

Geoff Brown & Associates Ltd

**REVIEW OF WESTERN POWER'S APPLICATION
FOR TECHNICAL RULES AMENDMENTS**

Prepared for

ECONOMIC REGULATION AUTHORITY

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Report prepared by: Geoff Brown

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DISCLAIMER

This report has been prepared for the Economic Regulation Authority to assist it in its review of Western Power's applications for amendments to its Technical Rules, which were submitted to the Authority in March and April 2016. Geoff Brown and Associates Ltd accepts no responsibility to any party other than the Authority for the accuracy or completeness of the information or advice provided in this report and does not accept liability to any party if this report is used for other than its stated purpose.

Geoff Brown & Associates Ltd

77 Taylors Rd
Mt Albert
Auckland 1025
New Zealand
www.gbassoc.com

Ph/Fax: 64-9-846 6004
Mob: 64-21-466 693
Email: geoff@gbassoc.com

1. INTRODUCTION

Western Power's Technical Rules (Rules) specify technical requirements for the design and operation of its South West Interconnected Network (SWIN) and the minimum technical standards that a network user's plant and equipment must meet before it can be connected to the network. The Rules are necessary to ensure that the power system (which comprises the dynamic system that generates electricity and delivers it to connected loads) remains in a secure state at all times and also that the connection of a user to the network does not have a detrimental effect on the level of service provided to other network users.

Western Power has prepared the Rules in accordance with Chapter 12 of the Electricity Networks Access Code (Code). Clauses 12.50-12.54 specify the process for amending the Rules and, in essence, require that any amendments to the Rules must be approved by the Economic Regulation Authority (Authority) before they can take effect. Clause 12.54 requires that, if the Authority considers a proposed amendment to be substantial, it must first consult with the public and then approve the proposed amendment only if it considers that the amendment will not have a material adverse effect on Western Power or a network user.

In March 2016 Western Power applied to the Authority to make a number of amendments to Rules¹. In April 2016 it submitted a further application relating to additional proposed amendments². On 2 May 2016, the Authority published two Issues Papers³ as a prelude to a public consultation process that it initiated in accordance with clause 12.54(a) of the Code. As a result of the public consultation, it received three submissions from interested parties, all of which are available on the Authority's website⁴.

We have been engaged by the Authority to provide advice to inform its consideration of whether or not to approve Western Power's proposed amendments and this report documents this advice. Our report takes into account the information provided in Western Power's applications, the submissions received by the Authority as a result of its public consultation process and any responses to these submissions provided by Western Power to the Authority.

¹ *Three phase fault credible contingency*; Western Power (Ref DM# 13508335), 2 March 2016.

User agreed access connections; Western Power (Ref M# 13508328), 2 March 2016

Weak infeed on transmission and distribution protection systems; Western Power (Ref DM# 13504813), 2 March 2016.

² *Submission to the Economic Regulation Authority for amendments to the Technical Rules, 2016 Part B*; Western Power (Ref DM# 130110167), 31 March 2016

³ *Proposed Amendments to the Technical Rules Submitted by Western Power (March 2016), Issues Paper*; Economic Regulation Authority, 2 May 2016.

Proposed Amendments to the Technical Rules Submitted by Western Power (April 2016), Issues Paper; Economic Regulation Authority, 2 May 2016.

⁴ <https://www.erawa.com.au/electricity/electricity-access/western-power-network/technical-rules/technical-rules>.

2. APPROVAL CRITERIA

Clause 12.54(b) of the Code states that the Authority must approve a proposed amendment *only* (our emphasis) if it considers that the amendment will not have a material adverse impact on [Western Power] or a user. In this case Western Power is the applicant, so we have assumed that the proposed amendments will not have a material adverse impact on it, and have not considered this aspect in detail for this report⁵.

Hence, in writing this report we have considered the impacts of Western Power's proposed amendments on its network users. We have looked at these impacts in the context of the objectives of the Rules as specified in clause 12.1 of the Code. These objectives 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.*

Application of criteria (a) and (b) above require a higher degree of judgement and are therefore more subjective than the application of the other two criteria. Furthermore, criterion (b) requires consideration of the economic impact and is therefore particularly relevant to the Authority's consideration of whether or not to approve the proposed amendments. Western Power is a monopoly and its network users do not have the option of choosing an alternative service provider. The constraints that the Code places on how Western Power can develop and amend the Rules, including the requirement for public consultation and the approval of an economic regulator before any changes can take effect, appear to be designed to limit the extent to which Western Power can use its monopoly power.

In undertaking this review, we have considered each amendment proposed by Western Power in the following context:

- What is the impact of the amendment on users?
- Why is the amendment necessary and are the benefits of the amendment greater than, or commensurate with, any adverse impact on users? We have taken the view that it is up to Western Power to describe and justify the benefits of any amendments it proposes. Our role is to critically review this information, and also information included in any public submissions, and to advise the Authority whether we think sufficient information has been provided to justify a Rules amendment. It does not extend to making an independent assessment of a proposed amendment if doing so requires reliance on information not provided to us in the application or the public submissions. It follows that it is open to the Authority to decline to approve an amendment because the benefits have not been justified, which is not to say that the amendments could not be justified if additional information not provided by the applicant was also taken into account.
- We have also considered whether the benefits could be achieved more cost effectively than implied by the proposed amendment. This assessment is regardless of where the cost falls – in our view an inappropriate barrier to entry is created if the costs imposed on users are materially greater than the costs that Western Power would incur to achieve the same outcome.

⁵ Clause 12.50 of the Code provides for an application for a technical Rules amendment by the Chairman of the Technical Rules Committee or the service provider of an interconnected network. In such a situation, the impact of a proposed amendment on Western Power would need to be considered.

Finally, we have looked at the wording of the amendments proposed by Western Power and suggested alternative wording where we considered it appropriate to increase clarity and conciseness, or to reduce ambiguity.

3. PROPOSED AMENDMENTS – MARCH 2016

3.1 THREE PHASE FAULT CREDIBLE CONTINGENCY

3.1.1 Description of Proposed Amendment

The definition of what is 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. In defining a credible contingency event, a balance must therefore be found between the following considerations:

- If the definition is overly stringent, more redundancy must be built into the network design at a cost to consumers;
- If the definition is not sufficiently stringent, the cost to consumers will be lower but the network will be less robust; voltage and frequency will be subject to greater fluctuation and supply interruptions will be more common.

Traditionally in power system design, a credible contingency involves the loss of a single transmission element or the largest generator connected to the network. A power system is expected to ride through such a contingency without loss of load. Some deviation of voltage and frequency outside of the normal operating band is generally considered acceptable but power system standards, which may differ across jurisdictions, limit the magnitude and duration of these excursions.

If a more severe event (or non-credible contingency) arises, the power system voltage and frequency are permitted to deviate further from the normal range. In more extreme situations, load may be shed automatically, in order to assist the power system recover stability and prevent a complete system blackout.

Events that the South Western Interconnected System (SWIS) must be designed to withstand are specified in the definition of “credible contingency” in the glossary of the Rules. Currently these include (together with other events such as the loss of generation or single phase faults):

- (a) a three phase to earth fault cleared by the disconnection of the faulted component, with the fastest main protection scheme out of service ...*

Western Power is proposing to change this component of the definition to:

- (a) for voltages below 66kV, a three phase to earth fault cleared by the 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....*

No change is proposed to the description of the other potential events that constitute a credible contingency.

The intent is that, for the transmission system, the outage of a single transmission line will, in general, no longer be treated as a credible contingency if the outage is caused by a three phase fault. The rationale for the proposed change is that transmission system three phase faults are rare events. However, these faults are usually more disruptive to system stability than the more frequent single phase faults or loss of generation and therefore are often the limiting factor in designing the network. If three phase faults are not considered to be a credible contingency, Western Power will be able to increase the allowed maximum power transfer through many of its existing transmission assets. Over

time, this will reduce the need to augment the existing network, reducing the cost to network users, without any significant negative impact on overall network reliability.

Western Power also submits that this change will bring it into line with the approach taken in the National Electricity Rules (NER).

3.1.2 References to Credible Contingencies in the Rules

The main requirement of the Rules that would be affected by this change is clause 2.3.7.1, which specifies how Western Power must plan design and construct its network to ensure that short term system security is maintained. This requires Western Power to simulate the dynamic performance of the network under a range of credible load and generation scenarios for each of the different categories of credible contingencies and be satisfied that the power system will meet all specified stability criteria under the most critical scenario simulated. This may require it to specify maximum power transfer limits below the thermal capacity of the equipment as specified by the manufacturer to some transmission elements.

Very often the most critical scenario is a three phase transmission fault. In such situations, if there was no requirement to simulate such a fault because it was not considered a credible contingency, it could be possible to increase the power transfer limit specified for particular lines. This would defer the need to augment this part of the network as the peak load increased.

3.1.3 Frequency Excursions

An allied requirement is the need to limit frequency excursions following a contingency event to within the relevant frequency envelope specified in Table 2.1 of the Rules. Unfortunately, Table 2.1 uses the terms *single contingency event* and *multiple contingency event*, notwithstanding the reference to the most severe *credible contingency event* in clause 2.2.1(d). On the other hand, clause 2.2.1(f) reverts to the term *multiple contingency event*.

As a three phase fault is also a single contingency event, there appears to be a need to harmonise the wording of clause 2.2.1, including Table 2.1, with the concept of a credible contingency if Western Power's proposed change is to have any practical effect.

3.1.4 National Electricity Rules

Clause 4.2.3(b) of the NER defines a credible contingency event as follows:

*A **credible contingency event** means a contingency event the occurrence of which [the Australian Electricity Market Operator] AEMO considers to be reasonably possible in the surrounding circumstances including the technical envelope. Without limitation, examples of credible contingency events are likely to include:*

- (1) the unexpected automatic or manual disconnection of, or the unplanned reduction in capacity of, one operating generating unit; or*
- (2) the unexpected disconnection of one major item of transmission plant (e.g. transmission line, transformer or reactive plant) **other than as a result of a three phase electrical fault anywhere on the power system** (our emphasis).*

Further, Clause 4.23(e) of the NER explicitly states that a three phase fault on the [transmission] system is considered to be a non-credible contingency event. Clause 4.2.3A of the NER authorises AEMO to temporarily declare a non-credible contingency event a credible contingency when abnormal conditions such as severe weather,

lightning, storms or bush fires pose an added risk to the power system. The effect of such a declaration is to require the power system to be managed more conservatively than would normally be the case.

There is also a requirement in clause 4.3.2A(i) for AEMO to publish a six monthly report setting out its reasons for reclassifying a non-credible contingency event as a credible contingency. This indicates a requirement for a high level of transparency and accountability.

3.1.5 Public Submissions

The only submission to the Authority on the proposed change was from Steve Davidson of Cooling Towers WA. Mr Davidson opposed the change for the following main reasons:

- The application contains insufficient information to justify the case for the proposed change and, in particular, provides no evidence to show that the proposed change will result in improved efficiency of investment in Western Power's infrastructure;
- If the proposed change is implemented, safety margins would be reduced below an acceptable level;
- Each power system is unique and has a unique history. Therefore, it cannot be assumed that the NER represent best practice in Western Australia or that Western Power's technical requirements should be aligned with the requirements for networks in the eastern states; and
- The computer models used by Western Power in its simulations are less accurate and fault clearance times are generally longer than is the case in the eastern states. While not explicitly stated, Mr Davidson appears to be arguing that this should drive a cautious approach to setting stability margins

We offer the following comments on the points made by Mr Davidson:

- If power transfer limits are allowed to move closer to the thermal capability of the relevant assets, it follows that, over time, costs to network users will be lower than they would otherwise have been because any need to augment the network to cater for increased load will be deferred. The issue is whether this change will lead to an unacceptable deterioration in power system reliability. The key factor here is the frequency with which three phase faults occur on the transmission network. Western Power's application suggests that such faults are rare, but it would have been helpful if the application had included an historical analysis of past faults so stakeholders could make their own assessment. Nevertheless, we accept Western Power's assurance on this point, given that Mr Davidson is the only stakeholder to have suggested otherwise and that there is nothing in his submission to support his assertion. Had the frequency of three phase faults been a concern, we would have expected other stakeholders to raise the issue.
- We do not consider safety to be a relevant issue. The change will have no impact on the frequency of three phase or on the time taken to clear these faults. It will adversely impact stability margins rather than safety margins.
- We acknowledge the differences between the SWIN and the interconnected network supporting the NEM. These differences are reflected in the differing system standards, where the Rules already permit greater fluctuations in voltage and frequency following any contingency event than is generally permitted in the eastern states. The key impact of the proposed change is that, following a three phase fault, the excursion limits applicable to non-credible contingencies will apply, rather than the tighter limits applicable to credible contingencies. If three phase faults are infrequent, we do not see this as a significant issue.

- We have been assisting the Authority review the Rules for almost ten years and do not share Mr Davidson's concerns regarding the validity of Western Power's computer modelling. If anything, we consider that Western Power's modelling tends to be conservative, although this should not be interpreted as a criticism. Mr Davidson's submission notes that three stability safety margins, transient voltage dip (TVD), transient voltage recovery (TVR) and 180° rotor angle stability criterion, were removed from the Rules in 2007 as over-conservative. We are not aware of any adverse impact as a result of these changes and suggest that the current proposal is intended to remove another overly conservative requirement.
- Based on our previous interactions with Western Power, we are satisfied that the power transfer limit on the Goldfields interconnector takes due account of both voltage and frequency stability margins.

3.1.6 Wording

As noted in Section 3.1.1, Western Power is proposing that the following wording be used.

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) ...

We assume that the proposed wording is intended to allow Western Power to decide whether it is appropriate to model a two phase or a three phase fault on a particular part of the network. However, the criteria on which this decision must be based (*consistent with good industry practice and based on modes of operation*) is extremely vague, and there is no requirement for Western Power to be transparent, or accountable to network users for the decisions that it makes. In the extreme, a conservative interpretation of this wording by Western Power would result in no meaningful change from the existing situation.

This contrasts with the NER, where the AEMO is required to publish the detailed criteria that it will apply when making similar decisions, and also to publish regular reports setting out the reasons for each decision. While Western Power's proposed change is intended to better align the Rules with the NER, it lacks the transparency of the NER and is worded in such a way that will provide stakeholders with no visibility as to the extent to which the intended outcome is achieved.

We think the intention of Western Power's proposed change (as we understand it) will be better reflected in the Rules if:

- the definition of a credible contingency is worded to exclude a three phase fault;
- there is a provision in the Rules for Western Power to assess the stability of the network by including a specified non-credible contingency (such a three phase to earth fault) in its modelled simulations, in situations where it considers a more conservative approach is warranted; and
- should Western Power decide to include a non-credible contingency event in its simulations, it be required to publish on its website a report stating:
 - the part of the transmission system affected;
 - the reasons for this decision;
 - the non-credible contingency modelled; and
 - the impact on power transfer capacity or other network operation criteria.

The proposed wording changes shown in Section 3.1.7 below addresses these concerns.

3.1.7 Conclusions

We think the Authority should approve in principle the changes proposed by Western Power, subject to wording changes to improve the consistency of the Rules and address the concerns raised in this report.

Our proposed changes are indicated below, where a strikethrough indicates a deletion and an underline indicates an insertion.

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.

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....

Glossary Definition of Single Contingency Event

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

3.2 USER AGREED ACCESS CONNECTIONS

3.2.1 Description of Proposed Amendment

Clause 2.5.2.2(b) of the Rules currently reads:

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.

Western Power is proposing to modify this clause to read:

For sub-networks designed to the N-1 criterion, 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 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).*

3.2.2 Rationale

The SWIN is intended to be an unconstrained access network where, under normal operating conditions, all connected users are guaranteed sufficient power transfer capacity at all times to accommodate their contracted maximum demand. Historically, if insufficient power transfer capacity is available to permit unconstrained access, a user has not been able to connect until the network is upgraded to provide the required additional capacity. This has been a barrier to connection for many new network users, who have considered it uneconomic to pay the capital contribution that Western Power has required to fund the necessary network upgrade.

In recent times a number of new network users have overcome this impediment by agreeing to a constrained access connection, whereby they have been allowed to connect provided they agree to, and pay for, the installation of a voluntary load shedding or generation run back scheme, which allows the system operator to automatically shed their load or reduce their generation output to ensure that sufficient power transfer capacity is available to meet the needs of users entitled to unconstrained access. Inclusion of the proposed amendment in the Technical Rules will allow Western Power to negotiate and agree to constrained access connections without the need to seek an exemption from the Technical Rules for each case.

3.2.3 Public Submissions

There was one public submission to the proposal, also from Mr Davidson. He submitted that:

- The proposed change was overly complex and the insertion of the word “involuntary” into the existing wording would suffice, presumably because clause 3.1(b) can be interpreted as already allowing the installation of constrained access connections. We assume that Mr Davidson’s preferred wording would be (with the inserted word underlined):

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 involuntary load shedding avoided at any load level and for any generation schedule following an outage of any single transmission element.

- Mr Davidson is concerned to lower the cost of electricity to small users. He submits that this can be viewed as finding a fair trade-off between the “causer pays” and “all users pay”. His concern is that when a large user and the network service provider are faced with two equal technical solutions, parties could agree that the network service provider owns the new assets so “all users pay”.

We agree with Mr Davidson that clause 3.1(b) can be interpreted as already allowing the installation of constrained access connections. However, in its submission Western Power noted that 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. We agree with Western Power that its proposed wording removes any potential inconsistency between the two clauses.

In respect of costs, the key issue is not who owns the assets but who pays for them. Western Power's application is explicit on this point – 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 attraction for this user is that the cost of a generation runback or load shedding scheme is generally much less than the cost of the network augmentation that would be needed to provide unconstrained access, so the required capital contribution is correspondingly lower.

Once the connection is in place, Western Power will earn revenue for the services provided to the new user. As it is subject to a revenue cap set by the Authority, this additional revenue will need to be offset by a reduction in the revenue received from other network users, so their costs will reduce.

3.2.4 Conclusion

Permitting the connection of users prepared to accept a constrained access arrangement will reduce the barriers to connecting to the network and is therefore consistent with the objectives of the Access Code. We see no downside for existing users as their right to unconstrained network access is preserved and their costs of using the network will not increase.

The Authority has already received a number of applications from Western Power for an exemption from the Technical Rules to allow the connection of users under an agreed constrained access arrangement. All these applications have been approved after due consideration, including a process of public consultation. As far as we are aware, no issues have arisen after the users have connected.

We are satisfied with the clarity of the wording proposed by Western Power and see no reason why the proposed change should not be approved.

3.3 WEAK INFEED ON TRANSMISSION AND DISTRIBUTION PROTECTION SYSTEMS

3.3.1 Description of Proposed Amendment

Western Power is proposing to add the following subclause to clause 2.9.4, which specifies the maximum fault clearance permitted on the network.

- (j) *Notwithstanding any other provision contained in this Rule 2.9.4, for weak infeed fault conditions resulting from the connection of embedded generating units the total fault clearing 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 the transmission or distribution system and to meet power system stability requirements.*

This is also proposed to add the following definition of *weak infeed fault conditions* to the glossary:

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

3.3.2 Rationale

The change is intended to make it easier for small embedded generators to connect to the distribution network. The fault infeed from these generators into a fault on the transmission system can be so small 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. As the Rules currently stand, in such situations the only currently alternatives available to Western Power are to:

- decline to connect the generator;
- upgrade the existing transmission system protection, funded by a capital contribution from the generator wanting to connect. 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; or
- seek an exemption from the Rules.

Western Power's proposed change would allow it to agree to such connections without the need to seek and exemption from the Rules for every new connection.

3.3.3 Public Consultation

There were no submissions on this issue following the Authority's public consultation process.

3.3.4 Comment and Conclusion

The Authority has already granted an exemption from the Technical Rules to permit Western Power to connect an 885kVA generator to the distribution network supplied from Wagin substation. Achieving the specified transmission network clearing times with this generator connected would have required a major upgrade up the Wagin substation including the installation of new high voltage circuit breakers. This could not be justified economically. In reviewing this exemption application, the Authority consulted the Office of Energy Safety, which agreed that the longer transmission network clearing times did not pose a safety risk and that there was no basis for upgrading the substation if the generator was connected.

The existing Rule requirement can be a major barrier to connecting to the network, for which there is little technical justification. Removing this impediment would be consistent with the objectives of the Access Code. We have no issues with the wording proposed by Western Power and see no reason for the Authority not to approve Western Power's proposed amendment.

4. PROPOSED AMENDMENTS – APRIL 2016

4.1 NORMAL CYCLIC RATING AMENDMENT

4.1.1 Description of Proposed Amendment

Clause 2.5.4(b) of the Rules currently reads:

Normal Cyclic Rating (NCR) Criterion

- (1) *The NCR risk criterion permits the loss of a portion of power transfer capacity at a substation following the unplanned loss of a supply transformer within that substation.*
- (2) *The portion of the power transfer capacity that may be lost is the lesser of:*
 - (A) *75% of the power transfer capacity of the smallest supply transformer within the substation; and*
 - (B) *90% of the power transfer capacity of the rapid response spare supply transformer.*

Western Power is not proposing any change to subclause (1), but is proposing that subclause (2) be amended to read:

- (2) *The maximum power transfer at an NCR substation is 75% of the power transfer capacity of the substation, except that the total power transfer capacity lost shall not exceed 90% of the power transfer capacity of the rapid response spare supply transformer.*

4.1.2 Public Submissions

The only public submission was from Mr Davidson, who submitted a comparison between his interpretation of the current NCR and the NCR that would apply if Western Power's proposed amendment is approved by the Authority.

We have not analysed Mr Davidson's submission in this report and do not agree with his interpretation of the "NCR now". The intent of the proposed change is to clarify the existing requirement, rather than to change it as suggested by Mr Davidson.

That said, Mr Davidson's submission has been very useful because it has highlighted the fact that the wording proposed by Western Power does not accurately reflect the intent of the proposed change. This is largely because a loss of power transfer capacity is not the same as unmet consumer power transfer demand. The proposed wording refers to the *total power transfer capacity lost* on the loss of a transformer – this will always be the equal to the rating of the transformer that is lost, irrespective of whether the N-0, N-1 or NCR rule is applied.

4.1.3 Analysis

The table below shows how we understand the NCR criterion is applied. Like Mr Davidson, we have assumed all transformers are rated at 33MVA, Western Power's standard zone substation transformer size.

	Calculation	No of Transformers		
		2	3	4
No of transformers	N	2	3	4
Maximum power transfer capacity (MVA)	Nx33	66	99	132
N-1 capacity (MVA) – (N-1) x33	(N-1) x 33	33	66	99
NCR capacity (MVA)	N x 33 x 0.75	49.5	74.3	99
Maximum unmet power transfer demand (MVA)	((N x 0.75) – (N-1)) x 33	16.5	8.3	-

In reviewing the above analysis, the following points are noted.

- The NCR criterion only applies to substations with more than one transformer. For a single (N-0) substation, the unmet demand following the loss of the transformer will be the total load on the substation;
- The NCR rating of a substation is 75% of the total transformer capacity of the substation with all transformers in service;
- The maximum unmet power transfer demand is the difference between the NCR rating of a substation and the N-1 transformer capacity. This unmet demand would only arise in practice if the actual power transfer through the substation was equal to the NCR rating. The actual power transfer varies over time and generally the actual unmet demand would be lower than this, both because of the cyclical nature of demand and also because the peak demand at most substations is lower than the substation rating;
- If a substation loaded to its NCR rating has four or more transformers of equal capacity, there will be no unmet demand on the loss of one transformer as the NCR rating is equal to, or less than, the N-1 rating. This may not be the case if the transformers are of unequal capacity, as the loss of the largest transformer will have the greatest effect.

4.1.4 Conclusion

We do not think the wording proposed by Western Power accurately specifies the NCR planning criterion and suggest the wording below. This wording takes into account the definition of the term *supply* in the Electricity Industry Act 2004, as discussed in Section 4.2.3 above.

Normal Cyclic Rating (NCR) Criterion

- (1) *The NCR risk criterion permits a limited amount of unmet demand for power transfer capacity following the unplanned loss of a supply transformer within a substation.*
- (2) *The maximum power transfer through a substation subject to the NCR risk criterion must be the lesser of:*
 - (A) *75% of the total power transfer capacity of the substation, with all supply transformers in service; or*
 - (B) *the power transfer for which the maximum unmet demand for power transfer capacity following the loss of the largest supply transformer in the substation is equal to 90% of the power transfer capacity of the rapid response spare supply transformer.*

We also suggest that the term *load shedding* in the second paragraph of the clause 2.5.4 explanatory box be replaced by the term *unmet demand* to reflect the fact that the power transfer capacity may be required for either supply from generators or supply to loads.

4.2 UPDATE FOR ELECTRICITY (NETWORK SAFETY) REGULATIONS 2015

Clauses 2.5.8(b), 2.7 and 3.4.6(a) of the Rules all reference the Electricity (Supply Standards and System Safety) Regulations 2001, which have now been superseded by the Electricity (Network Safety) Regulations 2015.

Western Power is proposing to update the reference in all three clauses. We agree with this proposal.

4.3 TYPOGRAPHICAL CORRECTIONS

4.3.1 Correction to Cross Reference in Clause 4.2.1(b)

Western Power is proposing to change this cross reference from *clause 4.1.1(a)* to *clause 4.2.1(a)*. This corrects an incorrect cross reference.

4.3.2 Typographical Corrections

Western Power is proposing to correct the spelling of the word *Distribution* in the title of Section 5. It is currently spelt *Distirbution*.

4.3.3 Dates of Standards and Regulations

Western Power is proposing to add definitions for the following terms to the glossary:

- *Australian Standard (AS) and Australian/New Zealand Standard (AS/NZS)*
- *IEC, EN*
- *Regulations, sets of regulation.*

The objective of the proposed change is to make it clear that the latest edition of the referenced standard or regulation within the standard will apply. For example, the proposed definition of *Australian Standard (AS) and Australian/New Zealand Standard (AS/NZS)* reads:

Unless otherwise stated, the latest version, as published and amended from time to time, of referenced International and Australian Standard and/or Australian/New Zealand Standard applies. Where a date reference is supplied this is to indicate the version of the Standard to which specific (content/location within the text) references are made.

While we agree with what Western Power is trying to achieve, we have misgivings about the proposed approach and whether the use of the glossary in this way would meet standard legal drafting requirements. We also note that the proposal does not appear to have the degree of legal precision that Western Power has tried to achieve in its other proposed amendments. These comments are based on the following observations:

- There is already a definition of *Australian Standard (AS)* in the glossary but this is not noted or referred to in Western Power's proposal.
- Our search of the Rules did not find any dated references to IEC standards.
- Our search of the Rules did not find a single reference to an EN standard.
- It is not always correct to say that *where a date reference is supplied this is to indicate the version of the Standard to which specific (content/location within the text) references are made*. For example, see clause 2.9.1(c). There appears to be a degree of randomness about whether or not some standards referenced in the body of the Rules are dated;

- It is standard legal practice for terms defined in the glossary to be italicised in the body of the Rules. In the current Rules, existing references to standards are generally not italicised and Western Power has not proposed to change this.
- Unlike standards, regulations are legally enforceable and always override the Rules. Also we think that, like legal Acts, the date in the title of regulations does not change even if the regulations are subsequently amended.

Our preference would be for Western Power to systematically work through the Rules and remove all inappropriate dates from the referenced standards, which are all identified in Section 3.2 of our report on Western Power's November 2015 Rules amendment application⁶. We do not think this would be an onerous task and we do not think that it should be necessary for the Authority to approve these changes on an individual clause by clause basis – a global approval should suffice. If this approach is taken, there should be no need for the proposed defined terms in the glossary and the definition of *Australian Standard (AS)* could be removed, as the meaning of references to standards and regulations is commonly known.

If Western Power wishes retain some dated Standards references and to include a clarification regarding the use of dates in these references, then we think it would be more consistent with standard legal drafting practice to include this clarification in Section 1, perhaps as clause 1.10 *References to Standards and Regulations*. This would avoid the need to italicise every reference. However, irrespective of whether Section 1 or the glossary is used, we see a need to systematically ensure that each Standard reference is appropriately dated or otherwise.

⁶ *Review of Western Power's Application for Technical Rules Amendments*; Geoff Brown & Associates Ltd, 30 April 2016.