Byford PV solar farm (3 x 9.9 MW) connections:

Submission for exemption from compliance with clause 2.5.2.2 (N-1 criterion) of the Technical Rules.

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safe reliable efficient

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Glossary

Acronym / term	Meaning
Authority	Economic Regulation Authority
AQP	Applications and Queuing Policy
CAG	Competing Applications Group
DSOC	Declared Sent Out Capacity
ERA	Economic Regulation Authority
MVA	Apparent power
MW	Real power
NCT	Network constraint tool
PV	photovoltaic
RIS	Require in service
SWIN	Southwest Interconnected Network
WPN	Western Power network

Executive Summary

This submission requests that the Economic Regulation Authority (ERA) grant Western Power an exemption from complying with clause 2.5.2.2 (N-1 criterion) of the Technical Rules with respect to the connection of the Byford solar farm (3 x 9.9 MW Declared Sent Out Capacity (DSOC) for a total of 29.7 MW DSOC). The exemption requested is temporary, and would cease when the Southern Country Competing Access Group (CAG-81) is operational.

The Byford PV solar farm is located to the west of the existing Western Power Byford substation. The proposal is to connect the PV solar farm over an approximate distance of 8 km to Byford Substation, via three 22 kV shared feeders.

In balancing WestGen Pty Ltd's (the Applicant) requirements with current network considerations, Western Power has arrived at a non-reference service under which the customer has agreed that their ability to export electricity will be constrained under certain network conditions via a post-contingent runback scheme. This will enable Byford Solar Farm to connect and operate without the need for significant network augmentation, and prevent contingent (N-1) overloading in the network.

The Applicant has requested the proposed connection arrangement and accepts the associated operational constraints imposed by the runback scheme through the attached letter of support.

Western Power considers that the proposed connection arrangement permits the Applicant to obtain a covered service to the extent reasonably practicable in accordance with good electricity practice while efficiently minimising any cost associated with network augmentation.

Western Power assesses the suitability for bespoke runback schemes on a case by case basis based on a specific criteria and the location on the Network. Western Power studies have shown that this proposed connection arrangement has no adverse impact on the existing level of safety and reliability to other network users.

In summary, Western Power therefore considers the advantages of operating with the exemption sought outweigh the disadvantages of requiring full compliance in this case.

1 Introduction

WestGen Pty Ltd has submitted three individual connection applications for connection of their 3 x 9.9 MW Byford solar photovoltaic (PV) farms to Western Power's South West Interconnected Network (SWIN). Each 9.9 MW PV solar farm is to be connected to the 22 kV Byford substation bus.

The proposed location is on Rice Road approximately 8 km from Western Power's Byford substation and the connection details are as shown in table 1, with the full solar farm connection being made up of three component sub systems.

Table 1 Point of connection details

Point(s) of connection	Byford Solar Farm connections 1, 2 and 3
Nominal voltage	22 kV
DSOC	29.7 MW (3 x 9.9 MW)

It is noted this Applicant is also a participant in the *Competing Applications Group (CAG) No. 81: South Country Generation* and the runback solution recommended as part of this submission is an interim solution until the proposed CAG solution involving implementation of a network constraint tool (NCT[1]) is available. Accordingly, the exemption requested is temporary, and would cease when the Southern Country Competing Access Group (CAG-81) is operational.

1.1 Network constraints for this connection

Western Power's studies have identified the following network constraints which need to be addressed to enable the connection of Byford PV solar farm:

- single phase fault levels at Kwinana and Southern Terminal 132 kV bus sections exceed 95% equipment rating limit stipulated in the Technical Rules[2];
- N-1 contingencies result in thermal overloading of several 132 kV circuits in the Mandurah Load Area;

Mindful of these constraints, internal studies have recommended that Western Power progress with the connection of each of the solar farms to 22 kV shared feeders with a post-contingent runback scheme monitoring the following 132 kV transmission lines:

- Pinjarra – Alcoa Pinjarra (PNJ – APJ 81) Transmission Line;
- Pinjarra – Cannington/Meadow Springs (PNJ – CT/MSS 81) Transmission Line;
- Pinjarra – Mandurah (PNJ – MH 81) Transmission Line

Under the proposed runback scheme, the generation output will be runback (reduced) as required to prevent a pre-contingent overloading as well as a contingent (N-1) overloading in the

[1] The network constraint tool (NCT) is a supervisory tool designed to automatically runback generation prior to a potential fault (known as pre-contingent) to ensure that the network remains in a satisfactory state should that fault occur.

[2] Western Power intends to resolve this issue by June 2016. We will submit a temporary Technical Rules exemption as this clause 2.5.7 applies for these works early in 2015. However, it is noted that the contribution by the proposed Byford solar PV farm is very small (calculated increase is in the order of 5 decimal places).

network. The proposed runback does not require co-ordination with any other runback schemes at present.

The proposed connection arrangements require a temporary exemption from the relevant clause of the Technical Rules, as explained in the section 2. The exemption will apply until such time as the CAG No.81 solution is implemented. Western Power is developing a longer-term solution (the NCT) to overcome the constraint issue posed by the volume and location of new entrant generation in various locations across the network.

1.2 Impacts on other Network users

In previous correspondence with the ERA[2], Western Power has stated that additional independent bespoke runback and load curtailment systems may be possible in some locations, providing these systems:

- do not compromise the management of system security
- can be coordinated to ensure appropriate non-discrimination of customers consistent with their connection agreements
- do not degrade the operability of the network to an unacceptable state
- do not violate market objectives or good industry practice

Western Power studies show that the location of the Byford PV Solar Farm in the South Country and the nature of the proposed runback scheme will meet the above requirements.

Other members of *Competing Applications Group (CAG) No. 81: South Country Generation* would not be impacted by the Byford PV Solar Farm connection. The current timelines for connection of other members of *Competing Applications Group (CAG) No. 81: South Country Generation* extends beyond the expected development of the NCT solution. As such, Western Power expects similar requests to be unlikely.

If another member of the CAG No. 81 seeks a similar interim arrangement, Western Power would assess their suitability on a case by case basis and potentially offer similar arrangements, subject to the same criteria, if the customer chose to connect earlier. However, regardless of the interim arrangement, all members of the CAG No. 81 will transition or connect using the proposed NCT solution once implemented.

As this interim solution has been requested by the Applicant, the solution will be funded by the customer contribution. Development of the NCT by Western Power will be funded by relevant applicants in accordance with Western Power's Contributions Policy.

2 Technical Rules requirements

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

[2] See DM#11849505 for ERA presentation on 27 March 2014

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.

3 Exemption Justification

3.1 Service Standards in consultation with WestGen Pty Ltd

This connection application has progressed in accordance with the Application and Queuing Policy (AQP), which involves extensive consultation with the Applicant to develop the solution. Based on efficiently balancing the Applicant's requirements and current network considerations, Western Power has proposed a non-reference service under which the customer has agreed that their ability to export electricity will be constrained via a post-contingent runback scheme under certain network conditions. This will enable Byford Solar Farm to connect and operate without the need for significant network augmentation, and prevent contingent (N-1) overloading in the network.

Following consultation with WestGen Pty Ltd, it was confirmed that constraining the connection as is proposed was preferable to any other option, subject to Western Power gaining a Technical Rules exemption. WestGen Pty Ltd has accepted the proposed service standard and understands and acknowledges the potential financial impact from the constrained connection.

WestGen Pty Ltd has provided a letter confirming its understanding of the nature of the proposed connection arrangement, the necessary runback scheme, and the impact on the solar farm operations. This letter further supports Western Power's submission and acknowledges the extensive consultation that has taken place. The letter is attached as Attachment 1.

3.2 Impact on other network users

Western Power's assessment of the proposed connection arrangement shows no adverse impact on the existing level of safety and reliability to the other network users.

3.3 Advantages for granting this Exemption

Advantages

Western Power considers the following grounds as reasonable and prudent to granting the Technical Rules exemption request:

- Western Power's assessment of the proposed connection arrangement shows no adverse impact on the existing level of safety and reliability to the other network users;
- Western Power considers that the proposed connection arrangement permits the Applicant to obtain a covered service to the extent reasonably practicable in accordance with good electricity practice while efficiently minimising any cost associated with network augmentation.
- The Applicant has agreed to the proposed connection arrangement, necessary runback scheme and associated minor potential impacts on solar farm operations;

- Granting the exemption request will enable the Byford PV solar farm to become operational in the shortest possible time frame in accordance with the customer's connection application and proposed operational time lines;

- The proposed connection arrangement provides for the connection to remain compatible with the *Competing Applications Group (CAG) No. 81: South Country Generation* solution, but is capable of operating acceptably as a standalone solution until this becomes operational;

- The request is in accord with a general view expressed by Geoff Brown & Associates Ltd in their review of the previous Nilgen wind farm Technical Rules exemption request for the applicable clause, dated 7 January 2013:

  > *"it may not be appropriate to apply clause 2.5.2.2 of Western Power's Technical Rules to generator points of connection and this clause should not be used as a basis for preventing a generator connecting to the network subject to operating constraints..." (page 4)*

In summary, Western Power therefore considers the advantages of operating with the exemption sought outweigh the disadvantages of requiring full compliance in this case.

4 Statement of Technical Rules exemption

Under section 12.40 of the Electricity Networks Access Code 2004, Western Power as the Service Provider for the Western Power Covered Network hereby applies to the Authority for exemption from a specific requirement of the Technical Rules, as follows:

> "Western Power is exempted from complying with the requirements of Clause 2.5.2.2 of the Technical Rules with respect to the connection of the Byford PV solar farm (3 x 9.9 MW Declared Sent Out Capacity (DSOC) for a total of 29.7 MW DSOC). The exemption will enable Western Power to provide a constrained connection. The generation output will be runback (reduced) as required to prevent a pre-contingent overloading as well as a contingent (N-1) overloading in the network.
>
> The exemption will apply until the Southern Country Competing Access Group (CAG) No. 81 is operational, or until it is otherwise varied or revoked in accordance with the provisions of the Electricity Networks Access Code 2004[3]".

[3] Access Code cl 12.43(c) provides for exemptions granted under section 12.41 to be varied or revoked by the service provider after reasonable notice to the user.

5 Addendum (18-Dec-2014)

This revised submission "18th December, 2014" addresses three questions raised (for tracking changes, new text is coloured blue, and ~~removed text is formatted with strikethrough~~).

1. Clarification for Technical Rules clause 2.5.7 constraint:

Footnote 2 added, page 5: "Western Power intends to resolve this issue by June 2016. We will submit a temporary Technical Rules exemption for clause 2.5.7 as it applies for these works early in 2015. However, it is noted that the contribution by the proposed Byford solar PV farm is very small (calculated increase is in the order of 5 decimal places)."

2. Timing:

Remove the date from the period of the exemption, to be amended to read:

"The exemption will apply until the Southern Country Competing Access Group (CAG-81) is operational or until it is otherwise revoked in accordance with the provisions of the Electricity Networks Access Code 2004".

Replace words, para 1, p 4, and para 3, page 5:

The exemption requested is temporary, and would cease when the Southern Country Competing Access Group (CAG-81) is operational. ~~at either the establishment of the network constraint tool (NCT) for the *Competing Applications Group (CAG) No. 81: South country generation* or 1 November 2018, whichever comes first~~.

Added footnote page 8 to clarify exemption variation or revocation details from Access Code:

Access Code cl. 12.43 refers to exemption variation or revocation as may apply at some time if circumstances change.

3. NCT definition:

Footnote 1 added, page 5: "The Network Constraint Tool (NCT) is a supervisory tool designed to automatically runback generation prior to a potential fault (known as pre-contingent) to ensure that the network remains in a satisfactory state should that fault occur."

Attachment 1: WestGen Pty Ltd letter of acknowledgement

Mr Paul Italiano
Chief Executive Officer
Western Power
363 Wellington Street
Perth WA 6000

24th September 2014

Dear Mr Italiano

Western Power submission for Byford Solar Farm Technical Rules exemption

WestGen is a WA based renewable energy development company. WestGen is developing 3 x 9.9 MW solar PV farms that will be constructed approximately 8 km to the west of the Western Power Byford substation. Each solar PV farm will be connected to the Byford substation via a 22kV cable that will be designed, installed and owned by Western Power.

WestGen has invested significant resources over several years progressing options for the Byford Solar Farm to connect to the Western Power network. Western Power and WestGen have studied a number of alternatives to allow the project to connect to the network with an acceptable level of reliability. The option recommended by Western Power is the only alternative that provides an appropriate balance between connection reliability and cost to the projects.

The implementation of a constrained connection and the operation of a runback scheme is supported by WestGen as a requirement of the network connection. We believe the level of reliability and energy at risk anticipated under the runback scheme to be acceptable and support Western Power's conclusion that this connection arrangement minimizes the cost for marginal improvement of reliability.

Please do not hesitate to contact me on (08) 9322 5406 should you wish to discuss.

Yours sincerely,

Kyle Jackson

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Attachment 2: Byford solar farm connection arrangement

Current network

The network interconnections for Western Power's Byford substation are shown in Figure 1.

Byford Substation is connected to the rest of the SWIN by the following lines:

- a 132 kV transmission line from Byford to Cockburn Cement (BYF-CC 81); and
- a 132 kV transmission line teed between Southern River, Southern Terminal and Byford Substations (SNR-ST/BYF 81).

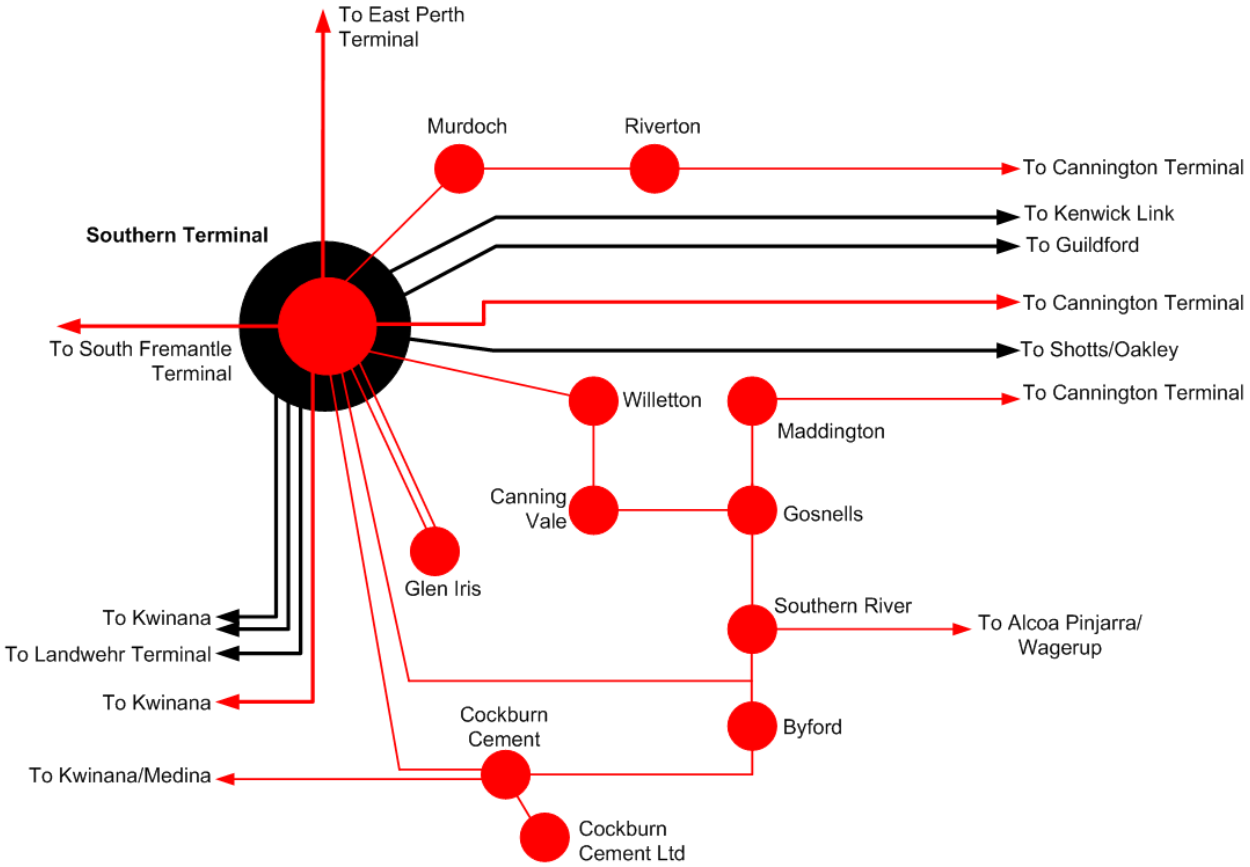

Figure 1: Network at Southern Terminal

Byford Substation has three 132/22 kV transformers with a total installed NCR transformer capacity of 76.9 MVA.