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Mr Chris Pattas
Australian Energy Regulator
GPO Box 520
Melbourne
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Dear Chris

**Review of the AER's adjustments to SP AusNet's proposed forecast capex allowance**

The Australian Energy Regulator (AER) has engaged Nuttall Consulting to review the analysis that the AER has undertaken to inform its draft decision on SP AusNet's maximum allowed revenue during the 2008/09 to 2013/14 period. The AER's analysis concerns SP AusNet's proposed ex-ante capital expenditure allowance, and specifically, the extent to which the findings of the detailed project reviews can be extrapolated across the balance of the proposed expenditure allowance. This analysis has resulted in a number of adjustments to SP AusNet's proposed ex ante capital expenditure allowance.

The AER has requested Nuttall Consulting to review this analysis, and the AER's position resulting from it, to confirm whether they are appropriate with regards to the technical/engineering considerations that SP AusNet has presented in its revenue proposal. The focus of this review is on the technical basis of the AER's adjustments, and does not include an examination of the associated expenditure amounts. The review has not involved detailed project evaluations; or any further discussions with, or information requests to, SP AusNet. Rather, this review has examined the AER's analysis and the information provided by SP AusNet to the AER during the detailed project reviews.

The main documents referenced during the Nuttall Consulting review include:

- a working version of section 4.6.4 and Appendix B.2 of the AER's draft decision, and the AER's supporting analysis spreadsheets[1];
- relevant SP AusNet ex ante project summaries (provided with the SP AusNet revenue proposal);
- the SP AusNet Asset Management Strategy Document (Appendix E of the SP AusNet revenue proposal);
- the SP AusNet Circuit Breaker Asset Management Strategy Summary;
- the SP AusNet circuit breaker risk model output; and
- the SP Ausnet ex ante substation rebuild/refurbishment NPV analysis.

The overall findings of the Nuttall Consulting review are as follows:

- There are a number of significant technical matters raised by SP AusNet in support of its proposed ex ante capital expenditure. Whilst these matters are appropriate in principle, Nuttall Consulting does not consider that SP AusNet's documentation

[1] Provided to Nuttall Consulting in an email from the AER, dated 16 August 2007.

provides sufficient evidence in support of these technical matters to reasonably justify that its proposed expenditure is prudent and efficient.

- Further, Nuttall Consulting has found nothing in the information presented to confirm that the basis of the AER's adjustments will not allow SP AusNet to maintain the quality, reliability and security of the transmission network.

The remainder of this letter provides a more detailed discussion of the Nuttall Consulting review.

The AER's adjustments predominantly relate to SP AusNet's circuit breaker asset management strategies, with by far the most significant of these adjustments occurring on the 66 kV circuit breakers and associated switchyards. Less significant adjustments have occurred on the 220 kV and 500 kV circuit breakers. Only one significant adjustment has occured on assets other than circuit breakers. This relates to the removal of a single 220/66 kV transformer replacement from SP AusNet's proposal.

The basis of these adjustments will be discussed in turn below. Firstly, the adjustments based upon the circuit breaker strategies (by voltage level) will be discussed, followed by the transformer adjustment.

***Circuit breakers – 66 kV***

As noted above, by far the most significant of the AER's adjustments relates to the removal of the majority of the 66 kV switchbay/switchyard replacements from SP AusNet's proposal. These recommendations impact SP AusNet's targeted replacement programs for HOTS and MWTS, and SP AusNet's station rebuild/refurbishment projects for BLTS, TTS, GNTS, KTS, and GTS.

The SP AusNet documents[2] indicate that the main factor driving the need for these replacements is the existing older 66 kV circuit breakers at a number of substations. Most of these are a bulk oil and minimum oil type, and were installed in the 1960s. The SP AusNet asset management strategy documents discuss many of the issues related to these older circuit breakers, including oil leakage, deteriorating bushings, wear, and corrosion. These documents also state that a significant problem for these breakers, which impacts the ongoing maintenance and operating costs, is that these breakers are obsolete and no longer supported by the manufacturer. Therefore, sourcing spares to maintain the fleet can be costly. This can involve expensive manufacturing of specialised components, and/or using retired units to provide spares.

SP AusNet is conducting a replacement program over the current regulatory period (2003-2007/8) to replace many of the circuit breakers that are the most expensive to maintain, and impose the most significant risks. This will resulted in the replacement of many of the *Reyrolle OS10*, *GEC OKG6C, ASEA HKEYC* 66 kV circuit breakers during this period[3].

The main strategy that underpins most of the 66 kV switchbay/switchyard replacements in the next regulatory period (2008/09-2013/14) is the programmed replacement of the bulk oil, *LG4C* 66 kV circuit breakers. The SP AusNet circuit breaker strategy document states that these are in the medium range for overall maintenance costs (planned plus unplanned), and are "*presently quite reliable*". The most significant factor that appears to be driving the need for this program is the large fleet size (~200) of this older 66 kV breaker. On this matter, SP AusNet's states[4]:

> "*The large LG4C fleet carries the risk associated with all large fleets that any rapid deterioration of the fleet will be very difficult to handle if replacement is required. The planning response to this risk is to schedule replacement over a period that keeps the annual replacement expenditure to a reasonable level.*"

[2] SP AusNet Asset Management Strategy documents, and the various associated SP AusNet ex ante project summaries.
[3] SP AusNet Circuit Breaker - Asset Management Strategy summary.
[4] SP AusNet ex ante project summary "Replacement Program for 66 kV Switch-Bays"

SP AusNet has also raised the low rating of these breakers as an issue[5]. Therefore, the replacement program will not only release spares for the ongoing maintenance of the remaining fleet, but also provide opportunities to upgrade certain breakers.

In considering the technical matters driving the *LG4C* replacement strategy, an important issue is the materiality of the problems associated with these older breakers. In this regard, the problems noted above on older bulk oil breakers, at a broad level, are certainly not obviously unreasonable. The phasing out of older bulk oil and minimum oil circuit breakers due to risks, and ongoing costs, has been occurring across the industry, both nationally and internationally. However, these programs still need to be prudent and efficient, and a type-based replacement strategy would not be considered best practice, unless a type-specific failure mechanism was known, and/or the risks of such a mechanism occurring were significant.

The SP AusNet documentation does not discuss any known systemic problems with the *LG4C* breakers that specifically warrant an early replacement program. Furthermore, SP AusNet's circuit breaker risk model indicates that the fleet of *LG4C* breakers are in a good condition, whereby the "effective" age of the breakers proposed for replacement is significantly younger than their actual age. In this regard, the breakers have an actual age between 40 and 45 years, but the "effective" age is around 30 years. Noting here that the life from the "effective" age may be between 40 to 50 years, then, setting aside unknown fleet risks, it would appear reasonable to assume that most of these breakers will last at least another 10 years.

Based upon the above, and noting SP AusNet's comments that the *LG4C* breakers are of medium ongoing cost and quite reliable, there does not appear to be a clear case on the need for this replacement strategy during the next period to maintain the quality, reliability and security of the transmission network.

Although the *LG4C* replacement strategy is raised as a significant driver of the 66 kV components of the substation rebuilds within SP AusNet's project summary documents, SP AusNet has also undertaken NPV options analysis of the proposed station rebuild projects. This indicates that the opex/capex trade-off has been a significant factor in setting the timing of the 66 kV circuit breaker replacements for particular rebuilds i.e. the ongoing maintenance and major overhaul costs of these breakers do not offset the deferment of the 66 kV rebuild project. Therefore, it would appear from this that the risk modelling is almost secondary in justifying the timing of the proposed projects. However, the NPV analysis appears inconsistent in the treatment of maintenance costs, risk costs, and capital costs across the various substation rebuild projects. For example, in some cases a deferral option requires an expensive overhaul/refurbishment of the *LG4C* breakers; in others the overhaul is not required. On this matter, it is not clear why this overhaul is required at all, noting that the risk model indicates they are in relatively good condition[6]. Furthermore, there are many parameters that impact the lowest NPV option that do not have a clear explanation as to their derivation. Therefore, it is difficult to gain comfort from this NPV analysis that the replacement of these breakers, while they are still in good condition, is prudent and efficient.

On balance, although Nuttall Consulting accepts that there may be a reasonable technical basis to program the replacement of the *LG4C* 66 kV breakers, based upon the information provided to Nuttall Consulting for this review, a clear technical argument has not been demonstrated that SP AusNet's proposed replacements during the next period will be required to maintain the quality, reliability and security of the transmission network.

On the issue of the availability of spare parts for the ongoing maintenance of the fleet, Nuttall Consulting considers that this may be an issue, and will become more significant as the fleet ages further during the next period. However, it is very difficult in the context of this review to confirm how many breakers will need to be retired to achieve an optimal level. The SP AusNet documentation does not provide any quantitative information on how this issue is being managed presently, or forecasts of the planned and unplanned maintenance across the fleet. However,

[5] SP AusNet ex ante project summary "Replacement Program for 66 kV Switch-Bays"

[6] It is also noted that in PB's review of the Richmond Terminal Station, PB recommended that the 66 kV rebuild could be deferred, but there was no mention that an overhaul of the *LG4C* breakers would be required instead.

Nuttall Consulting notes that around 17 of the *LG4C* 66 kV breakers that are in very good condition will be retired from the committed BETS, BATS and TGTS station rebuild projects occurring in this period, and the AER is allowing the retirement of a further 7 *LG4C* breakers from the proposed RWTS rebuild project in the next period. At this stage, and noting the relatively good condition of the existing fleet, Nuttall Consulting does not consider that SP AusNet has presented a sufficient technical argument that these retirements will not provide an efficient level of spares i.e. they will have spares to cover approximately 10% of the fleet.

Finally, it should also be noted that SP AusNet is also proposing a program to replace many of the *Sprecher and Schuh HPF 509* circuit breakers. Most of these breakers are being replaced as part of the station rebuilds, and as such, the AER's recommendations to remove the 66 kV components of these substation projects impact these breakers also. These breakers are of an old minimum oil type, and as such, suffer from the issues discussed above. However, SP AusNet has far fewer of these breakers within its 66 kV fleet – it is proposing the replacement of only 11 in the next period. It is also noted that the risk models indicate that, like the *LG4C* type, these breakers are in relatively good condition. As such, Nuttall Consulting does not consider that the lesser fleet risk issues around these breakers will impact the considerations and findings discussed above in any significant way.

Based upon the above, Nuttall Consulting considers that nothing in the information presented confirms that the basis of the AER's adjustments, relating to the 66 kV circuit breakers, switchbays, and switchyards, will not allow SP AusNet to maintain the quality, reliability, and security of the transmission network.

***Circuit breakers – 220 kV***

The AER has determined that a targeted replacement of the 220 kV assets at BLTS is more appropriate than SP AusNet proposed rebuild of the entire 220 kV switchyard. The most significant impact of this targeted replacement approach is the removal of the expenditure associated with the replacement of five 220 kV circuit breakers at BLTS.

The four breakers are of the same type, *Sprecher and Schuh HPF514* 220kV circuit breakers. These breakers are of an old minimum oil type, and as such, suffer from the general issues discussed above on 66 kV breakers. The main strategies around this 220 kV breaker type discussed in the SP AusNet asset management documentation relate to the maintenance and refurbishment of the existing fleet – a programmed replacement is not discussed.

With regards to the risk of the failure of these four breakers, the SP AusNet risk model indicates that they are in a condition commensurate with their age of 37 years. Other circuit breakers of this type proposed for replacement in the next period are in significantly poorer condition, showing an "effective" age of around 45-55 years. As such, from a circuit breaker risk of failure point of view, there does not appear to be a clear technical need to replace these particular assets.

However, the NPV analysis provided by SP AusNet indicates that there will be significant costs if the replacement of these breakers is deferred. This is due to "community risk costs" that may eventuate during the refurbishment of these units – presumably via a possible loss of supply event resulting from the reduced security during the refurbishment. SP AusNet has costed the *expected* community risk cost to be over $4 million during the refurbishment.

There are two main issues that are not clearly explained in the SP AusNet analysis with regards to the refurbishment option. The first is why the circuit breakers, which appear to be in reasonable condition based upon SP AusNet's risk model, will need a refurbishment to stay in service during the next period. The second is why such a very high risk cost is predicted during their refurbishment. As this risk cost is so significant in determining the least cost option, it would be expected that its derivation would be discussed. For example, it is not clear what assumptions have been made on the outage times, the level of load at risk, and contingency plans to limit the lost load should an outage eventuate. It is noted that without this risk cost, but still maintaining the refurbishment cost, the deferred option has the lowest NPV.

Noting the comments above on the NPV analysis, and the previous discussion concerning the inconsistencies in similar analysis for the 66 kV rebuilds, Nuttall Consulting is not satisfied that the

NPV analysis alone is sufficient to justify the replacement of these 220 kV circuit breakers. Furthermore, Nuttall Consulting does not consider that the targeted approach suggested by the AER is unreasonable. This approach should still allow SP AusNet to undertake a coordinated 220 kV circuit breaker replacement project at a later date.

Based upon the above, Nuttall Consulting considers that nothing in the information presented confirms that the basis of the AER's adjustments, relating to the 220 kV circuit breakers at BLTS, will not allow SP AusNet to maintain the quality, reliability, and security of the transmission network.

***Circuit breakers – 500 kV***

The AER has determined that SP AusNet's proposed replacement of two of its 500 kV circuit breakers, one at LYPS and one at HWTS, should be reduced to a single breaker. These two breakers are of an old SF6 type: *Siemens 3AT5*. These breakers are an obsolete design, but represent approximately 1/3 of the 500 kV fleet[7]. As such the availability of spares to maintain this fleet is a similar issue to that discussed above. The main strategies around this 500 kV breaker type, discussed in the SP AusNet asset management documentation, relate to the maintenance and refurbishment of the existing fleet – a programmed replacement is not discussed. The main driver behind the replacement of these two units appears to be primarily to release spares for the maintenance and refurbishment program.

On the issue of spares availability and the ongoing maintenance of the fleet, Nuttall Consulting considers that this may be an issue, and will become more significant as the fleet ages further during the next period. However, as with the *LG4C* 66 kV breaker above, it is very difficult in the context of this review to confirm how many breakers will need to be retired to achieve an optimal level. The SP AusNet documentation does not provide any quantitative information on how this issue is being managed presently, or forecasts of the spare requirements for the planned and unplanned maintenance across the fleet. However, Nuttall Consulting notes that the PB report detailing its review of the SP AusNet proposal did discuss the asset works program to refurbish the *3AT5* fleet. In this regard, the PB review approved $6.1 million for the refurbishment of 14 *3AT5* circuit breaker in the next period. Furthermore, the PB report noted that the $6.1 million forecast by SP AusNet was based upon actual contractor costs, and these costs appeared to include the provision of spare parts.

Therefore, although Nuttall Consulting accepts that there may be a reasonable technical argument to replace a number of *3AT5* 500 kV breakers to release spares, nothing in the information presented confirms that the basis of the AER's adjustments will not allow SP AusNet to maintain the quality, reliability, and security of the transmission network.

***220/66 kV Transformer***

The AER has determined that SP AusNet's proposed replacement of two of its 220/66 kV 150 MVA transformers at TTS, should be reduced to a single transformer. The main driver behind the replacement of the two transformers appears to be based mainly on their condition. One transformer consists of nine single phase units that form a 150 MVA bank. These units have a high risk ranking in SP AusNet's transformer risk model. The second 150 MVA transformer is a single 3 phase unit, that has a medium risk ranking in the SP AusNet model.

The AER has rejected the second transformer replacement as it does not consider that SP AusNet has demonstrated a clear need for this replacement. It is also noted that SP AusNet's NPV analysis for this project did not include an analysis of the options for the transformer replacements.

Unfortunately, there is little discussion in the project summary of SP AusNet's considerations with regards to the need for the replacement of both transformers at the same time. It is noted that the project summary states that the second unit has shown "deteriorating oil results". However, presumably, these are not sufficiently onerous to warrant a higher risk ranking for this transformer. It is also not clear what contingency arrangements may be available should the second transformer fail in service.

[7] SP AusNet ex ante project summary "Replacement Program for 500kV Circuit Breakers"

Based upon the above, provided that the second unit does not need a major refurbishment to remain in service, there does not appear to be a clear technical reason why it would not be prudent and efficient to defer the replacement of the second units. Nuttall Consulting accepts that this may require a higher overall capital cost, but would still expect the overall NPV to be lower provided ongoing risk costs are not excessive. It should also be noted that some efficiencies may be available if the replacement of the second transformer was coordinated with the replacement of the 66 kV switchbays, which the AER has also recommended the deferral of.

Based upon the above, Nuttall Consulting considers that nothing in the information presented confirms that the basis of the AER's adjustments, relating to the replacement of a single transformer at TTS, will not allow SP AusNet to maintain the quality, reliability, and security of the transmission network.

***Summary***

In summary, Nuttall Consulting has reviewed the AER's analysis of SP AusNet's proposed ex ante capital expenditure, and the AER's adjustment to this expenditure resulting from the analysis. The aim of this review was to confirm whether the technical basis for these adjustments was appropriate with regards to the technical/engineering considerations that SP AusNet has presented in support of its revenue proposal. The overall findings of the Nuttall Consulting review are as follows:

- There are a number of significant technical matters raised by SP AusNet in support of its proposed ex ante capital expenditure. Whilst these matters are appropriate in principle, Nuttall Consulting does not consider that SP AusNet's documentation provides sufficient evidence in support of these technical matters to reasonably justify that its proposed expenditure is prudent and efficient.

- Further, Nuttall Consulting has found nothing in the information presented to confirm that the basis of the AER's adjustments will not allow SP AusNet to maintain the quality, reliability and security of the transmission network.

I trust you will find the above satisfactory. However, do not hesitate to contact me should you require any clarifications.

Sincerely,

Brian Nuttall
Director