Proposed Amendments to the Technical Rules Submitted by Western Power (March 2016)

Issues Paper

2 May 2016

Economic Regulation Authority
WESTERN AUSTRALIA

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Invitation to make submissions

On 2 March 2016, Western Power submitted proposed amendments to the Technical Rules for the South West Interconnected Network to the Economic Regulation Authority (**Authority**). Western Power has proposed a number of amendments to its Technical Rules in order to better align its technical requirements with national requirements, and to improve accessibility to network connection for users with small embedded generating units. Western Power's proposal also addresses the need for alternative arrangements for load shedding in subnetworks which meet the N-1 criterion following an outage. Western Power's proposal is made under section 12.50 of the *Electricity Networks Access Code 2004* (**the Code**).

The purpose of this issues paper is to assist interested parties in making submissions in relation to the proposed amendments. These submissions will assist the Authority in making its determination.

Interested parties are invited to make submissions by **4.00 pm (WST) on Friday, 3 June 2016**. Submissions should be marked to the attention of the Assistant Director, Electricity and should be made via the portal on the ERA website.

CONFIDENTIALITY

In general, all submissions from interested parties will be treated as being in the public domain and placed on the Authority's website. 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. Any claim of confidentiality will be considered in accordance with the provisions of *Electricity Networks Access Code 2004*, sections 14.12 to 14.15.

The publication of a submission on the Authority's website 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 part contains information of a confidential nature and no duty of confidence will arise for the Authority.

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Introduction

In March 2016, Western Power submitted a proposal for a number of amendments to its Technical Rules in order to better align its technical requirements with national requirements, and to improve accessibility to network connection for users with small embedded generating units. Western Power's proposal also addresses the need for alternative arrangements for load shedding in subnetworks which meet the N-1 criterion following an outage. Western Power's proposal is made under section 12.50 of the *Electricity Networks Access Code 2004* (**the Code**).

Technical Rules consist of the standards, procedures and planning criteria governing the construction and operation of an electricity network, and are required under the Access Code for all covered networks. They set out the minimum standards for the facilities, loads and generators which connect to the network in order to ensure the safety of all network users.

The Authority first approved and published Western Power's Technical Rules on 26 April 2007 which became effective from 1 July 2007. As required by the Code, the Authority commenced a review of the Technical Rules in October 2008 which was completed in August 2011. Subsequent to this review, revisions to the Technical Rules were approved by the Authority on 10 November 2011 and took effect from 23 December 2011.

In November 2015, Western Power submitted a new proposal to the Authority for changes to the Technical Rules. The proposal from Western Power included amendments related to the limit for the injection of DC current into the network, the removal of out of date references to Australian Safety Standard AS 4777 (2005), and amendments to the definitions of a number of terms in the Technical Rules Glossary. Western Power also included its outstanding responses to public submissions on the 2011 review of the Technical Rules.

The Authority's Issues Paper for the November 2015 proposal, Western Power's proposal, and an invitation for submissions from stakeholders were published on the Authority's website on 10 February 2016. Submissions from five stakeholders were received by the Authority by the submission deadline of 15 March 2016. The Authority expects to publish the Draft Decision on Western Powers proposal of November 2015 in May, 2016.

Regulatory Requirements

Under Section 12.50 of the Code, a service provider may submit to the Authority a proposal to amend the Technical Rules at any time.

The Authority may reject the proposal if in its opinion, the proposal is misconceived or lacking in substance or has been made on trivial or vexatious grounds.

As soon as practicable, the Authority must consider whether the proposed amendments are consistent with Chapter 12 of the Code and the Code objective, having regard to any exemptions granted under sections 12.34 and 12.41, and then either approve or not approve the proposed amendments by publishing a notice of its decision, and if the decision was to approve the proposed amendments, the date on which the amendments commence.

Under section 12.54, the Authority must consult the public in accordance with Appendix 7 if it considers the proposed amendments to the Technical Rules to be substantial, and must

approve the proposed amendment only if it considers that the amendment will not have a material adverse effect on the service provider or a user.

The Authority will engage directly with stakeholders in a workshop to be held on 10 May 2016 at Albert Facey House, in order to seek their views on the proposed amendments. Stakeholders will also be invited to make submissions on the proposal by Western Power, the Authority's Issues Paper, and any matters discussed in the workshop.

To assist its review, the Authority has appointed an independent technical consultant to provide technical advice and assistance.

Western Power's Proposal

The amendments to the Technical Rules proposed by Western Power include:

- amendments to the treatment of Three Phase Earth Faults;
- new Rules to set out how quickly a protection relay and associated circuit breaker must clear a fault;
- amendments to the N-1 provisions in order to allow voluntary load shedding and post contingent 'run back' generation tripping for user agreed connections; and
- the addition of the term "Weak infeed fault conditions" to the Technical Rules Glossary.

A summary of Western Power's proposed amendments is set out below.

Three Phase Fault Credible Contingency

Western Power proposes to amend the definition of the term "credible contingency event" in the Glossary of the Technical Rules.

Western Power's proposed amendment reclassifies credible contingencies to include two phase to earth faults, as well as three phase to earth faults, and provides Western Power with the discretion, where it is possible to do so, to exempt three phase faults from consideration as credible contingency events at voltages greater than 66kV.

The current definition for the term "credible contingency event" in the Technical Rules Glossary, and the amendments proposed by Western Power, are outlined in Table 1 below:

Table 1 Current and proposed definitions for "credible contingency event".

Current definition	Amended definition proposed by Western Power
A single contingency event of one of the following types: a) A three-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service; b) a single-phase to earth fault cleared by the disconnection of the faulted component, with the fastest main protection scheme out of service; c) a single-phase to earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault; d) a single-phase to earth small zone fault or a single-phase to earth fault followed by a circuit breaker failure, in either case cleared by the operation of the fastest available protection scheme; or e) a sudden disconnection of a system component, e.g. a transmission line or a generation unit.	A single contingency event of one of the following types: a) <u>for voltages below 66 kV</u>, a three-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service; b) <u>for voltages at or above 66 kV, a two-phase or three-phase to earth fault (consistent with good industry practice and based on modes of operation) cleared by disconnection of the faulted component, with the fastest main protection scheme out of service;</u> Renumber b) through e) to c) through to f).

Western Power considers that its proposed amendment to the definition of the term "credible contingency event" will:

- improve system transfer capability;
- reduce the level of investment required to achieve a particular transfer limit;
- reduce the need to restrict power system transfers under certain network outage conditions;
- reduce or defer the need to build new or upgrade existing infrastructure; and
- deliver better network utilisation.

Western Power also suggests that the proposed amendments to the treatment of three phase to earth faults will further align the Technical Rules with the requirements of the National Electricity Rules (**NER**). Currently, treatment of the three phase to earth faults in the Technical Rules is more stringent than in the NER.

Western Power considers that while the reclassification of three phase faults from credible contingency scenarios does not change the likelihood of such a fault occurring, the risk margin applied in the calculation of power transfer limits would be reduced at the time of such an incident. Western Power expects there to be no adverse impact on the system as a result of the proposed amendment, as three phase to earth faults are rare and the interlocking design of the circuit breakers and earth switches further minimise the possibility of such a fault occurring.

Western Power has consulted with those stakeholders which it deems are the most likely to be impacted by the proposed change, and advises the Authority that no objections were raised at the time of consultation.

Issue 1

Submissions are invited from interested parties on whether the amended definition of "credible contingency event" will result in improved efficiency of investment in Western Power's infrastructure.

Issue 2

The Authority is also interested in stakeholder comments on whether the risk mitigation factors outlined by Western Power with reference to the amended treatment of three phase to earth faults provide an acceptable margin of safety.

Issue 3

Submissions are invited from interested parties on the likelihood that Western Power's proposed amendments will improve the efficiency with which the network is utilised.

User Agreed Access Connections

Western Power proposes to amend the N-1 criterion in the Technical Rules in order to allow voluntary load shedding and post contingent 'run back' generation tripping for user agreed connections. This will allow Western Power, where it has an agreement with a user, to switch off some loads (and some generators), in response to network needs. Western Power considers that this amendment will promote more efficient network operation.

Western Power advises that the current N-1 provisions do not consider load shedding, generation tripping, or output reduction arrangements, and that as a result, Western Power is required to obtain an exemption from the Authority each time it needs to implement such an arrangement with a user. Western Power considers that this has created a barrier to efficient use of the network, and has increased the cost associated with implementing voluntary load shedding arrangements.

The current N-1 provisions in the Technical Rules, and the amendments proposed by Western Power, are outlined in Table 2 below.

Table 2 Current and proposed N-1 provisions in Western Power's Technical Rules

Current clause	Amended clause proposed by Western Power
2.5.2.2 N-1 Criterion a) Any sub-network of the transmission system that is not identified within this clause 2.5.2 as being designed to another criterion must be designed to the N-1 planning criterion. b) For sub-networks designed to the N-1 criterion (excluding a zone substation designed to the 1% risk or NCR criteria in accordance with clause 2.5.4), supply must be maintained and load shedding avoided at any load level and for any generation schedule following an outage of any single transmission element. c) Following the loss of the transmission element, the power system must continue to operate in accordance with the power system performance standards specified in clause 2.2. d) Notwithstanding the requirements clauses 2.5.2.2(b) and 2.5.2.2(c), where the failed transmission element is a zone substation supply transformer, supply may be lost for a brief switching period while loads are transferred to un-faulted supply transformers by means of distribution system switching. The Network Service Provider must maintain sufficient power transfer capacity to allow supply to all Consumers to be restored following switching.	2.5.2.2 N-1 Criterion (b) For sub-networks designed to the N-1 criterion (~~excluding a zone substation designed to the 1% risk or NCR criteria in accordance with clause 2.5.4~~), supply must be maintained and load shedding avoided at any load level and for any generation schedule following an outage of any single transmission element, except where: (1) a zone substation was designed to the 1% risk or NCR criteria in accordance with clause 2.5.4; or (2) operational restrictions have been agreed between the Network Service Provider and a User as per clause 3.1(b).

Western Power suggests that its proposed amendment to the N-1 criterion will have the following benefits:

- the network will be utilised closer to its actual capacity more of the time;
- investment that is compliance driven will be deferred; [1]
- the efficiency of the network will be improved to the connection of customers who will maximise network utilisation in off peak and shoulder periods;
- improved certainty and reduced duration of the customer application process due to the removal of the need for exemption applications;
- customers in those areas of the network that would otherwise require significant network augmentation may be connected without additional investment that is compliance driven; and
- some existing exemptions can be renegotiated and retired.

[1] Western Power, *Submission to the Economic Regulation Authority for amendments to the Technical Rules: User Agreed Access Connections*, March, 2016, p. 5.

Western Power acknowledges that if its proposed amendments are approved, there will be some initial investment required in order to set up SCADA inter trip arrangements and suitable protection, and for the maintenance of existing ones. However, Western Power expects that the required level of investment will be less than the additional revenue resulting from better asset utilisation. Western Power also considers that the initial investment amount will be lower than the level of investment required for the purposes of network upgrade and maintenance works when exemptions to the N-1 provisions are (and have previously been) sought.

Western Power has not directly engaged with stakeholders in relation to its proposed amendment to the N-1 provisions thus far, however, included at Attachment 2 of its proposal is an outline of public comments made in relation to previous exemption proposals. A copy of Attachment 2 of Western Power's proposal is included at Appendix 1 this Issues Paper.

Issue 4

Submissions are invited from interested parties on whether the amended provisions for connections which are designated to the N-1 criterion will result in improved efficiency in the utilisation of Western Power's network.

Issue 5

The Authority is also interested in stakeholder comments on whether the proposed changes will improve the application process for customers wishing to connect to the network.

Issue 6

Submissions are invited from interested parties on whether Western Power's proposal to allow voluntary load shedding is adequately framed to protect the rights of customers who fall under the N-1 criterion.

Issue 7

Submissions are invited from interested parties on whether the proposed voluntary load shedding agreements will result in overall improved efficiency of investment in Western Power's infrastructure.

Weak Infeed on Transmission and Distribution Protection Systems

Clause 2.9.4 in conjunction with Tables 2.10 and 2.11 of the Technical Rules set out maximum fault clearance times, which outline how quickly a protection relay (and its associated circuit breaker) must clear a fault.

Embedded generators rated at less than 10MVA have small fault current contributions which can, under certain fault conditions, result in violations of the maximum fault clearance times. Such violations can trigger investment in significant upgrades to transmission line protections to ensure compliance with the Technical Rules.

Western Power's proposed amendment establishes Rules for assessing and dealing with weak infeed fault conditions. To achieve this, Western Power has included an additional provision to Clause 2.9.4 which allows, under credible network conditions, the connection

to the network of embedded generators with fault contributions that fall below the normal operating current of an existing transmission system relay.

The amendments proposed by Western Power to Clause 2.9.4, are outlined in Table 3Table 2 below.

Table 3 Proposed amendment to Clause 2.9.4

2.9.4 Maximum Total Fault Clearance Times … j) Notwithstanding any other provision contained in this Rule 2.9.4, for *weak infeed fault conditions* resulting from the connection of *embedded generating units*, *the total fault clearance time* of one of the protection schemes shall meet the remote end *total fault clearance time* of table 2.11. The *total fault clearance time* of the other *protection scheme* shall be as deemed necessary by the *Network Service Provider* to prevent damage to the *transmission or distribution system* and to meet *power system stability* requirements.

Western Power also proposes to make the following addition, outlined in Table 4 below, to the Technical Rules Glossary.

Table 4 Proposed addition to the Technical Rules Glossary

Weak infeed fault conditions	Occur when a *distribution connected embedded generated unit* supplies a fault current which is significantly below normal *load* current of the installed *transmission protection scheme*.

Western Power considers that where the risk profile associated with violations of maximum fault clearance times is low, (as with fault conditions associated with weak infeed generators), then the investment associated with enforcing compliance to the current Technical Rules dealing with maximum fault clearance times is not economically efficient, per the objectives of the Code.

Western Power advises that a weak infeed assessment is included in the network impact planning study, which Western Power undertakes in order to quantify and understand any potential risks or hazards that might arise as a result of any new generation connection to the network. If a potential problem is identified as a result of this process, Western Power considers that its proposed amendment to Clause 2.9.4 will allow it to determine the appropriate treatment for any associated risk.

Western Power also proposes that any cost for additional work, and costs associated with weak infeed fault condition reviews or assessments will be met by the applicant. Western Power submits that its proposed amendment to Clause 2.9.4, and the addition to the Technical Rules Glossary, will balance the cost of protection with the delivery of material benefits to customers with embedded generators, without having an adverse impact on other users of the Western Power Network.

Issue 8

Submissions are invited from interested parties on whether the proposed amendments to Clause 2.9.4, and the proposed addition to the Glossary of the term "Weak Infeed Fault Conditions" will result in improved efficiency of investment in Western Power's infrastructure.

Issue 9

Submissions are invited from interested parties on whether the proposed amendment will be effective in removing barriers to entry for connection to Western Power's network.

Appendix 1

Previous Load Shedding Exemption Decisions as Outlined by Western Power

Attachment 2 Previous exemption decisions

There have been *Rules* exemptions sought and gained in the past for load shedding and generation run-back schemes (see exemptions granted by the Authority[3]). Three directly related examples are provided below.

Project/Site	Restriction	Comments
Byford solar farm. Nilgen wind farm.	Generation run-back	Both these generation run-back exemptions involve *Generating equipment* is disconnected [to maintain NSP N-1 compliance], post contingent, if network overload constraints occur. A further outcome of this revision is that these (and similar exemptions) can be renegotiated and may be retired. The Byford (p. 4) and Nilgen (p. 7) exemption applications puts the definition of supply this way: Clause 2.5.2.2 of the Technical Rules specifies that any sub-network not otherwise identified as designed to N-0 or N-1-1 criterion) is to be designed to an N-1 planning criterion. The clause is applicable to the sub-network impacted by the Byford PV solar farm connection. The clause states: "For sub-networks designed to the N-1 criterion (excluding a *zone substation* designed to the 1% risk or NCR criteria in accordance with clause 2.5.4), *supply* must be maintained and *load shedding* avoided at any *load* level and for any *generation* schedule following an outage of any single *transmission element*." By defining *supply* to include *transport of electricity* this clause states that a generator must be able to export up to its DSOC value under N-1 for any generation schedule. The proposed connection arrangement for the Byford PV solar farm is not designed to meet this N-1 planning criterion. The post-contingent run-back scheme proposed is designed to mitigate any network risks posed by non-compliance with the N-1 planning criteria.
Geraldton Port Authority	Load shedding	An agreed (voluntary) portion of load can be shed (tripped off) when certain Northern transmission network overload conditions exist. This a post contingent load shed, upon the occurrence of an N-1 event in the transmission network. A suggestion to make a Rule change of this type was made in the Technical Consultants report for the Geraldton Port Authority (GPA) connection (a quote taken from that is included below). The curtailable solution for which the exemption was sought is a form of demand side management that is consistent with good electricity industry practice. It is therefore of concern that Western Power's technical rules are perceived as a barrier to the implementation of such a solution. Had clause 2.5.2.2 of the technical rules been worded *...supply must be maintained and **involuntary** load shedding avoided at any load level and for any generation schedule following an outage of any single transmission element* it is doubtful that a technical rules exemption application would be been necessary. We suggest that the reference to load shedding in clause 2.5.2.2 was intended to refer only to *involuntary* load shedding and propose that Western Power be required to clarify this wording when the rules are next revised. We don't think it was ever intended by the Authority that the technical rules be used as a barrier to the implementation of demand management involving voluntary load shedding and suggest that the use of the technical rules in this way is not consistent with the objectives of the Access Code. (see page 5 in the GPA Consultants Technical Report of 18-Dec-12[4])