h	Harmonic voltage %	Order h	Harmonic voltage %
5	5	3	4	2	1.6
7	4	9	1.2	4	1
11	3	15	0.3	6	0.5
13	2.5	21	0.2	8	0.4
17	1.6	>21	0.2	10	0.4
19	1.2			12	0.2
23	1.2			>12	0.2
23	1.2				
>25	0.2+0.5(25/h)				

Note — Total harmonic distortion (THD): 6.5%

Table 5: Technical Rules Compatibility Levels for Harmonic Voltage (>35kV nominal)

Odd harmonics non multiple of 3		Odd harmonics multiple of 3		Even harmonics	
Order h	Harmonic voltage %	Order h	Harmonic voltage %	Order h	Harmonic voltage %
5	2	3	2	2	1.5
7	2	9	1	4	1
11	1.5	15	0.3	6	0.5
13	1.5	21	0.2	8	0.4
17	1	>21	0.2	10	0.4
19	1			12	0.2
23	0.7			>12	0.2
25	0.7				
>25	0.2+1.3(25/h)				

Note — Total harmonic distortion (THD): 3%

5.3.3 Discussion and Recommendations

Comparing Table 3 with Table 4 and Table 5 we can see that the definition of the voltage harmonic standards in the *Reliability Code* and the definition of the voltage harmonic standards in the *Technical Rules* are based on the same measures. However, the *Technical Rules* defines different voltage harmonic *benchmarks* for distribution networks (≤35kV) and transmission networks (>35kV).

The *Authority* considers that it is appropriate to amend the structure of the voltage harmonics compatibility levels applying to Horizon Power under the *Reliability Code* (Table 3) to align with structure applying to Western Power under the *Technical Rules* (Table 4 and Table 5). The *Reliability Code* applies uniform compatibility levels to both distribution and transmission networks. The structure of the voltage fluctuation compatibility levels in the *Technical Rules* recognises that the impact of voltage harmonics on network users is a function of the network operating voltage.

The *Authority* recognises that the voltage harmonic compatibility *benchmarks* in the *Technical Rules* may not be appropriate for Horizon Power under the *Reliability Code*. It will be necessary to undertake further research to determine what the appropriate value of the voltage harmonics compatibility levels applying to Horizon Power should be.

Recommendations

The *Authority* is seeking comments on the following proposed recommendations:

3) Amend the *Reliability Code* to define separate voltage harmonic compatibility standards for distribution networks and transmission networks.

4) Undertake an assessment of what the appropriate voltage harmonic *benchmarks* applying to Horizon Power under the *Reliability Code* should be.

5.4 Voltage Frequency Standard

5.4.1 Reliability Code

Division 1 of the *Reliability Code* does not prescribe a *standard* for voltage frequency. Section 8 includes a note that the standards for the voltage frequency of electricity supplied by the networks operated by Western Power[18] is not covered by the *Reliability Code* because it is provided for by the *Electricity Act 1945* section 25(1)(d). Under the *Electricity Act 1945* the frequency must be maintained at ± 2.5% of the frequency so declared namely, 50 cycles per second.

5.4.2 Technical Rules

The *Technical Rules* define a number of voltage frequency bands. In Table 6, we can see that each frequency band relates to a specified network operating condition. The standards for a single or multiple contingency event (failure or removal from service of a network element) also includes target recovery times for the frequency to return to the normal range.

Table 6: Technical Rules Voltage Frequency Benchmarks for the SWIN

Condition	*Frequency* Band	Target Recovery Time
Normal Range:		
South West	49.8 to 50.2 Hz for 99% of the time	
Island[19]	49.5 to 50.5 Hz	
Single contingency event	48.75 to 51 Hz	Normal Range: within 15 minutes. For over-*frequency* events: below 50.5 Hz within 2 minutes
Multiple *contingency event*	47.0 to 52.0 Hz	Normal Range within 15 minutes For under-*frequency* events: (a) above 47.5 Hz within 10 seconds (b) above 48.0 Hz within 5 minutes (c) above 48.5 Hz within 15 minutes. (d) For over-*frequency* events: (e) below 51.5 Hz within 1 minute (f) below 51.0 Hz within 2 minutes (g) below 50.5 Hz within 5 minutes

[18] The *Reliability Code* was drafted before Western Power was disaggregated into the current business structure. Subsequently, the *Electricity Act 1945* was amended to extend this obligation to all distributors and transmitters.

[19] An island is formed when the *interconnection* between parts of the *interconnected transmission system* is broken, for example if the *interconnection* between the south-west and the Goldfields is broken.

5.4.3 Discussion and Recommendations

The note to section 8 of the *Reliability Code* states that the Code does not include a voltage frequency *standard* because the *standard* defined in the *Electricity Act 1945* applies to the networks operated by Horizon Power and Western Power, and other *distributors* and *transmitters* licensed by the *Authority*.

The *Technical Rules* set a number of voltage frequency *benchmarks* (bands) to reflect different network operating conditions whereas the *Electricity Act 1945* sets a single *standard* for all network operating conditions. Of particular note is the much narrower range of the frequency bands in the *Technical Rules* under normal operating conditions (49.8-50.2 Hz) and when a part of the network is isolated from the *SWIN* (49.5-50.5 Hz). The narrower frequency band ranges in the *Technical Rules* reflect modern network frequency capabilities compared to those available when the *standard* in the *Electricity Act 1945* was defined.

The *Authority* considers there is merit in introducing voltage frequency standards applying to Horizon Power into the *Reliability Code* with *benchmarks* that reflect the frequency control capabilities of the distribution and transmission systems operated by Horizon Power under different operating conditions.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

5) Amend the *Reliability Code* to include voltage frequency standards applying to Horizon Power based on the standards applying to Western Power under the *Technical Rules*.

6) Undertake an assessment of what the appropriate voltage frequency *benchmarks* applying to Horizon Power under the *Reliability Code* should be.

5.5 Steady State Power Voltage

5.5.1 Reliability Code

Division 1 of Part 2 does not prescribe a *standard* for steady state voltage. Section 8 includes a note that the standards for the steady state voltage of electricity supplied by the networks operated by Western Power[20] is not covered by the *Reliability Code* because it is provided for by the *Electricity Act 1945* section 25(1)(d). Under the *Electricity Act 1945* the voltage must be maintained at ± 6% of the voltage declared for the purposes of that section namely, 240v single-phase or 415v three-phase. It is of note that the voltage *standard* in the *Electricity Act 1945* applies to the point at which customer equipment is connected to the distribution network, limiting the application of the *standard* to residential and small business distribution supply voltages, i.e. 240V or 415V.

5.5.2 Technical Rules

The *Technical Rules* include a number of steady state voltage standards:

- For distribution networks operating at a voltage of ≥6kV and transmission networks, the steady state voltage is to be kept within a range of 90-110% of the nominal operating voltage;

[20] The *Reliability Code* was drafted before Western Power was disaggregated into the current business structure. Subsequently, the *Electricity Act 1945* was amended to extend this obligation to all distributors and transmitters.

- For networks operating at a voltage of <6kV, the steady state voltage is to be kept within:
  - ± 6% during normal operating states;
  - ± 8% during maintenance conditions;
  - ±10% during emergency conditions.

The *Technical Rules* also includes standards for step-change voltage limits due to routine switching or infrequent (fault type) switching that discriminate between distribution systems (≤66kV) and transmission systems (>66kV)[21].

5.5.3 Discussion and Recommendations

The note to section 8 of the *Reliability Code* states that the Code does not include a steady state voltage *standard* because the *standard* defined in the *Electricity Act 1945* applies to the networks operated by Horizon Power and Western Power, and other *distributors* and *transmitters* licensed by the *Authority*.

For distribution voltages (<6kV), the *Technical Rules* define 3 different steady state voltage *benchmarks* (bands) to reflect different network operating conditions (normal, maintenance and emergency) whereas the *Electricity Act 1945* sets a single *benchmark* (+/-6%) for all network operating conditions. The *Authority* considers there is merit in introducing into the *Reliability Code* steady state voltage standards applying to the Horizon Power distribution and transmission networks with separate *benchmarks* prescribed for steady state, maintenance and emergency operating conditions.

Recommendations

The *Authority* is seeking comments on the following proposed recommendations:

7) Amend the *Reliability Code* to include steady state voltage standards applying to Horizon Power.

8) The steady state voltage standards in the *Reliability Code* applying to Horizon Power should prescribe different *benchmarks* for distribution and transmission networks.

5.6 Negative Phase Sequence Voltage

A negative phase sequence voltage arises in a 3-phase electricity network when there is an imbalance in the loads on each phase of a distribution or transmission line, which may be caused by faults or changes in the loads connected to each phase. The resulting negative phase voltage has the potential to damage equipment connected to the network.

5.6.1 Reliability Code

The *Reliability Code* does not include any standards in relation to negative phase sequence voltage levels in networks.

5.6.2 Technical Rules

Section 2.2.5 of the *Technical Rules* defines *benchmarks* for negative phase sequence voltages in distribution and transmission networks that are described in Table 7.

[21] Refer to Table 2.2, Western Power *Technical Rules* for more information.

Table 7: Technical Rules Negative Phase Sequence Voltage Benchmarks

Nominal System Voltage (kV)	Negative Phase Sequence Voltage (% of positive phase voltage)
>100	1.0
10 – 100	1.5
<10	2.0

5.6.3 Discussion and Recommendations

Negative phase sequence voltage is a useful measure of power supply quality for *distributors* and *transmitters*. A key requirement when operating 3-phase supply networks is balancing the loads on each phase to minimise out of phase voltages occurring at each point in the network. This is particularly important in transmission networks, due to the high operating voltages on the lines and large power transfers that occur at interconnection points on the network.

The *Authority* considers that consideration should be given to introducing into the *Reliability Code* appropriate standards for negative phase voltage levels applying to Horizon Power.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

9) Amend the *Reliability Code* to include negative phase sequence voltage standards applying to Horizon Power.

10) Undertake an assessment of what the appropriate negative phase sequence voltage *benchmarks* applying to Horizon Power under the *Reliability Code* should be.

5.7 Temporary Overvoltage

Temporary overvoltage levels can arise in electricity networks due to faults on the network or the sudden removal of generation sources or loads from the network. The design of distribution and transmission networks should include measures to remove overvoltage conditions from the network as quickly as possible. Distribution and transmission networks incorporate protection against overvoltage that responds to voltage/time measurements, where higher levels of overvoltage are permitted for shorter periods of time than lower levels of overvoltage.

5.7.1 Reliability Code

The *Reliability Code* does not include any standards in relation to temporary overvoltage voltage levels in networks.

5.7.2 Technical Rules

Section 2.2.10 of the *Technical Rules* defines a voltage-time profile for temporary overvoltage in distribution and transmission networks in Figure 2.

5.7.3 Discussion and Recommendations

Temporary overvoltage protection is an important measure for *distributors* and *transmitters* to implement in order to reduce the risk of damage to their network assets and customer equipment when overvoltage events occur in the network.

The *Authority* proposes that the *Reliability Code* is amended to include appropriate standards for temporary overvoltage levels applying to Horizon Power.

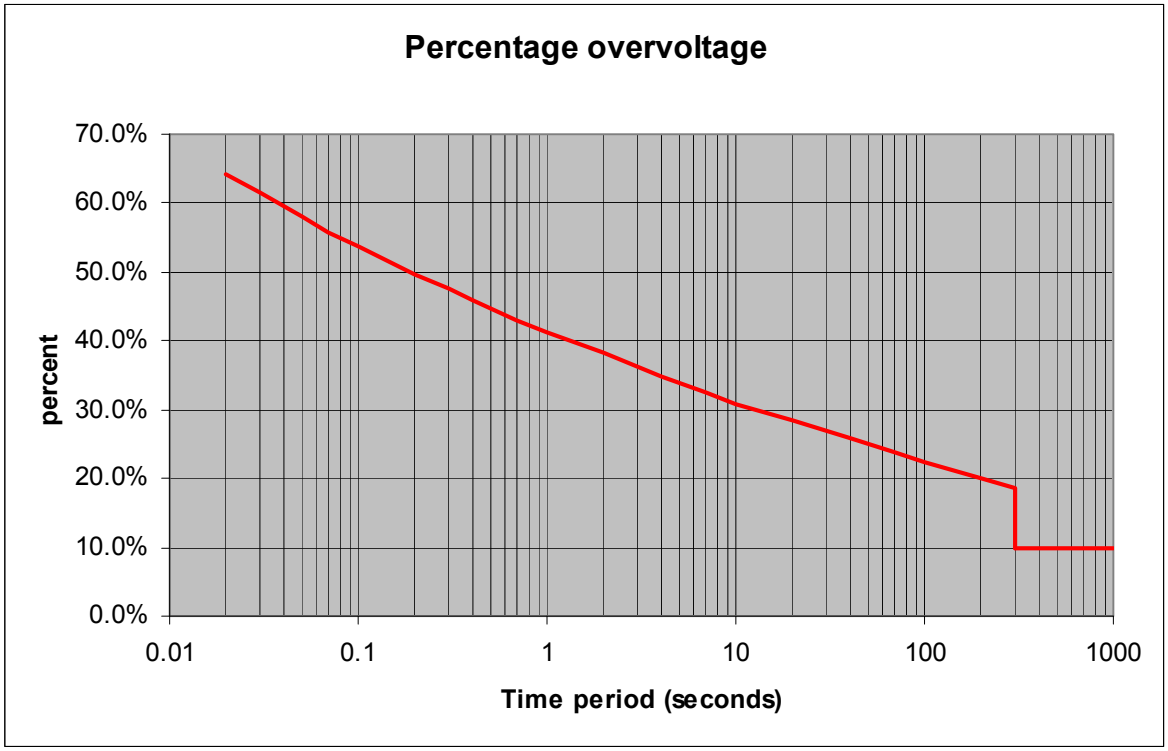
Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

11) Amend the *Reliability Code* to include temporary overvoltage standards applying to Horizon Power.

12) Undertake an assessment of what the appropriate temporary overvoltage *benchmarks* applying to Horizon Power under the *Reliability Code* should be.

Figure 2: Technical Rules Temporary Overvoltage Profile



6 Transmission Network Reliability Standards

This section compares the transmission network reliability standards that apply to Horizon Power under the *Reliability Code* and the standards that apply to Western Power under the *Access Arrangement*. The *Authority* proposes a number of amendments to the distribution and transmission reliability standards applying to Horizon Power under the *Reliability Code* with reference to the standards that are defined in the *Access Arrangement*.

6.1 Transmission Reliability Standards in the *Reliability Code*

The *Reliability Code* defines reliability standards that apply to all *transmitters* in the State, including Horizon Power and Western Power.

Division 3 of Part 2 of the *Reliability Code* prescribes standards for the duration of interruption of supply in particular areas of the State. The *Reliability Code* prescribes 3 areas of the State:

- Perth *CBD* – the area supplied by the Milligan Street or the Hay Street Zone Substations operated by Western Power;
- Urban Areas (other than the Perth *CBD*) – the metropolitan region, the local government district of Mandurah and the townsites of Albany, Bunbury, Geraldton and Kalgoorlie; and
- Other areas of the State – any area of the State other than the Perth *CBD* and Urban Areas.

Section 13(2) of Division 3 requires a *transmitter* or *distributor*, so far as is reasonably practicable, to ensure that the average total length of interruptions of supply does not exceed the number of minutes specified in Table 8.

Table 8: *Reliability Code* benchmarks for the average total length of interruptions by area

Area	*Standard* for total length of interruption (minutes)
The Perth *CBD*	30
The urban areas other than the Perth *CBD*	160
Any other area of the State	290

The average total length of interruptions of supply is to be calculated as at 30 June in each year:

- by taking the average total length, in minutes, of interruptions of supply to customer premises in an area during each year of the period of 4 years ending on that day; and
- by then taking the average of the 4 annual figures determined above[22].

[22] Note that, because the calculation described above averages the total length of interruptions over a 4 year period, it is possible for the standards in Table 8 to be exceeded in one or more of the 4 years covered by the calculation, but for the 4-year average to still meet the standard.

6.2 Transmission Reliability Standards in the Access Arrangement

The *Access Arrangement* defines a total of 13 reference services, including two transmission services. Each transmission service is subject to *service standard benchmarks* setting out the minimum *standard* for the service that is being provided.

For the two transmission services the *service standard benchmarks* are defined in terms of Circuit Availability and System Minutes Interrupted:

- The Circuit Availability *standard* measures, over a 12-month period, the percentage of time that the total pool of transmission circuits are available to carry load.
- The System Minutes Interrupted *standard* measures, over a 12-month period, the sum of the MW minutes of energy that is unserved at sub-stations connected to the transmission networks respectively. There are two standards for System Minutes Interrupted. The first *standard* measures the performance of the meshed networks and the second measures the performance of the radial networks[23].

The service *standard* benchmarks for transmission services for users directly connected to the transmission network expressed in terms of Circuit Availability and System Minutes Interrupted for each year of the current *Access Arrangement* period are detailed in Table 9. The System Minutes Interrupted *standard* for meshed networks is higher than that for radial networks because meshed networks are designed to have a higher level of protection against circuit failure than radial networks.

Table 9: Western Power Access Arrangement Transmission Service Standard Benchmarks

	Year ending June 2007	Year ending June 2008	Year ending June 2009
Circuit Availability (% of total time)	98.2	98.2	98.2
System Minutes Interrupted (meshed network)	7.8	7.8	7.8
System Minutes Interrupted (radial network)	3.9	3.9	3.9

6.3 Discussion and Recommendations

Section 39A(5) of the *Act*, requires the *Authority* to consider whether the reliability standards applying to Horizon Power under the *Reliability Code* are appropriate when assessed against the *service standards* that apply to Western Power under the *Access Arrangement*.

The *Reliability Code* defines transmission reliability standards applying to Horizon Power (and also Western Power) in terms of average total length of interruptions to customer premises in particular areas of the State. The reliability *benchmarks* in the *Reliability Code* (Table 8) do not distinguish between *transmitters* and *distributors*, which means that makes it unclear how the *standard* is to be applied to Horizon Power, who operate both distribution and transmission networks serving the same area of the State (the NWIS).

[23] See section 4.2 for a description of meshed and radial networks.

The three transmission *service standard benchmarks* defined in the *Access Arrangement*: Circuit Availability and System Minutes Interrupted Meshed/Radial Networks, are measures of reliability that apply to the transmission networks operated by Western Power in the *SWIN*. Each of the *benchmarks* measures the performance of the transmission network as experienced by an access customer, i.e. a generator, who connects directly to the transmission network. The definitions of each of the three *service standard benchmarks* is consistent with the current practice in other electricity markets, in particular the National Electricity Market[24].

If the *Reliability Code* were to be amended to define transmission network reliability standards based on circuit availability and system minutes interrupted then the next question that has to be addressed is "what are the appropriate reliability *benchmarks* for Horizon Power?"

It would be useful to firstly review the purpose of reliability standards in the *Reliability Code*. The definition of the reliability standards in Division 3 of Part 2 of the *Reliability Code* (see section 6.1) measures the impact of transmission network outages in terms of interruptions to customer premises. It is unusual to define transmission network reliability in terms of interruption to customer premises. With the exception of large single loads (of the order of MW of demand), it is normal practice to have a customer premises connected directly to the distribution network. Most distribution and transmission networks are designed to provide some level of protection to customer premises connected to the distribution network in the event of that an outage occurs on the transmission network that supplies that distribution network. The protection strategies implemented by networks businesses make it probable that, in most cases, an outage on the transmission network will not result in any interruption to supply of customer premises connected to the associated distribution networks.

It is also relevant to note the small quantity of transmission network that is owned and operated by Horizon Power. Section 4.1, states that Horizon Power manages the 1200km of transmission network in the NWIS on behalf of the network owners, but only owns and operates 464km of the network in it's own right. The transmission network in the NWIS owned by Horizon Power is used to supply power to Karratha, Point Samson, Port Hedland, Roebourne and South Hedland. Horizon Power owns and operates the distribution networks that supply the customers in these towns.

Implementing a system to record and report against the transmission reliability standards applying to Western Power under the *Access Arrangement* (section 6.2) will impose additional costs on Horizon Power. These costs are only justified if the benefits to be obtained from implementing the systems exceed the costs incurred. The small quantity of transmission lines owned and operated by Horizon Power in the NWIS, and that Horizon Power own and operate the distribution networks in the towns supplied from this network, suggest that a better solution to meeting the objectives of the *Reliability Code* may be achieved by defining appropriate distribution reliability *benchmarks* for interruptions to customer premises caused by outages on the transmission network. This is discussed further with in section 8.4.4.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

13) The *Reliability Code* should not define transmission reliability *benchmarks* applying to Horizon Power. Note transmission network reliability will be measured through the implementation of appropriate distribution reliability standards.

[24] The Australian Energy Regulator (AER) published the Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme in March 2008. Under the scheme, covered networks are required to meet circuit availability and loss of supply event frequency targets (measured in terms of system minutes lost). More details of the scheme can be found on the AER web site: http://www.aer.gov.au/content/index.phtml/itemId/709341

7 Interruption of Supply to Individual Customers

7.1 Customer Interruption Standards in the *Reliability Code*

Section 12(1) of the *Reliability Code* prescribes standards applicable to *distributors* for interruptions of supply to premises in relation to the maximum number of times that the supply to a customer premises can be interrupted during the year ending 30 June. The prescribed standards for multiple interruptions are:

- for customer premises in the *CBD* and Urban areas – no more than 9 interruptions per annum; and
- for customer premises in the other areas of the State - no more than 16 interruptions per annum.

Section 12(2)(b) requires the *distributor* to take the necessary measures to ensure that the prescribed *standard* for multiple interruptions to supply is met for 9 years in every 10.

Section 12(1) and (2)(a), taken in combination, require a *distributor* to take the necessary steps to ensure that a *small use customer* will not experience an interruption to supply of more than 12 hours continuously for 9 years in every 10.

Section 19 of the *Reliability Code* requires a *distributor*, upon application from a customer, to make a payment of $80 for each confirmed interruption to supply exceeding 12 hours continuously.

Schedule 1, clause 5 requires *distributors* to report on the number of premises of *small use customers* that have been interrupted for more than 12 hours continuously, or more than the maximum number of times in the year to 30 June.

Schedule 1, clause 9 requires *distributors* to report on the number and total amount of payments made under section 19.

7.2 Customer Interruption Standards in the Access Arrangement

The *Access Arrangement* does not prescribe standards related to the interruption of supply to individual customer premises.

7.3 Discussion and Recommendations

Because the *Access Arrangement* does not include reliability standards in relation to the interruption of supply to individual customers, the *Authority* is of the view that the current standards in the *Reliability Code* that apply to Horizon Power (and Western Power) should remain unchanged, particularly as these standards form the basis for customer compensation payments under section 19 of the *Reliability Code*.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

14) The reliability standards in relation to the interruption of supply to individual customers that apply to Horizon Power under the *Reliability Code* should remain unchanged.

8 Distribution Network Reliability Standards

The *Reliability Code* and the *Access Arrangement* both include reliability standards that apply to distribution networks.

This section provides an overview of the definitions of distribution reliability standards and then goes on to compare the distribution reliability standards that apply to Horizon Power under the *Reliability Code* with the distribution *service standard benchmarks* that apply to Western Power under the *Access Arrangement*.

8.1 Definition of Distribution Reliability Standards

There are three measures of distribution network reliability that are in use throughout Australia: *SAIDI*, *SAIFI* and *CAIDI*. These measures are based on the definitions in standard IEEE 1366-2003[25].

The distribution reliability measures relate to sustained interruptions to supply, as opposed to momentary interruptions. The IEEE 1366-2003 standard defines a sustained interruption as being an interruption of duration greater 5 minutes, and a momentary interruption as being an interruption of 5 minutes or less. The *SCONRRR* have adopted the IEEE definition of the reliability measures, but reduced the threshold duration for a sustained interruption from 5 minutes to 1 minute[26].

8.1.1 SAIDI

SAIDI (System Average Interruption Duration Index) measures the total duration of interruptions experienced by the average customer during the reporting period. The unit of measurement is minutes of interruption. *SAIDI* is defined as:

$$\sum \textit{(individual sustained customer interruption durations)/ total customers on the distribution network}$$

8.1.2 SAIFI

SAIFI (System Average Interruption Frequency Index) measures how often the average customer experiences a sustained interruption during the reporting period. The unit of measurement is the number of interruptions. *SAIFI* is defined as:

$$\sum \textit{(total number of customers interrupted)/ total number of customers on the distribution network}$$

8.1.3 CAIDI

CAIDI (Customer Average Interruption Duration Index) measures the average time to restore service to a customer that has experienced an interruption. The unit of measurement is the minutes. *CAIDI* is defined as:

$$\sum \textit{((individual sustained customer interruption durations)/}\sum\textit{(total number of customers interrupted)}$$

It can be shown that *CAIDI* is also equivalent to the ratio of *SAIDI*/*SAIFI*, which is useful to know, because if the system *SAIDI* and *SAIFI* is known, then the *CAIDI* can be calculated. The important distinction between *SAIDI* and *CAIDI* is that *SAIDI* averages the total length of interruptions on the network across all of the customers served by that network, even if they have not actually

[25] Standard IEEE 1366-2003: IEEE Guide for Electrical Power Distribution Reliability Indices, IEEE Power Engineering Society, 14 May 2004.

[26] Table 1, National Regulatory Reporting for Electricity Distribution and Retailing Businesses, Utility Regulators Forum, Steering Committee on National Regulatory Reporting Requirements, March 2002 describes the reliability of supply measures. A copy of the document is available on the *Authority's* web site: http://www.era.wa.gov.au/2/281/51/regulatory_guid.pm

experienced an interruption, whereas *CAIDI* measures the time to restore service to a customer who has experienced one or more interruptions during the reporting period.

8.2 Distribution Reliability Standards in the *Reliability Code*

The *Reliability Code* defines distribution reliability standards that apply to all *distributors* in the State that are licensed by the *Authority*, including Horizon Power and Western Power.

Division 3 of Part 2 of the *Reliability Code* prescribes standards for the duration of interruption of supply in particular areas of the State. The *Reliability Code* prescribes 3 areas of the State:

- Perth CBD – the area supplied by the Milligan Street or the Hay Street Zone Substations operated by Western Power;
- Urban Areas (other than the Perth *CBD*) – the metropolitan region, the local government district of Mandurah and the townsites of Albany, Bunbury, Geraldton and Kalgoorlie; and
- Other areas of the State – any area of the State other than the Perth *CBD* and Urban Areas.

Section 13(2) of Division 3 requires a *distributor*, so far as is reasonably practicable, to ensure that the average total length of interruptions of supply does not exceed the number of minutes specified in Table 10.

Table 10: *Reliability Code* benchmarks for average total length of interruptions by area

Area	Standard for total length of interruption (minutes)
The Perth *CBD*	30
The urban areas other than the Perth *CBD*	160
Any other area of the State	290

The average total length of interruptions of supply is to be calculated as at 30 June in each year:

- by taking the average total length, in minutes, of interruptions of supply to customer premises in an area during each year of the period of 4 years ending on that day; and
- by then taking the average of the 4 annual figures determined above[27].

Referring to section 8.1.1 it can be seen that a measure based on the average total length of interruptions to customer premises is equivalent to *SAIDI*. It is therefore reasonable to conclude that, in effect, the distribution reliability standards in section 13 of the *Reliability Code* (Table 10) prescribe a *SAIDI standard* for each of the 3 defined geographical supply areas.

8.3 Distribution Reliability Standards in the Access Arrangement

The *Access Arrangement* defines a total of 11 distribution reference services. Each distribution service is subject to *service standard benchmarks* setting out the minimum *standard* for the service

[27] Note that, because the calculation described above averages the total length of interruptions over a 4 year period, it is possible for the standards in Table 10 to be exceeded in one or more of the 4 years covered by the calculation, but for the 4-year average still meet the standard.

that is being provided. The *service standard benchmarks* for the 11 distribution network services are defined in terms of *SAIDI* and *SAIFI*.

Sections 3.16 and 3.17 of the *Access Arrangement* define *SAIDI* and *SAIFI* for the purposes of calculating the distribution *service standard benchmarks*. In particular, the definitions detail the following exclusions to be applied to the calculation of *SAIDI* and *SAIFI*:

- Major event days[28] in accordance with IEEE 1366-2003 definitions, as adopted by the *SCONRRR*;
- Outages shown to be caused by a fault or an event on the transmission system or a third party system (for instance, without limitation outages caused by an inter-trip signal, generator unavailability or a customer installation); or
- *Force majeure* events.

The *SCONRRR* never adopted the IEEE 1366 method for calculating major event days. Instead the *SCONRRR* defined the 4 reliability data sets that are described in Table 11.

Table 11: SCONRRR Reliability Data Sets - Sustained Interruptions

Title	Data Set
Overall interruptions	All sustained interruptions including transmission, directed load shedding, planned and unplanned
Distribution Network Interruptions – Planned	Excludes planned interruptions due to transmission outages and directed load shedding
Distribution Network Interruptions – Unplanned	Excludes unplanned interruptions due to transmission outages and directed load shedding
Normalised Distribution Network – Unplanned	Same as Distribution Network Interruptions Unplanned, but further excludes outages which: - exceed a threshold *SAIDI* impact of 3 minutes; - are caused by exceptional natural or third party events; - the *distributor* cannot reasonably be expected to mitigate the effect of the event on interruptions by prudent asset management.

The *Authority* has reached an agreement with Western Power to apply the *SCONRRR* definition of exclusions to the distribution *service standard benchmarks* for the current *Access Arrangement*.

The *service standard benchmarks* for distribution network *SAIDI* for each year of the current *Access Arrangement* period are shown in Table 12.

Table 12: Western Power Access Arrangement SAIDI benchmarks (minutes)

	SWIN total	*CBD*	Urban	Rural Short	Rural Long
June 2007	277	21.4	222	425	741
June 2008	259	20.0	208	398	693
June 2009	224	17.3	179	343	598

[28] A major event day is a day in which the daily system average interruption duration (SAIDI) exceeds the threshold value for the system. The threshold value is derived from a statistical analysis of all of the interruptions that occurred during the reporting year.

The *service standard benchmarks* for distribution *SAIFI* for each year of the current *Access Arrangement* period are shown in Table 13.

Table 13: Western Power Access Arrangement SAIFI benchmarks

	SWIN total	*CBD*	Urban	Rural Short	Rural Long
June 2007	3.44	0.32	3.12	4.89	5.58
June 2008	3.22	0.30	2.91	4.58	5.22
June 2009	2.78	0.26	2.51	3.95	4.50

Table 12 and Table 13 show that the *Access Arrangement* prescribes *SAIDI* and *SAIFI* benchmarks for the whole of the *SWIN*, i.e. the total network, and for 4 categories of feeder – *CBD*, Urban, Rural Short and Rural Long. Section 3.20 of the *Access Arrangement* states that the definition of the feeder categories is consistent with those applied by the *SCONRRR*[29]:

- *CBD* – a feeder supplying predominantly commercial, high rise buildings, supplied by a predominantly underground distribution network containing significant interconnection and redundancy compared to urban areas;
- Urban – a feeder, which is not a *CBD* feeder, with actual maximum demand over the reporting period per total feeder route length greater than 0.3MVA/km;
- Rural Short – A feeder which is not a *CBD* or Urban feeder with a total feeder route length less than 200km; and
- Rural Long - A feeder which is not a *CBD* or Urban feeder with a total feeder route length greater than 200km.

8.4 Discussion and Recommendations

Section 39A(5) of the *Act*, requires the *Authority* to consider whether the distribution reliability standards applying to Horizon Power under the *Reliability Code* are appropriate when assessed against the *service standards* that apply to Western Power under the *Access Arrangement*.

When we compare the distribution reliability standards applying to Horizon Power under the *Reliability Code* (section 8.2) with the *service standard benchmarks* applying to Western Power under the *Access Arrangement* (section 8.3), the following differences can be identified:

- The *Reliability Code* only defines the equivalent of a *SAIDI standard* whereas the *Access Arrangement* defines *SAIDI* and *SAIFI* standards. This is discussed further in section 8.4.1.
- The *Reliability Code* defines reliability standards for geographical areas of the State whereas the *Access Arrangement* defines *service standards* applied to the *SCONRRR* feeder classifications (section 8.3) and the whole of network (*SWIN*). This is discussed further in section 8.4.2.
- The *Reliability Code* reliability *standard* for *SAIDI* does not provide for any excluded events (or normalisation) whereas the *Access Arrangement service standards* do provide for certain interruptions to be excluded from the calculation of *SAIDI* and *SAIFI*. This is discussed further in section 8.4.3.

[29] Table 3, National Regulatory Reporting for Electricity Distribution and Retailing Businesses, Utility Regulators Forum, March 2002. A copy is available on the *Authority's* web site: http://www.era.wa.gov.au/2/281/51/regulatory_guid.pm

Section 6.3 recommended that transmission network reliability is to be measured by including in the *Reliability Code* distribution reliability standards that measure interruptions to customers on distribution networks that have been caused by transmission network outages. This is discussed further in section 8.4.4.

Section 8.4.5 summarises the proposed amendments to the distribution reliability standards in the *Reliability Code* arising from the recommendations in sections 8.4.1 to 8.4.4.

8.4.1 Including SAIFI Standards in the Reliability Code

In section 8.2, it was shown that the distribution reliability standards in the *Reliability Code* prescribe reliability *benchmarks*, equivalent to *SAIDI*, for particular areas of the State.

In section 8.3, it was shown that the distribution *service standard benchmarks* in the *Access Arrangement* are defined in terms of *SAIDI* and *SAIFI*, based on the reliability data sets defined by the *SCONRRR* (see section 8.1). The *SCONRRR* framework for distribution network reliability (feeder classifications and data sets) has been widely adopted by the regulatory authorities in other States, particularly in those States that are participating in the National Electricity Market: New South Wales, Queensland, South Australia, Tasmania and Victoria.

In section 8.1.3, it was shown that if the *SAIDI* and *SAIFI* values of a distribution system are known, then it is possible to calculate the average time to restore supply following an interruption, *CAIDI*.

The *Authority* proposes the distribution reliability standards applying to Horizon Power in the *Reliability Code* be expanded to include both *SAIDI* and *SAIFI* standards. This measure will provide additional information about the average number of customer interruptions on the distribution network and enable the average time to restore service, *CAIDI*, to be calculated for each discrete network operated by Horizon Power.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

15) Amend the distribution reliability standards applying to Horizon Power in the *Reliability Code* to include both *SAIDI* and *SAIFI* standards.

8.4.2 Reliability Standards by Discrete Area or Feeder Classification

8.4.2.1 Reliability Standards by Discrete Area

In section 8.2, it was shown that the distribution reliability standards applying to Horizon Power under the *Reliability Code* prescribe a reliability *benchmark*, equivalent to *SAIDI*, for particular areas of the State.

The key benefits of prescribing distribution network reliability *benchmarks* applying to defined geographical areas are that:

- the prescribed *benchmarks* inform customers in each area of the level of service they should expect to receive from their *distributor*;
- the customers in each area are able to assess how the level of service that their *distributor* is required to provide to them compares with the levels of service that are to be provided to customers in other areas; and
- over time it is possible to identify trends in distribution network reliability in each area.

However, comparing distribution reliability performance between each supply area in the State, or between supply areas in different States, presents significant difficulties. Each supply area comprises a unique mixture of feeders (*CBD*, Urban, Rural Short and Rural Long) as well as other local environmental and climatic conditions. Unless it is possible to identify supply areas with matching profiles of feeders, environmental and climatic conditions then comparing performance between areas will be problematic.

Looking to the distribution reliability performance frameworks in other States, it can be seen that three other States: South Australia, Tasmania and Victoria have distribution network reliability benchmarking and *distributor* performance reporting based on geographical areas. In all three States the number of discrete geographical areas are higher than those defined in the *Reliability Code*[30]. It can also be seen that these States also operate parallel distribution reliability frameworks based on feeder classifications (section 8.4.2.2).

The *Authority* is of the view that there is benefit in continuing to prescribe distribution reliability standards for specified areas of the State in the *Reliability Code*. However, it may be possible to expand the number of discrete areas of the State to better correlate the distribution networks that are operated by Horizon Power with the communities that they serve. Examples might include defining supply areas for: the NWIS and groups of isolated systems that have similar network characteristics.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

16) The *Reliability Code* continue to define distribution reliability standards for particular areas of the State.

17) Undertake an assessment to determine whether the number of areas of the State prescribed in the *Reliability Code* could be usefully expanded to align the distribution networks operated by Horizon Power with the discrete communities that they serve.

8.4.2.2 Reliability Standards by Feeder Classification

In section 8.3, we saw that the *Access Arrangement* prescribes *service standard benchmarks* for the whole of the *SWIN*, and four classes of feeder defined by the *SCONRRR*: *CBD*, Urban, Short Rural and Long Rural.

The key benefits of prescribing distribution network reliability *benchmarks* for each class of feeder are that:

- the value of the *benchmark* takes account of the physical characteristics of the feeder type (construction practice, maintenance and operating conditions);
- the same *benchmark* applies to all feeders of the same class, wherever they are located in the network;
- it aligns with *distributor* asset management systems and reliability reporting systems, which generally categorise feeders according to their physical characteristics;
- it is possible to compare the performance of *distributors* in the same State, or other States, that have similar feeder and service area profiles[31]; and

[30] South Australia defines 7 supply areas, Tasmania defines 19 supply areas and Victoria defines 5 supply areas (one for each supply area serviced by a *distributor*).

[31] Assuming the normalised data set is used to calculate feeder reliability, see section 8.4.3 for more information.

- The *SCONRRR* framework for defining distribution network reliability has been widely adopted by the regulatory authorities in other jurisdictions, particularly in those States that are participating in the National Electricity Market: New South Wales, Queensland, South Australia, Tasmania and Victoria, which provides a significant population of *distributors* for performance comparison purposes.

It is also interesting to note that both Horizon Power is subject to the distribution network reliability performance reporting obligations in the *Authority's* Electricity Compliance Reporting Manual (Compliance Manual)[32]. These obligations require Horizon Power to provide to the *Authority* annual *SAIDI* and *SAIFI* performance data for each of the four *SCONRRR* feeder categories[33].

The *Authority* is of the view that there is significant benefit to be obtained from amending the *Reliability Code* to include distribution reliability standards applying to Horizon Power based on the *SCONRRR* feeder classifications:

- Horizon Power and Western Power, through the *Access Arrangement*, will both be subject reliability standards based on feeder classifications;
- there is the potential to set Horizon Power's reliability *benchmarks* under the *Reliability Code* with reference to the feeder reliability *benchmarks* applying to Western Power under the *Access Arrangement* and the feeder reliability *benchmarks* for similar distribution businesses in other States;
- Horizon Power already calculate performance data under the Compliance Manual definitions that is compatible with the service standard *benchmarks* in the *Access Arrangement*. This means that there is no additional impost on Horizon Power if they are subject to feeder based reliability standards under the *Reliability Code*.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

18) Amend the *Reliability Code* to include distribution reliability standards based on the *SCONRRR* feeder classifications, and a separate reliability *standard* for the whole of each distribution network operated by Horizon Power.

8.4.3 Definition of Excluded Interruptions in the Reliability Code

The *Reliability Code* does not mention any method for excluding interruptions from the calculation of *SAIDI*. All interruptions that occur in a distribution network, irrespective of the cause, contribute to the calculation of *SAIDI*. The implications are that, under the *Reliability Code*, *distributors* are held accountable for distribution network interruptions that are caused by factors that are beyond their reasonable control, such as:

- generator failures;
- transmission network faults;
- directed load shedding;
- severe weather events; and
- damage to distribution assets caused by third parties.

[32] Electricity Compliance Reporting Manual, March 2008, which can be found on the *Authority's* web site: http://www.era.wa.gov.au/2/281/51/regulatory_guid.pm

[33] Horizon Power data relating to the year ending 30 June 2007 can be found in Tables 19 – 22, 2006/07 Annual Performance Report Electricity Distributors, which is available on the *Authority's* web site: http://www.era.wa.gov.au/2/246/51/reports__decisi.pm

Also, *distributors* are required to include planned outages (including where the appropriate notice has been given to customers) in the calculation of *SAIDI*.

The distribution service standard *benchmarks* applying to Western Power under the *Access Arrangement* prescribe *SAIDI* and *SAIFI benchmarks* for each of the 4 classes of feeder defined by the *SCONRRR* (section 8.3). The definition of *SAIDI* and *SAIFI* in the *Access Arrangement* is based on the *SCONRRR* Normalised Distribution Network – Unplanned data set (see Table 11), which excludes all outages that have been caused by factors that are considered to be beyond the reasonable control of the *distributor*.

There are strong similarities between the definition of the *service standards* in the *Access Arrangement* and the definition of distribution reliability standards in other States. *Distributors* in the States that participate in the National Electricity Market: New South Wales, Queensland, South Australia, Tasmania and Victoria are required to report performance against the *SCONRRR* Normalised Distribution Network – Unplanned data set as a minimum[34]. In most States, *distributors* are also required, consistent with the *SCONRRR* framework, to separately detail all interruption events that have been excluded from the calculation of the Normalised Distribution Network – Unplanned data set.

A key benefit of defining distribution reliability standards applying to Horizon Power in the *Reliability Code* based on the *SCONRRR* data sets is that provides a basis for comparing their distribution network reliability performance with the performance of Western Australian *distributors, and* with similar *distributors* in other States.

Currently, it is possible to compare the reliability standards applying to Western Power under the *Access Arrangement* with the standards applying to similar *distributors* in other States. This capability could be extended to include Horizon Power, and other *distributors*, if the *SCONRRR* Normalised Distribution Network – Unplanned data set is introduced into the *Reliability Code*.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

19) The definition of *SAIDI* and *SAIFI* in the *Reliability Code* applying to Horizon Power is to be consistent with the definition of the *SCONRRR* Normalised Distribution Network – Unplanned data set.

The *Authority* notes the importance of also requiring *distributors* to identify the interruptions that have been excluded from the Normalised Distribution Network – Unplanned data set. This can be achieved by either:

- Requiring *distributors* to provide details of each excluded event with the associated *SAIDI* and *SAIFI* values; or
- Requiring *distributors* to provide Normalised Distribution Network – Unplanned *SAIDI* and *SAIFI* values and the Overall Interruptions *SAIDI* and *SAIFI* values. The difference between the Overall and Normalised values is the total *SAIDI* and *SAIFI* caused by excluded events.

The *Authority* is of the view that the first option, separately identifying each excluded event, is preferable because it itemises each excluded event.

[34] some States additionally require reporting against the Overall, Distribution Network – Unplanned and Distribution Network – Planned data sets defined by the *SCONRRR* (Table 11)

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

20) Amend the *Reliability Code* to require Horizon Power to provide details of each excluded interruption excluded from the calculation of the Normalised Distribution Network – Unplanned data set, including a description of the event and the amount of *SAIDI* and *SAIFI*.

8.4.4 Reliability Standards to Account for Transmission Outages

In section 6.3 the *Authority* recommended the *Reliability Code* should not include reliability standards for transmission networks. Instead the *Authority* proposes that transmission network reliability is to be measured by including distribution reliability standards that measure interruptions to customers on distribution networks that have been caused by transmission network outages in the Code.

In section 8.4.1, the *Authority* recommended *SAIDI* and *SAIFI* as the appropriate standards for distribution network reliability. Under the performance reporting obligations in the Compliance Manual, Horizon Power already calculate annual *SAIDI* and *SAIFI* based on the Normalised Distribution Network – Unplanned data set. Also, the process of determining which interruptions should be excluded from the Normalised Distribution Network – Unplanned data set requires *distributors* to identify interruptions caused by transmission outages. Therefore, it is reasonable to assume that calculating a *SAIDI* and *SAIFI* data set for interruptions caused by unplanned transmission outages will be straightforward to implement.

Recommendations

The *Authority* is seeking comments on the following proposed recommendation:

21) Amend the *Reliability Code* to include two reliability standards applying to Horizon Power that measure interruptions in the distribution network caused by unplanned outages in the transmission networks that supply those distribution networks:

- *SAIDI* – unplanned transmission outages; and
- *SAIFI* – unplanned transmission outages.

8.4.5 Summary of the Recommended Distribution Reliability Standards for Inclusion in the Reliability Code

This section summarises the distribution reliability standards applying to Horizon Power in the *Reliability Code* that arise from the recommendations in sections 8.4.1 to 8.4.4.

Prescribed Areas of the State

There are four distribution reliability standards defined for each prescribed area of the State:

- *SAIDI* (Normalised Distribution Network – Unplanned);
- *SAIFI* (Normalised Distribution Network – Unplanned);

- *SAIDI* (Unplanned Transmission Outages);
- *SAIFI* (Unplanned Transmission Outages).

Classes of Distribution Feeder

Table 14 summarises the distribution reliability standards defined for classes of feeder.

Table 14: Recommended distribution reliability standards for classes of distribution feeder

Standard	*CBD* Feeders	Urban Feeders	Rural Short Feeders	Rural Long Feeders
SAIDI (Normalised Distribution Network – Unplanned)	√	√	√	√
SAIFI (Normalised Distribution Network – Unplanned)	√	√	√	√
SAIDI (Unplanned Transmission Outages)	√	√	√	√
SAIFI (Unplanned Transmission Outages)	√	√	√	√

Whole of Network

There are four distribution reliability standards defined for the whole of each discrete distribution network operated by Horizon Power:

- *SAIDI* (Normalised Distribution Network – Unplanned);
- *SAIFI* (Normalised Distribution Network – Unplanned);
- *SAIDI* (Unplanned Transmission Outages);
- *SAIFI* (Unplanned Transmission Outages).

9 Compulsory or Aspirational Standards

The status of the *service standards* in Western Power's *Access Arrangement* differs from that applying to Horizon Power under the *Reliability Code* because:

- the *Authority* considers the *service standard benchmarks* in Western Power's *Access Arrangement* are compulsory because section 11.1 of the *Access Code* requires that Western Power "*must provide reference services at a service standard at least equivalent to the service standard benchmarks set out in the Access Arrangement and must provide non-reference services to a service standard at least equivalent to the service standard in the access contract*"; whereas
- the *Reliability Code* provides that *distributors* and *transmitters* "*must, so far as is reasonably practicable*" comply with the various *service standards*. This means that the *Reliability Code* requires *distributors* and *transmitters* to use best endeavours to achieve the required power quality and reliability *benchmarks.*

The *Technical Rules* set out the requirements for the operation of distribution and transmission systems covered by the *Technical Rules* and the design and operation of equipment that is connected to those systems. Because the *Technical Rules* set out what are, in effect, minimum standards for the operation of the SWIN, it is reasonable to assume that the obligations in the *Technical Rules* are compulsory.

Setting aspirational, or best endeavours, *benchmarks* applying to Horizon Power in the *Reliability Code* is undesirable because it is difficult to determine whether they have used best endeavours to achieve performance consistent with a prescribed *benchmark*. On the other hand, setting compulsory *benchmarks*, that are based on all available relevant information, provide an incentive for Horizon Power to allocate resources to meet the *benchmark*.

In situations where there is a gap between the current level of performance and the desired level of a *benchmark*, it is possible to define *benchmarks* that progressively close the gap over a defined period of time, usually measured in years[35]. Setting progressively more onerous *benchmarks* over a period of years allows time for Horizon Power to plan and implement capital works programs and systems upgrades to address those parts of the network that contribute to the shortfall between current performance and the required level of performance. It is notable that a number of the electricity markets operating in other States have regulatory frameworks that link the revenues of *distributors* or *transmitters* to a formula based on performance against prescribed *service standard benchmarks*[36].

The *Authority* acknowledges that there is a relationship between the values of the power quality and reliability *benchmarks* and the cost impost on Horizon Power to resource the infrastructure and reporting systems needed to comply with the *benchmarks*. The *Authority* is of the view that balancing the societal value of prescribing the values of power quality and reliability *benchmarks* and the costs of compliance incurred by Horizon Power to achieve the *benchmarks* is a matter of energy policy. Therefore, the *Authority* recommends that the Office of Energy, who are responsible for energy policy in Western Australia, rather than the *Authority*, should determine what are appropriate power quality and reliability *benchmarks* applying to Horizon Power under the *Reliability Code* should be.

[35] This approach is used to improve the level of distribution reliability in the Access Arrangement, see Table 12 and Table 13.

[36] Pricing/reliability formulas are used to determine annual distribution and transmission pricing in South Australia, Tasmania, Victoria, and the AER transmission service target incentive scheme.

Recommendations

The *Authority* is seeking comments on the following recommendations:

22) Amend the *Reliability Code* to include compulsory *service standard benchmarks* applying to Horizon Power.

23) Undertake an assessment of what the appropriate value of power quality and distribution reliability *benchmarks* in the *Reliability Code* applying to Horizon Power should be.

10 Quality and Reliability Performance Reporting Arrangements

Reliability performance reporting is dealt with differently by the various regulatory instruments that deal with Horizon Power and Western Power's *service standards*:

- Chapter 11 of the *Access Code* requires Western Power to provide to the *Authority* an annual service standard performance report, setting out performance against the *service standard benchmarks* in the *Access Arrangement*, which is to be published by the *Authority*;
- The *Reliability Code* requires *distributors* who supply *small use customers*[37] to publish an annual performance report in relation to their performance against the performance reporting obligations in Schedule 1[38]; and
- The *Authority's* Compliance Manual and the associated Electricity Distribution Licence Performance Reporting Handbook[39] prescribe performance reporting requirements for *distributors*, who are required to provide data in respect of the performance indicators in the *Reliability Code* and the performance indicators in the *SCONRRR* framework.

The *Authority* is of the view that the current performance reporting arrangements under the *Access Code* and the *Reliability Code* should be retained. The Compliance Manual reporting obligations should also be retained, because the performance data is used by the *Authority* to prepare a State-wide performance report, which will, in future, include comparison of Western Australian *distributor* performance against *distributors* in other States.

The performance reporting requirements in the Compliance Manual and the report prepared under the *Access Code* are both based on the *SCONRRR* performance reporting framework whereas the *Reliability Code* reporting requirements are based on the geographical areas of the State. In the event that the *Reliability Code* is amended to incorporate *SCONRRR* reliability standards[40], then *distributors* and *transmitters* will only be required to calculate one set of performance data based on the *SCONRRR* framework.

If the service standards in Part 2 of the *Reliability Code* are amended in response to the recommendations of this review, then it will be necessary to amend the performance reporting

[37] The performance reporting obligations are restricted to distributors who supply *small use customers*. The systems used by these distributors to monitor compliance with their obligations under Part 2 of the *Reliability Code* are also subject to an annual audit by an independent expert.

[38] The *Reliability Code* requires distributors to provide a copy of the annual report to the *Authority* and the Minister for Energy at least 7 days before it is published.

[39] Electricity Distribution Licence Performance Reporting Handbook, April 2008, which is available on the *Authority's* web site: http://www.era.wa.gov.au/2/281/51/regulatory_guid.pm

[40] Refer to section 8.4.5

obligations in Schedule 1 to align with the standards in Part 2. The Authority notes that responsibility for the *Reliability Code* currently resides with the Office of Energy. The Authority notes that responsibility for the *Reliability Code* currently resides with the Office of Energy.

Recommendations

The *Authority* is seeking comments on the following recommendations:

24) The requirement for *distributors* and *transmitters* to publish reliability reports complying with Schedule 1 of the *Reliability Code* is to be retained.

25) Amend Schedule 1 of the *Reliability Code* to align with the amended service standards in Part 2 of the Code resulting from this review.

11 Standards Applying to other Distributors and Transmitters under the Reliability Code

This Discussion Paper recommends a number of amendments to the *service standards* applying to Horizon Power under the *Reliability Code*. The *Authority* considers that, at the same time as reviewing the *service standards* applying to Horizon Power under the *Reliability Code,* consideration is also given to the issue of whether the *service standards* applying *distributors* and *transmitters*, other than Horizon Power, should also be amended. Such a review might assess the benefits of applying to other *distributors* and *transmitters* that are subject to the *Reliability Code, service standards* that are consistent with those applying to Horizon Power. However, the *Authority* notes that this matter is beyond the scope of this Discussion Paper.

12 Timing of the Current and Future Reviews

Section 39A(5) of the *Act* requires the *Authority* to consider whether the standards that apply to Horizon Power are appropriate when assessed against the *service standards* applying to Western Power under its *Access Arrangement*. The current *Access Arrangement* expires in June 2009 and Western Power and the *Authority* plan to commence negotiations on a new *Access Arrangement* in October 2008. This means that, subject to the timely completion of the negotiations, a new *Access Arrangement* will be approved by the *Authority* on or before 1 July 2009. Chapter 12 of the *Access Code* requires Western Power to submit to the *Authority* for it's approval *Technical Rules* for the *SWIN* at the same time as the new *Access Arrangement*.

It is possible that the 2009 *Access Arrangement* and the *Technical Rules* may include revised power quality and reliability *benchmarks*. In order to account for this possibility, the *Authority* is of the view that the implementation of the recommendations in the report on the current review should be delayed until the 2009 *Access Arrangement*, and the associated *Technical Rules* have been approved by the *Authority*.

Given that the comparison point for the standards applying to Horizon power is the standards applying to Western Power under the *Access Arrangement* and, for the reasons outlined in section 5, the *Technical Rules*, it would be sensible to undertake future reviews after the *Authority* has approved a new *Access Arrangement* and *Technical Rules*[41]. This is subject to the period between

[41] Section 39A(4) mandates the *Authority* to undertake subsequent reviews as soon as practicable after the date fixed by an order under section 39A(11) expires. Section 39A(7) gives the *Authority* at least 4 months from the date the review commences to give the report to the Minister. Section 39A(8) enables the Minister to extend the period prescribed in section 39A(7) by up to 28 days, if requested by the *Authority*.

the approval of future *Access Arrangements* (and *Technical Rules*) being less than, or equal to, the five year period mandated in section 39A(12) of the *Act*[42]. Setting the dates for future reviews is implemented by the Minister for Energy publishing a notice in the *Government Gazette*, as required by section 39A(11) of the *Act*[43].

Recommendations

The *Authority* is seeking comments on the following recommendations:

26) The implementation of the recommendations in the report on the current review is to take place as soon as practicable after the date that the *Authority* approves an *Access Arrangement* and *Technical Rules* for the South West Interconnected System operated by Western Power for the period commencing July 2009.

27) The Minister publish a notice in the *Government Gazette* fixing the date to commence future reviews of the standards that apply to Horizon Power beyond 2009 to commence as soon as practicable after the date that the *Authority* has approved an *Access Arrangement* for the South West Interconnected System operated by Western Power. This is subject to the period between the approval of future *Access Arrangements* being less than five years.

[42] Section 39A(12) of the *Act* requires the period between reviews to be no longer than 5 years from the date that the previous review report was published in accordance with section 39A(10).

[43] Section 39A(11) of the *Act* provides that the Minister, by order published in the Government Gazette, is to fix a period for subsequent reviews.