

Western Power's Proposed Amendments to the Technical Rules Submitted March 2016

Draft Decision

September 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's proposal was made under section 12.50 of the *Electricity Networks Access Code 2004* (**the Code**).

The Authority published an Issues Paper on 2 May 2016, inviting interested parties to make submissions regarding the changes proposed by Western Power by 3 June 2016. Two submissions were received from interested parties.

Interested parties are invited to make submissions on this Draft Decision by **4.00 pm (WST) on 28 September 2016**. Submissions should be marked to the attention of the Assistant Director, Electricity Access.

Submissions 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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Decision

1. On 2 March 2016, Western Power submitted to the Economic Regulation Authority (**Authority**) a number of proposed amendments to the Technical Rules.¹
2. Western Power's proposed amendments are:
 - removal of three phase faults from credible contingency scenarios² for voltages at or above 66kV (i.e. the transmission system);
 - amendments to the N-1³ provisions to allow voluntary load shedding⁴ and post contingent 'run back' generation tripping⁵ for user agreed connections; and
 - addition of the term "Weak infeed fault conditions⁶" to the Technical Rules Glossary and a new subclause to clause 2.9.4 setting out how quickly a protection relay and associated circuit breaker⁷ must clear a fault.
3. The Authority's Draft Decision approves all of Western Power's proposed amendments, with the exception of the proposed removal of three phase faults from credible contingency scenarios.
4. Whilst the Authority considers the proposed amendment in relation to the treatment of three phase faults complies in principle with the requirements of chapter 12 of the *Electricity Networks Access Code 2004* (the **Code**), and the Code objective, the Authority does not consider the specific amendments proposed by Western Power are consistent with the requirements of chapter 12 of the Code or the Code objective.
5. The Authority's considerations and reasoning in coming to its Draft Decision are set out in the following sections.

¹ The Technical Rules set out the standards, procedures and planning criteria governing the construction and operation of Western Power's network. Technical Rules are a requirement for all covered networks under the *Electricity Networks Access Code* (2004).

² The definition of a credible contingency event is important to power system planning and operation, as it specifies the most severe event that a power system must be designed to withstand with voltage and current remaining within a specified operating envelope.

³ Terminology such as "N-0" and "N-1" is commonly used for describing the level of security of the transmission system. Where loss of a single transmission element (a line, transformer or other essential piece of equipment) could cause a supply interruption to some customers, the level of security of supply is said to be "N" or "N-0". "N-1" is a higher level of security and describes a network built to a standard such that a network element can be out of service without overloading the remaining elements or resorting to load shedding.

⁴ Load shedding is the deliberate shutdown of electric power in a part or parts of a power-distributions system, generally to prevent the failure of the entire system when the demand strains the capacity of the system.

⁵ Generation runback schemes detect real time line overloads and send automatic signals to generators to runback i.e. reduce output quickly without tripping the generator.

⁶ Weak infeed fault conditions occur when a distribution connected embedded generated unit supplies a fault current which is significantly below the normal load current of the installed protection scheme, thereby resulting in the protection scheme not being able to detect the fault and respond accordingly.

⁷ A protection relay is an automatic device designed to trip a circuit breaker when a fault (i.e. any abnormal electric current) is detected. The need to act quickly to protect circuits and equipment as well as the general public often requires protective relays to respond and trip a circuit breaker within a few thousandths of a second.

Reasons

Background

6. On 2 March 2016, Western Power submitted a number of proposed amendments to its Technical Rules. Western Power's proposal was made under section 12.50 of the Code.
7. The proposed amendments are:
 - removal of three phase faults from credible contingency scenarios for voltages at or above 66kV (i.e. the transmission system);
 - amendments to the N-1 provisions to allow voluntary load shedding and post contingent 'run back' generation tripping for user agreed connections; and
 - addition of the term "Weak infeed fault conditions" to the Technical Rules Glossary and a new subclause to clause 2.9.4 setting out how quickly a protection relay and associated circuit breaker must clear a fault.
8. The Authority published an Issues Paper on 2 May 2016, inviting interested parties to make submissions regarding the changes proposed by Western Power by 3 June 2016. On 10 May 2016, the Authority held a workshop to allow Western Power to communicate its proposed changes directly to interested stakeholders. Stakeholders were able to ask questions about the proposed changes, and to raise any further issues that might arise as a result of the amended proposal.
9. Two public submissions were received and are available on the ERA website.
10. The Authority is not required under the Code to issue a detailed decision when approving revisions to the Technical Rules. However, the Authority is committed to a transparent decision making process and accordingly, has published this Draft Decision.
11. To assist it in making its decision, the Authority appointed a technical consultant, Geoff Brown and Associates (**GBA**) to provide advice on the proposed amendments. Matters raised in stakeholder submissions have also been considered in this decision.

Regulatory Requirements

12. Under Section 12.50 of the Code, a service provider may submit a proposal to amend its technical rules to the Authority at any time.
13. 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.
14. The objectives for technical rules as specified in section 12.1 of the Code are that they:
 - a) are reasonable;
 - b) do not impose inappropriate barriers to entry to a market;
 - c) are consistent with good electricity industry practice; and

- d) are consistent with relevant written laws and statutory instruments.
15. The objective of the Code is to promote the economically efficient investment in and operation of and use of, networks and services of networks in order to promote competition in markets upstream and downstream of the networks.
 16. If the network is part of an interconnected system, the technical rules must work in an integrated fashion with the technical rules governing all interconnected networks and reasonably accommodate the interconnection of further networks in the future.
 17. 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.
 18. Subject to paragraph 17 above, the Authority must either approve or not approve the proposed amendments by publishing a notice of its decision. If a decision is to approve the proposed amendments, the Authority must also approve and publish the date on which the amendments commence.
 19. The Authority must consult the public⁸ 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.

Considerations of the Authority

20. Each of Western Power's proposed amendments are considered separately below.

Three Phase Fault Credible Contingency

21. Western Power proposes to amend the definition of the term "credible contingency event" in the Glossary of the Technical Rules. The definition of what is a credible contingency event is important as it specifies the most severe event that a power system must be designed to withstand whilst remaining within specified operating parameters in relation to voltage and current.
22. In its proposal, Western Power notes that its system transfer capability, as determined through power system simulations, is limited by the inclusion of three phase faults⁹ as a "credible contingency event". Western Power notes that three phase faults are not treated as a credible contingency event in the National Electricity Rules (**NER**).
23. 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:

⁸ The process for public consultation is set out in Appendix 7 of the Code.

⁹ Three phase electric power systems have at least three conductors carrying alternating current voltages. In three phase systems a fault may involve one or more phases and ground or may only occur between phases. In a "ground fault" or "earth fault", current flows into the earth.

Table 1 Current and proposed definitions for “credible contingency event”.

Current definition	Amended definition proposed by Western Power
<p>A single contingency event of one of the following types:</p> <ol style="list-style-type: none"> 1) A three-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service; 2) a single-phase to earth fault cleared by the disconnection of the faulted component, with the fastest main protection scheme out of service; 3) a single-phase to earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault; 4) 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 5) a sudden disconnection of a system component, e.g. a transmission line or a generation unit. 	<p>A single contingency event of one of the following types:</p> <ol style="list-style-type: none"> 1) <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; <p>(Points 2 to 5 remain unchanged from the current definition)</p> <ol style="list-style-type: none"> 6) <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>

24. 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;
 - deliver better network utilisation; and
 - better align with the NER.
25. Western Power notes that the removal 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.
26. Western Power has consulted with those stakeholders which it deems are the most likely to be affected by the proposed change, and advises the Authority that no objections were raised at the time of consultation.
27. A public submission was made to the Authority by Steve Davidson of Cooling Towers WA who raised concerns that:

- there was insufficient justification or evidence to support Western Power's proposed change to the treatment of three phase to earth faults;
 - the proposed change would reduce safety margins below acceptable levels;
 - the unique nature of the Western Power network mean that alignment with the NER or with the requirements of networks in the eastern states might not necessarily be best practice; and
 - Western Power's simulation modelling is less accurate than in the eastern states, and fault clearance times are generally longer, indicating that a cautious approach might be prudent when setting stability margins.
28. The Authority's technical consultant, Geoff Brown and Associates (**GBA**), has reviewed Western Power's proposal and the public submission received by the Authority.
29. The Authority notes GBA's advice that:
- no evidence has been put forward which would suggest that raising the power transfer limits closer to the thermal capacity of the relevant asset will have a negative impact on system safety and reliability;¹⁰;
 - as Western Power's proposal indicates that the frequency of such events is low, and the proposed change will have no effect on the frequency of three phase to earth fault events or the time taken to clear such fault events, it is unlikely that system safety will be adversely affected¹¹;
 - the key effect of the rule change is that excursion limits for a non-credible contingency will apply, instead of the tighter limits applicable to credible contingencies;
 - Western Power's modelling is valid and appropriately conservative;¹²
 - in principle, Western Power's proposed change is consistent with Chapter 12 of the Code, but the proposed wording is vague, does not require Western Power to be sufficiently transparent or accountable to network users for the decisions it makes and potentially could result in no meaningful change from the existing situation;
 - in contrast, the approach utilised by the Australian Energy Market Operator (**AEMO**) for networks in the NEM, requires detailed criteria for decision making and regular reports setting out the reasons for each decision are published.
30. GBA recommends revising the definition of a credible contingency to exclude three phase faults and adding a provision for Western Power to assess the stability of the network by including a specified non-credible contingency (such as a three phase to earth fault) in its modelled simulations in situations where it considers a more conservative approach is warranted, providing it publishes a report setting out the details and reasons for this decision.

¹⁰ Geoff Brown and Associates, *Review of Western Power's Application for Technical Rules Amendments*, 2 August 2016, p. 6.

¹¹ Geoff Brown and Associates, *Review of Western Power's Application for Technical Rules Amendments*, 2 August 2016, p. 6.

¹² Geoff Brown and Associates, *Review of Western Power's Application for Technical Rules Amendments*, 2 August 2016, p. 7.

31. GBA's recommended wording is set out below:

Proposed Definition of Contingency Event

(a) for voltages below 66kV, a three phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service;

(b) for voltages at or above 66kV, a two phase ~~or three phase~~ to earth fault ~~(consistent with good industry practice and based on modes of operation)~~ cleared by the disconnection of the faulted component, with the fastest main protection scheme out of service....

Table 2.1:

Row 5: ~~single~~ credible contingency event

Row 6: ~~multiple~~ non-credible contingency event

Clause 2.2.1(f)

Load shedding facilities (described in clause 2.3.2) may be used to ensure compliance with the frequency operating standards prescribed in Table 2.1 following a ~~multiple~~ non-credible contingency event.

New Clause 2.3.7.1(b)

Where considered appropriate to better meet the expectations of Users, the Network Service Provider may include a non-credible contingency event in the simulations undertaken in accordance with the requirements of clause 2.3.7.1(a).

New Clause 2.3.7.1(c)

Where the simulation of a non-credible contingency event in accordance with the provisions of clause 2.3.7.1(b) limits the maximum power transfer capability or other relevant operating parameter of a part of the power system, the Network Service Provider must publish on its website a report that includes:

- 1) the part of the transmission system affected;
- 2) the non-credible contingency event modelled;
- 3) the reasons for modelling the non-credible contingency event;
- 4) the impact of modelling the non-credible contingency event on maximum power transfer capability or other power system operating parameter.

Glossary Definition of Single Contingency Event

This may be deleted as no longer required, if the proposed changes to Table 2.1 are accepted.

32. Taking account of the information in Western Power's proposal, public submissions and GBA's technical advice, the Authority considers Western Power's proposal to remove three phase faults from the definition of credible contingency events is consistent with Chapter 12 and the objectives of the Code in relation to efficient investment. In particular the Authority considers the proposed change will enable higher power transfer limits which will lead to greater utilisation of the existing network and reduced costs to users over time as the need to augment the network to cater for increased load will be deferred.
33. In relation to any impact on safety, the Authority notes GBA's advice that safety is not a relevant issue in this instance and that the proposed change affects stability margins rather than safety margins. The Authority notes the effect on power system reliability is related to the frequency with which three phase faults occur on the transmission network. Western Power has stated these faults are rare but not provided any data to support this assertion. The Authority considers Western Power should provide

sufficient evidence to demonstrate the proposed change will not affect power system reliability.

34. Although the Authority considers the intent of the proposed amendment is consistent with Chapter 12 and the objectives of the Code, the proposed wording is unclear and does not provide users with clarity on how Western Power would treat three phase faults when undertaking power system planning. On that basis, the Authority does not consider the proposed amendment, as submitted by Western Power, is consistent with good electricity industry practice or the Code objective. Consequently the Authority does not approve the proposed amendment.
35. The Authority notes the approach adopted in the NEM explicitly excludes three phase faults from the definition of credible contingency events. However, non-credible contingency events can be considered on a temporary basis when abnormal conditions such as severe weather, lightning, storms or bushfires pose an added risk to the power system. This enables the power system to be managed more conservatively than would normally be the case. In the NEM a six monthly report must be published setting out reasons for classifying a non-credible contingency event as a credible contingency.
36. The Authority considers explicitly excluding three phase faults from the definition of credible contingency events and adding a provision which allows for non-credible contingency events (such as three phase faults) to be considered on a temporary basis in certain circumstances would provide greater clarity and transparency in relation to how three phase faults are treated. Amending the rules in this way would achieve an appropriate balance between ensuring efficient investment whilst maintaining power reliability.

Required Amendment 1

- Western Power must provide data to support the claim that three phase faults on the transmission system are rare and amend the wording to provide clarity and transparency in relation to how three phase faults will be treated. Specifically, three phase faults should be excluded from the definition of credible contingency events and a provision added to enable non-credible contingency events (such as three phase faults) to be included in appropriate circumstances. A requirement to publish a report setting out details and reasons for including a non-credible contingency event should be included in the rule amendment.

Amendments to N-1 provisions

37. Western Power proposes to amend the N-1 criterion¹³ in the Technical Rules in order to allow voluntary load shedding and post contingent 'run back' generation tripping for

¹³ Terminology such as "N-0" and "N-1" is commonly used for describing the level of security of the transmission system. Where loss of a single transmission element (a line, transformer or other essential piece of equipment) could cause a supply interruption to some customers, the level of security of supply is said to be "N" or "N-0". "N-1" is a higher level of security and describes a network built to a standard such

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.

38. 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.
39. 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
<p>2.5.2.2 N-1 Criterion</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p>	<p>2.5.2.2 N-1 Criterion</p> <p>(a) no change</p> <p>(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, <u>except where:</u></p> <p style="padding-left: 20px;">(1) <u>a zone substation was designed to the 1% risk or NCR criteria in accordance with clause 2.5.4; or</u></p> <p style="padding-left: 20px;">(2) <u>operational restrictions have been agreed between the Network Service Provider and a User as per clause 3.1(b).</u></p> <p>(c) no change</p> <p>(d) no change</p>

40. Western Power considers its proposed amendment to the N-1 criterion will have the following benefits:

that a network element can be out of service without overloading the remaining elements or resorting to load shedding.

- the network will be utilised closer to its actual capacity more of the time;
 - investment that is compliance driven will be deferred;¹⁴
 - the efficiency of the network will be improved by the connection of customers who will maximise network utilisation in off peak and shoulder periods;
 - improved certainty and reduced time for 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.
41. 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 arrangements. 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.
42. 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 of this Draft Decision.
43. A public submission made by Cooling Towers WA considered that the proposed amendment was overly complex. Cooling Towers WA considers the stated objective of the proposed rule change could be accommodated within the existing rules as the planning criteria in clause 2.5 applies only to the transmission and distribution systems and not to connection assets. The submission notes that connection assets must be designed in accordance with the user's requirements and the relevant requirements of section 3, which include provision for additional operating restrictions to be agreed between Western Power and the user. Cooling Towers WA considers these provisions effectively allow for constrained access provided the constraints of clause 3.1(c) in relation to maintaining power system performance standards do not adversely affect other users. Cooling Towers WA considers that insertion of the word "involuntary" into the existing wording of clause 3.1(b) would provide explicit clarity and that no further amendment would be required.
44. Cooling Towers WA also considered the proposed changes could, if Western Power owns the assets, result in the costs of the constrained connections being passed on to other users.
45. The Authority's technical consultant, GBA, has reviewed both Western Power's proposed amendments, and the submission made by Cooling Towers WA.

¹⁴ Western Power, *Submission to the Economic Regulation Authority for amendments to the Technical Rules: User Agreed Access Connections*, March, 2016, p. 5.

46. GBA advises that clause 3.1(b) can be interpreted as already allowing the installation of constrained access connections. However, as noted in Western Power's proposal, the term "supply must be maintained" is interpreted to mean both supply to loads and supply from generators due to the broad definition of the term "supply" in the *Electricity Industry Act 2004*. GBA notes Western Power's proposed wording removes any potential inconsistency between the two clauses.
47. In relation to costs, GBA notes the key issue is not who owns the assets but who pays for them. As set out in Western Power's application, the costs of any voluntary load shedding or generation run back scheme will be borne by the new user requesting the constrained access connection in accordance with its contribution policy. The benefit to the user is that the cost of a generation runback or load shedding scheme would generally be much less than the cost of a network augmentation that would be needed to provide unconstrained access, so the required capital contribution would be correspondingly lower. The Authority notes that charges to other users would not be affected by the costs of any voluntary load shedding or generation run back schemes.
48. GBA considers that the changes proposed by Western Power are appropriate and points to the existing exemptions to clause 2.5.2.2 of the Current Technical rules¹⁵ as evidence that such connections create no issues for the network or for its users.¹⁶
49. As set out in the Authority's *2014 Wholesale Electricity Market Report for the Minister for Energy*,¹⁷ network planning in relation to congestion management is a key issue for all electricity networks and a variety of approaches have been adopted around the world with varying degrees of success. Unlike the explicit constrained network access regime of the NEM, the WEM does not have a prescribed approach. The Access Code can accommodate a variety of approaches, provided they achieve the objective of promoting economically efficient investment in and operation and use of the network in order to promote competition in markets upstream and downstream of the network.
50. In some parts of the network, the cost of upgrades to provide unconstrained access is significant and, as a result, prospective generators do not want, or cannot afford, the cost of connection. As Western Power has noted in its proposal, it has previously sought exemptions from the N-1 provisions in the Technical Rules to enable it to offer specific constrained connections. The Authority considers amending the Technical Rules to accommodate constrained connections if required in future, rather than Western Power continuing to seek exemptions on an ad hoc basis, will reduce administrative costs and connection times without introducing new or increased risks to the network.

¹⁵ The Authority notes that it has previously granted the following exemptions to Clause 2.5.2.2 N-1 Criterion of the Technical Rules:

- Byford PV Solar Farms
- Geraldton Port Authority
- Nilgen Wind Farm
- Karara Mining Ltd

¹⁶ Geoff Brown and Associates, *Review of Western Power's Application for Technical Rules Amendments*, 2 August 2016, p. 10.

¹⁷ See page 11

[http://www.erawa.com.au/cproot/13865/2/2014%20Report%20for%20the%20Minister%20for%20Energy%20\(Including%20Appendix%201\).PDF](http://www.erawa.com.au/cproot/13865/2/2014%20Report%20for%20the%20Minister%20for%20Energy%20(Including%20Appendix%201).PDF)

51. The Authority considers the proposed amendment will reduce the need for network investment and improve the utilisation of the existing network whilst maintaining a safe and reliable power supply for all users. Consequently, the Authority is satisfied that the changes proposed by Western Power to clause 2.5.2.2 are in line with Chapter 12 and the objectives of the Code as they will allow for the most efficient possible use of the network, and will promote efficient investment in the network.
52. The Authority therefore approves the changes proposed by Western Power to clause 2.5.2.2.

Weak infeed fault conditions

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

Table 3 Proposed addition to the Technical Rules Glossary

Weak infeed fault conditions	Occur when a <i>distribution connected embedded generated unit</i> supplies a fault current which is significantly below normal <i>load</i> current of the installed <i>transmission protection scheme</i> .
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54. 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.
55. 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.
56. 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.
57. The amendments proposed by Western Power to clause 2.9.4, are outlined in **Table 4** below.

Table 4 Proposed amendment to Clause 2.9.4

<p>2.9.4 Maximum Total Fault Clearance Times</p> <p>...</p> <p>10) Notwithstanding any other provision contained in this Rule 2.9.4, for <i>weak infeed fault conditions</i> resulting from the connection of <i>embedded generating units</i>, the <i>total fault clearance time</i> of one of the protection schemes shall meet the remote end <i>total fault clearance time</i> of table 2.11. The <i>total fault clearance time</i> of the other <i>protection scheme</i> shall be as deemed necessary by the <i>Network Service Provider</i> to prevent damage to the <i>transmission or distribution system</i> and to meet <i>power system stability</i> requirements.</p>

58. 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 with the current Technical Rules dealing with maximum fault clearance times is not economically efficient, and inconsistent with the objectives of the Code.

59. 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.
60. 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.
61. No submissions were made with respect to Western Power's proposed addition of Clause 2.9.4(10) to the Technical Rules, or the addition of the term "Weak infeed fault condition" to the Technical Rules Glossary.
62. The Authority's consultant, GBA, has reviewed Western Power's proposed amendments and additions to the Technical Rules Glossary.
63. GBA considers that as the rules currently stand, there are limited options available to Western Power in circumstances where:
- "the fault infeed from small embedded generators into a fault in the transmission system is so small that that many of the transmission protection systems currently installed on Western Power's network cannot clear the fault within the maximum times specified in clause 2.9.4 of the Rules"
64. These options include:
- declining to connect the generator;
 - upgrading the existing transmission system protection, funded by a capital contribution from the generator wanting to connect; or
 - seeking an exemption to the Rules.
65. GBA advises that:
- "Very often, there is no technical justification for the upgrade apart from meeting the requirements of the Rules, and the capital contribution that would be required far exceeds the economic benefits to the generator of connecting the new generating unit"
66. GBA considers that the changes proposed by Western Power will remove barriers to network connection for small embedded generators, and advises that it sees no reason for the Authority not to approve the proposed amendments.
67. The Authority notes that it has previously granted exemptions to clause 2.9.4 of the Technical Rules, with no evidence of adverse impact on the network or its users.¹⁸
68. On the basis of the information provided by Western Power in its submission, and the advice from GBA, the Authority considers that the proposed amendments comply with

¹⁸ Current Exemptions to Clause 2.9.4

- Wagin Substation
- Mumbida Wind Farm

Chapter 12 and the objectives of the Code by promoting efficient use of, and investment in, the Western Power electricity network.

69. Accordingly, the Authority approves Western Power's proposed amendments to clause 2.9.4, and the proposed addition of the term "Weak infeed fault conditions" to the Technical Rules Glossary.

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 Authority³). Three directly related examples are provided below.

Project/Site	Restriction	Comments
Byford solar farm.	Generation run-back	Both these generation run-back exemptions involve <i>Generating equipment</i> 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:
Nilgen wind farm.		"For sub-networks designed to the N-1 criterion (excluding a <i>zone substation</i> designed to the 1% risk or NCR criteria in accordance with clause 2.5.4), <i>supply</i> must be maintained and <i>load shedding</i> avoided at any <i>load level</i> and for any <i>generation</i> schedule following an outage of any single <i>transmission element</i> ." By defining <i>supply</i> to include <i>transport of electricity</i> 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 ... <i>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</i> 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 <i>involuntary</i> 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)