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

Final Decision

November 2016

Economic Regulation Authority
WESTERN AUSTRALIA

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Decision

1. On 2 March 2016, Western Power submitted to the Economic Regulation Authority (**Authority**) the following proposed amendments to the Technical Rules:[1]

   - removal of three phase faults from credible contingency scenarios[2] for voltages at or above 66kV (i.e. the transmission system);
   - amendments to the N-1[3] provisions to allow voluntary load shedding[4] and post contingent 'run back' generation tripping[5] for user agreed connections; and
   - addition of the term "Weak infeed fault conditions"[6] 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[7] must clear a fault.

2. On 7 September 2016, the Authority published its Draft Decision to approve all of Western Power's proposed amendments, with the exception of the proposed removal of three phase faults from the definition of "credible contingency event". The Authority considered this amendment, as drafted by Western Power, did not meet the requirements of chapter 12 of the *Electricity Networks Access Code 2004* (the **Code**) or the Code objective.

3. Western Power submitted a revised proposal dated 29 September 2016. The revised proposal included further revisions to change the definition of "credible contingency event".

4. A public submission on the Draft Decision was received from Mr Steve Davidson.

5. The Authority has reviewed Western Power's revised proposal and the submission received from Mr Steve Davidson. The Authority considers the revised amendments:

   - are reasonable;

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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.

- do not impose inappropriate barriers to entry to the electricity market;
- are consistent with good industry practice; and
- will work in an integrated fashion with interconnected networks and reasonably accommodate the interconnection of further networks in the future.

6. The Authority's Final Decision is that Western Power's revised proposal to amend the Technical Rules does comply with chapter 12 of the Code and the Code objective.

7. Consistent with clause 12.53 of the Code, the Authority has determined that the date the approved amendments to the Technical Rules will take effect is 1 December 2016.

8. The Authority's considerations and reasoning in coming to its Final Decision are set out in the following sections.

Reasons

Background

9. 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.

10. The proposed amendments are:

- the 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
- the 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.

11. 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 because of the amended proposal.

12. Two public submissions in response to the Issues Paper were received. These submissions are available on the Authority's website.

13. On 7 September 2016, the Authority published its Draft Decision to approve all of Western Power's proposed amendments, with the exception of the proposed removal of three-phase faults from credible contingency events. While the Authority considered the proposed amendment in relation to the treatment of three-phase faults complied in principle with the requirements of chapter 12 of the Code and the Code objective, it did not consider the specific amendments drafted by Western Power met the requirements of chapter 12 or the Code objective.

14. Western Power submitted a revised proposal on 29 September 2016 and a further revision on 3 November 2016.

15. The Authority received a submission on its Draft Decision from Mr Steve Davidson. A copy of this submission is available on the Authority's website.

16. The Authority has made its Final Decision with respect to the changes proposed by Western Power, based on the amended proposal submitted by Western Power to the Authority dated 29 September 2016 and the further revision submitted on 3 November 2016.

17. The Authority is not required under the Code to issue a detailed decision when approving revisions to the Technical Rules. The Authority is committed to making transparent decisions, and accordingly, has published this Final Decision. The Authority appointed a technical consultant, Geoff Brown and Associates (**GBA**) to provide independent advice on the proposed amendments. The matters raised in stakeholder submissions have also been considered in this decision.

Regulatory Requirements

18. 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. 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 technical rules exemptions granted under sections 12.34 and 12.41 of the Code.

19. The objectives for technical rules as specified in section 12.1 of the Code are that the rules:

    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.

20. The Code objective 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".*

21. 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.

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

23. The Authority may make a draft decision prior to making its final decision. 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. The Authority must consult the public[8] if it considers the proposed amendments to the technical rules are substantial, and must approve the proposed amendments only if it considers that the amendments will not have a material adverse effect on the service provider or a user.

Considerations of the Authority

24. Each of Western Power's proposed amendments is considered below.

Three Phase Fault Credible Contingency

Draft Decision

25. Western Power proposed to amend the definition of the term "credible contingency event" in the Technical Rules Glossary. The definition of what is a credible contingency event is important as it specifies the most severe event that a power

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

system must be designed to withstand while remaining within specified voltage and current operating parameters.

26. In its proposal, Western Power noted that its system transfer capability, as determined through power system simulations, is limited by the inclusion of three-phase faults[9] as a "credible contingency event". Western Power further noted that three-phase faults are not treated as a credible contingency event in the *National Electricity Rules* (**NER**).

27. The current definition for the term "credible contingency event" in the Technical Rules Glossary and the amendments proposed by Western Power are outlined in

28. 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: 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.	A single contingency event of one of the following types: 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; [Points 2 to 5 remain unchanged from the current definition] 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>

29. Western Power considered that its proposed amendment to the definition of "credible contingency event" would:

- 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;

[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.

- deliver better network utilisation; and
- better align with the NER.

30. Western Power noted that the removal of three-phase faults from credible contingency scenarios does not change the likelihood of such a fault occurring, rather 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 minimise the possibility of such a fault occurring.

31. Western Power consulted with those stakeholders that it deemed were most likely to be affected by the proposed change and advised the Authority that no objections were raised at the time of consultation.

32. The public submission made to the Authority by Mr Steve Davidson in response to the Authority's Issues Paper, 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 means 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.

33. The Authority's technical consultant, Geoff Brown and Associates (**GBA**), reviewed Western Power's proposal and the public submission received by the Authority. The Authority noted the following advice.[10]

- No evidence had been put forward that 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.
- As Western Power's proposal indicated 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 was unlikely that system safety will be adversely affected.
- The key effect of the rule change was that excursion limits for a non-credible contingency would apply, instead of the tighter limits applicable to credible contingencies.
- Western Power's modelling was valid and appropriately conservative.
- In principle, Western Power's proposed change was consistent with chapter 12 of the Code, but the proposed wording (drafting) was vague and did not require Western Power to be sufficiently transparent or accountable to network users for the decisions it makes. This could result in no meaningful change from the existing situation.

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

- In contrast, the approach used by the Australian Energy Market Operator (**AEMO**) for networks in the National Electricity Market (**NEM**) requires detailed criteria for decision making and regular reports setting out the reasons for each decision to be published.

34. GBA recommended revising the definition of a credible contingency to exclude three-phase faults. GBA also recommended making 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. GBA also recommended that if Western Power decides to include a non-credible contingency event in its simulations it be required to publish a report on its website setting out the details and reasons for such a decision.

35. 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.

36. Based on the information in Western Power's proposal, public submissions and GBA's technical advice, the Authority considered Western Power's proposal to remove three-phase faults from the definition of "credible contingency events" was consistent with chapter 12 of the Code and its objective in relation to efficient investment. In particular, the Authority considered the proposed change would enable higher power transfer limits that would 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.

37. The Authority noted GBA's advice that safety was not a relevant issue in this instance as the proposed change affected stability margins rather than safety margins. The Authority noted the effect on power system reliability was dependent on the frequency of three phase faults. Western Power stated these faults were rare, but did not provide any supporting data. The Authority considered Western Power should provide sufficient evidence to support this claim.

38. Although the Authority considered the intent of the proposed amendment was consistent with chapter 12 and the objective of the Code, the proposed drafting was unclear and did not provide users with sufficient information on how Western Power would treat three-phase faults when undertaking power system planning. On that basis, the Authority did not consider the proposed amendment, as drafted by Western Power, was consistent with good electricity industry practice or the Code objective. Consequently, the Authority did not approve the proposed amendment.

39. The Authority noted the approach adopted in the NEM that explicitly excludes three-phase faults from the definition of credible contingency events, but allows for non-credible contingency events to be considered on a temporary basis when abnormal conditions (such as severe weather, lightning, storms or bushfires) impose added risk to the power system. In the NEM a six monthly report must be published setting out the reasons for classifying any non-credible contingency events as credible contingencies.

40. The Authority considered excluding three-phase faults from the definition of credible contingency events, and instead adding a provision that allowed for non-credible contingency events (such as three-phase to earth 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. It would also achieve an appropriate balance between ensuring efficient investment while maintaining power reliability.

41. The Authority requested Western Power to provide data to support the claim that three-phase faults on the transmission system are rare. It also required Western Power to amend the definition to provide clarity and transparency regarding the treatment of three-phase faults. In particular, three phase faults should be excluded from the definition of credible contingency events and a new provision added to enable non-credible contingency events (such as three-phase faults) to be included in appropriate circumstances. The Authority required Western Power to publish a report setting out details and reasons for including three-phase faults as a non-credible contingency event.

Revised Proposal

42. In response to the Authority's Draft Decision, Western Power has confirmed that while three-phase faults are rare, they can and do occur. Since the Technical Rules commenced in July 2007, two such faults were identified – one occurred because of bushfire damage and the other due to human error after line maintenance work. Western Power does not consider that planning for either of these events would be an efficient method for analysing or establishing network requirements.

43. Western Power has amended its proposed wording to clarify where a three-phase fault should be considered a credible contingency on the existing network. The proposed wording, as set out in its submission dated 3 November 2016, is set out below:

> A single contingency event of one of the following types:
>
> (a) for voltages at or 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 above 66 kV:
>
> (1) a two-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service, or
>
> (2) a three-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service. This criterion is to be applied only to transmission elements where the Network Service Provider can demonstrate that the design type, environmental conditions, historic performance or operational parameters results in a material increase in the likelihood of a three-phase to earth fault occurring.
>
> (c) a single-phase to earth fault cleared by the disconnection of the faulted component, with the fastest main protection scheme out of service;
>
> (d) a single-phase to earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault;
>
> (e) 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
>
> (f) a sudden disconnection of a system component, e.g. a transmission line or a generation unit.

44. Western Power does not consider wider reporting on credible contingency modelling is required because the proposed amendment will not decrease or increase transparency. Western Power notes there is no data currently published about the fault clearance times used, faulted elements, location of faults on elements, or specifics of load models used in the simulations. For customer projects the

justification of the fault type used and any requested results of non-credible contingencies would be published in the relevant planning report.

45. However, Western Power agrees that publishing information will improve transparency where investment decisions are taken based on a risk assessment that determines it prudent to augment the network on the basis of using two phase or three phase faults in the planning considerations. Western Power has added a new clause requiring a higher level of transparency when applied to capital works that trigger the Regulatory Investment Test as follows.[11]

> **New Clause 2.3.7.1(c)**
>
> Where the simulation of 2PH-G or 3PH-G fault events in accordance with the provisions of clause 2.3.7.1 limits the maximum power transfer capability or other relevant operating parameter of a part of the power system and this forms the basis for an investment decision which triggers the requirement for a Regulatory Investment Test, the Network Service Provider must provide to the Economic Regulation Authority with its submission, information regarding:
>
> - the part of the transmission system affected;
> - the contingency events modelled;
> - an overview of the investment decision and the reasons for modelling particular contingency events; and
> - the impact of contingency events on the maximum power transfer capability.

Public Submissions

46. The submission from Mr Steve Davidson in response to the Draft Decision raised concerns, similar to those raised in his submission to the Authority's Issues Paper, that the proposed changes do not adequately consider safety implications. In particular, Mr Davidson submits that equipment must be designed to withstand three-phase faults. Mr Davidson also considers the proposal does not take into account that the risk of a three-phase fault is higher in Western Australia than the NEM because transmission lines are designed to a lower standard.

Final Decision

47. Additional technical advice was sought by the Authority from GBA on Western Power's amended proposal. GBA considers that Western Power's amended proposal should be allowed. Specifically, GBA advises that the purpose of the amendment is to allow Western Power to increase the transfer capacity of network elements that are currently constrained. While GBA considers the application of the term "consistent with good industry practice based on modes of operation" is not well defined and can be interpreted (in relation to the existing network) as Western Power sees fit, this should only be an issue if a user is denied access to network capacity as a result of a

[11] The Code specifies financial thresholds for transmission and distribution network augmentations above which the service provider must seek approval from the ERA prior to commencing the augmentation. This is the Regulatory Investment Test. The test assesses whether the proposed major augmentation maximises the net benefits after considering alternative options. The current thresholds are $36 million and $12 million respectively.

conservative interpretation. Should such a situation arise, it is still open to an affected user to trigger the dispute procedure in the Access Code.[12]

48. The Authority notes, as set out in the Draft Decision and confirmed by GBA, the proposed change does not increase either the frequency of three-phase faults or their clearing time. GBA further notes that the proposed amendment does not relax any technical requirements in respect of the capability of equipment connected to the network to withstand three-phase faults. On that basis, no new safety issues arise because of the proposed change.[13] As noted in GBA's advice, the appropriateness of existing safety requirements is a separate issue that is outside the Authority's jurisdiction.

49. GBA notes there are differences in design standards between Western Australia and the NEM as stated by Mr Steve Davidson. However, only two three-phase faults have been identified in Western Australia since 2007 with neither resulting from line design issues. Despite the lower design standards, the frequency of three-phase faults is very low.

50. The Authority considers the wording in Western Power's revised proposal provides less clarity about how Western Power treats three-phase faults when undertaking power system planning than the wording proposed by the Authority in its Draft Decision. However, given the Code only allows the Authority to approve or not approve an amendment proposed by Western Power and GBA's additional advice the Authority considers Western Power's the revised proposed amendment meets the requirements of the Code and is therefore approved.

Amendments to N-1 provisions

51. Western Power proposed to amend the N-1 criterion[14] 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 this amendment will promote more efficient network operation.

52. Western Power advised that the current N-1 provisions do not consider load shedding, generation tripping, or output reduction arrangements. 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 considered this process created a barrier to efficient use of the network, and increased the cost associated with implementing voluntary load shedding arrangements.

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[12] Geoff Brown and Associates, *Response to Comments on Draft Decision on Proposed Amendments to Western Power's Technical Rules*, 20 October 2016.

[13] Geoff Brown and Associates, *Response to Comments on Draft Decision on Proposed Amendments to Western Power's Technical Rules*, 20 October 2016.

[14] 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.

53. 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 (a) [no change] (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). (c) [no change] (d) [no change]

54. Western Power considered its proposed amendment to the N-1 criterion had the following benefits:

- the network would be utilised closer to its actual capacity more of the time;
- investment that was compliance driven would be deferred;[15]
- the efficiency of the network would be improved by the connection of customers who would maximise network utilisation in off peak and shoulder periods;
- there would be improved certainty and reduced time for the customer application process due to the removal of the need for exemption applications;

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

- customers in those areas of the network that would otherwise require significant network augmentation could be connected without additional investment that was compliance driven; and
- some existing exemptions could be renegotiated and retired.

55. Western Power acknowledged that if its proposed amendments were approved, there would 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 expected the required level of investment would be less than the additional revenue resulting from better asset utilisation. Western Power also considered the initial investment amount would be lower than the level of investment required for the purposes of network upgrade and maintenance works when exemptions to the N-1 provisions were (and had previously been) sought.

56. Western Power noted it had not directly engaged with stakeholders in relation to its proposed amendment to the N-1 provisions thus far, however, it included in its proposal an outline of public comments made in relation to previous exemption proposals.[16] A copy of these comments is included at Appendix 1 of this Final Decision.

57. A public submission made by Mr Steve Davidson considered that the proposed amendment was overly complex. Specifically, Mr Davidson considered 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 also noted 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. Mr Davidson further considered that the provisions effectively allowed for constrained access, provided the constraints of clause 3.1(c), in relation to maintaining power system performance standards, did not adversely affect other users. Mr Davidson considered that including the word "involuntary" into the existing wording of clause 3.1(b) would provide explicit clarity and that no further amendment would be required. Mr Davidson 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.

58. The Authority's technical consultant, GBA, reviewed Western Power's proposed amendments, and the submission made by Mr Steve Davidson.

59. GBA advised that clause 3.1(b) could 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 noted Western Power's proposed wording removes any potential inconsistency between the two clauses.

60. In relation to costs, GBA noted the key issue was 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 would 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

[16] Attachment 2 of Western Power's proposal.

augmentation that would be needed to provide unconstrained access, so the required capital contribution would be correspondingly lower. The Authority noted that charges to other users would not be affected by the costs of any voluntary load shedding or generation run back schemes.

61. GBA considered that the changes proposed by Western Power were appropriate and pointed to the existing exemptions to clause 2.5.2.2 of the current Technical Rules[17] as evidence that such connections create no issues for the network or for its users.[18]

62. As set out in the Authority's *2014 Wholesale Electricity Market Report for the Minister for Energy*,[19] 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 Code can accommodate a variety of planning approaches, provided they achieve the Code 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.

63. In some parts of the network, the cost of upgrades to provide unconstrained access are 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. In its Draft Decision the Authority considered that amending the Technical Rules to accommodate constrained connections would reduce administrative costs and connection times without introducing new or increased risks to the network, and thus preferable to Western Power continuing to seek exemptions on an ad hoc basis,.

64. The Authority considered the proposed amendment would 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, in its Draft Decision the Authority was satisfied that the changes proposed by Western Power to clause 2.5.2.2 of the Technical Rules were in line with chapter 12 and the objectives of the Code as they would allow for the most efficient possible use of the network, and would promote efficient investment in the network. The Authority therefore approved the changes proposed by Western Power to clause 2.5.2.2.

Revised Proposal

65. Western Power did not revise its proposal.

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[17] 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

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

[19] See page 11 http://www.erawa.com.au/cproot/13865/2/2014%20Report%20for%20the%20Minister%20for%20Energy%20(Including%20Appendix%201).PDF

Public Submissions on Draft Decision

66. The submission from Mr Steve Davidson maintains a similar view to his earlier submission (in response to the Authority's Issues Paper). Mr Davidson considers the proposed amendment is overly complex and proposes an alternative wording amendment, which he considers to be more concise, as set out below:

> "involuntary load shedding and involuntary generation runback".

Final Decision

67. The Authority notes further advice from GBA that generator runback cannot be involuntary, as it requires a special protection scheme that can only be installed with the cooperation of the generator owner. GBA also advises that alternative wording could be developed, but it is of the view that Western Power's proposed wording is clear and reasonably concise.[20] Given this advice, and as there were no other submissions on this matter, the Authority maintains its Draft Decision to approve Western Power's proposed amendment.

Weak infeed fault conditions

68. Western Power proposes to make wording changes to the term "weak infeed fault conditions" within the Technical Rules Glossary as outlined in Table 3 below.

Table 3 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*.

69. Clause 2.9.4 in conjunction with Tables 2.10 and 2.11 of the Technical Rules set out maximum fault clearance times, which specify 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.

70. Western Power's proposed amendment established rules for assessing and dealing with weak infeed fault conditions. To achieve this, Western Power included an additional provision to clause 2.9.4 to allow, 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 4 below.

[20] Geoff Brown and Associates, *Response to Comments on Draft Decision on Proposed Amendments to Western Power's Technical Rules*, 20 October 2016.

Table 4 Proposed amendment to Clause 2.9.4

2.9.4 Maximum Total Fault Clearance Times

…

10) 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.

71. Western Power considered 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 is hence inconsistent with the objectives of the Code.

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

73. Western Power also proposed that any cost for additional work, and costs associated with weak infeed fault condition reviews or assessments, would be met by the applicant. Western Power considered that its proposed amendment to clause 2.9.4 and the changes to the Technical Rules Glossary would 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 network.

74. 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.

75. The Authority's technical consultant, GBA, reviewed Western Power's proposed amendments. GBA considered that, as the rules currently stand, there were 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"

76. The options included:

- 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.

77. GBA further advised 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."* GBA considered that the changes proposed by Western

Power would remove the barriers to network connection for small embedded generators, and advised that it sees no reason for the Authority not to approve the proposed amendments.

78. The Authority noted 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.[21]

79. Based on the information provided by Western Power in its submission and the advice from GBA, the Authority considered that the proposed amendments complied with chapter 12 and the objectives of the Code by promoting efficient use of, and investment in, the Western Power electricity network. Accordingly, the Authority approved 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.

Revised Proposal

80. Western Power did not revise its proposal.

Public Submissions on Draft Decision

81. There were no public submissions.

Final Decision

82. As there were no further submissions from Western Power or interested parties, the Authority has maintained its Draft Decision to approve Western Power's proposed amendments to clause 2.9.4 of the Technical Rules and the proposed addition of the term "weak infeed fault conditions" to the Technical Rules Glossary.

[21] Current Exemptions to Clause 2.9.4
- Wagin Substation
- Mumbida Wind Farm

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])