Nuttall Consulting

Regulation and business strategy

VENCorp's revenue proposal and reconciliation to the 2007 EAPR

A report to Australian Energy Regulator

Final

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1. Introduction

The Australian Energy Regulator (AER), in accordance with its responsibilities under Chapter 6A of the National Electricity Rules (NER), is determining VENCorp's maximum allowed revenue for its prescribed transmission services during the 2008/09 to 2013/14 period. In accordance with the NER, VENCorp submitted a revenue proposal to the AER in May 2007 (the original proposal) that set out VENCorp's revenue requirements for this period.

The AER engaged PB Associates (PB) to review the VENCorp proposal. The PB review included a number of detailed project reviews of historical (and committed) and planned augmentation projects. PB provided a draft report on its review to the AER in July 2007, which was finalised in October 2007 (the PB report).

In accordance with the NER, VENCorp published its 2007 Electricity Annual Planning Report (2007 EAPR) in June 2007. The process undertaken by VENCorp to produce its 2007 EAPR resulted in some changes to the planned augmentation program that was used to prepare the original proposal. This was most notably with respect to project costs estimates. Therefore, in July 2007, VENCorp provided the AER with a reconciliation between the original proposal and the 2007 EAPR. This reconciliation amended the original proposal. The amendments only impacted VENCorp's proposed planned augmentation expenditure, the historical (committed) augmentation expenditure, and operating expenditure forecasts[1] were left unchanged from the original proposal. The reconciliation and the resulting amended proposal are referred to as the revised proposal in this report.

The 2007 EAPR also includes a revised load forecast. This revised forecast has not been used by VENCorp to assess its planned augmentation in the 2007 EAPR. As such, VENCorp's revised proposal is still based upon the load forecast used to produce the original proposal – the load forecast published in the 2006 EAPR.

The release of the 2007 EAPR, and VENCorp's revised proposal, occurred near the completion of the PB review. Therefore, PB was unable to properly review these documents, and identified in its draft report that further work was required. As a result, the AER has requested Nuttall Consulting to consider whether the 2007 EAPR, and specifically the revised project costs, should lead to a material change to PB's recommendations in its report. Where Nuttall Consulting concludes that a material change should result, it must provide the AER with the prudent and efficient adjustment. The main focus of this work is PB's recommendations on the five planned augmentation projects that PB reviewed in detail.

The AER has also requested Nuttall Consulting to consider the following:

- the impact of the 2007 EAPR (and information provided subsequent to this) on PB's recommendations on the efficiency and prudency of VENCorp's revenue proposal; and
- the impact of the load forecast in the 2007 EAPR on PB's recommendations.

[1] Other than the impact that the revised planned augmentation expenditure has on VENCorp's operating expenditure through the associated charges for these augmentations.

This report discusses the Nuttall Consulting review and presents the findings. An important point, with respect to the recommendation in this report on prudency and efficiency, is that a fundamental assumption is that PB's recommendations on these matters are valid based upon the information it had available prior to the release of the 2007 EAPR. Nuttall Consulting has not attempted to "re-do" PB's detailed project reviews, or validate its recommendations.

The report is structured as follows:

- Section 2 provides a background discussion on VENCorp's revised proposal, the main changes to the original, and reasons for these changes.
- In section 3, the five planned augmentation projects reviewed by PB are re-examined, in light of the 2007 EAPR and revised proposal. The section considers each project in turn, summarising the original proposal, the revised proposal and PB's recommendations. PB's recommendations are then analysed and conclusions are drawn on whether there should be material changes to these recommendations. The section concludes with a reconciliation of the expenditure for all five projects, covering the revised proposal, PB's recommendations, and Nuttall Consulting's findings.
- Section 4 then considers the findings of these project reviews, with regards to the appropriateness of the revised project costs for the remainder of the planned augmentation projects in VENCorp's revised proposal.
- In Section 5, PB's recommendation on the prudent and efficient expenditure for the planned augmentation program is then considered in light of the findings of the project reviews in Section 3, and the appropriateness of the revised costs in Section 4.
- Section 6 then examines the changes to the maximum demand and the generation scenarios that may result from the new load forecast in the 2007 EAPR. The possible impacts of these changes on PB's recommendations are then discussed.
- Finally, in Section 7, the findings of the Nuttall Consulting review are summarised, and a reconciliation of the total planned augmentation expenditure is provided, covering the revised proposal, PB recommendations, and Nuttall Consulting's findings.

It should be noted that in this report, all expenditure is in real 2007/08 dollars, unless explicitly stated otherwise.

2. Background to VENCorp's revised proposal, and reconciliation to the original

VENCorp's revised proposal has resulted from the work VENCorp has performed to produce the 2007 EAPR. This work followed the preparation of the original proposal.

The revised proposal forecasts a planned augmentation expenditure program of $288 million. This represents a significant reduction from VENCorp's original proposal, which contained a planned augmentation expenditure program of $354 million.

The main changes to VENCorps revised proposal are due to the following:

- the removal of the 25 % contingency factor that was applied to the estimated cost of each project;
- increases in the estimated cost for a number of the projects; and
- adjustments due to further analysis performed for the 2007 EAPR, which impacted the timing of some projects, and changed the need for others in the four generation scenarios.

The remainder of this section summarises these changes in terms of the *predominantly load driven* and *predominately generation driven* projects. Following this, the basis of VENCorp's project cost increases that have occurred in the revised proposal is summarised.

2.1. Predominantly load driven projects

Table 1 Predominately load driven expenditure

	Planned augmentation expenditure ($ millions real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Original proposal	2	15.7	20	47.7	106.5	35.8	227.7
Original proposal (ex. 25 %)	1.6	12.56	16	38.16	85.2	28.64	182.2
Revised proposal	2.6	9.3	10.5	42.0	43.0	49.4	156.8

Table 1 above compares the expenditure between the original and revised proposals for the predominantly load driven projects. This shows a significant reduction of approximately $71 million. The majority of this reduction is due to the removal of the 25 % contingency factor in the revised proposal. To aid in the illustration of this impact, the expenditure in the original proposal is shown in the table with the

25 % removed. This indicates that there is still a significant reduction of $25 million from the original proposal.

The reasons for this change are summarised below in terms of three factors:

- those resulting in expenditure reductions;
- those resulting in expenditure increases; and
- those that have impacted the annual profile of the expenditure.

Expenditure reduction from original to the revised proposal.

The most significant reduction is due to the re-allocation of the *Minimum reactive support in metropolitan area* project between the *predominately load driven* and *predominantly generation driven* categories. This has reduced from $20 million (excluding the 25% multiplier) in the original proposal to $3.5 million in the revised proposal. VENCorp has advised that this revision is due to some improved analysis performed for the 2007 EAPR. Table 2 below indicates the movement of the expenditure related to reactive support in the metropolitan area.

Table 2 *Minimum reactive support in the metropolitan area* project movements

	Total Expenditure ($ million real 07/08)	
	Original proposal	Revised proposal
Predominantly load driven	20	3.5
Predominantly generation driven		
Latrobe Valley scenario	20	16
South west scenario	-	1.5
Import from NSW scenario	-	16
Metro/state grid scenario	-	0

A second significant reduction is due to a number of projects that have been removed from the revised proposal – essentially due to the deferral of the need for these projects until after the 2013/14. VENCorp has advised[2] that the main reason for this deferment is the higher revised cost estimate for these projects. That is, the on going "risk" costs of the associated constraint (e.g. the cost of expected energy not served) will need to have increased to justify the higher cost to remove the constraint. VENcorp has also stated that some further analysis has been performed on some projects, which indicates their need may be deferred. These projects account for approximately $13 million in the original proposal (excluding the 25% contingency). The projects are:

- 220kV line uprate to 75deg Ballarat to Bendigo
- 220kV line uprate to 75deg Ballarat to Moorabool
- 220kV line & CB replacement W. Melbourne & Keilor
- 220kV line & plant replacement Fish Bend & W Melbourne

[2] Verbal advice in meeting between VENCorp, Nuttall Consulting and the AER, dated 31 July 2007.

- 220kV line wind monitoring Ballarat to Bendigo

Furthermore, the *220kV TS at Sth Morang & assoc line changes* project has moved from being a *predominantly load driven* project, to being *predominantly generation driven* and only needed for the *import* scenario. The cost for this project is $5 million. VENCorp has advised that further studies performed for the 2007 EAPR have indicated that this project will not be required until 2014/15, unless the Snowy/NSW import capability is increased prior to this date. Therefore, this project has been moved to the *import* scenario.

A more minor reduction is due to the *Minimum reactive support in state grid* project, which has reduced slightly ($7.5 million from $8 million) because of a slight change in the scope and cost of this project. This project is discussed further in the Section 3.2, which details Nuttall Consulting's considerations on PB's detailed project reviews.

Expenditure increases from original to the revised proposal.

A number of project costs have increased from the original to the revised proposal. The most significant of these is the cost of the SVCs in the state grid area. This has increased from $20 million (excluding the 25% contingency) to $28 million. In addition to this cost increase, there have also been cost increases on the following projects:

- Terminal Station upgrades at Moorabool & Geelong
- 220kV line wind monitoring Eildon to Thomastown
- 220kV line wind monitoring Rowville to Richmond
- 220kV line wind monitoring Rowville to Malvern
- 220kV line wind monitoring Springvale to Heatherton.

This has resulted in a $0.7 million increase in the total cost of these 5 projects, from $3 million in the original proposal.

VENCorp has advised that these increases have been required to account for cost factors not incorporated in the original estimates. The background to these cost increases is discussed further in Section 2.3.

A more minor increase is due to the inclusion of a new project, the *Generator tripping control scheme at Hazelwood* project, at the cost of $1 million. This project is required in 2008 to alleviate a market constraint related to the potential overload of the existing Hazelwood transformer for an outage of a parallel line. VENCorp has advised[3] that the need for this project has resulted from further analysis performed as part of the 2007 EAPR project.

Changes to the annual expenditure profile from original to the revised proposal.

The most significant change to the annual profile of expenditure is in the last two years of the period, whereby total costs have reduced by around $40 million in 2012/13, but have increased by approximately $20 million in 2013/14. This change in the distribution of the projects is predominantly driven by the deferment from 2012/13 to 2013/14 of the $35 million *1000 MVA 500/220 kV transformer in the*

[3] Verbal advice in meeting between VENCorp, Nuttall Consulting and the AER, dated 31 July 2007.

metropolitan area project. This project is discussed further in Section 3.1, which details Nuttall Consulting's considerations on PB's detailed project reviews.

A number of more minor line uprating projects are also deferred to 2013/14 in the revised proposal. There are also some changes to the projects related to the reactive support needs in the metropolitan and state grid areas, which have impacted the distribution of expenditure in the period.

The only project to be advanced is the $1.3 million *Terminal Station plant upgrade Moorabool & Geelong* project. This has been advanced by 2 years from 2011/12 in the original proposal to 2009/10. VENCorp has advised[4] that this had been advanced to allow it to be coordinated with SP AusNet's asset replacement needs.

2.2. Predominantly generation driven projects

Table 3 Predominantly generation driven expenditure

	Expenditure ($ millions real07/08)[5]						
	SC1	SC2	SC3	SC4	SC5a	SC5b	Total
Original proposal							
Total projects	138	83	164	125	53	128	
Contribution	34	21	41	31	0	0	127
Original (ex. 25 %)							
Total projects	110	66	131	100	42	102	
Contribution	28	17	33	25	0	0	102
Revised proposal							
Total projects	140	88	175	124	63	225	
Contribution	35	22	44	31	0	0	131
% increase	27%	33%	33%	24%			

Table 3 above compares the expenditure between the original and revised proposals for the *predominantly generation driven* projects. The expenditure in the revised proposal has only increased from the original proposal by $4 million, or 3%, which is a relatively small amount. However, noting that the 25% contingency factor has been removed from the revised proposal, then it can be seen that the equivalent increase is far greater, increasing 28% or $29 million.

The main reason for this increase is due to significant increases to the cost estimates of a number of the individual projects. These increases in the project cost estimates have resulted from two main sources:

- revised project cost estimates provided by SP AusNet for the 2007 EAPR; and
- the extrapolation of the original project cost estimates, by VENCorp as part of its 2007 EAPR process.

[4] Verbal advice in meeting between VENCorp, Nuttall Consulting and the AER, dated 31 July 2007.
[5] The scenario numbering in this table matches that defined in Tables 7.3 and 7.4 of VENCorp's original proposal.

Table 4 below lists the projects that have significant cost estimate increases. This table indicates the source of the increase, the cost increase, and the number of scenarios for which the project are required.

This table indicates that SP AusNet has provided revised estimates for 5 of the projects in VENCorp's revised proposal. The increases in the cost estimates for these projects are very significant, ranging from a 40% increase to a 360% increase. Furthermore, VENCorp has increased the original cost estimates of a further 8 projects. These increases are not as great as SP AusNet's increases. However, they are still significant, ranging from 25% to 50%.

Table 4 *predominantly generation driven* project cost increases

	Project	Original		Revised		
		Cost ($ m)	scenarios	Cost ($ m)	Increase %	scenarios
SP AusNet's revised cost	Another 500/220kV transformer at Hazelwood[6]	22	3	40	82%	3
	Phase angle transformer on 220kV line Bend to Shep[7]	5	1	23	360%	1
	4th 330/220kV x'fomer at Dederang	11	4	21	91%	1
	3rd 700MVA 330/220kV x'former at Sth Morang	20	1	28	40%	1
	220kV line uprate to 70deg Eildon to Thomastown	2.4	1	5	108%	1
VENCorp's cost extrapolations	4th 500kV line Loy Yang to Hazelwood	30	2	45	50%	1
	Additional SVCs in state grid area[8]	20	1	28	40%	1
	New 500kV TS nr Mortlake	12	1	15	25%	1
	Series comp + shunt cap bank Wodonga/Dederang	12	1	15	25%	1
	330kV line uprate Sth Morang to Dederang + comp	7.4	1	10	35%	1
	Series comp on 220kV line Eildon to Thomastown	7	1	9	29%	1
	Upgrade terminations and CBs at Hazelwood	6	2	7.5	25%	2
	Additional reactive support in state grid area	4	3	5	25%	3

It is also noted that there are some changes to the expenditure due to changes to the allocation of the projects to the scenarios. These changes include:

- the *4th 500kV line Loy Yang to Hazelwood* project, which originally was needed in the *Latrobe Valley* and *import* scenarios, and is only required in the *Latrobe Valley* scenario in the revised proposal;

[6] The cost increase from SP AusNet went from $13 million to $34 million. VENCorp has increased these SP AusNet estimates to account for 4 additional GIS circuit breakers that VENCorp will be replacing for fault level reasons if this project is required.

[7] Nuttall Consulting has assumed that the original estimate for the "Phase angle transformer on 220kV line Bend to Shepparton" project was based upon the SP AusNet June 2005 planning estimates, which included a cost estimate of $5 million for a "Phase shift transformer BETS-FVTS" within the "Smelter feasibility investigation" estimates.

[8] VENCorp used the SP AusNet's estimate for the Heywood SVC, which was $22 million, for the project cost and then escalated this project cost by 25%.

- the *4th 330/220kV transformer at Dederang* project, which was originally in all four scenarios, but is only in the *import* scenario in the revised proposal;
- the changes to the *reactive support in the metropolitan area* project that have already been discussed in the previous section on the *predominantly load driven* projects; and
- the *220kV TS at Sth Morang & assoc line changes* project, which has also been discussed above.

There have also been some significant increases in the cost estimates for the projects that are only required in the *export* scenarios. As these projects do not impact VENCorp's planned augmentation expenditure in its original or revised proposals, these cost increases are not specifically discussed further in this report.

2.3. The basis of VENCorp's project cost increases

Many of the project cost estimates used by VENCorp to generate its EAPR's, and its revenue proposal, are provided by SP AusNet. The basis of much of VENCorp's original proposal, and the 2006 EAPR, was project cost estimates provided by SP AusNet in June 2005[9], with some revised project costs provided by SP AusNet in April 2006[10].

As part of the 2007 EAPR process, in February 2007, VENCorp requested revised project cost estimates from SP AusNet[11] for 6 projects. SP AusNet provided revised cost estimates for these projects in May 2007[12]. These estimates showed a very significant increase in the cost from the previous estimates provided by SP AusNet for these projects - as has been highlighted in the section above. Furthermore, the SP AusNet document stated that "*SP AusNet would expect there to be significant increases from previous estimates and we would recommend caution when using these costs*".

The basis for these cost increases was not provided in the SP AusNet document. Therefore, VENCorp requested further detail on the reasons for such significant increases[13]. In response to this request, SP AusNet has provided some general comments on the need for the increases[14].

This response states that SP AusNet's previous estimates were based upon a "greenfield desk top approach", and used cost data based upon 2000-2004 prices. It also clarifies that SP AusNet's revised estimates use an improved estimating process, which is more focused on the likely brownfield elements of the projects and up to date prices. Some specific points that were provided by SP AusNet as reasons for the increases include:

[9] Letter from SP AusNet to VENCorp, dated 15 June 2005, entitled Planning Estimates.
[10] Letter from SP AusNet to VENCorp, dated 3 April 2006, entitles Planning Estimates for VENCorp's 2006 Electricity Annual Planning Review (Z604).
[11] Letter from VENCorp to SP AusNet, dated 28 February 2007, entitled Planning Estimates for VENCorp's 2007 Electricity APR .
[12] Letter from SP AusNet to VENCorp, dated 10 May 2007, entitles Planning Estimates for VENCorp's 2007 Electricity Annual Planning Review (Z712).
[13] Email VENCorp to SP AusNet, dated 23 May 2007.
[14] Email SP AusNet to VENCorp, dated 25 May 2007.

- prices have increased substantially in the last 5 years, for example transformer costs have doubled and construction costs have increased by 50%;
- previously, planning estimates excluded allowances for the risk in VENCorp contracts; and
- additional allowances were required for:
  - unspecified protection and control requirements;
  - brownfield costs that are likely to be incurred for associated project activities (e.g. latent soil conditions, old sewerage works, incorrect design information, costs to work around outage constraints);
  - work to meet functional requirements;
  - practical site specific constraints that would need to be overcome (e.g. access, space, planning and environmental requirements); and
  - project specific costs such as secondary upgrades, latent site conditions & control room upgrades.

VENCorp has then increased some of the other project cost estimated for the 2007 EAPR and the revised proposal. On the need for VENCorp to increase the cost estimate of other projects and the approach it adopted, VENCorp has stated[15]:

> "*The [*SP AusNet revised*] estimates were provided three weeks ahead of the finalisation of the EAPR, but on this occasion were significantly higher than historic cost estimates (approximately doubling in many cases). …*
>
> *…With no time to obtain updated cost estimates for all the other potential augmentations covered in the EAPR, and not wanting to use clearly out of date and incorrect estimates, VENCorp applied a 'Rule of Thumb' increase to all projects not covered by the recently received estimates from SP AusNet. To do this projects were split into 'transformers', 'lines', and 'other', to reflect the different proportions of raw materials, labour and site issues associated with each. A fourth category of 'X' covered those projects that it would not be appropriate to treat in this way (eg because original estimates had not come from SP AusNet etc.).*
>
> *'Rules of Thumb' were created by averaging, by project type, the percentage increases in the recent estimates received. These averages were deliberately kept as very round figures to reflect the level of accuracy available from the statistically low number of estimates we had to work from.*
>
> *Where the application of these 'Rule of Thumb' averages lead to inconsistencies between similar projects, or we were aware of other issues that needed to be taken into account, further adjustments to the new derived estimates were made.*"

The "Rule of Thumb" cost extrapolation factors applied by VENCorp are:

- 100 % for transformer projects, which has been calculated based upon the increase in SP AusNet's revised costs for the transformer projects – although this factor did not impact the revised proposal;

[15] Email from VENCorp to AER, dated 3 August 2007.

- 50 % for some line projects, which has been calculated based upon the increase in SP AusNet's revised costs for a line project;
- 25 % for some other projects, which has been set by VENCorp as an appropriate level to account for the factors raised by SP AusNet; and
- 10 % for some reactive projects, where the original estimate was based upon actual contract costs from contestable projects initiated by VENCorp.

3. The PB project reviews

The basis of VENCorp's revised proposal was discussed in the previous section. This explained that the demand forecasts, and generation scenarios, have remained largely unchanged from those that underpinned the original proposal. However, the estimated costs for many of the projects have increased. These increases are largely responsible for most of the changes in the revised proposal, covering the timing of some projects, and the movement of some projects to, or from, the *predominately load driven* projects to the *predominantly generation driven* projects. These movements are due to the probabilistic planning approach adopted by VENCorp, or the simplifications applied by VENCorp to replicate this approach, whereby cost changes can impact the timing of the need for the project.

This section re-examines the projects that formed PB's detailed project reviews. The intention of the Nuttall Consulting review is to determine whether new information in VENCorp's revised proposal and the 2007 EAPR (including any new information supporting the revised proposal) will materially impact PB's recommendations on the prudent and efficient allowance for these projects.

PB undertook a detailed review on the following five projects:

- *1000 MVA 500/220 kV transformer in the metropolitan area*
- *minimum reactive support in the state grid*
- *line terminations and monitoring equipment in the metropolitan area*
- *4th 330/220 kV Transformer at Dederang*
- *4th 500 kV Line from Loy Yang to Hazelwood*

This section considers each of these projects in turn. For each project, a summary of the following information is provided:

- the project as defined in the original VENCorp proposal;
- PB's recommendations, and the reasoning behind these recommendations; and
- the project in the revised proposal, and basis for changes, if any, to the original proposal.

Following this, the implications that VENCorp's changes may have on PB's recommendations are discussed. It is important to note that only the most relevant points on these projects are discussed here. More detailed discussions of these projects are contained in the PB report.

An important issue in the Nuttall Consulting review is the increases in the project cost estimates that have occurred in the revised proposal. As discussed in Section 2.3, VENCorp has advised that a significant factor driving these cost increases are the labour, equipment and material cost escalations that have occurred since 2000, and are forecast to occur in the next period. In assessing the validity of the revised costs, Nuttall Consulting has been provided with capital expenditure escalation data by the AER (the AER escalation data). This escalation data has been used by the AER in its draft decision on SP AusNet's revenue proposal. Therefore, the AER

considers this to be an appropriate basis for assessing VENCorp's revised project costs.

Nuttall Consulting has not undertaken a detailed review of the AER escalations data, and therefore, it should not be inferred that Nuttall Consulting is endorsing the AER escalation data by its application in the Nuttall Consulting review. Further details on the AER escalation data is contained in Appendix A.

3.1. 1000 MVA 500/220 kV transformer in the metropolitan area

3.1.1. Summary of VENCorp's ERCP proposals, and PB's recommendations

VENCorp's original ERCP proposal

As the name suggests, the *1000 MVA 500/220 kV transformer in the metropolitan area* project involves the augmentation of the tie-transformer capacity serving the metropolitan Melbourne area. The existing tie-transformers connect the 500 kV and 330 kV networks to the 220 kV network supplying the metropolitan region. The tie-transformers related to this project are located at the Rowville, Cranbourne and South Morang terminal stations[16], and supply these and other metropolitan terminal substations, including East Richmond, Richmond, Brunswick, Templestowe, Thomastown and Ringwood, via the 220 kV network. The need for the project is related to constraints on the supply to the metropolitan region, due to possible overloads of the existing tie-transformers at times of high demand.

The project proposed by VENCorp involves the installation of a new 1000 MVA 500/220 kV transformer at either Templestowe or Ringwood, plus the associated substation works, including the "greenfield" establishment of a 500 kV switchyard at the chosen terminal station.

VENCorp's original proposal defined this project to be *predominately load driven*. The project cost was $43.8 million (or $35 million excluding the 25% contingency). VENCorp has advised that this cost estimate was based upon "*similar contestable projects undertaken recently*[17]". The timing of the need for this project in the original proposal was the summer of 2012/13.

This cost and timing is in accordance with VENCorp's 2006 EAPR, which stated a project cost of $35 million and an estimated timing "around" 2012.

PB's recommendation

PB's recommendation is that it would not be prudent and efficient to commission this project, or undertake any alternatives, within the next revenue control period. As such, PB has recommended the removal from VENCorp's proposal of the total project cost of $43.8 million in the year 2012/13.

[16] These tie-transformers are related to potential projects in the wider Metropolitan network, including Keilor and Moorabool.
[17] Table 6, VENCorp Electricity Revenue Cap Proposal 1 July 2008 to 30 June 2014 – Explanation for Planned augmentation program, Version 2.4.

PB's recommendation is based, partly, upon study information provided by VENCorp during PB's review. VENCorp's analysis involved power flow studies assessing various normal and outage loadings on the existing tie-transformers, under the forecast maximum demand conditions (10% PoE, medium economic growth). This analysis indicated that for these maximum demand conditions, the continuous rating of transformers at Cranbourne and Rowville would be exceeded by:

- 2009/10 following a single transformer outage (N-1); and
- 2014/15 for the normal system (N-0) i.e. no outages.

Although this project was classified as *predominantly load driven*, the above results only related to the *Latrobe Valley* generation scenario. Studies applying the other generation scenarios were also provided by VENCorp. These studies indicated a small, but still significant, reduction in the loading of the tie-transformers for the other three scenarios. VENCorp had not performed its full probabilistic planning approach on this project, and therefore, considered 2012/13 to be an appropriate commissioning date assuming the application of this planning approach i.e. 3 years deferral from the N-1 date.

PB disagreed with this position, and considered that a more likely date, resulting from the application of VENCorp's probabilistic planning approach, would be outside of the next control period i.e. after 2013/14. The important matters that PB considered in arriving at this recommendation were:

- **The low probability of tie-transformer failure, and short outage duration if a failure occurs**. The majority of the outages leading to the overloads are all associated with transformers that are relatively new and reliable, and each transformer has a strategic spare.
- **A conservative view of the likelihood of overloads by the adoption of the maximum demand forecast with 10% probability of exceedance**. The 10% PoE maximum demand forecast is considerably higher than the 50% PoE forecast. As such, the timing of overloads for similar N-0 and N-1 conditions would be deferred by up to 5 years if the 50% PoE maximum demand forecast was used.
- **The adoption of the worst case generation scenario – the Latrobe Valley scenario**. Whilst PB recognised that the transformer loading was relatively insensitive to the scenarios, in PB's opinion, there was a sufficient reduction in the transformer loadings with the other scenarios to materially impact the timing for the different scenarios.

VENCorp's revised ERCP proposal and the 2007 EAPR

VENCorp's revised proposal includes the *1000 MVA 500/220 kV transformer in the metropolitan area* project. The scope of this project remains unchanged to that in the original proposal. The cost is $35 million, which is the project cost in the original proposal with the 25% contingency removed. The timing of this project has changed in the revised proposal, whereby the date has been deferred by one year resulting in a commissioning date of 2013/14.

The cost in the revised proposal matches that in VENCorp's 2007 EAPR. However, the commissioning date in the 2007 EAPR is "approximately" 2014,

which represents an additional year's deferral from that in the revised proposal, and two years from the original proposal.

VENCorp has provided some commentary on the reason for the difference between the timings in the original proposal, the 2007 EAPR, and the revised proposal. In this regard, with respect to the new studies for the 2007 EAPR, VENCorp has stated that[18]:

> "*…approximately 400 MW of the new scheduled generation required within the next 10 years was modelled outside both the metropolitan and Latrobe Valley areas, as a most probable credible scenario. For the study work behind the [original] ERCP all this generation had been assumed to locate in the Latrobe Valley. The extra generation in South-western Victoria has the affect in the modelling of reducing the loading through the metropolitan tie-transformers.*
>
> *The studies again concluded that an 'N-0' planning criteria would not require an additional metro transformer until 2015/16 or shortly thereafter.*"

With respect to the one year advancement from the 2007 EAPR, VENCorp has stated that[19]:

> "*…this large network augmentation (is) likely to be advanced following detailed assessment and with due consideration of risk assessment including project lead time.*"

3.1.2. Nuttall Consulting's analysis

The scope of the project and the cost (excluding the 25% contingency) has not changed from VENCorp's original proposal to the revised. The only change is in the timing of the project, which has been deferred one year i.e. 2012/13 in the original proposal to 2013/14 in the revised proposal.

In determining the timing for the 2007 EAPR, the form of analysis performed by VENCorp does not appear to have changed from that applied to produce the original proposal. That is, the analysis is still essentially based upon deterministic analysis of normal and outage network conditions, applying the maximum demand forecast. Certainly, there is no indication in the 2007 EAPR that VENCorp's probabilistic approach has been applied in any detailed way.

Of important note here is that the maximum demand forecasts and generation scenarios that underpin these 2007 EAPR studies, have not significantly changed from the original proposal i.e. the studies in the original proposal and the 2007 EAPR are both based upon the 2006 APR maximum demand forecasts. Therefore, the results of the studies used for the 2007 EAPR should not be significantly different from those provided to PB during its review.

Furthermore, no new information has been introduced by VENCorp that may be counter to any of PB's views that formed the basis of its recommendation. The three main factors raised by PB that supported its recommendation, summarised above, should be just as appropriate to the revised analysis for the 2007 EAPR.

[18] VENCorp document: VEN_DOCS-#216074-v5-Metro_transformer_date_reconciliation.doc
[19] VENCorp revised proposal, Attachment 1.

It should also be noted that VENCorp's revised analysis has effectively validated one of PB's concerns that the prudent timing is likely to be later than 2012/13 due to the probable location of new generation. In this regard, the main reason for the deferral of the need by one year, from the date stated in the original proposal, is that VENCorp is basing its "indicative probabilistic assessment" in the 2007 EAPR on the results of the *South West* generation scenario studies – the more onerous *Latrobe Valley* scenario was assumed for the original proposal. This has resulted in the timing of the project being defined as approximately 2014 in the 2007 EAPR, which is outside of the next revenue period (assuming it is commissioned in time for the summer of 2014/15). Although VENCorp has stated that it considers this date will be advanced to 2013/14 following a more detailed assessment, there is no explicit information supporting why such a detailed assessment will advance the optimal date for the project anymore than confirm PB's view.

As such, based upon the discussions above, Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendations on the *1000 MVA 500/220 kV transformer in the metropolitan area* project. Table 5 below provides a reconciliation of the project expenditure between the original proposal, PB's recommendation, the revised proposal, and the finding above.

Table 5 *1000 MVA 500/220 kV transformer in the metropolitan area* project expenditure reconciliation

	Expenditure $ millions (real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Original proposal	-	-	-	-	43.8	-	43.8
Original proposal (ex. 25 %)	-	-	-	-	35.0	-	35.0
PB recommendation	-	-	-	-	-	-	-
Revised proposal	-	-	-	-	-	35.0	35.0
Nuttall Consulting's findings	-	-	-	-	-	-	-

3.2. Minimum reactive support in the state grid area

3.2.1. Summary of VENCorp's ERCP proposals, and PB's recommendation

VENCorp's original ERCP proposal

The *minimum reactive support in the state grid* project involves the installation of capacitor banks in the Victorian state grid. This project is driven by the need to control voltages in the state grid at times of high demand. The project involves a program of works, covering the installation of a number of 66 kV switched shunt capacitor banks (i.e. the capacitor bank plus the 66 kV circuit breaker and associated primary and secondary works).

VENCorp's original proposal defined this project to be *predominately load driven*. The project cost was $10 million in total (or $8 million excluding the 25% contingency), with $2.5 million required in the four years from 2010/11 to 2013/14.

The original proposal and other documents supplied for the PB review are not clear on the exact scope of works covered by the $10 million. A report provided by VENCorp[20] in support of its original proposal indicated a need for 150 MVAr, provided by three banks of 2 x 25 MVAr, with one bank installed in three separate years. However, the same report also indicated that this project may cover four banks of 2 x 25 MVAr (200 MVAr in total) to be installed in the four years from 2010/11 to 2013/14. This four bank possibility also aligned well with the proposal, which, as noted above, has $2.5 million in each year from 2010/11 to 2013/14.

Nuttall Consulting has requested clarification from VENCorp[21] on the scope of work covered by the $10 million in the original proposal. VENCorp has stated that the scope of the project in the original proposal was three 2 x 25 MVAr capacitor banks plus an additional 1 x 25 MVAr unit, which were costed at $2.3 million per 2 x 25 MVAr bank and $1.4 for the single 25 MVAr bank. This amounted to $8.3 million (plus the 25 % contingency). This was then rounded to $8 million, and the total cost allocated equally across the four years from 2010/11 to 2013/14 for the original proposal.

PB's recommendation

PB's recommendation is that it would not be prudent and efficient to install all the capacitor banks during the next revenue control period. PB has recommended that only one 2 x 25 MVAr capacitor bank will be needed in the last year, 2013/14, of the next period.

In assessing the project, PB has assumed that the project consisted of four banks of 2 x 25 MVAr capacitors, and therefore, assumed $2 million to be VENCorp's estimated cost for the installation of a 2 x 25 MVAr bank (excluding the 25% contingency). PB has deemed $2 million to be an efficient cost for these works, recommending the removal of the 25% contingency. As such, PB has recommended that VENCorp should only be allowed $2 million in year 2013/14 for a 2 x 25 MVAr 66 kV switched shunt capacitor bank.

PB's recommendation on the need for only the 2 x 25 MVAr bank is based largely upon the lack of a detailed technical and economic evaluation of this project, and in particular, a coordinated analysis with other projects. In PB's opinion, it is likely that the need for much of the reactive support allowed for in this project will not eventuate. This is due to other projects, allowed for in the proposal, either providing some of this reactive support or reducing the need for additional reactive support. To substantiate this opinion further, PB has cited $26 million for specific reactive support projects that was allowed for in the previous revenue control decision, of which the need for much of this did not eventuate.

VENCorp's revised ERCP proposal and the 2007 EAPR

VENCorp's revised proposal includes the *minimum reactive support in the state grid* project, and once again, this is defined as *predominately load driven*. The revised proposal defines the scope of this project to be the installation of 150 MVAr of capacitor banks in the state grid. The revised proposal also clarifies that this project is a program of works, covering the installation of one bank of 2 x 25

[20] VENCorp Electricity Revenue Cap Proposal 1 July 2008 to 30 June 2014 – Explanation for Planned augmentation program, Version 2.4.
[21] Email AER to VENCorp, dated 26 July 2007.

MVAr 66 kV switched shunt capacitors in each of the years 2010/11, 2011/13, and 2013/14.

The cost in the revised proposal is $7.5 million, and no longer includes the 25% contingency. This revised cost represents a $0.5 million reduction from the original proposal of $8 million (excluding the 25% contingency). However, VENCorp has increased the cost of the 2 x 25 MVAr bank by 10% from $2.3 million in the original proposal to $2.5 million in the revised proposal – noting VENCorp's clarifications on the scope and costs in the original proposal.

The 2007 EAPR does not provide much detail on this project, simply stating that the reactive support in the state grid is "needs driven". Furthermore, the 2007 EAPR does not provide an estimated cost, or the scale or timing of the need.

3.2.2. Nuttall Consulting's analysis

The project scope and total cost (excluding the 25% contingency) has changed from VENCorp's original proposal to the revised. Furthermore, the cost for the 2 x 25 MVAr switched capacitor bank has increased from $2.3 million to $2.5 million.

In the discussion below, two main issues are considered in turn.

- Firstly, the appropriateness of the revised cost is considered, and specifically the efficient cost for the 2 x 25 MVAr switched capacitor bank, which forms the basis of VENCorp's estimate and PB's recommendation. An important factor in this regard is that the *minimum reactive support in the state grid* project represents one of only two projects in the detailed project reviews that have a revised estimate based upon VENCorp's cost extrapolations. Therefore, the analysis of the revised cost for this project has been an important factor in Nuttall Consulting's further considerations of VENCorp's cost extrapolations applied to other projects, which are discussed in Section 4.2.
- Secondly, PB's recommendation on the project scope, and specifically that only a 2 x 25 MVAr switched capacitor bank is required in 2013/14, is considered in light of the findings on the revised cost and other information relating to the 2007 EAPR.

The revised project cost and VENCorp's cost extrapolation

As discussed in the above section, the scope of the project in the original proposal was somewhat ambiguous. PB has assumed the project consists of the installation of four 2 x 25 MVAr 66 kV switched capacitor banks, and accepted $2 million as an efficient cost for the 2 x 25 MVAr unit. However, VENCorp has since advised that the original proposals scope was three 2 x 25 MVAr banks plus an additional single 25 MVAr bank, and the cost for a single 2 x 25 MVAr bank was assumed to be $2.3 million.

In VENCorp's revised proposal the estimated cost for a 2 x 25 MVAr switched capacitor bank has risen to $2.5 million. VENCorp has advised that the original $2.3 million[22] cost was determined from actual contract costs from recent

[22] VENCorp project cost spreadsheet "VEN_DOCS-218386-v1-Cost_estimates_-_as_prepared_for_AER.XLS"

contestable projects, and VENCorp has increased this original cost by 10% in the revised proposal.

Nuttall Consulting has not reviewed any information on the contestable project relating to this cost estimate, neither is it within its terms of reference to undertake any additional cost benchmarking. However, it notes that PB has stated that its recommendation on the efficient cost was[23] "*informed through the review of actual costs associated with the capacitor bank installations completed recently by VENCorp and unit costs within PB's internal benchmarking database*". That said, the PB report provides no detail of its analysis, what the actual costs were, or where the $2 million sits in the range of a reasonable estimate.

Considering the misunderstanding in the exact scope of the original proposal, VENCorp's position that $2.3 million represented its cost for a 2 x 2.5 MVAr bank in the original proposal, and the expected tolerance on PB's benchmark of $2 million, it is Nuttall Consulting's opinion that VENCorp's original cost of $2.3 million for the installation of a 2 x 25 MVAr 66 kV capacitor bank is within a reasonable range for an estimate of the efficient cost.

However, there appears to be far less of a case to allow the further 10% increase that VENCorp has applied in the revised proposal, particularly noting that PB accepted $2 million as an efficient cost. With regards to the basis for the 10% increase, in May 2007, the time of the original proposal, VENCorp appears to have been satisfied that $2.3 million represented an efficient cost, based upon *its* cost analysis of *its* contestable projects. Therefore, it is assumed that the basis for the increase has resulted from the increases seen in SP AusNet's revised project costs that have been provided to VENCorp as part of the 2007 EAPR process. However, SP AusNet's basis for the significant increases in its revised project costs (i.e. brownfield issues and price increases) is not as appropriate for this particular project.

In this regard, an important point is that the original cost estimate has been derived by VENCorp from recent contestable projects that it has procured. As such, it would be expected that this cost estimation process would intrinsically allow for the brownfield costs occurring through the historical projects. Furthermore, project cost information provided by VENCorp during this review[24] indicates that the basis of the unit cost estimates is December 2006 costs, not 2000-2004 cost as in SP AusNet's original estimates.

Therefore, Nuttall Consulting does not accept that the further 10% increase in the revised proposal has been justified by VENCorp. Nuttall Consulting accepts however that some increase may be warranted to allow for the forecast real price increases from 2006 to the time of the project.

To estimate the appropriate level of the cost increase, Nuttall Consulting has used the AER escalation data. Assuming that the original project costs are based upon December 2006 prices, and noting that the VENCorp's reactive project occurs in the last four years of the next period (2010/11 to 2013/14), then the AER escalation data indicates that a total increase of 1.9% (real $2007/08) is appropriate. This factor has been applied to VENCorp's original cost for the 2 x 25 MVAr switched capacitor banks ($2.3 million) to calculate the efficient unit cost for this project to

[23] PB report pg 74
[24] VENCorp spreadsheet: VEN_DOCS-218386-v1-Cost_estimates_-_as_prepared_for_AER.XLS

be $2.34 million. Further details of the escalation data underlying this calculation are contained in Appendix A.

PB Recommendation of the efficient scope

On the issue of PB's recommendation on the scope, the basis for this recommendation was the lack of detailed technical and economic evaluations, and as such, the expectation that much of the need for this project would be displaced by other projects allowed for in the proposal – as has occurred in the current period. On this matter, it appears that the analysis underpinning the 2007 EAPR is still at a similar level to that undertaken for the original proposal. VENCorp has indicated[25] that further analysis has occurred since the original proposal. However, there is no evidence that this is substantially different from that underpinning the original proposal, and as such, specifically addressing PB's concerns.

Therefore, Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendation on the prudent and efficient scope of the *minimum reactive support in the state grid* project. Namely, that only a 2 x 25 MVAr 66 kV switched capacitor bank will be needed in 2013/14.

Summary

The main findings of Nuttall Consulting's review of the *minimum reactive support in the state grid* project are as follows:

- Nuttall Consulting accepts that there is a basis for increasing the original project cost, but considers that VENCorp's increase of 10% is too high, and has recommended an increase of only 1.9%.
- Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendation on the prudent and efficient scope of this project.

Therefore, Nuttall Consulting is of the view that the 2007 EAPR and revised proposal will materially impact PB's recommendation on the prudent and efficient cost for the *minimum reactive support in the state grid* project. In this regard, PB's recommendation that only $2 million should be allowed for in 2013/14, should be revised to $2.34 million in 2013/14.

Table 6 below provides a reconciliation of the project expenditure between the original proposal, PB's recommendation, the revised proposal, and the findings above.

[25] Stated in meeting between VENCorp, Nuttall Consulting, and the AER on 31/7/2007.

Table 6 *minimum reactive support in the state grid* project expenditure reconciliation

	Expenditure $ millions (real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Original proposal	-	-	2.5	2.5	2.5	2.5	10.0
Original proposal (ex. 25 %)	-	-	2.0	2.0	2.0	2.0	8.0
PB recommendation	-	-	-	-	-	2.0	2.0
Revised proposal	-	-	2.5	2.5	-	2.5	7.5
Nuttall Consulting's findings	-	-	-	-	-	2.34	2.34

3.3. Line Terminations and Monitoring Equipment in the Metropolitan Area

3.3.1. Summary of VENCorp's ERCP proposals, and PB's recommendation

VENCorp's original ERCP proposal

The *line terminations and monitoring equipment in the metropolitan area* project involves the installation of primary and secondary transmission plant across the metropolitan region. This project is driven by the need to increase the transfer capability of the existing lines by replacing line termination equipment that imposes limitations, and installing monitoring equipment. The project does not have a defined scope of works, rather it is an annual allowance to cover these types of projects in the next period.

VENCorp's original proposal defined this project to be *predominately load driven*. The project cost was $18.8 million in total (or $15 million excluding the 25% contingency), with $3.8 million allocated for each of the five years from 2009/10 to 2013/14.

PB's recommendation

PB's recommendation is that 50% of the amount proposed by VENCorp is prudent and efficient, namely $9.4 million in total and $1.9 million in each year from 2009/10 to 2013/14.

PB's recommendation is based largely upon its view that VENCorp has not performed any detailed technical assessments, and more specifically, VENCorp has not suitably accounted for SP AusNet's replacement program, which includes the replacement of 8 metropolitan terminal stations, 2 in the current control period and 6 in the next. PB based its 50% estimate on the historical level of expenditure for similar works.

VENCorp's revised ERCP proposal and the 2007 EAPR

VENCorp's revised proposal includes the *line terminations and monitoring equipment in the metropolitan area* project, and once again, this is defined as *predominately load driven*. The cost in the revised proposal is $15 million, noting that this cost no longer includes the 25% contingency. As such, there is no change

in the project costs (excluding this 25% contingency) between the original and the revised proposals.

Neither the revised proposal, nor the 2007 EAPR, provides much detail on this project. Both simply state that it is "needs driven".

3.3.2. Nuttall Consulting's analysis

As noted above, there is no change in the scope or cost (excluding the 25% contingency) of this project between VENCorp's original and revised proposal. Furthermore, there is no additional information provided in the revised proposal and the 2007 EAPR on this project. As such, there is no new information that could be considered counter to PB's views that formed the basis of its recommendations on this project.

Therefore, Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendations on the prudent and efficient costs for the *line terminations and monitoring equipment in the metropolitan area* project. This being $1.9 million for each year from 2009/10 to 2013/14. Table 7 below provides a reconciliation of the project expenditure between the original proposal, PB's recommendation, the revised proposal, and the finding above.

Table 7 *line terminations and monitoring equipment in the metropolitan area* project expenditure reconciliation

	Expenditure $ millions (real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Original proposal	-	3.8	3.8	3.8	3.8	3.8	19.0
Original proposal (ex. 25 %)	-	3.0	3.0	3.0	3.0	3.0	15.2
PB recommendation	-	1.9	1.9	1.9	1.9	1.9	9.5
Revised proposal	-	3.0	3.0	3.0	3.0	3.0	15.0
Nuttall Consulting's findings	-	1.9	1.9	1.9	1.9	1.9	9.5

3.4. 4th 330/220 kV Transformer at Dederang

3.4.1. Summary of VENCorp's ERCP proposals, and PB's recommendation

VENCorp's original ERCP proposal

As the name suggests, the *4th 330/220 kV Transformer at Dederang* project involves the augmentation of the transformer capacity at the Dederang terminal station. This transformer capacity serves an important role in the interconnection of the Victorian, Snowy and New South Wales transmission systems. The need for the project is related to constraints on the interconnector's import capability (into Victoria) due to projected overloads of the existing transformers at Dederang, which limit the import capability to existing levels.

The project proposed by VENCorp involves the installation of a new 4th 400 MVA 3300/220 kV transformer at Dederang, plus the associated substation works, including a new double switched 220 kV bay and a single switched 330 kV bay.

VENCorp's original proposal defined this project to be *predominately generation driven*. However, the project was proposed in all four generation scenarios. The project cost was $13.8 million (or $11 million excluding the 25% contingency). As the project was *predominately generation driven*, the costs were apportioned equally (25%) in the four years from 2010/11 to 2013/14.

This is in accordance with VENCorp's 2006 EAPR, which stated the project was required at the time of an 180 MW interconnector upgrade, and provided an estimated project cost of $11 million. This cost was advised to VENCorp by SP AusNet in the June 2005 planning estimate letter.

PB's recommendation

PB's recommendation is that it would not be prudent and efficient to commission this project within the next revenue control period. However, PB has noted that SP AusNet is proposing to replace an older transformer at Dederang in the next control period. Therefore, PB's opinion is that the prudent and efficient augmentation would be a coordinated project with SP AusNet, involving the replacement of an existing unit with a higher rated unit. As such, PB has recommended the inclusion of $5 million in 2012/13 in place of the 4th transformer project to allow VENCorp to fund the additional augmentation costs.

PB's recommendation is based, partly, upon study information provided by VENCorp during PB's review. VENCorp's analysis involves power flow studies assessing various normal and outage loadings on the existing transformers, under the forecast maximum demand (10% PoE, medium economic growth) and import conditions. This analysis indicates that constraints may eventuate, particularly if the import capability is increased. However, PB does not consider that these studies are sufficient to establish a clear need for the 4th transformer. Its main concerns in this regard are:

- the implications of SP AusNet's proposed transformer replacement project, which involves the replacement of the oldest and lowest rated transformer at Dederang - this existing transformer is the most severely overloaded in the VENCorp studies;
- the lack of an explanation of the estimates of energy at risk, and forecast of how this may grow in the future (and presumably other market cost/benefits); and
- the implications of the available spare transformer on the market benefits.

In PB's opinion, as the replacement of the oldest unit is already proposed by SP AusNet for the next period, the (possibly advanced) replacement of this unit with one of a higher rating will be prudent and efficient.

VENCorp's revised ERCP proposal and the 2007 EAPR

VENCorp's revised proposal includes the *4th 330/220 kV Transformer at Dederang* project. This project is once again defined to be *predominately generation driven*.

However, in the revised proposal it is only included in the *increased Snowy/NSW import* scenario – noting it was in all four scenarios in the original proposal[26].

The cost of this project in the revised proposal is $21 million and no longer includes the 25% contingency. This represents a substantial increase from the $11 million (ex. 25% contingency) in the original proposal. The revised cost matches that defined in VENCorp's 2007 EAPR.

The cost increase has resulted from revised estimates provided by SP AusNet to assist VENCorp in the preparation of its 2007 EAPR[27]. In this regard, SP AusNet has provided a revised cost for this specific project. The functional scope of the project has not changed significantly from the original proposal i.e. a 4th 400 MVA 330/220 kV transformer at Dederang. The only small change to the functional aspects of the scope is that the revised proposal includes a double switched 330 kV bay, as apposed to a single switched bay in the original proposal.

3.4.2. Nuttall Consulting's analysis

As discussed above, the cost of the *4th 330/220 kV Transformer at Dederang* project has increased substantially from the original proposal to the revised proposal without any significant changes to the functional scope. However, PB's recommendation is that the 4th transformer will not be required in the next period.

In the discussion below, two main issues are considered in turn.

- Firstly, the appropriateness of the revised cost is considered. This analysis is provided to assist the AER in its deliberation should it decide to accept the need for the 4th transformer at Dederang. Further, the *4th 330/220 kV Transformer at Dederang* project represents the only project in the detailed project reviews that has a revised estimate supplied by SP AusNet. Therefore, the analysis of the revised cost for this project is an important factor in Nuttall Consulting's further considerations of the other project cost increases due to SP AusNet's revised costs, which are discussed in Section 4.1.
- Secondly, PB's recommendation on the need for the *4th 330/220 kV Transformer at Dederang* project is considered, in light of the findings on the revised cost and other information relating to the 2007 EAPR.

SP AusNet's revised project cost

The cost estimate for the *4th 330/220 kV Transformer at Dederang* project has increased by 90%, from $11 million to $21 million. In considering the appropriateness of SP AusNet's revised estimate for this project there are two conflicting positions. One of these is SP AusNet's basis for the significant revised estimates. As discussed in Section 2.3, SP AusNet has provided some general commentary on the need for the revised estimates[28]. This states that the original estimates were indicative "greenfield" estimates based upon pricing data from 2000-2004 projects. The revised estimates have resulted from a more detailed

[26] The need for this project in only one scenario was identified and amended by VENcorp during the PB review.
[27] Letter SP AusNet to VENCorp, dated 10 May 2007.
[28] Email from SP AusNet to VENCorp dated 25 May 2007

assessment of the project scope by SP AusNet, and include "brownfield" factors and more up to date plant, equipment and construction costs. On these updated costs, SP AusNet advises that transformer costs have "*typically doubled in the last 5 years*", and "*construction cost are typically 50% higher*".

Nuttall Consulting does not disagree that significant cost increases due to these factors would be required if the basis of the original estimate was as stated by SP AusNet. It is also noted that the need for cost increases to allow for "brownfield" factors and cost escalations have been broadly accepted by PB during its review of SP AusNet's revenue proposal.

However, the counter position on the need for such a cost increase to SP AusNet's original estimates stems from PB's analysis of the original estimate for the *4th 330/220 kV Transformer at Dederang* project. In this regard, PB benchmarked the original project cost ($11 million) as part of its detailed project review[29]. Its finding on this matter was that the cost was a "*reasonable and efficient allowance*". PB also stated that this opinion was "*informed through (its) review of the benchmark costs associated with transformer installations*". In undertaking this benchmarking exercise, it would be expected that this allowed for the price escalation and "brownfield" factors, and as such, it should allow for much of SP AusNet's basis for the increases. Furthermore, the revised scope for the project does not include any major functional additions – certainly not ones that could be considered to represent an increase of $10 million.

Therefore, there appears to be a possible argument to reject the revised estimate based upon PB's benchmarking alone. Unfortunately, PB does not provide an explicit statement on where the original cost is placed within a reasonable range for such a project. As such, it is considered that the findings of PB's benchmarking are insufficient to reject the need for the revised cost outright.

Based upon the above conflicting positions, Nuttall Consulting has considered two main questions:

1. is there any supporting evidence that the basis for SP AusNet's revised costs is valid; and
2. if so, does the SP AusNet revised cost represent the efficient cost for the project in the context of VENCorp's revenue proposal.

On the first question, Nuttall Consulting has considered whether there is any evidence that the actual project costs, based upon VENCorp's contracts, are significantly higher than the estimates in VENCorp's past EAPRs. In this regard, Nuttall Consulting has compared the actual project contract costs, provided in Attachment 4 of the VENCorp revenue proposal, against the project cost estimates in VENCorp's recent EAPRs (2001 to 2006). Of particular note for the *4th 330/220 kV Transformer at Dederang* project are the recent Moorabool, Rowville, and Cranbourne transformer projects. The findings of this analysis are that there has not been a significant increase from the EAPR estimate to the actual contract cost. Most notably, for the Moorabool 500/220 kV transformer, the early 2003 EAPR estimates appear to be significantly higher than the actual cost.

[29] PB report Section 4.10.7 pg 82

At first site, this analysis appears to support the position that the need for the revised estimate is not required. However, Nuttall Consulting has discussed this analysis with VENCorp and SP AusNet[30]. SP AusNet has advised that, as the need for these projects was within a five year window of the project commissioning date, the SP AusNet estimates for these particular projects adopted a relatively detailed estimation process, similar to that applied for the revised estimates. Further, VENCorp advised that the early estimates for the Moorabool transformer project cost (which were significantly higher than the actual contract cost) were estimates prepared by VENCorp, not SP AusNet.

Although Nuttall Consulting has not been able to confirm these statements, it sees no reason to discount them. In light of these findings, Nuttall Consulting has also performed some analysis on the costs of the recent transformer projects that VENCorp has contracted, and the *4th 330/220 kV Transformer at Dederang* project. This analysis has attempted to develop high level substation bay and transformer costs, calibrated to the actual contract costs for the recent transformer projects, in order to develop an indicative cost estimate for the *4th 330/220 kV Transformer at Dederang* project. This analysis has also compared the unit costs against the benchmarks in PB's review of SP AusNet's proposal[31]. The analysis indicates that a project cost of $17 million would be broadly in line with recent transformer project costs.

This analysis supports the position that the original cost is too low, and SP Ausnet's basis for increasing the costs is valid. Therefore, on balance, Nuttall Consulting considers it reasonable to accept that there is a valid basis for the SP AusNet revised estimate.

Turning now to the second question on whether the estimate represents the efficient cost for the project, the cost analysis performed by Nuttall Consulting indicates that SP AusNet's revised estimate may be on the high side of a reasonable range. However, Nuttall Consulting does not consider that its cost analysis is sufficiently robust to justify that $17 million represents the efficient cost for this project, and therefore, it has requested further details from VENCorp on the basis of the revised cost estimate[32]. Of particular interest was the cost breakdown between the transformer works, and the substation bay costs, and associated factors specific to the Dederang substation that were driving the increased costs.

Resulting from this request, SP AusNet has supplied a more detailed description of the cost build-up and underlying assumptions that it applied in developing the *4th 330/220 kV Transformer at Dederang* project revised cost estimate[33]. This indicates three main factors, specific to the Dederang substation, that are resulting in increased costs.

The first two factors involve the transformer works. One factor relates to the new transformer, which appears to be a non standard design requiring a high impedance to ensure it load shares appropriately with the existing units. The second factor is the need to retire the existing spare transformer at Dederang to make way for the 4th

[30] Discussed during meeting between Nuttall Consulting, VENCorp, SP AusNet, and AER, dated 30 August 2007.
[31] PB report: SP AusNet Revenue Reset – An Independent Review, Section 3.4.
[32] Request made in meeting between Nuttall Consulting, VENCorp, SP AusNet, and AER, dated 30 August 2007.
[33] Supplied in an email from VENCorp, dated 7 September 2007.

transformer. SP AusNet has estimated the transformer provision and installation works to be $12.8 million, which appears to include a transformer cost of approximately $10 million. This represents a significant increase on the original estimate of $6 million, which was based upon the actual cost of a Dederang transformer replacement undertaken in 2001.

The final factor relates to the 330 kV bays. In this regard, SP AusNet has advised that the "*330 kV switchyard is under-width to provide suitable conditions for maintenance of equipment in adjacent bays*". This has resulted in increased bay costs to account for non-standard bay designs. It is also important to note here that the revised estimate allows for a 330 kV double circuit breaker arrangement, whereas the original estimate only allowed for a single breaker arrangement. SP AusNet has estimated the bay works to be $7.6 million. This represents a 60% increase on the original estimate of $4.7 million.

Based upon the findings of Nuttall Consulting's cost analysis, and the further clarifications on the scope provided by SP AusNet, Nuttall Consulting considers the revised cost estimate for the *4th 330/220 kV Transformer at Dederang* project appear to be reasonable in the broad context of an APR planning estimate.

However, the issue here is whether the cost is reasonable in terms of representing the efficient cost for VENCorp's revenue proposal. An important factor here is whether the revised project cost estimates reflects forecast prices at the likely time of the project. In this regard, one of the underlying factors for the need for SP AusNet's revised cost was the cost increases that have occurred since 2000-2004. The AER escalation data confirms significant cost increases have occurred since 2002 (the base year of the data). However, the data also indicate that prices should peak in real terms around 2007/08, and then reduce to the end of the next period (2013/14). This is most significant for transformer costs, whereby transformer real costs will be approximately 20% less by the last year of the period than their peak cost in 2007/08.

The important issue here with regards to SP AusNet's revised estimates is that the estimation methodology applied by SP AusNet appears to be based around producing estimates for this peak cost period, without any adjustment to account for the year that VENCorp has assumed the project will be required. For example, with regards to the Dederang project, SP AusNet has advised that the transformer cost estimate is based upon a recent estimate from a transformer manufacturer. Noting the recent significant increases in transformer costs, and the lead time of around 12-18 months for the transformer, it must be assumed that such an estimate must represent the expected peak in prices forecast to occur around 2007/08. Whilst it is accepted that this issue is unlikely to be unreasonable for APR purposes, it is considered that material adjustments should be made to produce the efficient cost estimate for the revenue proposal.

With respect to the *4th 330/220 kV Transformer at Dederang* project, the VENCorp proposal assumes that this project is equally likely to be needed in the last four years of the period. Therefore, to determine the efficient cost for this project, Nuttall Consulting has used the AER escalation forecasts to determine the reduction in the revised project cost, in real terms, from 2007/08 to the average of 2010/11 to 2013/14. This has been performed by separating the project cost into transformer and substation cost components, and then calculating separate reduction factors for

each component from the AER escalation data[34]. Based upon these calculations, the estimated cost for the project, as scoped by SP AusNet and based upon the timing in VENCorp's proposal, is determined to be $19.0 million (real 2007/08).

One other issue concerning the efficient cost is the appropriateness of the functional scope of the revised estimate, and specifically, the double switched 330 kV arrangements as apposed to the single switched arrangement in the original proposal. Neither VENCorp nor SP AusNet has provided any discussion on why these revised switching arrangements are warranted. However, it is noted that with regards to the original project scope, PB stated that it "*considers this scope is efficient and reasonable based upon the existing switching configuration at Dederang*"[35]. Therefore, there is no reason that PB's view of the efficient project scope - the single switched 330 kV arrangement - should change.

As SP AusNet has not provided a detailed cost build-up of the 330 kV bay cost in the revised estimate it is difficult to recommend an appropriate reduction to the revised cost to account for the change back to the 330 kV single switched arrangement. However, in Nuttall Consulting's opinion, a reduction of $1.2 million in the project cost is reasonable[36]. As such, Nuttall Consulting recommends that, should the AER accept the inclusion of the *4th 330/220 kV Transformer at Dederang* project, then the efficient project cost is $17.8 million.

PB's recommendation on the need for the 4th transformer at Dederang.

The discussion so far is around the reasonableness of VENCorp's revised cost for the *4th 330/220 kV Transformer at Dederang* project. However, PB has recommended that it would not be prudent and efficient to commission a 4th transformer during the next period. The main basis of PB's recommendation is that, in its opinion, VENCorp has not established a clear need for this project. In this regard, since the project cost has increased by approximately 90% in the revised proposal, the net market benefits of this project, and therefore this need, should be reduced even further.

Therefore, the main issue for further consideration here is whether or not there is new information in the 2007 EAPR (or the other information provided for this review) that may be counter to PB's opinion on this matter.

On this issue, as stated previously, it is important to note that the maximum demand forecasts and generation scenarios, that underpin these 2007 EAPR studies, have not significantly changed from the original proposal. Furthermore, the form of analysis performed by VENCorp does not appear to have changed from that applied to produce the original proposal. Certainly, there is no indication in the 2007 EAPR that VENCorp has undertaken a full market benefits test in any detailed way[37].

[34] Further details of the AER data, and Nuttall Consulting's underlying assumptions and calculations are contained in Appendix A.
[35] PB report Section 4.10.7 pg 82
[36] This is based upon PB's recommendation of $2 million for a similar situation in the 4th 500 kV line from Loy Yang to Hazelwood, whereby PB considered that a $2 million reduction represented the change from a 500 kV double switched arrangement to a single switched arrangement.
[37] It is noted that the lack of a detailed market benefits assessment of this project, based upon its expected timing, is consistent with VENCorp's approach to planning in the medium to long term.

It is noted that estimates of the cost of the associated constraint are provided in the 2006 and 2007 EAPR. These estimates have increased from the 2006 EAPR to the 2007 EAPR. The 2007 EAPR estimates the constraint cost to be $247,000 in 2007/08 rising to $249,000 in 2011/12[38], whereas the constraint costs in the 2006 EAPR are $187,000 in 2006/07 rising to $189,000 in 2010/11[39]. However, the reason for this change is not provided. Even so, $249,000 only represents 1.2% of the revised cost of the project ($21 million), whereas $189,000 represents 1.7% of the original cost ($11 million) i.e. the annual cost of the constraint remains at a very low percentage of the cost to remove the constraint. Therefore, in Nuttall Consulting's opinion, this in itself does not indicate a greater need for the project from the 2006 to 2007 EAPRs.

Furthermore, no new information has been introduced by VENCorp that may be counter to PB's other consideration. In this regard, there is no discussion on the spare transformer or SP AusNet's replacement plans. It is noted that in the cost estimate for this project provided by SP AusNet, SP AusNet states:

> "*No 1 Transformer Bank is scheduled for replacement in 2009. This replacement transformer (H1) will be replaced in the same location. An extended outage will be required to enable replacement of the transformer bank. It is expected that the installation of the H4 transformer will enable an extended outage of this transformer.*
>
> *It is recommended that the two transformers replacements be coordinated to minimise outages and temporary works.*"

This does raise the issue that installing the 4th transformer prior to the replacement of the existing unit may have some benefits in terms of reducing outage requirements – noting that outages of a Dederang transformer (without the 4th unit) may constrain the interconnector import level significantly. However, it would not be expected that this issue would be something new, and not already part of VENCorp and PB's deliberations on the need for this project. It is also important to note that the market benefits of an advanced installation of the 4th transformer would need to be significant to offset the cost of this project. Therefore, it is not considered that these comments made by SP AusNet would change PB's recommendation.

Summary

The main findings of Nuttall Consulting's review of the *4th 330/220 kV Transformer at Dederang* project are as follows:

- Nuttall Consulting accepts that there is a basis for SP AusNet's revised cost estimate, but considers that the revised cost does not reflect the efficient cost at the time VENCorp has assumed the project is required. Therefore, Nuttall Consulting has recommended a reduction of $2 million to SP AusNet's revised project cost to account for this factor (a reduction from $21 million to $19 million).
- Nuttall Consulting does not accept that VENCorp has justified the increase in the function scope of the project with regards to the double switched 330 kV arrangement. Therefore, Nuttall Consulting has recommended a further

[38] 2007 EAPR pg 62.
[39] 2006 EAPR pg 64.

$1.2 million reduction to allow for a single switched 330 kV arrangement (a further reduction from $19 million to $17.8 million).

- Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendation on the prudent and efficient scope of this project. This recommendation is that the 4th transformer will not be required in the next period, but an allowance should be made for the advanced replacement of an existing old transformer at Dederang with one of a higher rating.

Therefore, Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendations on the *4th 330/220 kV Transformer at Dederang* project. Table 8 below provides a reconciliation of the project expenditure, between the original proposal, PB's recommendation, the revised proposal, and the findings above.

Table 8 *4th 330/220 kV Transformer at Dederang* project expenditure reconciliation

	Expenditure $ millions (real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Project cost							
Original proposal							13.80
Original proposal (ex. 25 %)							11.0
PB recommendation							5.00
Revised proposal							21.00
Nuttall Consulting's findings							5.00
Project weighted contribution to expenditure							
Original proposal	-	-	3.45	3.45	3.45	3.45	13.80
Original proposal (ex. 25 %)	-	-	2.76	2.76	2.76	2.76	11.04
PB recommendation	-	-	-	-	5.00	-	5.00
Revised proposal	-	-	1.31	1.31	1.31	1.31	5.25
Nuttall Consulting's findings	-	-	-	-	5.00	-	5.00

3.5. 4th 500 kV Line from Loy Yang to Hazelwood

3.5.1. Summary of VENCorp's ERCP proposals, and PB's recommendation

VENCorp's original ERCP proposal

The *4th 500 kV Line from Loy Yang to Hazelwood* project involves the construction of a new 500 kV line from Loy Yang to Hazelwood. Loy Yang Power Station and Hazelwood Terminal Station are situated in the Latrobe valley, and are presently connected by three 500 kV overhead lines. The need for the project is related to constraints on the generation in this area due to projected overloads of the existing lines under outage conditions. These constraints are forecast to become significant

if large amounts of additional generation connect at Loy Yang, or "up stream" of this constraint.

The project proposed by VENCorp involves the construction of 15 km of single circuit 500 kV overhead line (rated 3,150 MVA), plus the switching arrangements to connect this line at Loy Yang Power Station and Hazelwood Terminal Station. These switching arrangements require one new 500 kV circuit breaker at Loy Yang, and two new 500 kV circuit breakers at Hazelwood.

VENCorp's original proposal defined this project to be *predominately generation driven*, with the project being required in the *Latrobe Valley* and *Import* scenarios – it is in these two scenarios where there are significant levels of new generation in the Latrobe Valley. The project cost was $37.5 million (or $30 million excluding the 25% contingency). As the project was *predominately generation driven*, the costs were apportioned equally (25%) in the four years from 2010/11 to 2013/14.

This is in accordance with VENCorp's 2006 EAPR, which stated a project cost of $30 million at the time of approximately 500 MW of additional generation at Loy Yang. This cost was advised to VENCorp by SP AusNet in the April 2006 planning estimate letter – although it is noted that this letter states the estimated project cost to be $29.5 million.

PB's recommendation

PB's recommendation is that it would be prudent to allow for the removal of the associated constraint in the next revenue control period, for the relevant generation scenarios. However, PB has recommended a slightly different scope for the project, whereby, it considers the prudent and efficient project to consist of a new 500 kV line that is single switched at both ends – effectively VENCorp's proposed project minus one of the 500 kV circuit breakers at Hazelwood.

PB's recommendation on the need for the project is based upon the study information provided by VENCorp during PB's review. In this regard, PB is satisfied that these studies indicate a clear need for the project should at least 500 MW of additional generation connect "up stream" of the 500 kV bus at Loy Yang Power Station. PB has also accepted that this need is appropriate for the two scenarios proposed by VENCorp (the *Latrobe Valley* and *Import* scenarios), and that the spread of the project costs equally across the four years from 2010/11 to 2013/14 is appropriate.

With respect to the cost for the project, PB's opinion is that the VENCorp cost is reasonable (although on the high side of a reasonable range), if the 25% contingency is removed. However, PB has costed the installation of a 500 kV circuit breaker to be $2 million, and therefore removed this value from VENCorp's project estimate to arrive at an efficient cost of $28 million for the recommended project.

VENCorp's revised ERCP proposal and the 2007 EAPR

VENCorp's revised proposal includes the *4th 500 kV Line from Loy Yang to Hazelwood* project. This project is once again defined to be *predominately generation driven.* However, in the revised proposal it is only included in the *Latrobe Valley* scenario – noting it was in both the *Latrobe Valley* and *Import* scenarios in the original proposal.

The cost of this project in the revised proposal is $45 million, and no longer includes the 25% contingency. This cost matches that in VENCorp's 2007 EAPR. However, this cost represents a substantial increase from the $30 million (excluding the 25% contingency) in the original proposal.

The cost increase has resulted indirectly from the revised estimates provided by SP AusNet to VENCorp for the preparation of the 2007 EAPR. In this regard, SP AusNet has not provided a revised cost for this specific project. However, VENCorp has used SP AusNet's revised cost to determine a cost extrapolation factor for lines projects, based upon the increase in another line project in SP AusNet's revised costs. VENCorp has determined this extrapolation factor to be 50%, and applied this to the cost of the project in the original proposal.

With regards to the change to the number of scenarios that VENCorp considers this project to be justified, this has been driven by the increased cost in the revised proposal. VENCorp has assumed that there is insufficient additional generation connecting at Latrobe Valley in the *import* scenario to justify this revised project cost. The important point here is that the project in the revised proposal only makes a 25% contribution of its cost to the total expenditure allowance i.e. $11.25 million. Had the cost remained as in the original proposal (i.e. $30 million) then the project would have remained in two scenarios, and as such, would have contributed 50% to the total expenditure allowance i.e. $15 million.

3.5.2. Nuttall Consulting's analysis

As discussed above, the cost of the *4th 500 kV Line from Loy Yang to Hazelwood* project has increased substantially from the original proposal to the revised proposal without any significant changes to the functional scope. Although, this increase in project cost has resulted in VENCorp considering that the project is only required in the *Latrobe Valley* scenario.

PB accepted the need for the project in the original proposal, and accepted that it would be required in both the *Latrobe Valley* and *Import* generation scenarios. PB also accepted that VENCorp's cost for the project scope was an efficient cost, but noted that it was on the high side of a reasonable range. However, PB recommended that the prudent and efficient project scope to satisfy this need would be slightly different from that proposed by VENCorp. In this regard it recommended that the efficient project would be a 500 kV line, single switched at both ends – as apposed to double switched at Hazelwood.

In the discussion below, two main issues are considered in turn.

- Firstly, the appropriateness of the revised cost is considered. An important factor in this regard is that the *4th 500 kV Line from Loy Yang to Hazelwood* project represents the only project in the detailed project reviews that VENCorp has applied an extrapolation, which has been determined from SP AusNet's revised estimates. Therefore, the analysis of the revised cost for this project is an important factor in Nuttall Consulting's further considerations of the VENCorp extrapolations applied to other projects, which are discussed in Section 4.2.

- Secondly, PB's recommendation on the need for *4th 500 kV Line from Loy Yang to Hazelwood* project is considered in light of the findings on the revised cost and other information relating to the 2007 EAPR.

VENCorp's cost extrapolation and revised project cost

As discussed above, VENCorp has increased the original project cost by 50%. This 50% factor has been based upon SP AusNet's revised cost for another line project – the *3rd 220kV line Moorabool to Ballarat* project. The cost of this other project was estimated by SP AusNet to be $8 million in June 2005[40]. However, in the revised cost estimates produced by SP AusNet in May 2007 for the 2007 EAPR, the cost of this project has increased by 63% to $13 million. Based upon this increase, VENCorp has adopted a 50% "Rule of Thumb" factor to extrapolate the cost of some of its lines projects.

The project VENCorp used to calculate this 50% factor involves the construction of a 3rd 220 kV circuit from Moorabool to Ballarat with single circuit breakers at each end. The 3rd circuit is constructed by stringing a second circuit on an existing double circuit line that is presently strung with only one circuit. The functional scope of this project did not change between the two SP AusNet estimates, and SP AusNet has not provided an itemised breakdown of the cost increase. However, it is clear that these increases are due to the same factors raised by SP AusNet and discussed above on the *4th Dederang transformer* project e.g. increases in construction costs, and the inclusion of "brownfield" issues.

In assessing the appropriateness of accepting that there is a basis for increasing the original project cost for the *4th 500 kV Line from Loy Yang to Hazelwood* project, it is important to reconsider the findings on the *4th Dederang transformer* project. In this regard it was accepted that the original SP AusNet estimate was low, and as such, it was appropriate to allow an increase in the costs. The original estimate of the *4th 500 kV Line from Loy Yang to Hazelwood* project is also based upon an SP AusNet estimate, and therefore, similarly there may be a case for allowing an increase to the original cost.

However, PB has stated in its cost benchmarking of the original cost for the *4th 500 kV Line from Loy Yang to Hazelwood* project that, in its opinion, it is a reasonable cost for the project. More importantly, PB has also specifically noted that the original cost is on the "*high side*" of its benchmarks, although it still considers it to represent an efficient cost due to the short line length. This is unlike the *4th Dederang transformer* project, where PB did not explicitly state whether the original estimate was on the low or high side. Therefore, the case for accepting the basis for increasing this project cost further does not appear to be as strong. However, noting PB's comments on the implications of the short line length on its benchmarking, it is accepted that some increase of the original project cost should be allowed.

With regards to the appropriateness of the "Rule of Thumb" factor calculated by VENCorp, and specifically whether this will reflect the efficient cost for the project, it is important to consider the basis of this factor. This factor has been calculated from the SP AusNet's revised costs for an alternative overhead line

[40] Letter from SP AusNet to VENCorp dated 15 June 2005, which provided planning cost estimates for a large number of VENCorp's projects.

project. The scope of work for the *4th 500 kV Line from Loy Yang to Hazelwood* project and this alternative project are different. The *4th 500 kV Line from Loy Yang to Hazelwood* project involves the construction of a new single circuit, single tower, 500 kV line. This is significantly different to the alternative project, which involves the stringing of a second 220 kV circuit on an existing line.

As such, Nuttall Consulting does not accept that the alternative project represents a suitable basis for calculating an appropriate increase for the *4th 500 kV Line from Loy Yang to Hazelwood* project cost. Therefore, to determine the efficient cost for this project, Nuttall Consulting has performed a bottom-up calculation of the cost increase from the original project cost. This bottom-up calculation has used the AER escalation data to determine the cost increase due to price escalations. To calculate the appropriate increase in real 2007/08 terms to the original cost, Nuttall Consulting has assumed that the original cost is based upon 2002-2004 prices[41], and the project timing is assumed to be equally likely in the last four years of the next period.

Nuttall Consulting has also allowed for brownfield factors in the cost increase. In this regard, Nuttall Consulting has allowed a further increase for the substation component of the cost of this project. However, the line component of the cost is considered to be a greenfield development, and as such, additional costs to cover brownfield factors is not considered necessary. These bottom-up calculations have resulted in a revised cost of $37.7 million for the project based upon the original scope[42].

With regards to PB's recommendation on the efficient scope (i.e. single switching both ends of the 500 kV line), this was based upon PB's view of the value of the operational benefits of a double-switched arrangement versus the additional cost of this arrangement. In this regard, PB's view is that the additional costs for the double switching arrangement will not be efficient, and recommended a reduction of $2 million from the project cost to reflect these arrangements. There is no information in the 2007 EAPR to confirm or counter this view, and as such, there does not appear to be any reason that PB's recommendation on the efficient scope should change. Furthermore, with regards to PB's estimate of the $2 million adjustment, it is assumed that this already allows for appropriate price escalations and brownfield issues. Therefore, the efficient cost for this project, accounting for PB's recommendation on the scope and the project cost increases discussed above, is calculated to be $35.7 million.

PB's recommendation on the need for the 4th 500 kV line

In considering PB's recommendations on the need for the *4th 500 kV Line from Loy Yang to Hazelwood* project, as with the other projects reviewed here, the underlining study methodology, the demand forecast and generation scenarios, do not appear to have changed significantly from those applied to produce the original proposal. Furthermore, no new information (other than the cost increase) has been

[41] Nuttall Consulting acknowledges that SP AusNet has advised that its original cost estimates were based upon 2000-2004 prices. However, as specific detail on the spread of prices has not been provided, and noting that it is expected that the number of capital project was most likely increasing from 2000 to 2004, Nuttall Consulting considers that an average increase from 2002 to 2004 is reasonable.

[42] Further details of the calculation of Nuttall Consulting's revised cost estimate for this project is contained in Appendix A.

introduced by VENCorp that may be counter to PB's considerations on the need for the project. Based upon the above, there does not appear to be any reason that PB's opinion on the need for the project would change, other than in which scenario the project may be required.

In considering the need for this project in the various scenarios, it is important to appreciate there must be sufficient new generation "behind" the constraint (Loy Yang's 500 kV bus) to justify its removal i.e. the market benefits must outweigh the project cost.

On this linkage between the cost increase and the need, VENCorp has introduced the relationship that:

- a $30 million project requires at least an additional 500 MW of generation at Loy Yang's 500 kV bus to justify the need for the project; whereas
- a $45 million project requires at least an additional 1000 MW of generation at Loy Yang's 500 kV bus to justify the need for the project.

For the original project cost of $30 million, both the *Latrobe Valley* and *Import* scenarios had sufficient generation behind the constraint to justify the need for the project (1200 MW and 600 MW in the *Latrobe Valley* and *Import* scenarios respectively). As can be seen from these levels of new generation in each scenario, the project cannot be justified in the *Import* scenario, assuming VENCorp's revised project cost of $45 million.

With regards to the appropriateness of VENCorp's relationship, PB does not make any statements on its view of the relationship between the project cost and the amount of generation required to justify that cost. However, VENCorp's assumption appears reasonable, and it is important to note that this assumption reduced the weighted contribution of this project to the expenditure allowance by removing the need for the project from the *import* scenario. As such, there does not appear to be any reason to discount this relationship.

The issue for consideration here is whether the project will be needed in one or two scenarios based upon the recommended efficient project cost of $35.7 million. In this regard, VENCorp's relationship does not indicate what the cost limit must be to justify the need if only 600 MW of new generation is behind the constraint, as in the *import* scenario. Assuming, however, a relatively linear relationship then this indicates that the cost limit is around $33 million i.e. a project cost greater than $33 million will require more than 600 MW of new generation behind the constraint.

Based upon this relationship, and the recommended project cost of $35.7 million, Nuttall Consulting considers that this project will only be justified in the one scenario – the *Latrobe Valley* scenario.

Summary

The main findings of Nuttall Consulting's review of the *4th 500 kV Line from Loy Yang to Hazelwood* project are as follows:

- Nuttall Consulting accepts that there is a basis for VENCorp's cost extrapolation of the original project cost, but considers that the 50% factor applied by VENCorp is not justified. Therefore, Nuttall Consulting has undertaken a bottom-up calculation of the cost increase and determined a

more appropriate cost for this project to be $37.7 million (up $7.7 million from the original cost of $30 million).

- Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not materially change PB's recommendation on the prudent and efficient scope of this project i.e. a reduction from a 500 kV double-switched arrangement to a single-switched arrangement. PB has recommended a reduction of $2 million in the project cost to allow for this recommendation, resulting in a final revised project cost of $35.7 million.
- Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will materially change PB's recommendation on the need for this project. In this regard, the increased cost will result in the project only being justified in one generation scenario – the *Latrobe Valley* scenario.

Therefore, Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will materially change PB's recommendations on the prudent and efficient allowance for the *4th 500 kV Line from Loy Yang to Hazelwood* project. Table 9 below provides a reconciliation of the project expenditure between the original proposal, PB's recommendation, the revised proposal, and the finding above.

Table 9 *4th 500 kV Line from Loy Yang to Hazelwood* project expenditure reconciliation

	Expenditure $ millions (real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Project cost							
Original proposal							37.50
Original proposal (ex. 25 %)							30.00
PB recommendation							28.00
Revised proposal							45.00
Nuttall Consulting's findings							35.74
Project weighted contribution to expenditure							
Original proposal	-	-	4.69	4.69	4.69	4.69	18.75
Original proposal (ex. 25 %)	-	-	3.75	3.75	3.75	3.75	15.00
PB recommendation	-	-	3.50	3.50	3.50	3.50	14.00
Revised proposal	-	-	2.81	2.81	2.81	2.81	11.25
Nuttall Consulting's findings	-	-	2.23	2.23	2.23	2.23	8.94

3.6. Summary of project review findings

The main findings of Nuttall Consulting's review of the five projects in PB's detailed project review are as follows:

- Nuttall Consulting accepts that there is a basis for the increases in the project costs that have been submitted in the revised proposal. However, in all

cases, Nuttall Consulting has recommended an adjustment to the revised project costs. The basis of these adjustments is as follows[43]:

- **SP AusNet's revised costs**. Nuttall Consulting has recommended reductions to these revised costs to account for the forecast reduction, in real terms, of costs during the next period.
- **VENCorp's cost extrapolations**. Nuttall Consulting has not accepted that the "Rule of Thumb" extrapolation factors are reasonable. As such, Nuttall Consulting has performed a bottom-up calculation of the appropriate increase for each project.

- Nuttall Consulting is of the opinion that the 2007 EAPR, and information provided by VENCorp following the release of the 2007 EAPR, will not result in any major changes to PB's recommendations on the prudent and efficient scope and need for these projects.

Table 10 below provides a summary reconciliation of the five projects reviewed in this section. This table shows the total project costs and the total weighted contribution of these project costs to the planned augmentation expenditure.

Table 10 Summary reconciliation of total project expenditure

	Expenditure $ millions (real 07/08)						
	08/09	09/10	10/11	11/12	12/13	13/14	Total
Total project cost							
Original proposal							124.10
Original proposal (ex. 25 %)							99.30
PB recommendation							44.50
Revised proposal							123.50
Nuttall Consulting's findings							52.58
Total weighted contribution to expenditure							
Original proposal	-	3.80	14.44	14.44	58.24	14.44	105.35
Original proposal (ex. 25 %)	-	3.04	11.55	11.55	46.59	11.55	84.28
PB recommendation	-	1.90	5.40	5.40	10.40	7.40	30.50
Revised proposal	-	3.00	9.63	9.63	7.13	44.63	74.00
Nuttall Consulting's findings	-	1.90	4.13	4.13	9.13	6.48	25.78

[43] Further details of Nuttall Consulting's adjustments to the revised project costs are contained in Appendix A.

4. Extending the project review findings to other revised project costs

Section 2.3 explained that the significant changes in VENCorps revised proposal are a result of increases in project cost estimates that have occurred through the 2007 EAPR preparation process. The basis of these increases to projects has also been discussed, showing that there are two main reasons why project costs have increased. These are:

- SP AusNet has provided revised project cost estimates; and
- VENCorp has applied "Rule of Thumb" cost extrapolations for other projects, based largely upon SP AusNet's revised project costs.

The appropriateness of the cost increases for specific projects has been discussed in the previous section, which re-assessed the five projects that PB performed detail reviews on.

In this section, the findings of the project reviews are extended to make recommendations on the appropriateness of the cost increases that have occurred to other projects, not assessed within these detailed reviews. This section first discusses the cost increases resulting directly from SP AusNet's revised costs, and then the increases resulting from VENCorp's cost extrapolations.

4.1. SP AusNet's project cost increases

SP AusNet provided revised project costs for six projects. Five of these projects contribute to VENCorp's *predominately generation driven* expenditure allowance - the sixth is not included in VENCorp's proposal. The total revised cost of these five projects is $117 million. This represents a 95% increase from the total original cost of $60 million.

The revised costs for these five projects contribute $49 million to VENCorp's proposed planned augmentation expenditure. This is a 43% increase from the $34 million weighted contribution from the original project costs. The reduction in the proportion of the increase in the weighted contribution is due to the fact that the number of scenarios that these projects are required in has reduced from the original proposal to the revised.

The background to the significant cost increases in SP AusNet revised estimates is discussed in Section 2.3. The main factors raised by SP AusNet behind the need for cost increases were that the original estimates for these projects were:

- "Greenfield desk top" estimates, and did not account for known specific site issues, and more general "brownfield" development factors; and

- the plant, equipment, and construction costs were based upon 2000-2004 cost data, which was considered to significantly underestimate the current, and forecast costs.

The main issue for consideration here is how the findings of the detailed project reviews can be extended to assess the appropriateness of SP Ausnet's revised estimates for the remainder of the revised proposal. Out of the six projects that SP AusNet has provided revised cost estimates, only one of these is a project included in the detailed project reviews – the *4th 330/220 kV Transformer at Dederang* project. SP AusNet's revised cost estimate for this project has risen by 90% from $11 million (in SP AusNet's June 2005 estimates) to $21 million (in SP AusNet's revised May 2007 estimates).

The main findings of Nuttall Consulting's review of this project cost increase (Section 3.4.2) were as follows:

- there is evidence that the SP AusNet's original cost for this project is low, and as such, there is a valid basis for increasing the project cost;
- the revised project cost may be appropriate in the context of VENCorp's EAPR requirements, however, it does not represent the efficient cost for the purposes of VENCorp's revenue proposal;
- a reduction in the cost was recommended to reflect the reduction in real prices that are forecast to occur during the next period – this was most significant with respect to the transformer costs.

In considering whether the findings of this project review are applicable across the other projects that SP AusNet provided a revised estimate, it is important to state the following observations:

- the cost in the original proposal, for all these projects, was based upon a previous SP AusNet estimate;
- three of the projects are transformer projects, as is the *4th 330/220 kV Transformer at Dederang* project;
- the fourth, is a line upgrade project;
- all projects are defined in VENCorp's proposal to be equally likely in the last four years of the next period (2010/11 to 2013/14), as is the *4th 330/220 kV Transformer at Dederang* project.

Although it has not been possible in this review to assess SP AusNet's revised cost estimates for these projects in any detail, there does not appear to be any reason to consider that the basis of SP AusNet's original estimates was not similar to the *4th 330/220 kV Transformer at Dederang* project. In this regard, all four projects were on the "long term" horizon, and therefore, it could be expected that the original estimate suffered from the similar limitations as the *4th 330/220 kV Transformer at Dederang* projects original estimate. Therefore, it appears reasonable to accept that there is a valid case to allow an increase in the estimated cost for these projects.

However, based upon discussions with VENCorp and SP AusNet[44], the underlying methodology and unit cost assumptions used to develop the revised estimates

[44] Meeting between VENCorp, SP AusNet, Nuttall Consulting and the AER, dated 30 August 2007.

appears to be consistent across all the projects. Therefore, based upon the findings on the *4th 330/220 kV Transformer at Dederang* project, it is expected that some reduction of the revised project costs is required to reflect the forecast reduction in real cost towards the end of the next period i.e. reflecting the time these project are most likely to be required.

Based upon the above, Nuttall Consulting has calculated reductions for each project using a similar methodology to that applied to the *4th 330/220 kV Transformer at Dederang* project revised cost. This methodology splits the revised project cost into transformer, substations, and line components. Then, the cost reduction for each component has been calculated from the AER escalation data.

Table 11 provides a summary of Nuttall Consulting's recommended adjustments to SP AusNet's revised project cost based upon the above described calculations. This represents a $9.6 million reduction in the revised project costs, which results in a reduction of $4.3 million on VENCorp's planned augmentation allowance (in addition to the reductions resulting from the detailed project reviews). Further details of the project cost calculations are contained within Appendix A.

Table 11 Nuttall Consulting's recommendations on the SP AusNet revised project costs

	Project cost ($ millions real 2007/08)		
Project	**Original**	**Revised**	**Recommended**
Another 500/220 kV transformer at Hazelwood[1]	$22.0	$40.0	$36.2
3rd 700 MVA 330/220 kV transformer at South Morang	$20.0	$28.0	$25.5
Phase angle transformer on 220 kV Bendigo to Shepparton line	$5.0	$23.0	$20.6
220 kV line uprate to 70deg Eildon to Thomastown	$2.4	$21	$4.9

1 The cost indicated for this project include $6 million added by VENCorp for associated fault mitigation works. This cost has not been increased in the revised proposal, and as such, Nuttall Consulting has not adjusted this amount.

One further issue for consideration is whether the revised project costs also include inefficient scope, not included in the original cost. The review of the *4th Dederang Transformer* project has found that the revised cost included some additional items that were deemed to be inefficient, based upon PB's recommendation of the efficient project scope. Specifically, this related to the 330 kV double switching arrangement for the transformer in the revised estimate, where only a single switching arrangement has been assumed in the original. This has resulted in a recommended $1.2 million reduction in SP AusNet's revised estimate.

It is difficult to apply this finding across the other projects, as this recommendation is specific to the project and PB's recommendations on the efficient scope of the project. However, to at least confirm whether or not other functional scope changes may have occurred from the original to the revised proposal, Nuttall Consulting has conducted a very high level review of the relevant scopes in SP AusNet's cost estimate documents. This review has found:

- increases to the transformer ratings on two projects: 850 MVA from 700 MVA for the South Morang 330/220 kV unit, 800 MVA from 600 MVA for the Hazelwood 500/220 kV unit; and
- 220 kV double switching for the Hazelwood transformer project, where 220 kV single switching is assumed in the original.

Both of these changes resulted from scope increases in VENCorp's request to SP AusNet for revised project costs. Based upon the above, there may be some justification for a further reduction in the revised estimate based upon an inefficient scope, particularly for the Hazelwood transformer project. To confirm whether such a reduction is warranted would require a more detailed investigation of these specific projects, which is beyond the scope of this review. As it is likely that these changes have resulted from the further considerations of VENCorp's planning process, and therefore, most likely represent efficient scope, Nuttall Consulting is not proposing a further cost reduction here to account for possible scope issues.

4.2. VENCorp's cost extrapolations

As discussed in Section 2.3, VENCorp has increased the project costs from the original proposal to the revised proposal (and the 2006 EAPR to the 2007 EAPR) for a significant number of the projects, where a revised estimate from SP AusNet was not provided.

To calculate the revised project costs, VENCorp developed a number of "Rule of Thumb" extrapolation factors to apply to the original costs. The main factors are as follows:

- 50 % to selected projects relating to transmission lines;
- 10 % to selected capacitor bank projects; and
- 25 % to a selection of other projects.

The total revised cost of the projects that have VENCorp's cost extrapolations applied is $147 million, of which $41 million is *predominantly load driven*, and $107 million is *predominantly generation driven*. This represents a 32% increase from the total original cost of $111 million. The revised costs for the *predominantly generation driven* projects contribute $31 million to the VENCorp's proposed planned expenditure. This is approximately equal to the weighted contribution from the original project costs[45].

The need for an increase in the original project costs was advised by SP AusNet in its letter containing the revised project estimates. This letter states that:

> "*…SP AusNet would expect there to be significant increases from previous estimates and we would recommend caution when using these costs*."

[45] The reason that the *predominantly generation driven* project contribution has not changed, even though the project costs have increased significantly, is due to changes to the *4th 500 kV line from Loy Yang to Hazelwood* project. The cost for this project has increased from $30 million to $45 million. However, as a result of the cost increase, VENCorp is proposing that the project is only required in one scenario as apposed to two in the original. Therefore, its contribution to the planned augmentation expenditure has reduced significantly, from $15 million to $ 11 million.

VENCorp has advised that it adopted the "Rule of Thumb" methodology due to the limited time available to VENCorp to source revised estimates for the other planned projects. On this matter, VENCorp has stated[46]:

> *"With no time to obtain updated cost estimates for all the other potential augmentations covered in the EAPR, and not wanting to use clearly out of date and incorrect estimates, VENCorp applied a 'Rule of Thumb' increase to all projects not covered by the recently received estimates from SP AusNet."*

With regards to the process VENCorp applied to calculate these "Rule of thumb" factors, VENCorp has stated[47]:

> *"…projects were split into 'transformers', 'lines', and 'other', to reflect the different proportions of raw materials, labour and site issues associated with each. A fourth category of 'X' covered those projects that it would not be appropriate to treat in this way (eg because original estimates had not come from SP AusNet etc.).*
>
> *'Rules of Thumb' were created by averaging, by project type, the percentage increases in the recent estimates received. These averages were deliberately kept as very round figures to reflect the level of accuracy available from the statistically low number of estimates we had to work from."*

The main issue for consideration here is whether the findings of the project reviews discussed in the previous section, can be extended to assess the overall appropriateness of these project cost extrapolations. Two projects included in PB's detailed project reviews have had VENCorp's project cost extrapolations, namely the *minimum reactive support in the state grid* project and *4th 500 kV line from Loy Yang to Hazelwood* project.

For both of these projects, Nuttall Consulting has accepted that the increase of the original project cost is appropriate, but considered that the scale of the increase determined by VENCorp, via the "Rule of Thumb" factor, was not justified.

With regards to the *minimum reactive support in the state grid* project, the original cost was derived by VENCorp from its own recent historical contestable projects. Therefore, much of the basis for SP AusNet's revised cost increase is not valid. For the *4th 500 kV line from Loy Yang to Hazelwood* project, the original cost was based upon a previous estimate from SP AusNet, however, Nuttall Consulting has disagreed with VENCorp on the appropriateness of the basis for its 50% extrapolation factor applied to the original project cost. In both cases, Nuttall Consulting has derived a project specific cost increase from the original cost, based upon the AER escalation data and assumed brownfield factors.

Based upon the findings of these two reviews, Nuttall Consulting considers it appropriate to allow an increase of the original cost for some of the VENCorp projects. However, it does not consider that the application of VENCorp's "Rule of Thumb" factors is appropriate. Therefore, Nuttall Consulting has assessed each project to develop a cost increase that should represent the efficient cost for each project. The methodology applied by Nuttall Consulting is similar to that applied in the detailed project reviews, and relies upon the AER escalation data and

[46] Email from VENCorp to AER, dated 3 August 2007.
[47] Ibid.

assumed brownfield factors to develop the cost increase from the original project cost for a number of specific projects.

Table 12 provides a summary of Nuttall Consulting's recommended project cost, based upon the above described process. This represents a $15.0 million reduction in the revised project costs, which results in a reduction of $9.1 million on VENCorp's planned augmentation allowance (in addition to the reductions resulting from the detailed project reviews). Further details of the project cost calculations are contained within Appendix A.

It is important to note that in undertaking this project specific assessment, Nuttall Consulting has accepted VENCorp's selection of the projects that do not require an increase in the cost estimate. As such, Nuttall Consulting's project cost assessment, and the summary in Table 12, does not include those projects where the cost has remained the same in the original and revised proposals.

Table 12 Nuttall Consulting's recommendations on the projects involving VENCorp's cost extrapolations

	Project cost ($ millions real 2007/08)		
Project	**Original**	**Revised**	**Recommended**
Reactive projects			
Load driven			
• Minimum reactive support in met area	$20	$3.5	$3.2
Generation driven			
• Additional reactive support in met area	$20 / $0	$16 / $1.5	$14.8/$1.4
• Additional reactive support in state grid	$4	$5	$4.6
SVCs in State grid			
• Load driven	$20	$28	$23.2
• Generation driven	$20	$28	$23.2
Wind monitoring projects – all load driven			
• 220 kV Eildon to Thomastown	$0.7	$0.8	$0.7
• 220 kV Rowville to Richmond	$0.5	$0.6	$0.5
• 220 kV Rowville to Malvern	$0.4	$0.5	$0.4
• 220 kV Springvale to Heatherton	$0.4	$0.5	$0.4
220 kV line uprates 82deg Rowville – Springvale	$1	$1.5	$1.3
Terminal Station works			
• upgrade Moorabool and Geelong	$1	$1.3	$1
• upgrade terminations at Hazelwood	$6	$7.5	$6
New 500 kV terminal station at Mortlake	$12	$15	$14.2
Series compensation and shunt capacitor bank Wodonga/Dederang	$12	$15	$15
330 kV line uprate South Morang to Dederang and line compensation	$7.4	$10	$9.2
Series compensation on 220 kV line Eildon to Thomastown	$7	$9	$9.2

5. Implications on PB's overall recommendation

In section 3, PB's recommendations from its detailed project reviews were re-assessed in light of VENCorp's revised proposal and the 2007 EAPR. The findings of this were that, broadly, this will not result in a major change to PB's recommendations. Section 4 then reviewed the overall project cost changes in the revised proposal in light of the findings from the project reviews. The findings in this regard were that the need for the increase in the project costs has been accepted, but a downward adjustment of the cost increases to most of the projects has been recommended.

In this section, PB's recommendation on the prudent and efficient planned augmentation expenditure level is reviewed, in light of the previous analysis. The aim here is to determine whether there will be any material changes to PB recommendations, given these previous findings.

VENCorp's original proposal included $354 million for its planned augmentation expenditure. PB's recommendation is that the prudent and efficient allowance is $180 million.

There are two main factors driving PB's recommendations, these are:

- the removal of the 25% contingency factor that VENCorp applied to each individual project making up its planned augmentation expenditure; and
- the findings and recommendations from the detailed project reviews, and the extension of these across the remainder of the planned augmentations based upon high level augmentation expenditure benchmarks.

VENCorp's has removed the 25% contingency factors from its revised proposal. This is in agreement with PB's recommendations, and therefore, this factor is not discussed further here. The remainder of this section considers the extension of PB's findings across the remainder of the planned augmentations.

PB's recommendations on the five detailed project reviews resulted in a reduction of approximately 70% from the planned augmentation expenditure associated with these five projects i.e. down from $105.2 million (or $84.2 million excluding the 25% contingency factor) to $30.8 million. This represents a reduction of approximately 63% if the 25% contingency factor is removed.

PB has then assessed the basis of its project recommendations, to determine whether the findings can be extended across the remainder of VENCorp's planned augmentation expenditure. The findings here were that it would be appropriate, based upon a number of factors.

This is most notably with regards to VENCorp's probabilistic planning approach, which has not been applied in full for much of the planned augmentation. PB has accepted that this approach is resulting in the prudent and efficient augmentation of the Victorian transmission network. However, PB's view is that some of these efficiencies are not being captured by VENCorp's current analysis on many of the planned projects, for which the analysis at this stage is based upon a deterministic

approach with some empirical rules to determine an "indicative" probabilistic timing. In this regard, PB has noted the reliance on the 10% PoE maximum demand forecast for much of the current deterministic analysis, and the implications of assets in good condition on the risk costs inherent in VENCorps full probabilistic approach (i.e. good asset condition equals a lower "do nothing" risk cost, and hence, less need for an augmentation). Furthermore, PB has noted the lack of substantiation for some projects, and the lack of recognition of efficiencies through the coordination with SP AusNet's planned replacement program.

In addition to this project based assessment, PB has also performed some high level benchmarking of VENCorp's historical and planned augmentation expenditure. In this regard, PB has defined an appropriate benchmark for VENCorp to be $0.15 million per MW growth in the 10% PoE maximum demand.

PB has determined its prudent and efficient allowance for planned augmentation expenditure based largely upon the findings of the high level benchmarking. However, it has used the findings from the project based assessment to provide confidence that such an approach is reasonable.

Two points are most relevant in considering whether PB's recommendations on the prudent and efficient planned augmentation expenditure will materially change due to VENCorp's revised proposal, and the 2007 EAPR.

The first relates to the findings from this review, and specifically that the basis of PB recommendations on the detailed projects has not changed, although some minor cost changes at the project level have occurred. Therefore, the findings from PB's overall project based assessment should be still valid. That is, the reductions recommended from the detailed project reviews should be still applicable across other planned augmentation projects. With regards to the revised findings for the five projects reviewed, these result in a reduction of approximately 65% from the revised estimates i.e. down from $74 million to $25.8 million.

The second point is that the basis of PB's high level benchmarking, and its resulting planned augmentation expenditure, should be relatively insensitive to the revised proposal and the revised project cost. On this matter, the PB benchmarking should inherently capture the basis for SP AusNet's cost revisions. In this regard, the benchmarking is based upon historical expenditure, and therefore, it should capture costs due to historical site specific issues, and general brownfield factors. Furthermore, PB has stated that the benchmark is set at a level to account for labour and material cost increases.

As such, Nuttall Consulting is of the view that there is no reason that the revised proposal should result in a material change to PB's recommendation on the overall planned augmentation expenditure of $180.4 million.

6. Implication of the revised load forecast in the 2007 EAPR

The project plans in the original and revised proposal, and those in the 2007 EAPR, are all based upon the load forecast detailed in the 2006 EAPR. The 2007 EAPR provides a revised load forecast; however, this forecast will be used to produce the plans for the 2008 EAPR. As such, VENCorp has not performed any significant studies based upon this forecast at this stage.

This section examines the 2007 EAPR load forecast to determine its possible impact on VENCorp's planned augmentation expenditure needs, and PB's recommendations.

It is important to note that in the discussion below, Nuttall Consulting is not suggesting that VENCorp should have incorporated the 2007 EAPR load forecast into its revised proposal.

6.1. The 2007 EAPR load forecast

This section examines the load forecasts in the 2006 EAPR and 2007 EAPR to assess whether there may be any significant differences that may impact planned augmentation expenditure.

There are two factors that are most relevant to this assessment, these are:

- the system maximum demand that is supplied by generators (scheduled and non scheduled) that are connected to the transmission network i.e. the demand that is supplied through the shared transmission network; and
- additional generation requirements, which relates to the maximum demand.

These two factors are assessed in turn below.

6.1.1. Maximum Demand

There are a number of system maximum demand forecasts provided in VENCorp's EAPRs, covering: summer and winter; various weather conditions (i.e. the % PoE); and various economic outlooks. The most relevant to VENCorp's project plans, and the generation scenarios, is the summer maximum demand (10% PoE, medium economic growth). This maximum demand forecast is the basis for much of VENCorp's analysis in its EAPR and proposals, and the basis for the calculation of the additional generation in the generation scenarios.

The maximum demand supplied by generators connected to the transmission network can be calculated from the EAPR load forecasts by summing two components of the maximum demand:

- the contribution supplied by scheduled generators; and

- the contribution supplied by non scheduled generators connected directly to the transmission network (this is essentially large wind farms).

Table 13 below provides this maximum demand from 2007/08 to 2013/14, based upon the data in the 2006 EAPR.

Table 13 Transmission system summer maximum Demand based upon 2006 EAPR.

2006 EAPR	Annual maximum demand (MW)					
	08/09	09/10	10/11	11/12	12/13	13/14
Total	10749	10964	11183	11382	11634	11849
Sch. contribution[48]	10683	10819	10990	11163	11415	11627
Non-sch. Contribution[49]	66	145	193	219	219	222
Wind (transmission)[50]	274	606	805	911	911	923

Table 14 below provides the equivalent maximum demands from 2008/09 to 2013/14, based upon the data in the 2007 EAPR. This table also indicates the reduction in the 2007 EAPR maximum demand forecast from the 2006 EAPR maximum demand forecast.

Table 14 Transmission system summer maximum Demand based upon 2007 EAPR.

2007 EAPR	Annual maximum demand (MW)					
	08/09	09/10	10/11	11/12	12/13	13/14
Total	10183	10478	10746	10951	11171	11404
Sch. contribution[51]	10124	10297	10515	10720	10940	11173
Non-sch. Contribution[52]	59	181	231	231	231	231
Wind (transmission)[53]	255	785	1005	1005	1005	1005
Reduction from 2006 EAPR	566	487	437	430	462	444

The assessment indicates that, based upon the 2007 EAPR, the summer maximum demand (10% PoE) carried by the transmission network will be approximately 450 MW less than that assumed to produce the original and revised proposals. This equates to, approximately, a two year deferment in the maximum demand levels.

[48] Table 3.10, 2006 EAPR
[49] These values assume a contribution factor of 24%, as defined in Table A6.4 of the 2006 EAPR.
[50] Table A6.2, 2006 EAPR. Assuming the majority of new generation will connect to the transmission network, with the existing level embedded in the distribution network.
[51] Table 4.1, 2007 EAPR
[52] These values assume a contribution factor of 23%, as defined in Table D-3 of the VENCorp public report "Long Term Electricity Energy and Maximum Demand Forecasts 2006/07-2016/17".
[53] Table D-3, of the VENCorp public report "Long Term Electricity Energy and Maximum Demand Forecasts 2006/07-2016/17".

6.1.2. Generation scenarios

The generation scenarios for 2013/14 are calculated based upon the maximum demand that must be met by the scheduled generation in that year. This maximum demand is used to calculate the amount of additional scheduled generation that is required to ensure the supply (available generation *plus* imports) equals the demand (maximum demand *plus* reserves *plus* exports).

Table 15 below shows the generation scenarios used for the original and revised proposal[54]. This table also indicates the additional non-schedule (wind) generation that is assumed to be connected to the network for the VENCorp studies.

Table 15 Generation scenarios in original and revised proposals

	Additional generation/import location (MW)									
	LV	SW			Metro/regional			Imp.	Total	
	Sch	Sch	N-S cont	N-S	Sch	N-S cont	N-S		Sch	N-S
SC1 LV	1200	-	145	600	300	55	220	-	1500	820
SC2 SW	200	700	145	600	600	55	220	-	1500	820
SC3 I	600	-	145	600	300	55	220	600	1500	820
SC4 M/R	300	-	190	600	1200	145	220	-	1500	820

Similar calculations to those applied by VENCorp to calculate the above scenarios can be applied using the 2007 EAPR load forecast. In this regard, the revised amount of additional scheduled generation in 2013/14 can be calculated based upon the forecast maximum demand to be met by the scheduled generation (see Table 14 above), and the parameters in the supply/demand balance provided in Table 5-15 of the 2007 EAPR. This calculation indicates that at least an additional 929 MW of generation capacity will be required by 2013/14. This is approximately 550 MW less than that assumed in the original and revised proposals.

Furthermore, based upon the 2007 EAPR forecast of additional wind generation (see Table 14 above), the additional wind generation connecting directly to the transmission network will increase from an assumed 820 MW to approximately 1000 MW.

Table 16 provides an indicative equivalent set of scenarios based upon the 2007 EAPR load forecast, and the calculations noted above. The following assumptions have been applied to produce these scenarios:

- the 929 MW of additional generation by 2013/14 has been rounded up to 1000 MW; and

[54] This table is based upon Table 7.3 in the VENCorp original proposal, with the assumed additional wind generation capacity (and its contribution to the maximum demand) as shown in Table 5-14 of the 2007 EAPR.

- it is assumed that the reductions in generation from the existing scenarios will be most significant at Latrobe Valley – this assumption appears to have been applied by VENCorp to scale its existing scenarios.

Table 16 Indicative generation scenarios based upon 2007 EAPR load forecast.

	Additional generation/import location (MW)									
	LV	SW			Metro/regional			Imp.	Total	
	Sch	Sch	N-S cont	N-S	Sch	N-S cont	N-S		Sch	N-S
SC1 LV	800		161	700	200	69	300		1000	1000
SC2 SW		500	161	700	500	69	300		1000	1000
SC3 I	200		161	700	200	69	300	600	1000	1000
SC4 M/R			161	700	1000	69	300		1000	1000

6.2. The implications on PB's recommendations

The section above has shown that the 2007 EAPR load forecast indicates the summer maximum demand (10% PoE) to be approximately 450 MW less than that used to produce the original and revised proposals. Furthermore, the additional scheduled generation has reduced by approximately 500 MW, although the wind generation has risen by approximately 180 MW.

With regards to the impact of this on VENCorp's planned projects: the reductions in the maximum demand will tend to defer the predominately load driven projects; and the reduction in the additional generation levels will tend to defer the predominantly generation driven projects.

An important issue for consideration is the possible impact on the findings on the detailed project reviews, noting that this review (Section 4) has found that the revised proposal will not materially impact PB's recommendations on the need for these projects. The five projects reviewed are considered in turn below.

6.2.1. Project reviews

1000 MVA 500/220 kV transformer in the metropolitan area

This is a *predominately load driven* project, for which VENCorp's revised proposal has a commission date of 2013/14. PB's recommendation, based upon the original proposal, is that this project will not be justified prior to 2014/15.

The need for this project is related to the loading of the existing tie-transformers, which in turn, is most significantly related to the demand in the metropolitan area. Obviously, if the forecast maximum demand of the metropolitan area is reduced then the likely timing will be deferred. Noting that the above analysis has not examined a specific metropolitan maximum demand forecast, it is still reasonable to assume that a similar proportional reduction in the metropolitan maximum demand would occur. Furthermore, as the maximum demand appears to be

deferring by approximately two years, then, even on VENCorp's basis for the current estimate of the timing (2013/14), the project may not be justified prior to 2014/15 with the 2007 EAPR load forecast.

Minimum reactive support in the state grid

This is a *predominately load driven* project, for which VENCorp's revised proposal assumes three 2 x 25 MVAr capacitor banks are required between 2010/11 and 2013/14. PB's recommendation, based upon the original proposal, is that only one 2 x 25 MVAr capacitor bank will be required in 2013/14.

The need for this project is related to the demand in the state grid region, which is proportional to the reactive requirement. As was the case above, if the forecast maximum demand of the state grid is reduced then the likely level of reactive support will be deferred. Furthermore, as the maximum demand appears to be deferring by approximately two years, then, even on VENCorp's basis for the current estimate of the timing for the first 2 x 25 MVAr bank (2010/11), the project may not be justified until to 2012/13 with the 2007 EAPR load forecast.

Line terminations and monitoring equipment in the metropolitan area

This is a *predominately load driven* project, for which VENCorp's revised proposal does not provide a specific scope or timing. Rather an annual allowance is made to cover upgrades that will fall within the project description. PB's recommendation, based upon the original proposal, is that these works are required. However it has reduced the allowance, based upon it view that less upgrades will be required.

The need for this project is related to the demand in the metropolitan area, and therefore, if the demand is reduced then the need for some of the line termination upgrades, and line monitoring will be reduced.

4th 330/220 kV Transformer at Dederang

This is a *predominately generation driven* project, for which VENCorp's revised proposal has it in the import scenario. PB's recommendation, based upon the original proposal, is that this project will not be justified prior to 2014/15. However, it has recommended an alternative based upon a replacement of an existing older unit with one of a higher rating.

The need for this project is related to the loading of the existing transformer, which in turn, is related to the Snowy/NSW import level. The *import* scenario is relatively unaffected by the 2007 EAPR load forecast, in terms of the increased import requirement. As such, the changes due to the 2007 EAPR load forecast may have little impact on the need for this project.

4th 500 kV Line from Loy Yang to Hazelwood

This is a *predominately generation driven* project. The need for this project is related to the loading of the existing line between Loy Yang and Hazelwood, which in turn, is related to the generation levels at Loy Yang's 500 kV bus. VENCorp's analysis determined at least 500 MW of generation to justify a $30 million project, and at least 1000 MW to justify a $45 million project.

The original proposal ($30 million) has the project in the *Latrobe Valley* and *Import* scenarios, as there is sufficient additional generation connecting at Loy Yang in each of these scenarios to justify the project. The revised proposal ($45 million) only has the project in the Latrobe Valley scenario, as there is insufficient

additional generation connecting at Loy Yang in the *Import* scenario to justify the higher project cost. PB's recommendation, based upon the original proposal, is that this project will be justified.

The scenarios derived from the 2007 EAPR load forecast, have 800 MW of additional Loy Yang generation in the *Latrobe Valley* scenario, but only 200 MW in the *Import* scenario. As such, only the $30 million project could be justified with the 2007 EAPR load forecast, and this would only be justified for the Latrobe Valley scenario.

6.2.2. Overall implications

The discussion above has shown that PB's reasoning for reducing, or rejecting, project expenditure will be further strengthened by the reduced maximum demand forecast in the 2007 EAPR, and the resulting generation scenarios.

This is most noticeable on the *predominantly load driven* projects, where the lower demand forecast may result in a deferment of the need for the projects by up to 2 years from existing indicative timings. Furthermore, noting that VENCorp's revised proposal has approximately $92 million in the last two years of the next period, then, even based upon VENCorp's project timings, a significant level of expenditure could be impacted by the 2007 EAPR forecast.

The impact on the *predominately generation driven* projects could be less significant. The scenarios based upon the 2007 EAPR forecast assume significantly less generation connecting at Latrobe Valley across all four scenarios. Therefore, the projects most impacted here would be those driven by additional generation connected to the Latrobe Valley. The result of this will be that some projects, which may have formally occurred across multiple scenarios, may only be required in the *Latrobe Valley* scenario – where the assumed additional Latrobe Valley generation is still reasonably high.

The two projects most likely to be impacted by this would be:

- *Another 500/220kV transformer at Hazelwood* project. This has a revised cost of $40 million and is required in the *Latrobe Valley*, *South West* and *Metro/Regional* scenarios. This may only be required in the *Latrobe Valley* scenario with the 2007 EAPR revised forecast i.e. its weighted contribution to the planned expenditure would reduce from $30 million to $10 million.
- *Upgrade terminations and CBs at Hazelwood* project. This has a revised cost of $7.5 million and is required in the *Latrobe Valley* and *Import* scenarios. This may only be required in the *Latrobe Valley* scenario with the 2007 EAPR revised forecast i.e. its weighted contribution to the planned expenditure would reduce from $3.8 million to $1.9 million.

Of course, the above impacts on the *predominately generation driven* project are due to the assumption applied by Nuttall Consulting to produce the revised scenarios. This assumption was that the reduction in the additional generation resulting from the 2007 EAPR load forecast will most likely occur at Latrobe Valley. If the reduction occurs in other locations then the need for other projects may be more significantly impacted.

One other important point to note is that the scenarios resulting from the 2007 EAPR load forecast indicate approximately 180 MW extra wind generation. Depending on the reactive capabilities of this wind generation, this could exacerbate reactive support requirements. This additional wind generation, presumably connecting in regional areas, may also advance some other projects.

However, it would be expected that these possible increases in expenditure needs, due to the increased wind generation forecasts, would be far less significant than expenditure reductions resulting from the reduced demand, and the 500 MW reduction in additional scheduled generation.

Finally, with respect to PB's recommendation of $180 million for the prudent and efficient planned augmentation expenditure. This was based largely upon a high level benchmark of $0.15 million per MW of maximum demand growth over the period. PB calculated the historical level to be $0.1 million per MW of maximum demand growth. Unfortunately, the appropriateness of the benchmark is based upon consistency between the historical and forecast maximum demand. This appears to have changed with the 2007 EAPR forecast.

Therefore, to confirm that the basis of PB's recommendation is still reasonable with the 2007 EAPR load forecast, Nuttall Consulting has re-assessed the historical maximum demand using the maximum demand "backcasts" available in VENCorp's 2007 load forecast report[55]. This "backcast" of the historical maximum demand is based upon the methodology applied to produce the 2007 EAPR load forecast. As such, this should provide a relatively consistent basis between historical and forecast demand. This analysis has shown that the historical growth in maximum demand, using this "backcast", is not significantly different from that assumed by PB to produce its benchmarks.

Therefore, the 2007 EAPR load forecast may not materially impact PB's recommendation of $180 million for the prudent and efficient planned augmentation expenditure. Although, noting the comments above on specific project implications, the 2007 EAPR load forecast may give the AER greater confidence that such a benchmark may represent the prudent and efficient expenditure for planned augmentations.

[55] Appendix A, of the VENCorp public report "Long Term Electricity Energy and Maximum Demand Forecasts 2006/07-2016/17".

7. Summary of findings

Nuttall Consulting has considered whether VENCorp's revised proposal, which is based upon the 2007 EAPR, should lead to a material change to PB's recommendations in the PB report. A specific focus of this analysis has been the revised project costs that VENCorp has used to produce the 2007 EAPR and its revised proposal.

The revised proposal only impacted VENCorp's proposed planned augmentation expenditure. Nuttall Consulting has re-assessed the five planned augmentation projects covered in PB detailed project reviews. The findings of Nuttall Consulting where that, in a broad sense, the 2007 EAPR will not lead to a material change to PB's recommendations on the need for these projects. However, the revised project costs have lead to some minor changes to PB's recommendations. These finding are summarised below:

- ***1000 MVA 500/220 kV transformer in the metropolitan area***. The 2007 EAPR should not lead to a material change to PB's recommendation that this project will not be required prior to 2014/15.
- ***minimum reactive support in the state grid***. The 2007 EAPR should not lead to a material change to PB's recommendation that only one 2 x 25 MVAr 66 kV switch capacitor bank will be required in 2013/14. However, the findings of this review are that the efficient cost for this project is $2.34 million, which is a material change to PB's recommendation of $2 million.
- ***line terminations and monitoring equipment in the metropolitan area***. The 2007 EAPR should not lead to a material change to PB's recommendation that this project will be required, and the prudent and efficient annual expenditure should be $1.9 million.
- ***4th 330/220 kV Transformer at Dederang***. The 2007 EAPR should not lead to a material change to PB's recommendation that this project will not be required prior to 2014/15, but an expenditure allowance of $5 million will be required to enable VENCorp to undertake a combined augmentation/replacement project with SP AusNet.
- ***4th 500 kV Line from Loy Yang to Hazelwood***. The 2007 EAPR should not lead to a material change to PB's recommendation that this project will be required should sufficient additional generation connect at Latrobe Valley. However, the findings of this review are that the efficient expenditure allowance for this project is $8.23 million, which is a material change to PB's recommendation of $14 million.

Nuttall Consulting has also considered the appropriateness of the basis for VENCorp adopting the revised costs for a number of other projects. These revised costs arose from two main sources: SP AusNet's revised project cost estimates provided to VENCorp during the 2007 EAPR process; and VENCorp's cost extrapolations of the original project cost of other projects.

Nuttall Consulting has accepted the basis for these cost increases. However, it has not accepted that, in all cases, the revised cost will represent the efficient cost of the

project. Therefore, Nuttall Consulting has recommended a number of changes to the revised project costs. These changes have resulted in an additional $13.4 million reduction to VENCorp's revised planned augmentation allowance.

Following this assessment of the revised costs, Nuttall Consuting has then examined PB's recommendations on the overall prudent and efficient planned augmentation expenditure. PB's recommendations drew on the findings of its detailed project reviews and high level benchmarking, to recommend a prudent and efficient planned augmentation expenditure level of $180 million. Nuttall Consulting does not consider that the 2007 EAPR, and the revised costs, will lead to a material change to this recommendation.

Table 17 below provides an overall reconciliation of the planned augmentation expenditure, showing: the expenditure in VENCorps original proposal; and the reduction to this expenditure through PB's recommendations. The table then shows the expenditure in VENCorp's revised proposal, and the reduction in this expenditure resulting from the findings of Nuttall Consulting's analysis.

Table 17 ***Planned Augmentation expenditure reconciliation***

Project costs	08/09	09/10	10/11	11/12	12/13	13/14	Total
Original proposal	2.0	15.7	51.8	79.5	138.3	67.6	354.7
PB 25% contingency	(0.4)	(3.1)	(10.3)	(15.9)	(27.6)	(13.5)	(71.0)
Original proposal (ex 25%)	1.6	12.6	41.5	63.6	110.7	54.1	283.7
PB projects recommendation	-	(1.1)	(6.2)	(6.2)	(36.2)	(4.2)	(53.8)
PB high level adjustment	-	-	(12.5)	(12.5)	(12.5)	(12.5)	(50.0)
PB recommendation	1.6	11.4	22.8	45.0	62.0	37.5	180.4
Revised proposal	2.6	9.3	43.3	74.8	75.8	82.2	288.2
PB 25% contingency	(not applicable – removed in VENCorp's revised proposal)						
Projects recommendation	-	(1.1)	(5.5)	(5.5)	2.0	(38.1)	(48.2)
SP revised estimate adjustments	-	-	(1.1)	(1.1)	(1.1)	(1.1)	(4.3)
VC extrapolation adjustments	-	(0.3)	(0.8)	(5.8)	(0.8)	(1.4)	(9.1)
PB high level adjustment	-	-	(11.5)	(11.5)	(11.5)	(11.5)	(46.2)
Recommendation	2.6	7.9	24.5	50.9	64.5	30.1	180.4

The 2007 EAPR contains a revised load forecast. This forecast however has not been used to produce the project plans in the 2007 EAPR or the revised proposal. Nuttall Consulting has examined this revised load forecast to determine whether it may impact the recommendations discussed above.

The findings of this review where that the 2007 EAPR load forecast indicates a reduction of approximately 450 MW in the summer maximum demand (10% PoE) across the next control period, over that used by VENCorp to produce its original and revised proposals. Furthermore, the load forecast also indicates that VENCorp's assumed generation scenarios may require approximately 500 MW less additional scheduled generation.

The reduced maximum demand and level of additional generation forecast should strengthen PB's reasoning for reducing, or rejecting, project expenditure. This will be most noticeable on the *predominantly load driven* project, where the lower

demand forecast may result in a deferment of the need for the project by up to 2 years from existing indicative timings. The impact on the *predominately generation driven* project could be less significant. However, it would still be expected that the need for a number of projects would be reduced.

Nuttall Consulting has also assessed PB's recommendation of $180 million for the prudent and efficient planned augmentation expenditure. The findings on this matter are that the 2007 EAPR load forecast may not materially impact PB's recommendations. As such, Nuttall Consulting has not attempted to recommend an adjustment to PB's recommendations based upon the 2007 EAPR load forecast. However, noting the comments above on specific project implications, the 2007 EAPR load forecast may give the AER greater confidence that such a benchmark may represent the prudent and efficient expenditure for planned augmentations.

8. Appendix A – Nuttall Consulting's adjustments to the revised project costs

Sections 3 and 4 of this report discuss Nuttall Consulting's review of the revised project costs in VENCorp's revised proposal. The findings of this review have resulting in a number of recommended adjustments to the revised project costs. This appendix sets out the data, assumptions, and calculations that have been used by Nuttall Consulting to assess the revised costs, and calculate these adjustments.

The appendix first set-out the source data and assumptions used by Nuttall Consulting, covering the price escalation data and brownfield factors. Following this, the basis of Nuttall Consultings individual project adjustments is provided.

8.1. Source data

8.1.1. The AER cost escalation data

As noted in Section 3, the main data used by Nuttall Consulting to assess price increases has been provided by the AER (the AER escalation data). This escalation data has been used by the AER in its draft decision on SP AusNet's revenue proposal. Therefore, the AER considers this to be an appropriate basis for assessing VENCorp's revised project costs.

The AER escalation data is based upon an independent consultant's report (the SKM report) that is contained in SP AusNet's revenue proposal[56]. The SKM report was provided in support of SP AusNet's proposal, and contains data on historical and forecast cost escalations for transmission capital projects, and components thereof. The AER's assessment of this report, and the adjustment it has made to the SKM escalation data to produce the AER cost escalation data, is discussed in the AER's draft decision on SP AusNet's revenue proposal. This detail is not discussed further here.

Table 18 summarises the AER escalation data that has been provided to Nuttall Consulting. This table provides the cumulative cost escalation from base year of 2002, in nominal terms, for various components that constitute substation and lines development projects.

[56] Appendix C of the SP AusNet revenue proposal, SKM report, "Escalation Factors affecting Capital Expenditure Forecasts"

Table 18 The AER escalation data

Project component[1]	Nominal accumulative escalations – base year 2002											
	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Substation												
Switchgear	1.000	0.969	0.991	1.065	1.168	1.233	1.227	1.225	1.231	1.244	1.253	1.263
Transformers	1.000	1.032	1.105	1.281	1.363	1.575	1.562	1.494	1.457	1.446	1.452	1.457
Structures	1.000	1.147	1.442	1.409	1.502	1.524	1.457	1.439	1.413	1.422	1.431	1.443
Civil and Foundations	1.000	1.037	1.078	1.125	1.175	1.233	1.285	1.338	1.394	1.452	1.513	1.576
Protection & Control	1.000	1.035	1.070	1.112	1.157	1.207	1.253	1.299	1.348	1.399	1.451	1.506
Erection & Commissioning	1.000	1.039	1.082	1.133	1.185	1.249	1.304	1.360	1.421	1.484	1.549	1.618
Misc material	1.000	1.024	1.046	1.072	1.103	1.131	1.159	1.188	1.218	1.249	1.279	1.313
Lines												
Conductor & Earthwire	1.000	0.987	1.050	1.229	1.319	1.555	1.518	1.466	1.438	1.417	1.421	1.431
Towers	1.000	1.147	1.442	1.409	1.502	1.524	1.457	1.439	1.413	1.422	1.431	1.443
Insulators & Fittings	1.000	1.034	1.067	1.107	1.150	1.196	1.238	1.281	1.326	1.373	1.421	1.472
Foundations	1.000	1.037	1.078	1.125	1.175	1.233	1.285	1.338	1.394	1.452	1.513	1.576
Erection	1.000	1.039	1.082	1.133	1.185	1.249	1.304	1.360	1.421	1.484	1.549	1.618

1 The project component categories, and associated definitions, are assumed to be equivalent to those in the SKM report

8.1.2. Nuttall Consulting's transforms to the AER's escalation data

In order to produce escalation data in a format appropriate for Nuttall Consulting's assessments, Nuttall Consulting has transformed the AER's escalation data to produce escalation data for four high level project components[57]:

- Substation (excluding the transformer);
- Transformer (not installed);
- New line (excluding substation works); and
- Line upgrade (assuming no re-conductoring i.e. tower replacements, re-sagging, etc.).

[57] It is important to note that Nuttall Consulting has not made specific adjustment to the AER's escalation data, therefore, the underlying escalation rates have remained the same.

To perform this task, Nuttall Consulting has assumed weightings to apply to the AER escalation data categories to produce aggregate escalation factors applicable for the Nuttall Consulting categories. The weightings applied by Nuttall Consulting are summarised in Table 19.

Table 19 Nuttall Consulting's weighting for the AER escalation data

	Nuttall Consulting component			
AER component	**Substation[1]**	**Transformer**	**New line[2]**	**Line upgrade[3]**
Substation				
Switchgear	54 %	-	-	-
Transformers	-	100 %	-	-
Structures	4 %	-	-	-
Civil and Foundations	5 %	-	-	-
Protection & Control	17 %	-	-	-
Erection & Commissioning	17 %	-	-	-
Misc material	3 %	-	-	-
Lines				
Conductor & Earthwire	-	-	40 %	-
Towers	-	-	30 %	65 %
Insulators & Fittings	-	-	5 %	5 %
Foundations	-	-	5 %	10 %
Erection	-	-	20 %	20%

1 The percentages have been calculated based upon the cost breakdown of the 275 kV breaker and half switchbay estimate provided in Appendix D of the SKM report. The breakdown of this switchbay is considered to be representative of VENCorp's switchbay requirements.
2 In the absence of a more specific line project breakdown in the SKM report, the percentages have been assumed by Nuttall Consulting to reasonably represent a typical new line construction project. It is also noted that these weightings produce line escalation factors reasonably in accordance with the SKM report's aggregate line escalations.
3 Similar to the new line breakdown above, the percentages have been assumed by Nuttall Consulting to reasonably represent a typical line upgrade project.

These weightings have been combined with the AER escalation data to produce the forecast cost increase of the Nuttall Consulting project components in real terms ($ 2007/08) throughout the next period (2008/09 to 2013/14), for various reference years. The reference years indicate the year of the original project cost data. These cost increases resulting from this analysis are summarised below in Table 20 to Table 23.

Table 20 Substation escalation data

		Real 2007/08 accumulative escalation for year project required					
		2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Reference year of original project cost	2002	1.223	1.212	1.205	1.202	1.199	1.197
	2003	1.218	1.206	1.199	1.196	1.193	1.190
	2004	1.176	1.164	1.157	1.155	1.151	1.148
	2005	1.112	1.101	1.095	1.093	1.090	1.087
	2006	1.037	1.028	1.022	1.020	1.018	1.016
	2007	0.988	0.979	0.973	0.972	0.969	0.967

Table 21 Transformer escalation data

		Real 2007/08 accumulative escalation for year project required					
		2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Reference year of original project cost	2002	1.524	1.422	1.353	1.310	1.283	1.256
	2003	1.477	1.378	1.311	1.269	1.244	1.218
	2004	1.378	1.286	1.224	1.185	1.161	1.136
	2005	1.189	1.110	1.056	1.022	1.001	0.980
	2006	1.118	1.044	0.993	0.961	0.942	0.922
	2007	0.967	0.903	0.859	0.831	0.814	0.797

Table 22 New line escalation data

		Real 2007/08 accumulative escalation for year project required					
		2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Reference year of original project cost	2002	1.396	1.352	1.318	1.296	1.285	1.277
	2003	1.335	1.293	1.260	1.239	1.229	1.221
	2004	1.209	1.172	1.143	1.124	1.116	1.109
	2005	1.119	1.086	1.060	1.044	1.036	1.030
	2006	1.053	1.022	0.998	0.983	0.976	0.971
	2007	0.965	0.938	0.917	0.904	0.898	0.894

Table 23 Line upgrade escalation data

		Real 2007/08 accumulative escalation for year project required					
		2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Reference year of original project cost	2002	1.363	1.337	1.307	1.299	1.292	1.287
	2003	1.229	1.207	1.181	1.175	1.170	1.166
	2004	1.048	1.032	1.013	1.009	1.006	1.004
	2005	1.046	1.028	1.008	1.004	1.000	0.998
	2006	0.988	0.972	0.954	0.950	0.947	0.944
	2007	0.962	0.946	0.927	0.923	0.919	0.917

Nuttall Consulting has used the cost escalations summarised in the above four tables to determine various forecast cost increases and reduction factors. These factors have been used to determine the adjustments to the revised project costs. This analysis is summarised in Table 24.

Table 24 Nuttall Cunsultings project adjustment factors.

	Real 2007/08 cost ncrease / reduction factors			
	Increase			Reduction
From:	average 2002-2004			2007/08
To:	year project required			2010-2014
	2007/08	2013/14	Average 2010-2014	
Substations	22%	18%	18%	3%
Transformers	51%	20%	25%	17%
New line	36%	20%	22%	11%
Line upgrade	26%	15%	16%	8%

The important points from Table 24 are as follows:

- The first column represents the average percentage increase in costs from 2002/2004 to 2007/08. This indicates a significant increase, particular with transformers.
- The second column represents the average percentage increase in costs from 2002/2004 to the last year of the next period 2013/14. This indicates a significant reduction in costs (in real terms) from the 2007/08 costs (the first column).

- The third column represents the average percentage increase in costs from 2002/2004 for the last four years of the next period 2010/11 to 2013/14. This still indicates a significant reduction in costs (in real terms) from the 2007/08 costs. The important point here is that many of the VENCorp projects fall in these last four years of the period. These cost increase factors have been used by Nuttall Consulting to produce a bottom-up development of an appropriate cost multiplier for some of the projects that had a VENCorp cost extrapolation applied.
- The fourth column represents the average percentage reduction in costs (in real 2007/08 terms) from the cost developed for projects occurring in 2007/08 to those occurring in the last four years of the period. These cost reduction factors have been used by Nuttall Consulting to calculate the reduction to the project with SP AusNet's revised estimates.

For some specific projects, appropriate cost increases have been derived directly from Table 20 to Table 23. In the project cost descriptions in Section 8.2, these cases will be noted.

8.1.3. Nuttall Consulting's brownfield factor assumptions

In order to calculate appropriate cost increases for the projects that have had a VENCorp cost extrapolation applied, Nuttall Consulting has applied the brownfield factors defined in Table 25. This table indicates the brownfield factor for various components, and the source of this factor.

Table 25 Nuttall Consulting's brownfield factors.

Component	Factor	Source
Substation	23%	Based upon 132, 275 kV switchbay brownfield factor on Table 11 of the SKM report
SVC	1.8%	Based upon SVC brownfield factor on Table 11 of the SKM report.
Line compensation	5%	Assumed as indicative, based upon Capacitor banks, reactor brownfield factors on Table 11 of the SKM report
Line upgrade	10%	Assumed.

8.2. Nuttall Consulting's recommendations on the project costs

8.2.1. Nuttall Consulting adjustments to SP AusNet's revised cost estimates

The adjustments to SP AusNet's revised cost estimates have been made by first apportioning SP AusNet's revised project cost into the four project components (substation, transformer, new line, and line upgrade). The apportioning of the project cost into these categories is not directly contained in the project cost information, and therefore, Nuttall Consulting has estimated this based upon the project scope provided with the estimate. Following this, the reduction factors summarised in Table 25 (forth data column) have been applied to each component to calculate the overall reduction in the project cost. Table 26 provides a summary of these calculations, indicating: SP AusNet's original and revised cost; the assumed breakdown of SP AusNet's revised cost into the project components; and Nuttall Consulting's recommended cost.

It is important to note that Table 26 only shows the reductions resulting from this cost analysis, other reductions discussed in Section 3 resulting from PB's recommendations on the scope are not detailed here.

Table 26 Nuttall Consulting's adjustments to SP AusNet's revised cost estimates

	Project cost ($ millions real 2007/08)						
	SP AusNet	SP AusNet	Project component				Nuttall Consulting
Project	SP Original	SP Revised	Substation	Transformer	New line	Line upgrade	Recommended
4th 330/220 kV Dederang transformer	$11	$21	$11	$10	-	-	$19.0
Another 500/220 kV transformer at Hazelwood[1]	$22	$40	$14	$10	$10	-	$36.2
3rd 700 MVA 330/220 kV transformer at South Morang	$20	$28	$14	$14	-	-	$25.2
Phase angle transformer on 220 kV Bendigo to Shepparton line	$5	$23	$12	$11	-	-	$20.3
220 kV line uprate to 70deg Eildon to Thomastown	$2.4	$5.1	-	-	-	$5.1	$4.7

1 The *Another 500/220 kV transformer at Hazelwood* project has an additional $6 million to cover other fault mitigation works. This cost has been added to the SP AusNet estimate by VENCorp, but does not appear to have been increased in the revised estimate. Therefore, Nuttall Consulting has not adjusted this $6 million.

8.2.2. Nuttall Consulting adjustments to VENCorp's cost extrapolations

The adjustments to SP AusNet's revised cost estimates have been made by undertaking the following process on each of the projects VENCorp has applied a cost extrapolation:

- Determining the basis of the original estimate and whether a cost increase is justified, which involves:
  - Assessing the original estimate[58] to determine whether it is based upon
    - VENCorp's past project data
    - A SP AusNet estimate (not one of the May 2007 revised estimates)
    - Not specified
  - Based upon the above, determine the appropriate reference year(s) for the original cost estimate.
- Apportioning the original project cost into the project components discussed in Section 8.1.
- Determining the appropriate cost increase factors to cover:
  - Historic and forecast cost escalations for each component, as discussed in Section 8.1.2; and
  - Brownfield factors for each component, as discussed in Section 8.1.3.

Table 27 provides a summary of Nuttall Consulting's assessment of each project that involved a cost extrapolation. This summary indicates the following: VENCorp's original and revised cost; Nuttall Consulting's recommended cost; and the relevant considerations and assumptions used to produce the recommended cost. It is important to note that Table 27 only shows the reductions resulting from this cost analysis, other reductions discussed in Section 3 resulting from PB's recommendations on the scope are not detailed here.

[58] This has been performed by using the spreadsheet supplied by VENCorp "VEN_DOCS-218386-v1-Cost_estimates_-_as_prepared_for_AER.XLS"

Table 27 Nuttall Consulting's adjustments to VENCorp's cost extrapolations

Project	Project cost ($ millions real 2007/08)			Considerations and assumptions
	Original	Revised	Nuttall Consulting	
Reactive projects				Cost basis and extrapolation considerations: The basis of cost estimates are past contestable projects (December 2006), with a further 10% increase applied in the revised cost estimates. Therefore, it is considered appropriate to allow an increase to cover the price escalation from 2006 to the time of the projects. Project component breakdown: As there is no reactive component in the AER escalation data, Nuttall Consulting has assumed the "substation" component is a reasonable proxy for these reactive projects. Cost escalation: A 1.9% accumulative escalation 2006/07 to the average of the last four years has been calculated from Table 20. The project cost adjustments have been calculated by removing 10% from the revised estimate, and then increasing the cost by 1.9%. Brown field: This is not considered applicable as it should be allowed for in the unit costs derived from past projects.
Load driven				
• Minimum reactive support in state grid	$8	$7.5	$7.0	
• Minimum reactive support in met area	$20	$3.5	$3.2	
Generation driven				
• Additional reactive support in met area	$20 / $0	$16 / $1.5	$14.8/$1.4	
• Additional reactive support in state grid	$4	$5	$4.6	
SVCs in State grid				Cost basis and extrapolation considerations: VENCorp has stated that these project costs have been increased to align the cost with the Heywood SVC project. The Heywood SVC is estimated at $25 million in the SP AusNet's June 2005 estimates. However, the Heywood SVC is due to be connected at 500 kV via a 500 kV double switched arrangement. It is also noted that another SVC connected at 330 kV is costed at $22 million in the SP AusNet's June 2005 estimates. Therefore, it would appear that the original $20 million is a more appropriate cost basis for the state grid units which will connect at 220 kV. It is accepted that some escalation will be required for the $20 million to account for price increases and brownfield issues. However, it is assumed that the June 2005 estimate was a reasonable estimate for the SVC at the time. Project component breakdown: As there is no SVC component in AER escalation data, Nuttall Consulting has assumed that the "substation" component is a reasonable proxy for the SVC. The original project cost has been apportioned as follows: $15 million to the SVC cost and $5 million to the substation costs. Cost escalation: A 9% accumulative escalation from 2005/06 to 2011/12 (load driven), and to the average of the last four years (generation driven), has been calculated from Table 20. Brown field: The SVC component has a 1.8% brownfield factor and the substation component has a 23% brownfield factor, as defined in Table 25.
• Load driven	$20	$28	$23.2	
• Generation driven	$20	$28	$23.2	

Project	Project cost ($ millions real 2007/08) Original	Revised	Nuttall Consulting	Considerations and assumptions
Wind monitoring projects – all load driven • 220 kV Eildon to Thomastown • 220 kV Rowville to Richmond • 220 kV Rowville to Malvern • 220 kV Springvale to Heatherton	 $0.7 $0.5 $0.4 $0.4	 $0.8 $0.6 $0.5 $0.5	 $0.7 $0.5 $0.4 $0.4	Cost basis and extrapolation considerations: VENCorp has increased the original costs by 25 %. There is no clear basis for the original estimate in terms of scope and cost. As such, there is no clear basis for the increase. It is noted however that VENCorp has undertaken a number of wind monitoring projects in this current period. The estimates and actual costs for these historic projects are similar to the original project estimates i.e. not significantly lower. Furthermore, the forecast projects are all proposed in the last year of next period (2013/14) so the increase from present costs, in real 07/08 terms, is not so significant based upon the AER data (~1.5% assuming the substation data as the proxy). Therefore, based upon the information available, the original estimates appear reasonable and there does not appear to be a material case for any further increase.
220 kV line uprates 82deg Rowville – Springvale	$1	$1.5	$1.3	Cost basis and extrapolation considerations: VENCorp has increased the original estimate by 50% in the revised proposal. The original estimate is based upon an SP AusNet June 2005 estimate. Therefore, it is considered appropriate to allow an increase to the original estimate to cover the price escalation from 2000-2004 to the time of the project, and brownfield factors. Project component breakdown: All project costs have been assigned to the line upgrade component. Cost escalation: A 15% accumulative escalation has been calculated from Table 24 (line upgrade, second data column). Brown field: A 10% brownfield factor has been applied, as defined in Table 25.
Terminal Station works • upgrade Moorabool and Geelong • upgrade terminations at Hazelwood	 $1 $6	 $1.3 $7.5	 $1 $6	Cost basis and extrapolation considerations: VENCorp has increased the original costs by 25 %. There is no clear basis for the scope and cost of the original estimate. As such there is no clear basis for the increase. Noting that VENCorp has undertaken significant levels of terminal station and fault mitigation works in the current period, it would be expected that VENCorp would be reasonably capable of estimating and/or verifying an appropriate cost, accounting for real 2007/08 prices and other factors. As such, there does not appear to be a sufficiently justified basis for the need to increase the original cost further.
New 500 kV terminal station at Mortlake	$12	$15	$14.2	Cost basis and extrapolation considerations: VENCorp has increased the original estimate by 25% in the revised proposal. The original estimate is based upon an SP AusNet June 2005 estimate. Therefore, it is considered appropriate to allow an increase to the original estimate to cover the price escalation from 2000-2004 to the time of the project. Project component breakdown: All project costs have been assigned to the substation component. Cost escalation: An 18% accumulative escalation has been calculated from Table 24 (substation, third data column). Brown field: No brownfield factors have been allows as this project is a greenfield development.

Project	Project cost ($ millions real 2007/08)			Considerations and assumptions
	Original	Revised	Nuttall Consulting	
Series compensation and shunt capacitor bank Wodonga/Dederang	$12	$15	$15	Cost basis and extrapolation considerations: The original cost was partly based upon an SP AusNet estimate in June 2005. This cost has been increased by VENCorp by 25% in the revised proposal. As the original cost was an SP AusNet estimate, there is a case for this further escalation. However, the basis of the cost for the series compensation is not clear, although $12-15m appears reasonable for the overall project. Noting the uncertainty in the basis of part of the cost estimate, and the AER escalation data (which indicates price increases in the order of 10-20%), the 25% escalation does not appear unreasonable. As such, the revised cost has been accepted.
330 kV line uprate South Morang to Dederang and line compensation	$7.4	$10	$9.2	Cost basis and extrapolation considerations: VENCorp has increased the original estimate by 35% in the revised proposal. The original estimate is based upon an SP AusNet June 2005 estimate. Therefore, it is considered appropriate to allow an increase to the original estimate to cover the price escalation from 2000-2004 to the time of the project, and brownfield factors. Project component breakdown: As there is no line compensation component in the AER escalation data, Nuttall Consulting has assumed that the "substation" component is a reasonable proxy for the compensation costs. The original project cost has been apportioned as follows: $4 million to the compensation component; $2.4 million to the substation component; and $1 million to the line upgrade component. Cost escalation: 18%, 18% and 16% accumulative escalations have been calculated from Table 24 (third data column) for the compensation, substation and line upgrade components respectively. Brown field: 5%, 23% and 10% brownfield factors have been applied to the compensation, substation and line upgrade components respectively, as defined in Table 25.
Series compensation on 220 kV line Eildon to Thomastown	$7	$9	$9.2	Cost basis and extrapolation considerations: VENCorp has increased the original estimate by 25% in the revised proposal. The original estimate is based upon an SP AusNet June 2005 estimate. Therefore, it is considered appropriate to allow an increase to the original estimate to cover the price escalation from 2000-2004 to the time of the project, and brownfield factors. Project component breakdown: As there is no line compensation component in AER escalation data, Nuttall Consulting has assumed that the "substation" component is a reasonable proxy for the compensation costs. The original project cost has been apportioned as follows: $4 million to the compensation component and $3 million to the substation component. Cost escalation: An 18% accumulative escalation has been calculated from Table 24 (third data column) for the compensation and substation components. Brown field: 5% and 23% brownfield factors have been applied to the compensation and substation components respectively, as defined in Table 25.

Project	Project cost ($ millions real 2007/08)			Considerations and assumptions
	Original	Revised	Nuttall Consulting	
4th 500 kV line Loy Yang to Hazelwood	$30	$45	$37.7	Cost basis and extrapolation considerations: VENCorp has increased the original estimate by 50% in the revised proposal. The original estimate is based upon an SP AusNet April 2006 estimate. Therefore, it is considered appropriate to allow an increase to the original estimate to cover the price escalation from 2000-2004 to the time of the project, and brownfield factors. Project component breakdown: The original project cost has been apportioned as follows: $24 million to the new line component and $6 million to the substation component. Cost escalation: 22% and 18% accumulative escalations have been calculated from Table 24 (third data column) for the new line and substation components respectively. Brown field: A 23% brownfield factor has been applied to the substation components, as defined in Table 25. No brownfield factor has been applied to the new line component as this is considered to be a greenfield development.