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# Report to the Australian Energy Regulator

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## Review of Conversion of Braemar – Kogan Creek Line Assets

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## 1 BACKGROUND

The Revenue Proposal for 2012 – 2017 by Powerlink Queensland (ref 1) contains the following statement at section 6.2.1 :

***Transfer of existing assets into the regulatory asset base***

*Powerlink has previously identified that, due to forecast growth in electricity demand in southern Queensland, the capability of the existing transmission network supplying this area would be fully utilised by late 2011.*

*Powerlink has undertaken planning and public consultation in accordance with the requirements of the Rules and the Regulatory Test to determine the most efficient option to address the identified need. Part of the recommended solution involves prescribed services being provided by a section of an existing transmission line and other relevant assets, all of which are owned by Powerlink, that currently provide non-prescribed connection services between Kogan Creek power station and Powerlink's Braemar Substation. Powerlink has been in discussions with the AER on this matter.*

*As Powerlink already owns the relevant assets, the Revenue Proposal includes the actual cost of construction of the relevant non-prescribed assets in the RAB in the amount of \$25.4m.*

In reviewing this part of the Proposal the Australian Energy Regulator (AER) sought advice from CHC Associates P/L (CHC) regarding the following questions:

1. Is Powerlink's proposed solution to the identified constraint at Kogan Creek a reasonable and expected response for an efficient network operator/planner? If so, is the proposed valuation of the assets to be included in the 2012 opening RAB reasonable? If not, what is a reasonable valuation?
2. If the proposed solution is not optimal, what solution would represent a reasonable response from Powerlink to address the emerging constraint, and what would the cost of that solution be estimated at?

## 2 SCOPE OF THIS REPORT

This Report reviews the evolution of the proposal to reconfigure some existing assets that are owned by Powerlink Queensland (PLQ) and that currently provide non-prescribed services to the owner of the Kogan Creek Power Station. This proposal is made in the context of PLQ's stated requirement to maintain a reliable electricity supply to Southern (South West and South East) Queensland.

The Report also considers the manner of dealing with other capital expenditure that is stated to be essentially related to the reconfiguration of PLQ's network to give effect to the conversion.

The Report does not consider the overall efficiency of the large suite of major projects that are proposed to address the reliability requirement, of which the conversion of the Braemar to Kogan Creek line is a relatively small component, by value.

## 3 CONTEXT OF THE PROPOSAL

### 3.1 History

The portion of PLQ's network that requires augmentation was commissioned in 2000 as a part of the Queensland – NSW – Interconnector (QNI). In Queensland this comprised a double circuit 330kV steel

tower line from the NSW border, via Bulli Creek to Braemar, where the voltage was transformed to 275 kV (the standard highest voltage used in the rest of Queensland. From Braemar a double circuit 275 kV line was built to Tarong Power Station switchyard, where the transmitted power to, or from, NSW was transmitted through the pre-existing network that serves the greater Brisbane area.

Soon after the commissioning of QNI a major power station (865 MW) was built at Millmerran, and connected to both Bulli Creek at 330 kV and through a series of 275 kV lines to the Gold Coast area. The lines in and out of Millmerran are part of the regulated network, as they facilitate transfers in addition to that which is attributable to the power station.

Later (about 2006) the Kogan Creek Power Station (a single 724 MW generator) was built some 30 km from Braemar in an area not then served by transmission lines, and this was connected to Braemar through a double circuit 275kV line (arranged as a single circuit). This line and associated substation equipment is dedicated solely to connection of the power station, and is therefore a non-prescribed asset.

More recently another power station (called Braemar- 435 MW) was built closer to Braemar substation and connected to the 275 kV busbar, and two other power stations (Braemar 2- 495 MW and Darling Downs- 605 MW) have either been commissioned or are nearing this status. Their connections are also non-prescribed, but are not relevant to the proposal.

### **3.2 The current augmentation proposal: the Application Notice**

The combined output of all these power stations (allowing also for some market-driven transfer northwards over QNI, and subtracting transfers from Millmerran towards the Gold Coast) will shortly exceed the capacity of the existing lines between Braemar and Tarong and, together with the power output of Tarong will also exceed the capacity of the 275 kV lines from Tarong towards Brisbane. Of itself this does not justify augmentation: it simply means that some of this generation might be constrained off in the market.

However PLQ has assessed that there will be insufficient generation capacity to supply the South East demand (Sunshine Coast/ Brisbane/ Gold Coast), and that there are insufficient power sources elsewhere in Queensland (e.g. central Queensland) to address this deficiency over time.

This triggers a reliability augmentation, which PLQ proposes to address by increasing the transmission capacity both to the east out of Braemar towards Tarong, and in the corridor to the east of Tarong, so giving the group of power stations around Braemar increased access. PLQ proposes to not connect additional circuits at Tarong, but to establish an additional switching station at Halys, so creating a new Northern corridor.

In March 2009 PLQ issued an Application Notice (ref 3), under the National Electricity Rules that were then in force, that included six network options, each comprising a sequence of major new line and substation developments, extending over several years. These options were quite strongly related, and included works that were the same in several options, but were constructed in different time sequences.

A common feature of all six options was the intention for the new line corridor out of Braemar to be routed in a northerly direction, close to Kogan Creek, before heading in a generally easterly direction towards Halys, and to establish a switching station called “Western Downs” near Kogan Creek. Western Downs was proposed to be connected to Braemar through a new double circuit 275 kV line. In some of the options the Braemar – Western Downs line was shown as a later “modelled” project, being preceded by a new line direct from Braemar to Halys, not via Western Downs.

PLQ said in the Application Notice that it was negotiating with CS Energy, the owner of Kogan Creek PS, for the conversion of part of the existing 275 kV Braemar to Kogan Creek line to regulated status, instead of building a new line between these two points. It was implied, but not stated, that in this case Kogan Creek would be connected to Western Downs instead of Braemar.

In the original proposal for a new line to Western Downs there was no need to connect Kogan Creek at that point. The justification for including a switching station at Western Downs was not clear, as there was a double circuit line from Western Downs to Halys. These two circuits could have been connected together to form a Braemar to Halys line with no intermediate switching. PLQ appears to have formed the view on the basis of Connection Enquiries that energy resources in the Western Downs area would lead to more connections if a line was to pass through that area, particularly if there was a switching station there. The Australian Energy Market Operator (AEMO) provides on its website a list of “Proposed Generation”, which currently includes the following near Braemar: Braemar 3 – 500 MW, Darling Downs 2 – 500 MW and Kogan Creek Solar Thermal -44 MW). These do not envisage large developments near Kogan Creek at an early date.

CHC considers that such speculative views are usually not sufficient to include such works in a capital expenditure proposal, unless there are other considerations. However, this is not an issue with the modified proposal presented in the Final Report (ref 4), as discussed below.

### **3.3 The Final Report**

In the Final Report PLQ stated that:

“Powerlink and CS Energy have agreed on utilising the existing 275kV double circuit line (presently providing non-regulated connection services) instead of constructing an additional 275kV transmission line, to the extent that this delivers an overall lower cost solution to consumers”.

In the Final Report PLQ replaced the words “construction of a 275kV double circuit line between Western Downs and Braemar substations” with “rearrangement of existing 275kV double circuit line between Kogan Creek and Braemar Substation, to connect Western Downs Substation” in all six of the previous options. Omitting the previous options from the analysis implies that PLQ no longer considered them to be feasible, which is clearly not the case.

The Regulatory Test applied in the Application Notice and Final Report used 2008/09 dollars for all assets, and the two tests are understood to be directly comparable. Comparing the cost and timing schedules in the Application Notice and Final Report shows that PLQ deleted the item:

Kogan – Braemar line duplication (cost \$32.45M)

and replaced it with:

Kogan – Braemar line rearrangement (line) (cost \$18.38M commencing one year earlier than the original), plus Kogan – Braemar line rearrangement (substation) (cost \$1.22M, same timing as original) and Kogan fault level management measures (cost \$13M) (payment of \$12.0M some years later, and a further \$1.0M some years later)

The sum of the above amounts is \$32.60M, a very small increase of \$0.15M, but the timing is such that, in most scenarios, the net present value was either less or about the same. The change did not alter the relative ranking of the options.

On the basis of the costs presented it can be concluded that the “rearrangement” variant of option 3 presented in the Final Report is as efficient as the original proposal in the Application Notice. This

would have been immediately evident if the original option had been included in the Final Report for comparison.

## **4 STRATEGIC CONSIDERATIONS**

The following considerations support the current proposal to connect Kogan Creek to Western Downs instead of Braemar, as in the “rearrangement” proposal.

### ***4.1 Anticipated and Modelled Developments***

The suite of projects, of which conversion of the Braemar – Western Downs project is one small component, addresses the immediate reliability issue in Brisbane by providing an enhanced capacity between Braemar and Brisbane. However the Regulatory Test had to look forward to a future where most of the scenarios required substantially more capacity between many new modelled power stations in the Darling Downs region and the Brisbane load centre.

If these high generation concentration scenarios come to fruition PLQ plans that the next stage will involve development of a 500 kV overlay to the existing 275 kV network: in the initial stages between Western Downs and Halys. These lines will commence operation at 275 kV, but will be converted to 500 kV operation within a few years if growth continues.

At this stage there would be an operational incentive to connect Kogan Creek to Western Downs rather than Braemar, as this would free up transmission capacity on the Braemar – Western Downs path. Otherwise the path for transfer of power from Kogan Creek would be via Braemar and back again.

Therefore in the medium term future it is probable that the most efficient arrangement would be to have just one 275 kV line between Braemar and Western Downs.

### ***4.2 Avoidance of Duplication***

The Regulatory Test applied by PLQ does not consider externalities such as the impact of the costs of the transmission connection on market outcomes for the Kogan Creek owners, and for consumers in Queensland. As such costs are internalized and reflected in market behaviour and outcomes, the inefficiency of unnecessary duplication of transmission lines would be expected to be evident in the results of a test that aimed to minimise costs to producers and consumers.

While not revealed in the results of the regulatory test that was applied, it is clear that duplication of transmission lines is not an efficient solution to address the identified network constraints.

### ***4.3 Fault Level Mitigation***

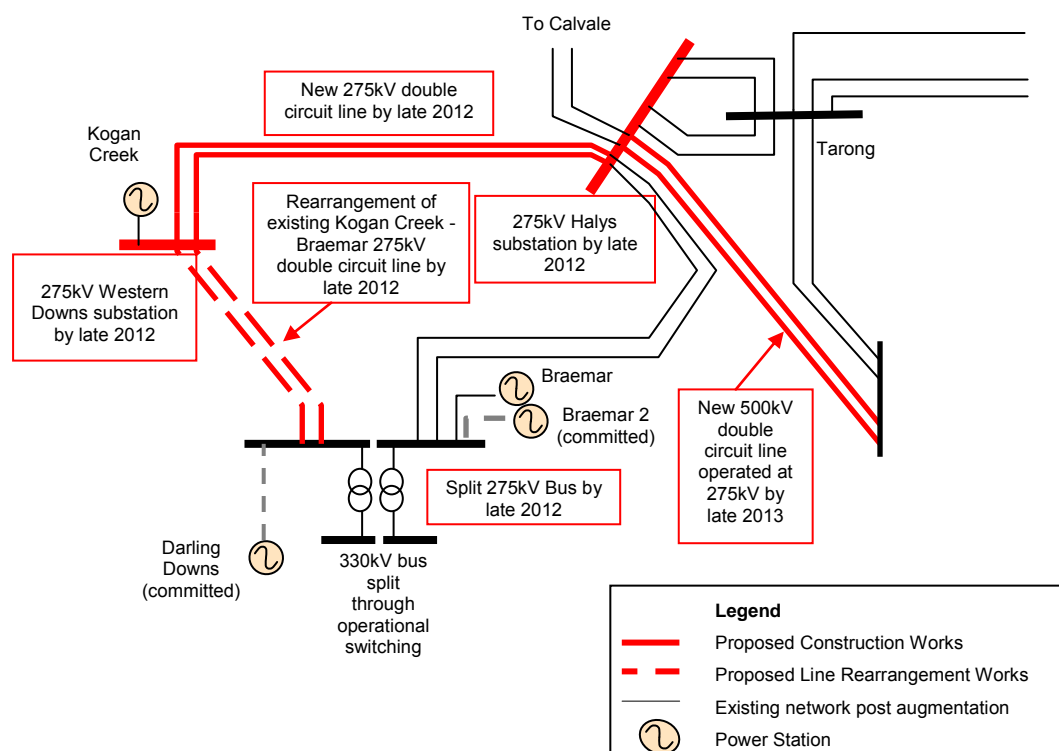
The development of very significant amounts of generating capacity in the general area of Braemar is clearly of concern to PLQ, not only because the capacity of the network to export energy will soon be exceeded, but also because the concentration of new generation near Braemar is raising the fault level at Braemar by an amount that will soon exceed the capacity of installed plant.

The plan described in the Application Notice and Final Report calls for the Braemar substation to be split into two sections: West and East, each comprising a 330kV and 275kV busbar connected through a transformer, and with the generating capacity shared between these two halves. This requires that the substation be arranged so that the halves can be separated by opening circuit breakers on both the 330 kV and 275 kV sides. The transmission circuits in and out of the substation will come together

only at two remote substations: Bulli Creek and the future Halys. In other words there will be two separate paths:

1. Bulli Creek – Braemar West – Halys, and
2. Bulli Creek – Braemar East – Halys.

This means that generators connected to Braemar West will make a reduced contribution to a fault at Braemar East and vice versa, so that the fault level on both sides is reduced. The diagram provided by PLQ in the Final Report is copied below for convenient reference.



In the plan outlined in the Application Notice the Kogan Creek generator remained connected to Braemar West, whereas in the Final Report it is connected to Western Downs, at which location other yet-to-be-announced generators could be connected with slightly less impact on the Braemar West fault level.

## 5 COST PROPOSED TO BE TRANSFERRED TO THE REGULATED ASSET BASE

PLQ has advised that the non-prescribed assets to be included in the transfer are:

- a proportion, being 28/30ths, of the existing transmission line and easement between Braemar and Western Downs substations. The existing transmission line is a total of 30km long between Braemar and Kogan Creek of which 28km will be utilised between Braemar and Western Downs;
- substation assets at Braemar that will connect the line from Western Downs; and
- telecommunications assets required to support the protection and control systems for the line between Western Downs and Braemar.

PLQ has provided an outline of the calculations involved as follows:

*The proposed value of these assets to be included in Powerlink's RAB has been determined consistent with the actual cost and roll-forward approach in the revenue regulation framework for TNSPs under the NER. The rolled forward value of the relevant assets is*

*projected to be \$25.8 million at 1 June 2012, the start of Powerlink's next regulatory control period, which is the time that these assets are proposed to be included in Powerlink's RAB.*

*For the Regulatory Test financial analysis this figure was de-escalated to 2008/09 dollars as Powerlink's Regulatory Test financial model uses real dollars. The financial analysis in the Final Report demonstrates that using these assets at this value to provide prescribed services is a lower cost solution than constructing a new line to provide those prescribed services.*

CHC understands that the assets are to be included in the RAB at their depreciated Book Value at the relevant time, and that they will be assigned asset lives consistent with them being new assets, at the time of being added to the RAB.

To give effect to the rearrangement new Capital works will be required, and these are accounted for in the normal way. Rearrangement of this line will involve removal of connections between the conductors of the two circuits that were originally paralleled, and the separate termination of these two circuits at the Western Downs end. The termination of the line at Braemar is included in the transferred assets.

The new termination of Kogan Creek at Western Downs will be part of the non-prescribed assets that form the new connection.

CHC considers that the cost provision for all these assets is reasonable. The line and related costs are historic audited amounts.

## **6 COST OF KOGAN CREEK "FAULT LEVEL MANAGEMENT"**

Because of the operational splitting of Braemar Substation and the establishment of Western Downs there will be a greater amount of fault level "head room" to connect additional generation in the Braemar/ Western Downs area over time.

However a consequence of the reconnection at Western Downs is that the potential fault level inside the Kogan Creek plant itself will be greater than if it had remained connected to Braemar because the connection is through a much shorter line<sup>1</sup>. This is the reason for the cost provision for "Kogan Creek fault level management" in the Final Report.

In response to questions PLQ has advised that if Kogan Creek remained connected to Braemar through 30km of line the fault current would have been within plant ratings at Kogan Creek, even if the fault level at Braemar reached the maximum allowable value. However with the 2 km line connection at Western Downs the fault capability at Kogan Creek would be exceeded if the fault level at Western Downs rose to the maximum allowable value there. Two options available to PLQ would be to permit fewer generators to connect at Western Downs, or to replace the under-rated equipment at Kogan Creek. In its modelling of the scenarios in the Final Report PLQ selected the second option. This is a reasonable assumption.

These works will only become necessary if future developments result in an increase in the fault level at Western Downs above some amount. It is not "committed" expenditure, and its timing is uncertain, as evidenced by different dates across the scenarios. The works comprise the replacement of the Kogan Creek generator transformer as the first stage, and replacement of other equipment later. The first stage expenditure is the most significant.

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<sup>1</sup> The electrical property called "impedance" is proportional to the length of line. Greater impedance in the path of a fault current reduces the amount of current that will flow into the fault.



These assets are owned by CS Energy, and are not part of the non-prescribed assets owned by PLQ, and are certainly not part of the RAB. In the financial modelling in the Final Report PLQ represented them as single capital payments in the relevant years (that differed from scenario to scenario).

CHC understands that there is precedent<sup>2</sup> for such costs to be recovered under the cost pass-through provisions of the Rules, based on audited actual expenditure. It is therefore considered reasonable to anticipate such payments in scenarios that require them, if this is relevant to the revenue proposal.

## 7 CONCLUSIONS

Based on the information provided by PLQ and independent analysis CHC concludes that PLQs proposed solution to the identified constraint that affects reliability in the greater Brisbane area is best addressed by a suite of projects that include the conversion of non-prescribed assets between Braemar and Kogan Creek to regulated status. This is a reasonable and expected response for an efficient network operator/planner.

CHC also considers that the proposed valuation of the assets to be included in the opening RAB is reasonable.

Future modelled payments to CS Energy for fault level mitigation at Kogan Creek will need to be handled separately, and use of the cost pass-through mechanism has been suggested by PLQ as a possible means of recovering such costs in the future.

## 8 REFERENCES

1. Revenue Proposal 2013 – 2017, Powerlink Queensland (31 May 2011)
2. Powerlink Annual Planning Review 2011
3. Maintaining a reliable electricity supply to Southern (South West and South East) Queensland Application Notice by Powerlink Queensland (6 March 2009)
4. Maintaining a reliable electricity supply to Southern (South West and South East) Queensland Final Report by Powerlink Queensland (5 June 2009)

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<sup>2</sup> For example payment was made to Macquarie Generation for the cost of new transformers to reconnect two of its Bayswater PS generating units from the 330 kV network to the 500 kV network in New South Wales, because of the benefit this provided to transmission network services overall.