Geoff Brown & Associates Ltd

REVIEW OF WESTERN POWER'S APPLICATION FOR A TECHNICAL RULES EXEMPTION FOR NEWMONT MINING SERVICES

Prepared for

ECONOMIC REGULATION AUTHORITY

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DISCLAIMER

This report has been prepared for the Economic Regulation Authority to assist in its review of Western Power's application for an exemption from clause 2.5.2.2 of its Technical Rules to allow it to provide an increase in the contracted maximum demand of the Newmont Mining Services mine at Parkeston in the Goldfields region of Western Australia. 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. INTRODUCTION

The contracted maximum demand (CMD) from the Western Power network of the Newmont Mining Services' (Newmont) gold mine in at Parkeston, in the Goldfields region of Western Australia, is currently 13 MW. The maximum demand of the mine is significantly larger than this, but the load that can be supplied from the network is limited by the power transfer capacity of the 220kV Goldfields interconnector that supplies electricity to Kalgoorlie from the west. The balance of the electricity required to operate the mine is supplied from Newmont's own on-site gas turbine generation, fuelled by gas.

Newmont has requested an increase in its CMD to 45MW between the hours of 10pm and 7am daily. This will allow it to reduce the use of its on-site generation during these hours and instead utilise cheaper electricity supplied from base load coal-fired generation south of Perth and transported to the mine site using the Western Power grid. Western Power is able to accommodate this request, subject to operating constraints acceptable to Newmont, because during the periods when an increased CMD is proposed, there is unused power transfer capacity on the 220kV interconnector. However, Western Power understands that it is unable to agree to Newmont's request without an exemption from clause 2.5.2.2 of its Technical Rules because of transformer capacity limitations at the West Kalgoorlie terminal station and also at the Parkeston zone substation that supplies the mine. It has therefore applied to the Economic Regulation Authority (Authority) for exemptions from the requirements of this clause of its Technical Rules in respect of these transformer capacity limitations at these two substations so that it can agree to Newmont's request[1]. For brevity, Western Power's application is referred to in this report as the "Application".

The Application has been submitted in accordance with clause 12.40 of the Electricity Networks Access Code (Code), which allows Western Power to apply to the Authority for a project to be exempted from one or more of the requirements of its Technical Rules clause 2.41 of the Code states that the Authority **must** [our emphasis] grant the exemption if it determines that in all the circumstances the disadvantages of requiring [Western Power] to comply with the requirements are likely to exceed the advantages.

The Authority has contracted Geoff Brown & Associates Ltd to review the Application and provide advice on whether or not the exemptions should be granted in accordance with the relevant provisions of the Code. This report documents our review and the advice provided to the Authority.

[1] *Submission to the Economic Regulation Authority for exemption from the Technical Rules clause 2.5.2.2 for Newmont Mining Services*; Western Power DM# 12797025, 3 July 2015.

2. BACKGROUND

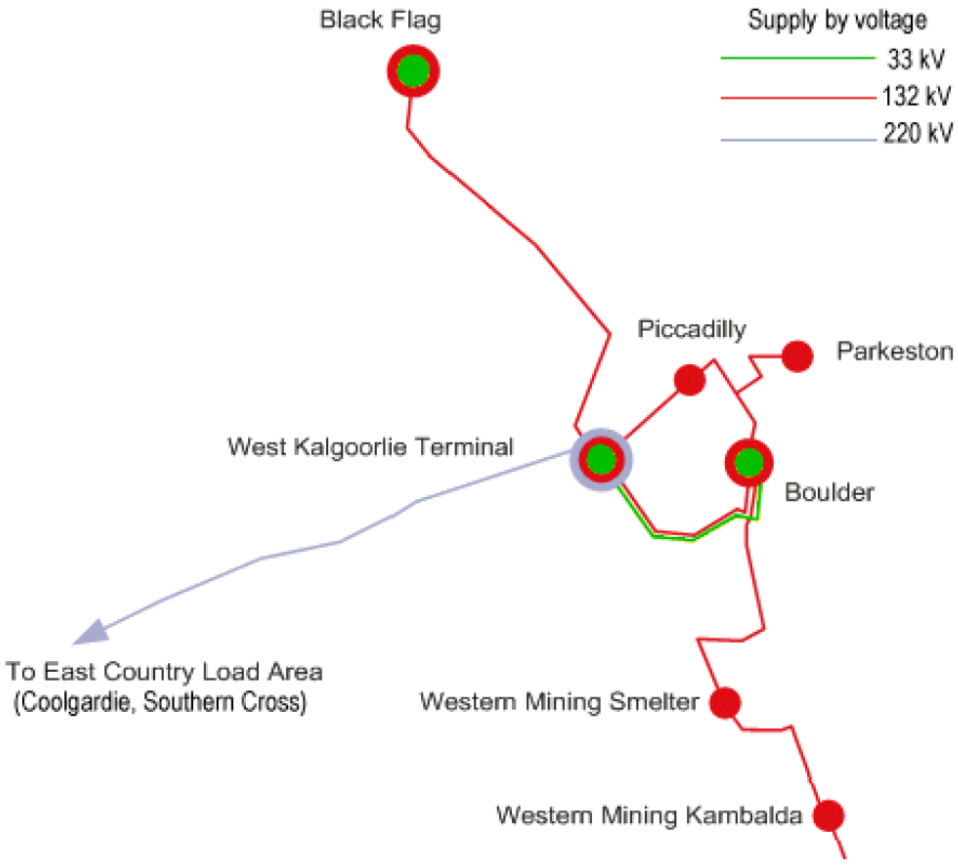
In this section we describe those parts of the Western Power network relevant to the Application and discuss the transformer capacity limitations that have triggered the Application. We also discuss those clauses of Western Power's Technical Rules that are relevant and in this context provide a brief overview of the Application.

Our assessment of the Application is presented in Section 3 of this report.

2.1 GOLDFIELDS INTERCONNECTOR

The Goldfields interconnector is a single circuit 220kV line running between Merredin and Kalgoorlie, a distance of more than 300km. It connects Western Power's 132kV transmission system in the Western Goldfields area to the remainder of the South West Interconnected System (SWIS) serving the south west of Western Australia. Figure 1, which is a snapshot of a schematic diagram included in the Application[2], shows the Goldfields transmission system and the 220kV interconnector.

Figure 1: Schematic of the Western Goldfields Transmission System



There is sufficient local generation connected to the Goldfields transmission system to supply the Goldfields load[3] when the interconnector is not in service. However, this generation is primarily open circuit gas turbines operating on gas supplied through the Goldfields gas transmission pipeline. The interconnector allows the Goldfields electricity demand to be supplied from the cheaper generation available in the west of the State, such as the Collie and Muja coal-fired power stations. Hence the presence of the interconnector reduces the total cost of the generation required to supply the demand for electricity by consumers connected to the SWIS.

[2] Newmont Application, Figure 1, p5.

[3] Large mining loads have their own private generation and Synergy operates sufficient generation to provide a supply to other customers.

Western Power has advised that the minimum summer thermal rating of the Goldfields interconnector is 376MVA. However, because of the length of the interconnector and the lack of facilities to control reactive power, it is not possible to operate at this load level as the system would not be in a secure operating state and voltages would not be within the specified voltage envelope. Hence, the power system can only be operated in accordance with the Western Australia Market (WEM) Rules with a lower level of interconnector power transfer.

Clause 2.3.8 of the Technical Rules requires Western Power to assign a power transfer limit that ensures that the SWIS can be operated in accordance with the WEM Rules. This limit is currently 155 MW and is assigned on the basis of the current network configuration. There are relatively low-cost network enhancements available, such as the installation of additional voltage control devices, which would allow this power transfer limit to be increased[4].

In the Application Western Power has indicated that the current power transfer limit of 155MW is sufficient to meet forecast short to medium term load requirements. It notes that the expected replacement of the ageing saturated reactors at Merredin and West Kalgoorlie terminal stations with new technology is likely to offer an increase in transfer limits in 2018/19[5].

Because of the cyclical load pattern, while the load on the interconnector can approach the transfer limit of 155 MW during the day, at night it reduces to approximately 120 MW, resulting in unused power transfer capacity of about 35 MW if bulk mining loads such as Newmont are limited to their CMD.

2.2 WEST KALGOORLIE TERMINAL STATION

The West Kalgoorlie terminal station connects the 220kV Goldfields interconnector to the 132kV Goldfields transmission system through two 120 MVA 220/132kV power transformers. These provide sufficient capacity to allow maximum power transfer through the interconnector only if both transformers are in service. With one transformer out of service, interconnector power transfer would need to be reduced. This can be done by using local gas turbine generating plant directly connected to the 132kV Goldfields transmission system to supply some of the load. However the cost of the electricity generated locally is normally higher than the cost of electricity generated in the west and transported to the Goldfields region using the interconnector.

2.3 PARKESTON ZONE SUBSTATION

The Parkeston zone substation has a single 90 MVA 132kV power transformer. This is well in excess of the capacity required to supply the current 13 MW CMD of the Newmont mine and also has ample capacity to accommodate the requested increase in the CMD. While the zone substation is now classified as a shared network asset, Western Power has advised that “little or no” non-Newmont load is supplied from the substation. It notes that the Mt Percy feeder may supply some residential load but that the Mt Percy mine (and its load) that this feeder was built to supply has not been operational for some time.

2.4 PLANNING CRITERIA

Section 2.5 of the Technical Rules specifies planning criteria that govern the design of the South West Interconnected Network. The following criteria are relevant to the Application.

- The N-0 criterion specified in clause 2.5.1 applies to the Goldfields interconnector (as it consists of only one circuit) and may also be applied to zone substations with a peak load of less than 10 MVA. Under the N-0 criteria the network will

[4] This is discussed on p39 of Western Power’s 2014-15 Annual Planning Report, which notes that *thermal limitations are not expected to present any [interconnector capacity] issues over the next five years. At present, there are voltage and stability limitations which determine the power transfer capability to the Eastern Goldfields load area. Should these voltage and stability limits be relieved in the future, thermal limitations may then become the dominant constraint.*

[5] Newmont Application, p6.

experience the loss of its ability to transfer power into the area supplied on the loss of a transmission element. Following such an event, this power transfer capability will not be restored until the transmission element has been repaired or replaced.

- The N-1 criterion specified in clause 2.5.2.2 applies to the shared Goldfields 132kV transmission network. Under this 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. However, as provided for in clause 2.5.2.2(d), supply may be lost for a brief switching period while loads are transferred to un-faulted supply transformers by means of distribution system switching. Western Power must maintain sufficient power transfer capacity to allow supply to all consumers to be restored following switching.

2.5 OVERVIEW OF THE APPLICATION

The Newmont mine is supplied from the Parkeston zone substation and, as noted above, currently has a CMD of 13 MW. The CMD of the mine is constrained by the need to keep the power transfer over the Goldfields interconnector below the limit of 155 MW.

Newmont has now asked Western Power to increase its CMD to 45 MW between the hours of 10pm and 7am daily so that it can utilise the unused interconnector power transfer capacity that is available overnight, as discussed in Section 2.1. Western Power is amenable to this, provided Newmont allows the installation of a load runback scheme to reduce the supply to the mine from the network should the load across the interconnector approach the power transfer limit, or should there be a need to reduce load due to the loss of one of the two transformers at the West Kalgoorlie terminal station at times when the 45 MW CMD applies. The load runback scheme is designed to shed 17 MW of Newmont load quickly and then initiate a further slower reduction loading via a signal to Newmont to start a gas turbine generator in order to revert to a demand of 13 MW within a specified timeframe.

The Newmont Application appears to be predicated on one of the following interpretations of the Technical Rules:

- The Rules prevent Western Power from increasing the CMD of an existing load customer, (or presumably connecting a new load customer since the effect on the network is the same) unless existing upstream assets are augmented, where necessary, to be fully compliant with the planning criteria specified in the Rules; or alternatively

- The Rules prevent Western Power from accommodating a request from a load customer for an increase in its CMD if that request involves the shedding of the customer's load under certain network operating conditions, even in a situation where the customer voluntarily agrees to a load shedding arrangement that involves the tripping of a connection, rather than a shared network, asset.

It is not clear to us which if these interpretations Western Power is relying on. Nevertheless Western Power considers that the Technical Rules prevent it from agreeing to Newmont's request unless it either augments the power transformer capacity at both West Kalgoorlie terminal and Parkeston zone substations, or obtains an exemption from the Authority from compliance with the planning criteria in the Rules in respect of these two substations. It has chosen the latter course of action in order to accommodate Newmont's request without the need for costly network augmentation.

3. ANALYSIS

In this section we first look at the impact on other network users if Western Power proceeds and increases Newmont's CMD, without any network augmentation. We then consider whether or not exemptions the Technical Rules are necessary before Western Power can agree to a time-constrained increase in Newmont's CMD.

3.1 IMPACT OF THE NEWMONT APPLICATION ON NETWORK USERS

3.1.1 Technical Impact

The proposed time-constrained increase in Newmont's CMD is designed to take advantage of interconnector power transmission capacity at times when the capacity is unlikely to be otherwise used. It will therefore not cause any material increase in the peak demand on either the interconnector or the Goldfields transmission system. Newmont's voluntary load shedding arrangement should ensure that, in the event of credible contingency arising, there will be no material adverse impact on other network users as a consequence of the CMD increase. In particular:

- Should there be a 220kV interconnector transmission line fault, all network users in the Goldfields area could lose supply, irrespective of when the fault occurs. This is no different from the existing situation without the proposed time-constrained increase in Newmont's CMD. In this event, Newmont and other large mining loads are already required to use their own generation to meet their full electricity demand until interconnector power transfer is restored. System Management would restore supply to other Users by dispatching Synergy gas turbine generation connected directly to the Goldfields transmission system.

- Should there be an unplanned outage of one of the two West Kalgoorlie terminal station transformers the available interconnector power transfer capacity would be reduced and could be lower than required at the time of the outage. This situation would arise irrespective of whether the outage occurred during the day, when Newmont's CMD was limited to 13 MW or in the evening when Newmont's increased 45 MW CMD applied. During the day Synergy generation would be used to make up the deficit, consistent with the existing contingency plan, and at night Newmont would be required to shed load and start up a generator so that interconnector power transfer is reduced to the below the thermal power transfer capacity of the remaining transformer.

- While Parkeston substation is classified as a shared network asset, any consumers other than Newmont that are connected to the distribution network downstream of the substation are already provided with an N-0 connection only. As there is currently ample transformer capacity at the substation to meet this N-0 requirement, the quality of supply provided to these consumers should not be any lower than Western Power currently provides.

3.1.2 Economic and Financial Impacts

The proposed time-constrained increase in Newmont's CMD will increase the total financial risk exposure of network users to the consequences of an unplanned outage of one of the West Kalgoorlie terminal station transformers. This is because should the unplanned outage occur at night and the Newmont load was below its current CMD of 13 MW, the actual interconnector power transfer would likely be below the thermal capacity of the remaining transformer. Hence there would be no need to dispatch more expensive local generation. However, should the same unplanned outage occur when the Newmont CMD of 45 MW applied, there would probably be a need to reduce the interconnector power transfer because of the additional Newmont load. The automatic

load shedding scheme is designed to ensure that this additional financial risk is carried by Newmont rather than passed to other network users.

The proposed time-constrained increase in Newmont's CMD will increase the utilisation of the interconnector and therefore the revenue received by Western Power from Newmont for the use of its transmission system. As Western Power is subject to a revenue cap, this additional Newmont revenue will need to be offset by a reduction in Western Power's revenue from other network users. This is a positive outcome for these other users.

3.1.3 Conclusion

The proposed time-constrained increase in Newmont's CMD, without any further network augmentation, will have no material adverse technical impact on other network users and will have a positive financial impact. We therefore see no reason for Western Power not to agree to the proposed increase.

3.2 INTERPRETATION OF THE TECHNICAL RULES

Given the conclusion in Section 3.1.3 that the proposed time-constrained increase in Newmont's CMD will have no detrimental technical impact on other network users, it follows that any network augmentation will provide an improved level of service to some users. It is pertinent to consider whether the Technical Rules require, as a condition for the provision of new or upgraded connections, network augmentations that provide enhanced levels of service, or whether required augmentations should be limited to those necessary to ensure that existing levels of service are maintained and no user is detrimentally affected by the new or upgraded connection.

Our view is that the Rules require only the maintenance of existing service levels and only require upgrades to meet current Rules requirements when new assets are installed or existing assets are being modified. However, this upgrade requirement applies only to the assets that are actually being installed or modified, and does not extend to assets not directly affected, unless the change results in the service provided by these other assets being **reduced** from their current level.

This interpretation is consistent with clause 1.9.4 of the Technical Rules, which states:

> ***1.9.4 Transmission and Distribution Systems and Facilities Existing at 1 July 2007***
>
> *(a) All facilities and equipment in the transmission and distribution systems, all connection assets, and all User facilities and equipment connected to the transmission or distribution system existing at the Rules commencement date are deemed to comply with the requirements of these Rules. This also applies to facilities in respect of which Users have signed a connection agreement or projects of the Network Service Provider for which work has commenced prior to the Rules commencement date.*
>
> *(b) When equipment covered by clause 1.9.4(a) is upgraded or modified for any reason, the modified or upgraded equipment must comply with the applicable requirements of these Rules.* ***This does not apply to other equipment that existed at the Rules commencement date and that forms part of the same facility*** [our emphasis].

Arguably, the wording of this clause may not directly address a situation where load growth creates a situation where an asset that met its required planning criteria at the Rules commencement date subsequently becomes non-compliant. However, we believe the intent of the clause is clear and this precludes an interpretation of the Rules that requires an asset to be proactively upgraded to provide a quality of supply greater than currently provided as a condition of a new or upgraded connection being added to the network. With this interpretation, an upgrade is only required where the service provided by an asset (typically the quality or reliability of supply) is reduced from its current level.

An interpretation that a proactive upgrade is required in such situations creates a number of problems. In particular,

- Taken to its logical conclusion, it would preclude any organic growth in the number of downstream connections unless all upstream assets are upgraded as necessary to fully meet the planning criteria in the Technical Rules. The difference between the CMD upgrade proposed for Newmont and the addition of a new domestic connection to the Mt Percy feeder is primarily one of magnitude. This would suggest that all practically all existing assets should by now have been upgraded to be fully compliant with the requirements of the Rules as they apply to new assets.;

- Notwithstanding the exemption provisions in the Code, it leaves open the potential for the Technical Rules to be applied in a way that creates an unnecessary barrier to connecting to the network. This is not consistent with the objective of the Code, which is for barriers to connection to be reduced to the extent reasonably possible; and

- It potentially creates a situation where the Technical Rules could require a network augmentation that fails to meet the requirements of the New Facilities Investment Test (NFIT). This could place the Authority in a difficult regulatory position.

The following sections examine Western Power's requested two exemptions in this regulatory context and consider whether the exemptions are really required by the Rules if Newmont's time-constrained CMD is to be allowed. While we don't consider it a determining factor, it is relevant to note that the load shedding scheme proposed in the Newmont application involves the modification to the controls of one or more circuit breakers at Parkeston substation that are Newmont connection assets rather than part of the shared transmission network.

3.3 WEST KALGOORLIE TERMINAL STATION TRANSFORMER CAPACITY

3.3.1 Applicable Planning Criterion

The two power transformers at West Kalgoorlie terminal station both have nameplate ratings of 120 MVA. Taken together, the transformers have an N-0 capacity of 240 MVA, and an N-1 capacity of 120 MVA, based on their nameplate rating. The transformers connect the single circuit Goldfields interconnector, with an N-0 planning criterion to the Goldfields transmission system with a rated power transfer capacity of 155 MW, to which the N-1 planning criterion applies. In the Newmont Application, Western Power has stated that the N-1 criterion applies to the transformers, implying they form part of the transmission network rather than the interconnector.

For completeness, we note that both transformers need to be in service if the interconnector is to operate at its full power transfer capacity and that if only one transformer is in service power transfer through the interconnector must be reduced.

We suggest that it should not simply be assumed that the power transformers must meet the N-1 criterion, as the planning criterion that applies is dependent on whether they are part of the transmission system or the interconnector. In our view, the test to establish this should be whether the transformers form a used and useful transmission function if the interconnector is not in service. There is nothing to suggest that this is the case – if the interconnector is not in service, we have seen nothing to indicate that de-energization or even removal of the transformers would have any impact on the operation of the 132kV Goldfields transmission system. We therefore consider that the transformers are part of the interconnector and that the N-0 planning criterion should apply.

3.3.2 New Facilities Investment Test

In this section we consider whether the installation of a third transformer at Kalgoorlie can be justified, irrespective of the relevant planning criterion, by applying the NFIT.

As downstream generation is available to replace the lost interconnector power transfer capacity in the event of a transformer failure, the reliability limb of the NFIT is not relevant. Under the NFIT, the augmentation could only be justified by the economic benefits limb, which requires that the net present value of the quantified benefits to all network users of installing the third transformer must exceed the capital cost of the project. The main benefit of the third transformer is the savings in incremental cost from not having to run local generation in the event of an unplanned transformer failure. In applying the test, these benefits would need to be weighted by the probability of a transformer failure during the life of the project. Transformer failures are rare and unplanned interruptions of the interconnector are much more likely to be caused by a 220kV line fault.

We conclude that, because of the low probability of a transformer failure, on present load projections it is unlikely that a third transformer could be justified, even if it is assumed that following a transformer fault local generation would need to operate at times of peak demand for up to a year while a replacement transformer was procured.

3.4 PARKESTON TRANSFORMER CAPACITY

At Parkeston zone substation, there is a single 90 MVA transformer and therefore all consumers supplied from this substation currently have N-0 supply security only. While Parkeston is technically a shared transmission asset, Western Power has advised that there is little or no load supplied from this substation, apart from the Newmont mine. It notes that any such load would be supplied from the Mt Percy feeder, but that the mine that this feeder was built to supply has not been operational for some time.

Hence there is already significant stranded transformer capacity at Parkeston, irrespective of whether or not the time-constrained Newmont CMD upgrade proceeds, and it would therefore be difficult to justify the installation of any additional transformer capacity. As noted in Section 3.2, the modification to enable the automatic load shedding is to be applied to a connection asset, rather than a shared network asset, and we have not seen anything to suggest that the proposed increase in Newmont's CMD will reduce the quality of supply to other consumers supplied from the substations.

Newmont does not require an N-1 supply and Western Power likely has risk management options available to it in the event of a transformer failure that would obviate the need to provide a second transformer. One option would be to negotiate a commercial arrangement with Newmont to provide a supply to the other users using its gas turbine generators. In the unlikely event that this is not technically possible, Western Power could install a small generator on the Mt Percy feeder to provide supply.

In the circumstances we do not believe an upgrade of the security if supply provided by the Parkeston zone substation is required by the Technical Rules as a pre-condition to Newmont's CMD being increased.

4. CONCLUSIONS

Western Power can provide a time-constrained increase in Newmont's CMD to 45 MW, as proposed in its Application, without any material adverse technical impact on other network users and without any augmentation to the existing network. We have not been able to identify any technical reason for Western Power not to agree to the CMD upgrade.

The proposed time-constrained CMD adjustment will increase the revenue Western Power receives from Newmont. As Western Power is subject to a revenue cap, this will have a positive financial and economic impact on other network users.

We do not believe that it is necessary for the Authority to grant any exemptions to the Technical Rules in order for the proposed time-constrained increase in Newmont's CMD to be provided. This is because the augmentations that Western Power considers would be needed if the exemptions are not granted would provide a quality of supply to the affected users over and above the quality they currently receive. We are unable to identify any provision in the Technical Rules that requires this.