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REVIEW OF WESTERN POWER'S APPLICATION FOR A TECHNICAL RULES EXEMPTION FOR GERALDTON PORT AUTHORITY NETWORK CONNECTION

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This report has been prepared for the Economic Regulation Authority to assist it in its review of Western Power's application for an exemption to its technical rules to allow the Geraldton Port Authority to increase its contracted maximum demand. 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.

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1. BACKGROUND

The Geraldton Port Authority (GPA) has submitted an application to Western Power to increase its contracted maximum demand by 11.65 MVA (from 7.35 MVA to 19 MVA) in December 2012. Western Power's transmission network supplying the Geraldton urban area has sufficient capacity to accommodate this additional demand *provided all elements of the relevant part of the network are in service*, but may not be able to supply the requested additional demand when a transmission element is not in service and electricity consumption by other network users is high.

It is not good electricity industry practice to load a transmission network to the extent that all available power transfer capacity is utilised under normal operating conditions. This is because, if a network element fails, the available power transfer capacity is reduced as a result. If this reduced capacity is insufficient to continue to supply the electricity demand, load shedding would be necessary to prevent an overload. As a result, the reliability of supply could fall below a level considered acceptable by most consumers.

Standard industry practice is therefore to operate a transmission network with sufficient redundant capacity so that, following a single transmission element failure, consumers would continue to receive an electricity supply that meets prescribed minimum quality standards. This is reflected in clause 2.5.2.2 of Western Power's technical rules, which requires that:

> *…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.*

This technical rules exemption application has arisen because Western Power's planning studies that have indicated that, if GPA is allowed to increase its maximum demand by an additional 11.65 MVA, the total load in the Geraldton area would increase to a level that could exceed the available power transfer capacity if a critical transmission element was out of service at a time of peak network loading. This would breach of clause 2.5.2.2 of technical rules and could potentially reduce the reliability of supply to existing consumers in and around Geraldton.

As described in Section 2, Western Power has evaluated a number of potential options that would allow GPA to increase its demand without materially affecting the reliability of supply to existing network users. It has requested an exemption from clause 2.5.2.2 of its technical rules as its preferred solution does not reinstate the network to full rules compliance.

2. GERALDTON PORT AUTHORITY CONNECTION OPTIONS

Western Power has considered the following three alternative approaches that would allow the additional GPA load to be connected without affecting the reliability of supply to other users.

2.1 NETWORK AUGMENTATION

This traditional solution involves the augmentation of the network to provide sufficient capacity to relieve the constraint. Western Power has identified three immediate constraints that would need to be separately addressed if this solution was adopted. While the number of constraints may seem high, the GPA application is for a block load will increase the peak demand in the Geraldton area by more than 10%, which is equivalent to approximately seven years' incremental load growth. Each of these constraints is discussed below. Additional constraints that could emerge in later years following incremental load growth are not considered.

Voltage Stability

There is already a voltage stability[1] issue at Geraldton, which is currently managed through the out of merit dispatch of Mungarra diesel generation. The additional GPA load would exacerbate this issue. The network solution for addressing this issue would be the installation of new sources of reactive power, such as network capacitors or a STATCOM in the Geraldton area. This solution could not be implemented until 2014.

Thermal Line Overloads

With the additional GPA load, there is a risk of either the Muchea-Moora or the Eneabba-Three Springs 132 kV circuits overloading in the event of the loss of one of the two incoming circuits into Three Springs. This will be addressed with the completion of the southern section of the Med West Energy Project (MWEP), currently scheduled for May 2014.

Rangeway Transformer Capacity

Western Power's analysis shows that, with the GPA load connected, there is a risk of a marginal overload (0.5 MW) of a power transformer at Rangeway substation should there be a failure of the other transformer at a time of peak network demand. The network solution to mitigate this risk is to install a third transformer at Rangeway or to proceed with a mooted new substation at the port. Neither solution could be implemented until 2015.

We think this is a very low risk that Western Power should be able to manage in the short to medium term without network augmentation. Power transformer failures are relatively rare events. The potential overload should a Rangeway transformer fail is small and Western Power's analysis indicates that initially it would exist for only 1.7 hours per year. One mitigation option would be rely on the transformer's cyclic load rating and permit the overload[2]. Alternatively Western Power could reconfigure the distribution network to transfer the excess load to a neighbouring substation. Should neither of these strategies be acceptable, it could simply ask GPA to reduce its load by approximately 1 MW for a short period of time. We suggest that this level of load curtailment would be unlikely to seriously disrupt port operations.

[1] A voltage stability issue arises if there are insufficient reactive power sources available to allow network voltages to recover to normal levels in the period immediately following a transmission fault. The amount of reactive power generation required to avoid stability problems increases with network demand.

[2] Power transformers are normally rated for maximum continuous load. However, where a load is cyclical it is considered acceptable practice to overload a transformer up to 20% above its continuous rating.

2.2 GENERATION SOLUTION

The additional power transfer capacity required to supply GPA could also be provided by increased use of network support generation. This would involve increasing the level of generation from Mungarra.

Western Power's analysis has indicated that full mitigation of the identified constraints would also require an additional 3 MW of network support generation. This would preferably be located close to Geraldton and, if the Rangeway transformer constraint was to be mitigated, at least 0.5 MW of this would need to be located on the low voltage side of the Rangeway transformers.

Demand side management (voluntary load curtailment) would be an alternative to the provision of additional generation support in Geraldton. This is discussed in Western Power's application which states:

> *Demand side management in Geraldton may also be used instead of dispatching generation in Geraldton. However this would not be deemed to be a Technical Rules compliant supply if the selected option was one with load curtailment with notice.*
>
> *Demand side management is an option currently being investigated by Western Power in a number of areas in the network; however such a scheme has yet to be implemented. A number of potential suitable sources in Geraldton have been identified. However the cost and feasibility of this option would require further investigation.*

2.3 PROVISION OF A CURTAILABLE SUPPLY

A third alternative is to provide GPA with a lower quality supply than provided for under the technical rules. Under this approach, supply to GPA would be provided utilising the power transfer capacity that normally kept in reserve for use following the loss of a network element. In the event a contingency arises where this reserve power transfer capacity is needed to supply other network users, the GPA load would automatically be disconnected to make the power transfer capacity available. Under this arrangement, GPA would be connected without materially impacting the quality of supply to other consumers. From Western Power's perspective, its existing assets would be more highly utilised and the need for a network augmentation would be deferred. However the quality of supply provided to GPA would be lower than that offered to other consumers and lower than it is entitled to under Western Power's technical rules.

The provision of a curtailable supply of this nature is a form of demand management. However it differs from the more traditional approach to demand side management in that there is no advanced warning and all incoming curtailable load is automatically disconnected[3][4].

It is difficult to assess the extent of the load curtailment that will be necessary. It will depend on the number of transmission faults that occur at times of peak demand, which in turn will be dependent on the weather and temperature. It will also depend on the proportion of GPA's contracted peak demand that is actually used and, more particularly, on GPA's actual demand at the time of peak demand on the network. Western Power has indicated a total of 25 curtailable events resulting in 120 unserved hours during the 2013 calendar year. We think this might be pessimistic as we understand that it assumes that GPA's contracted maximum demand will be 90% utilised at the time of contingency. This could be unlikely in the first year of expanded operations.

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[3] Under a more traditional demand side management arrangement there would be no disconnection of supply. The provider of the demand management service would be given notice of the need to reduce demand below an agreed level by a certain time and would be free to decide how this was done. As the service would be called upon before an event occurred, supply restrictions would be for longer periods than would apply to GPA. For GPA, no disconnection would occur until after a contingency. There would be no warning and all incoming supply subject to curtailment would be affected.

[4] Only GPA's additional demand would be subject to curtailment and its existing contracted maximum demand would not be affected. It should be able to rearrange its installation so that no essential supplies are curtailed.

3. SELECTED OPTION

The network augmentation option cannot be implemented until 2014 at the earliest. As GPA requires connection by December 2012, this has not been pursued.

Western Power offered GPA the generation solution on the basis that it would be required to pay the cost of additional out of merit dispatch of the Mungarra generators and also any costs incurred in arranging additional network support in the Geraldton area. GPA has rejected this as uneconomic to its operation. Currently the cost of using Mungarra generation for network support is shared by all network users. However, requiring all users to pay for the generation needed to accommodate GPA's additional load would subsidise GPA's operations. The offer made by Western Power to GPA avoids this.

GPA has accepted a curtailable supply between December 2012 and May 2014 or, as we understand it, the commissioning of the southern section of the MWEP. As a curtailable supply does not comply with Section 2.5.2.2 of its technical rules, Western Power requires an exemption before it can proceed. Its exemption application states:

> *The exemption sought is to apply only until the Mid West Energy Project (*MWEP) Southern Section is in service. The need for an exemption beyond this date would be the subject of a separate future submission to the Authority.*

This indicates that the curtailable supply arrangement for which the exemption is sought expires when the southern section of the MWEP is commissioned even though this will not remove the network constraints north of Three Springs. We have not pursued this as it does not affect the immediate need for an exemption.

4. RECOMMENDATIONS AND CONCLUSION

We see the proposed approach as a pragmatic solution that allows GPA to connect its additional load to Western Power's North Country transmission network without adversely impacting the reliability of supply to existing consumers. It is a technically elegant solution in that it defers the need for immediate network augmentation and reduces the risk of an augmentation proceeding that is not consistent with the optimal development of a network arrangement that best serves the longer term demand for transmission network services in the area. We note the high level of uncertainty that currently exists around these future requirements. The solution is also economically efficient in that it does not require GPA to pay for a level of service that it does not need.

We therefore recommend that Western Power's application for a technical rules exemption be approved.

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.