

Utilities Commission

**Review of Capital and Operating Expenses related to the 2009
Network Price Determination Cost Pass Through Application**

26 March 2013






**PARSONS
BRINCKERHOFF**

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Executive summary

In late 2008, a number of equipment failures resulted in widespread disruption in electricity supply to Darwin's Northern Suburbs. The Northern Territory Government established an independent enquiry, headed by Mervyn Davies, into these events, including Power and Water Corporation's (PWC) operational response and electrical substation maintenance practices. The Independent Enquiry into Casuarina Substation Event and Substation Maintenance across Darwin Final Report (the Davies Report) made a number of recommendations in relation to substation maintenance, systems and processes.

In the Utilities Commission 2009 Networks Price Determination (the 2009 Determination) the Commission explicitly excluded capital and maintenance costs associated with the Davies Report on the grounds that the likely impact on PWC Networks was unknown or too difficult to quantify at the time. The Commission noted that it would allow costs associated with the Davies Report recommendations to be passed through during the third regulatory period subject to PWC's application, and the Commission's public review in accordance with the requirements of the Electricity Networks (Third Party Access) Code.

On 5 February 2013 PWC lodged an application for a cost pass through of the increased operating and capital expenditure that exceeded that allowed for by the Commission in the 2009 Determination. PWC has advised the Commission that this application includes all costs that are a direct consequence of its implementation of the 2009 Davies Report recommendations and the subsequent enhancement of its asset management regime.

Parsons Brinckerhoff was engaged by the Utilities Commission of the Northern Territory (the Commission) to undertake a high level review of the documentation provided by PWC, providing specific advice on the overall reasonableness of the operational and capital expenditure identified by PWC and whether that expenditure is reasonably attributable to the Davies Report recommendations.

Parsons Brinckerhoff has identified Capex adjustments consisting of:

- project level contingency
- projects unrelated to Davies Report recommendations
- project scope components unrelated to Davies Report recommendations
- distribution system augmentation
- purchase of spares above the levels required
- generation assets funded by a separate business unit

Opex adjustments have been identified, consisting of:

- labour unrelated to Davies Report recommendations
- fleet and other costs unrelated to Davies Report recommendations
- hire of back-up gensets during the restoration of Casuarina Zone Substation

Based on this review, we recommend that the Commission considers the adjustments to the claimed capex and opex presented in Table 1.1 and Table 1.2.

Table 1.1 Recommended capex adjustments (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	3.07	7.93	18.63	28.87	31.13
Total Adjustments	-	(2.40)	(3.41)	(3.43)	(17.60)
Recommended total capex	3.07	5.53	15.22	24.44	13.53

Source: Parsons Brinckerhoff analysis

Table 1.2 Recommended opex adjustments (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Opex claimed	15.30	6.39	9.99	9.77	14.33	9.34
Total Adjustments	(9.93)	(1.39)	(1.26)	(3.15)	(3.05)	(3.14)
Recommended total opex	5.37	5.00	8.73	6.62	11.28	6.20

Source: Parsons Brinckerhoff analysis



1. Introduction

In the 2009 Determination specific provision was made for a cost pass through application relating to PWC's increased capital works and maintenance arising from the findings of the Davies Report. In the 2009 Determination, the Commission noted that it would allow costs associated with the Davies Report recommendations to be passed through during the third regulatory period subject to PWC's application, and the Commission's public review in accordance with the requirements of the Electricity Networks (Third Party Access) Code.

In the 2009 Determination the Commission explicitly excluded capital and maintenance costs associated with the Davies Report on the grounds that the likely impact on PWC Networks was unknown or too difficult to quantify at the time.

On 5 February 2013 PWC lodged an application for a cost pass through of the increased operating and capital expenditure that exceeded that allowed for by the Commission in the 2009 Determination. PWC has advised the Commission that this application includes all costs that are a direct consequence of its implementation of the 2009 Davies Report recommendations and the subsequent enhancement of its asset management regime.

This report is a high level review of the documentation provided by PWC, providing specific advice on the overall reasonableness of the operational and capital expenditure identified by PWC and whether that expenditure is reasonably attributable to the Davies Report recommendations.



2. Background

In late 2008, a number of equipment failures resulted in widespread disruption in electricity supply to Darwin's Northern Suburbs. The Northern Territory Government established an independent enquiry, headed by Mervyn Davies, into these events, including PWC's operational response and electrical substation maintenance practices.

The independent enquiry final report, the Davies Report, was provided to PWC and the NT Government in January 2009. The Davies Report made a number of recommendations in relation to substation maintenance, systems and processes. Refer to section 4 for details of these recommendations.

On 5 February 2013, the Commission received an application from PWC for a cost pass through of expenditure that exceeded that allowed for by the Commission in the 2009 Determination. The PWC application advises that the increased operating and capital expenditure is a direct consequence of PWC's implementation of the Davies Report recommendations and the subsequent enhancement of PWC Networks' asset management regime.

The 2009 Determination made specific provision for a cost pass through application relating to the increased capital and maintenance spending by Power and Water as a result of Government decisions responding to the findings of the Davies Report. The 2009 Determination noted that the Commission would allow costs associated with the Davies Report recommendation to be passed through during the third regulatory period if, upon application by Power and Water and following a public review by the Commission, any such spending increases satisfied, among other things, the requirements of clause 71(c) of the NT Electricity Networks (Third Party Access) Code¹.

The Commission explicitly excluded costs associated with the Davies Report from affecting the outcome of the 2009 Determination on the grounds that the likely impact on PWC Networks was unknown or too difficult to quantify at the time.

PWC's application for the cost pass through identifies all operating and capital expenditure over that allowed for in the 2009 Determination. The Commission has advised PWC that it will only consider expenditure that can be directly attributed to the Davies Report.

¹ Clause 71 (c) enables the regulator to revoke or reset a revenue or price cap with respect to a particular financial year or years only if it appears to the regulator that there were extraordinary developments with respect to any one of the key factors identified in clause 68 of the Code which, in the opinion of the regulator, were outside the network provider's control.



3. Our Approach

Parsons Brinckerhoff has undertaken a high-level independent expert review of the documentation provided by PWC to assess, from the perspective of the Davies Report recommendations:

- the overall reasonableness of the projects and associated operational and capital expenditure identified by PWC
- whether the projects and associated capital and operating expenditure are reasonably attributable to the Davies Report recommendations and if not, which projects and expenditure should be excluded and why
- for projects and expenditure appropriately linked to the Davies Report, any areas:
 - of inconsistency with the report's recommendations
 - where actual or forecast expenditure (capital and operational) appears unreasonable or inefficient in relation to implementing specific recommendations or projects
- the overall actual and forecast costs (operational and capital at a summary level) which are directly attributable to the Davies report.

This report considers the Davies Report recommendations as the basis for PWC's projects and expenditures. Parsons Brinckerhoff have utilised independent expert opinions and findings for each of the matters listed above, and have included recommendations relating to those findings. In undertaking this assessment, expenditure that appears unreasonable or inefficient has been estimated at a high-level, along with an explanation of the basis of this assessment. This information has been provided to assist the Commission with its determination.

These estimates reference our understanding of network capital and maintenance processes, condition based maintenance processes, and comparable reasonable costs incurred by other network providers in other Australian jurisdictions.

The validity of PWC's cost pass through application in terms of Clause 71(c) of the NT Access Code or the materiality threshold has not been considered in this report.

To undertake its review, Parsons Brinckerhoff reviewed the following documentation:

- PWC's cost pass through application
- Independent Enquiry into the Casuarina Substation Events and Substation Maintenance across Darwin, Final Report January 2009 (i.e. the Davies Report)

- PWC's Progress Reports on the implementation of the Mervyn Davies' Enquiry.
- Capital expenditure and operational expenditure (actual and forecast) provided by PWC, including business cases
- other supporting documentation provided by PWC.

Details of the full list of documents reviewed are contained in Appendix A.



4. Davies Report Recommendations

In late 2008, a number of equipment failures resulted in widespread disruption in electricity supply to Darwin's Northern Suburbs. The Northern Territory Government established an independent enquiry, headed by Mervyn Davies, into these events, including PWC's operational response and electrical substation maintenance practices.

The Davies Report was provided to PWC and Government in January 2009. The Davies Report made a number of recommendations in relation to substation maintenance, systems and processes, summarised below. The full list of recommendations is contained in Appendix B.

1. Implement a condition based approach to asset management, including systemic and rigorous and condition monitoring.
2. Develop an "in house" maintenance policy resource to:
 - a. be a pragmatic adopter of what other distributors are doing
 - b. be a specialist in monitoring, testing and diagnostics
 - c. undertake routine preventative tasks and common corrective tasks
 - d. foster a culture of local ownership
 - e. enforce accountability through measurement and reporting
3. Implement organisational changes to ensure:
 - a. adequate resource allocation to routine substation maintenance
 - b. the Maintenance Delivery group are empowered and able to focus on asset management
 - c. works management and scheduling are kept simple
 - d. routine testing and advanced diagnostic testing are the responsibility of different organisational entities
4. Ensure that the systems and processes provide capabilities for substation maintenance management and asset condition management
5. Adopt a three tier approach to substation maintenance policy documentation

6. Set quantity based plans for substation maintenance on a one and five year basis and resource to deliver
7. Develop reporting for:
 - a. delivery targets and delivery progress
 - b. substation asset condition
8. Ensure the sustained level of manning and equipment required to match the forecast works programme through:
 - a. training
 - b. employee exchanges or secondments with the other Australian distributors
 - c. ongoing participation by engineering staff, in relevant industry forums
 - d. recruitment of an additional 6 electrically trades qualified personnel
 - e. annually reviewing the five year forecast of substation maintenance requirements
 - f. upgrade and progressively acquire additional new condition monitoring equipment
9. Devise and implement a Human Resources Development programme to:
 - a. ensure an inclusive and collaborative supervision and leadership style
 - b. improve communication and collaboration between functional areas
 - c. achieve acceptance of individual accountability
 - d. improve performance measurement and recognition
10. Review the current incident management arrangements to provide PAWC with the credibility to manage its own system incidents including:
 - a. the Manton Investigation
 - b. the Residual Casuarina Incidents Investigation
 - c. the investigation of Hazard/Incident No 1768
11. Undertake the following remedial programmes:
 - a. Initiate a programme of rigorous condition assessment of all Zone Substation equipment immediately. Undertake a high level risk analysis to determine programme priorities and set a timetable
 - b. Implement a programme to verify the efficacy of all frame leakage protection systems and remediate, if necessary. Also review the associated earthing system designs, to verify their adequacy under all feasible fault conditions
 - c. Take immediate action to replace the Casuarina Zone Substation 11kV switchboard

- d. Undertake a rigorous condition assessment of all Distribution Substation Equipment. A high level risk analysis should be undertaken to determine programme priorities and timetable.

Although not specifically recorded as recommendations, Davies also suggests

12. The decision to widen the retrofit programme beyond the Mehta recommendations was an appropriately prudent step in minimising the oil hazard.
13. It may be prudent to implement some fine tuning of the organisational structure



5. PWC Cost Pass Through

On 5 February 2013, the Commission received an application from PWC for a cost pass through of expenditure that exceeded that allowed for by the Commission in the 2009 Determination. The PWC's Network Cost Pass Through application letter (5 February 2013) advises that the increased operating and capital expenditure is a direct consequence of PWC's implementation of the Davies Report recommendations and the subsequent enhancement of PWC Networks' asset management regime.

A further letter from PWC, dated 28 February 2013, provides additional information that outlines the details of the projects that constitute the opex and capex claimed in the pass through application. The details of PWC's Network Cost Pass Through application letter (28 February 2013) do not align with the details of the original application. For the purposes of this report, the values contained PWC's Network Cost Pass Through application letter (28 February 2013) have been considered. This detail is reproduced in Table 5.1 and Table 5.2 for convenience.

Table 5.1 PWC – “Actual and forecast capex compared with the regulatory allowance (\$M)”

Year	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Capex actual/forecast	65.9	85.2	88.8	78.8	123.8	98.7	541.2
Capex allowance	56.8	61.2	64.3	68.4	73.0	76.8	400.5
Incremental Capex	9.1	24.0	24.5	10.4	50.7	21.9	140.7

Source: PWC's Network Cost Pass Through application letter (28 February 2013)

Table 5.2 PWC – “Actual and forecast opex compared with the regulatory allowance (\$M)”

Year	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Opex actual/forecast	84.3	78.5	93.0	101.1	97.8	93.9	548.6
Opex allowance	45.6	48.7	50.9	53.7	56.9	59.4	315.1
Incremental Opex	38.7	29.8	42.1	47.5	40.9	34.5	233.4

Source: PWC's Network Cost Pass Through application letter (28 February 2013)

These figures are the total amount of capex and opex incurred (or expected to be incurred) by PWC, the regulatory allowance and the expenditure that has exceeded that allowed for. There is no breakdown of the

items that make up the actual and forecast opex and capex contained in the above tables. However, elsewhere in the letter there are details of the projects and associated costs claimed for capex relating to the Davies Report and opex relating to the Davies Report, reproduced in Table 5.3 and Table 5.4

Table 5.3 PWC Cost Pass Through Application “Capex directly attributable to the Davies Review recommendations (\$M)”

Capex Project (actual/forecast)	Davies Report recommendation		2008/09	2009/10	2010/11	2011/12	2012/13	Total
PXD39311 – Restoration of Casuarina Zone Substation	11.1 1	Replace Casuarina Zone Substation 11kV Switchboard	3.07	4.67	-0.97	1.03	0.00	7.79
PRD39541 – Rebuild Snell Street 66/11kV Zone Substation - Woolner Zone Substation	11.7	Report on asset condition, risks and failures	0.00	1.31	5.55	14.18	12.50	33.55
	11.1 1	Undertake and overall remedial program						
PDR39501 – Replace Manton 22kV Switchboard	11.7	Report on asset condition, risks and failures	0.00	0.00	0.39	1.21	2.00	3.59
	11.1 1	Undertake and overall remedial program						
PDR39712 – Reinforce Winnellie – Berrimah 11kV Network	11.7	Report on asset condition, risks and failures	0.00	0.00	0.01	0.80	1.80	2.61
	11.1 1	Undertake and overall remedial program						
Purchase spare zone substation transformers	11.7	Deliver improved systems and processes, including policies and policy documentation	0.00	0.77	2.18	0.67	0.19	3.81
PXD39703 – Purchase System Spare 132/22kV 20/27MVA Transformer								
PRD39707 – Purchase System Spare 132/66kV 35MVA Transformer								
PXD39713 – Supply and Delivery of a Spare 7.5MVA 66/22kV Transformer	11.5							
Purchase two mobile substations and switchboards:	11.7	Report on asset condition, risks and failures	0.00	0.00	6.44	4.71	2.64	13.79
PRD39738 – Purchase of Two Mobile Substations								
PRD39534 – Supply 2 x 22kV Mobile Switchboards Able to be Utilised for Both 11kV and 22kV Emergency use and Temporary Supply Use								
PRD30002 – Rebuild Weddell – Archer 66kV Line	11.7	Report on asset condition, risks and failures	0.00	0.00	0.00	1.93	12.00	13.93
PXK32080 – Replacement 22kV Katherine Switchboard	11.7	Report on asset condition, risks and failures	0.00	1.18	5.03	3.34	0.00	9.55
	11.1 1	Undertake and overall remedial program						
TOTAL			3.07	7.93	18.62	27.87	31.13	88.61

Source: PWC’s Network Cost Pass Through application letter (28 February 2013)

Table 5.4 PWC Cost Pass Through Application “Opex directly attributable to the Davies Review recommendations (\$M)”

OPEX (actual/ forecast)	Davies Review recommendation	2008/ 09	2009/ 10	2010/ 11	2011/ 12	2012/ 13	2013/ 14	Total
Remedial Works Program Opex	11.11 Undertake an overall remedial program							
	RAMP	15.30	5.00	8.56	5.68	-	-	34.54
	Substation Services Group	-	-	-	-	10.11	5.00	15.11
Step change in Networks' workforce levels	11.8 Modernising maintenance knowledge							
	11.9 Accelerate reform of maintenance operations	-	1.39	1.43	4.09	4.22	4.34	15.47
TOTAL		15.30	6.39	9.99	9.77	14.33	9.34	65.11

Source: PWC's Network Cost Pass Through application letter (28 February 2013)



6. Review

This section sets out Parsons Brinkerhoff's findings in relation to our review of the capital and operating expenditures claimed by PWC as expenditures related to the implementation of the Davies Report findings in their recent pass-through application.

Appendix A provides a list of the documents reviewed by Parsons Brinkerhoff

This section presents a review of the capital expenditure and our findings on a capital project by project basis. This is followed by a review of the operating expenditure.

6.1 Capital expenditure review

In their pass through application, PWC set out the capital costs associated with the recommendations of the Davies Report. These costs are summarised in Table 6.1.

Table 6.1 PWC's Capital Expenditure Claim (\$M)

Capex Project (actual/forecast)	2008/09	2009/10	2010/11	2011/12	2012/13	Total
PXD39311 – Restoration of Casuarina Zone Substation	3.07	4.67	-0.97	1.03	0.00	7.79
PRD39541 – Rebuild Snell Street 66/11kV Zone Substation - Woolner Zone Substation	0.00	1.31	5.55	14.18	12.50	33.55
PDR39501 – Replace Manton 22kV Switchboard	0.00	0.00	0.39	1.21	2.00	3.59
PDR39712 – Reinforce Winnellie – Berrimah 11kV Network	0.00	0.00	0.01	0.80	1.80	2.61
Purchase spare zone substation transformers PXD39703 – Purchase System Spare 132/22kV 20/27MVA Transformer PRD39707 – Purchase System Spare 132/66kV 35MVA Transformer PXD39713 – Supply and Delivery of a Spare 7.5MVA 66/22kV Transformer	0.00	0.77	2.18	0.67	0.19	3.81
Purchase two mobile substations and switchboards: PRD39738 – Purchase of Two Mobile Substations PRD39534 – Supply 2 x 22kV Mobile Switchboards Able to be Utilised for Both 11kV and 22kV Emergency use and Temporary Supply Use	0.00	0.00	6.44	4.71	2.64	13.79
PRD30002 – Rebuild Weddell – Archer 66kV Line	0.00	0.00	0.00	1.93	12.00	13.93
PXK32080 – Replacement 22kV Katherine Switchboard	0.00	1.18	5.03	3.34	0.00	9.55
Total	3.07	7.93	18.62	27.87	31.13	88.61

Source: PWC's Network Cost Pass Through application letter (28 February 2013)

6.1.1 Restoration of Casuarina Zone Substation

Recommendation 11.11.3 of the Davies Report states that immediate action should be taken to replace the Casuarina Zone Substation 11kV switchboard. In their pass through application, PWC has claimed the capital expenditure set out in Table 6.2 in relation to this recommendation and provided the following documents in support of this claim:

- Business Case: Restoration of Casuarina Zone Substation, Paper for Decision, Board Meeting of 10 December 2008
- Capital Investment, Asset Management and Fuel Supply Committee Paper, Casuarina Zone Substation Restoration, 28 April 2010.

While the original estimate for this works is noted in the Business Case at \$4.0M (2008/09), this was subsequently revised to \$8.1M (2009/10) in the April 2010 advice to the Capital Investment, Asset Management and Fuel Supply Committee. In that advice it is noted that the additional costs for this work are attributable to²:

- installation of a second mobile switchboard for safety and reliability of supply
- replacement of HV paper insulated lead cables
- rework of transformer cables
- removal of asbestos conduits and ductwork
- significant augmentation to distribution system
- replacement of LV AC and DC supply boards, lighting and services
- replacement of auxiliary supplies
- replacement of transformer protection relays
- site restoration including replacement of Transformer No 1, fire systems and building works.

In Parsons Brinckerhoff's opinion, most of these additional items could reasonably be considered as additional works that may be identified once restoration of the site and switchboard replacement had commenced. For example, the discovery of asbestos ducting, building damage, or the incompatibility of exiting cabling or ancillary systems with the replacement switchboard or the revised site arrangement may be required to accommodate replacement of an 11kV switchboard that has suffered catastrophic damage. However, the need to undertake significant augmentation of the distribution system or to replace Transformer No 1 is not supported by the information provided, and moreover, in our opinion is beyond the scope of the recommendation to replace the Casuarina Zone Substation 11kV switchboard. On this basis, Parsons Brinckerhoff recommends the adjustments set out in Table 6.2.

Table 6.2 Restoration of Casuarina Zone Substation Capex (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	3.07	4.67	-0.97	1.03	-
Adjustments					
Transformer	-	(1.20)	-	-	-
Distribution system augmentation	-	(0.50)	-	-	-
Recommended capex	3.07	2.97	-0.97	1.03	-

Source: Parsons Brinckerhoff analysis

² Power and Water Corporation, 28 April 2010, Casuarina Zone Substation Restoration, Capital Investment, Asset Management and Fuel Supply Committee Paper.

6.1.2 Rebuild Snell Street 66/11kV Zone Substation

In their pass through application, PWC are claiming the capital expenditure set out in Table 6.3 in relation to the rebuild of Snell Street Zone Substation. In support of this claim, PWC has provided the following documentation:

- Business Case: Rebuild Snell Street 66/11kV Zone Substation, Paper for Decision, Board Meeting of 29 April 2010
- Capital Investment, Asset Management and Fuel Supply Committee Paper, Variation to Approved Business Case Value: Woolner Zone Substation, 12 October 2011.

This documentation sets out (at a high level) a number of issues related to the overall condition of the substation equipment. In particular, it is noted that the substation comprises of an outdoor 66kV switchyard which is in poor overall condition and located adjacent to a concrete batching plant. In addition, test results for three of the four power transformers indicate that they are in poor or very poor condition, there is asbestos present in the 11kV switchroom, and the 11kV switchboard has a significant level of partial discharge reported.

Based on the information provided, Parsons Brinckerhoff is of the opinion that the overall condition of the Snell Street Zone Substation could reasonably be described as poor, and that refurbishment of the site is a reasonable response. Moreover, in our view, the scope of work set out in the documentation generally aligns with addressing the reported condition issues at the site. We also note the significant variation in costs from the original estimate as set out in the Capital Investment, Asset Management and Fuel Supply Committee Paper, and are of the opinion that these additional works are also reasonably attributable to the overall poor condition of the substation.

Having reviewed the overall scope of work and the associated variations, Parsons Brinckerhoff is of opinion that scope of work generally accords with the recommendations of the Davies Report in that these works are addressing poor condition zone substation assets that represent a high risk of failure. Moreover, in our view the capital cost of these works appear reasonable given that this is a live brownfield site in poor condition with a number of specific hazards (e.g. asbestos, significant partial discharge on the 11kV board).

In reviewing the Snell Zone Substation refurbishment documentation, Parsons Brinckerhoff noted that an unspecified contingency has been included in the overall cost estimates. In our experience, economic regulators generally do not accept the inclusion of unspecified contingencies as they effectively seek to pass project estimating risks and project management risks to the customer, and where they are included at project level (as opposed to at the overall project portfolio level) such contingencies build in an overall cost bias in favour of the distributor. Hence, such unspecified contingencies are generally removed from cost estimates.

Given that the estimated cost includes an unspecified contingency, and that there is a substantial estimated cost to be incurred in the 2012/13 financial year (refer Table 6.3), Parsons Brinckerhoff is of the view that this contingency portion should not be allowed. Hence, Parsons Brinckerhoff recommends the adjustments set out in Table 6.3.

Table 6.3 Rebuild Snell Street 66/11kV Zone Substation (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	1.31	5.55	14.18	12.50
Adjustment					
Unspecified contingency	-	-	-	-	(3.00)
Recommended capex	-	1.31	5.55	14.18	9.50

Source: Parsons Brinckerhoff analysis

6.1.3 Replace Manton 22kV Switchboard

The Davies Report specifically considered PWC’s Manton Investigation, and noted the bus bar failure on the YSF6 22kV switchboard at Manton Zone Substation as well as similar partial discharge problems being experienced with YSF6 22kV switchboards³. While Davies concluded that further investigation was warranted to “... establish the root cause of the failure and to assess whether better environmental controls would help to mitigate the risk.”, within the broader context of the Davies’ recommendations the intention was to address such condition issues through a risk based remedial program⁴.

In their pass through application, PWC are claiming the capital expenditure as set out in Table 6.4 in relation to the replacement of the Manton 22kV switchboard. To support this claim PWC provided Manton Zone Substation 22kV switchgear replacement Business Case.

The Manton business case notes that the Yorkshire YSF6 22kV switchboard has partial discharge problems and proposes to replace the switchgear and associated SCADA and control equipment in a new modular building and remove the existing building. Given the reported partial discharge issues with the Yorkshire YSF6 22kV switchboard, Parsons Brinckerhoff is of the opinion that this scope of work is generally reasonable. We are also of the opinion that the capital expenditure set out in Table 6.4, while very much at the higher end of our estimates, is reasonable for expedited works on a live brownfield site.

Accordingly, Parsons Brinckerhoff recommends no adjustments to the capital expenditure for this project.

Table 6.4 Replace Manton 22kV Switchboard (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	-	0.39	1.21	2.00
Adjustment					
	-	-	-	-	-
Recommended capex	-	-	0.39	1.21	2.00

Source: Parsons Brinckerhoff analysis

6.1.4 Reinforce Winnellie – Berrimah 11kV Network

In their pass through application, PWC are claiming the capital expenditure set out in Table 6.5 in relation to the reinforcement of the Winnellie – Berrimah 11kV Network. In support of this claim PWC submitted the BRC Business Case entitled “Reinforce the Winnellie – Berrimah 11kV Network”, dated 5 November 2010.

The business case sets out the need to reinforce the 11kV network in the Winnellie – Berrimah area to address network deficiencies and bolster supply. Specifically the business case notes the drivers of this project as being to:

- provide backup supply to the Darwin RFFA Base
- provide backup supply to the Winnellie Feeder 11BE07 Navy
- provide backup supply for radial feeder 11SN05
- improve load transfer capacity between Snell St Zone Substation and Berrimah Zone Substation
- provide backup supply for radial feeder 11SN05
- provide supply with backup to the Berrimah Industrial Estate

³ Mervyn Davies, 4 February 2009, Independent Enquiry Into Casuarina Substation Events And Substation Maintenance across Darwin, Final Report, p. 58.

⁴ ibid - recommendation 11.11, p. 84.

- solve a protection malfunction on the 11BE07 Navy feeder.

In Parsons Brinckerhoff's opinion, almost all of the above noted investment drivers of this project relate to complying with network planning criteria (i.e. providing backup supply) and hence are unrelated to the Davies Report recommendations.

While improving the transfer capacity between Snell St and Berrimah zone substations may have benefits in terms of managing condition based maintenance or refurbishment works at these zone substations, this is not reflected in the business case. Moreover, if this was a primary reason for this work, then it is not reflected by the options analysis in the business case which discusses compliance with planning criteria and SAIDI⁵ and SAIFI⁶ targets, rather than approaches to maintain supply during refurbishment works at either of these zone substation sites. Consequently, in Parsons Brinckerhoff's opinion this project is unrelated to the Davies Report recommendations and accordingly we recommend the adjustments as set out in Table 6.5.

Table 6.5 Reinforce Winnellie – Berrimah 11kV Network (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	-	0.01	0.80	1.80
Adjustment					
Project unrelated to Davies Report recommendations	-	-	(0.01)	(0.80)	(1.80)
Recommended capex	-	-	-	-	-

Source: Parsons Brinckerhoff analysis

6.1.5 Purchase spare zone substation transformers

In considering relevant previous reviews the Davies Report cited the findings of the Blanch Review, and in particular noted that spares holdings are inadequate⁷. Davies went on to note that “None of these findings are inconsistent with the observations of the current Enquiry.”

In their pass through application, PWC are claiming the capital expenditure as set out in Table 6.6 in relation to the purchase spare zone substation transformers. In support of this claim PWC submitted the following documentation:

- Business Case: Purchase System Spare 132/66kV 35MVA Transformer, 4 December 2009 (PRD39707)
- Business Review Committee, Business Case: Purchase System Spare 132/22kV 20/27MVA Transformer, 4 December 2009 (PRD39703)
- BRC Business Case: Supply and Delivery of a Spare 7.5MVA 66/22kV Transformer, 5 November 2010 (PXD39713).

These business cases note that there are no system spare transformers of these various sizes held by PWC, or held in the northern region, and in addition the only 132/66kV transformer at Pine Creek has shown signs of arcing.

⁵ SAIDI – System Average Interruption Duration Index. This is a service level measure that indicates the average level of reliability of supply provided by a distribution network.

⁶ SAIFI – System Average Interruption Frequency Index. This is a service level measure that indicates the average level of reliability of supply provided by a distribution network.

⁷ *ibid.* p. 56.

In general, it is our opinion that the purchase of zone substation spare transformers accords with the Davies Report recommendations and that the capital cost, while at the higher end of our estimates, is reasonable.

Nonetheless, in our view, demonstration of the appropriate level of spares should align the number of spares held with the risk of providing the required network service levels (e.g. level of SAIDI to be provided), and hence the procurement of spares should be assessed in terms of the reduction of this risk. However, we note that in addition to the above system spare transformers, PWC has included in its pass through application the purchase of two mobile substations, two mobile switchboards, and has indicated that it has plans to convert the old modular Manton building to accommodate a mobile switchboard⁸. In our view, in the context of the zone substation refurbishment works, and given that no analysis has been provided to demonstrate the appropriate level of spares, the contemplated level of ‘system spares’ appears excessive from the perspective of the 31 zone substations on PWC’s network.

In the “Purchase of Two Mobile Substations” business case, PWC notes:

*“The current SCI has allowances for additional spare transformers additional spare 11kV and 22kV switchboard bus sections and other ancillary equipment **which would no longer be required or considerably deferred**. This projected expenditure will be utilized now for the mobile solution.”⁹*

The business case goes on to further note that “Mobile substations will alleviate the need for at least two transformers saving approx \$2M.”¹⁰ Parsons Brinckerhoff concurs with the views expressed in the mobile substation business case that the spare 132/22kV 20/27MVA transformer (PRD39703) and the spare 7.5MVA 66/22kV transformer are not required in addition to the mobile substations. Accordingly we recommend the adjustments as set out in Table 6.6.

Table 6.6 Purchase spare zone substation transformers (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	0.77	2.18	0.67	0.19
Adjustment					
Remove PXD39703 (132/22kV 20/27MVA)	-	-	(1.00)	-	-
Remove PXD39713 (7.5MVA 66/22kV)	-	-	(0.90)	-	-
Recommended capex	-	0.77	0.28	0.67	0.19

Source: Parsons Brinckerhoff analysis

6.1.6 Purchase two mobile substations and switchboards

Within the electricity network industry it is common practice to hold complete spare mobile substations and other major components (e.g. spare power transformers) in order to manage major outages or prolonged programs of work at zone substation sites. As noted in section 6.1.5, the Davies Report noted the inadequacy of spares holdings cited by the cited Blanch Review¹¹.

⁸ Business Review Committee, Business Case: Manton Zone Substation 22kV Switchgear Replacement, 4 December 2009, p. 2.

⁹ Business Case: Purchase of Two Mobile Substations, Board Meeting of 16 June 2010, p. 9.

¹⁰ *ibid.*

¹¹ Mervyn Davies, 4 February 2009, Independent Enquiry Into Casuarina Substation Events And Substation Maintenance across Darwin, Final Report, p. 56.

In their pass through application, PWC are claiming the capital expenditure set out in Table 6.7 in relation to the purchase of two mobile substations (PRD39738) and two 22kV mobile switchboards (PRD39534). In support of this claim PWC submitted the following documentation:

- Business Case: Purchase of Two Mobile Substations, Board Meeting of 16 June 2010 (PRD39738)
- Business Review Committee, Business Case: Supply 2 x 22kV Mobile Switchboards Able to be Utilised for Both 11kV and 22kV Emergency use and Temporary Supply Use, 19 June 2009 (PRD39534).

Parsons Brinckerhoff is of the opinion that this capital expenditure generally accords with the principles of the Davies Report recommendations. However, as noted in section 6.1.5, we are also of the opinion that the combination of all the proposed spare transformers, switchboards and mobile substations in the context of other works and the size of the overall network is excessive. Moreover, as noted in the mobile substation business case the "... additional spare 11kV and 22kV switchboard ... would no longer be required or considerably deferred." and the "Mobile Switchboard ... money will be used directly for the mobile substations."¹² In general, Parsons Brinckerhoff concurs with these views as expressed in the mobile substation business case.

In reviewing the mobile substation business case, Parsons Brinckerhoff noted that an unspecified contingency has been included in the overall cost estimates. As discussed in section 6.1.2, in our experience economic regulators generally do not accept the inclusion of unspecified contingencies. Given that the estimated cost includes an unspecified contingency, and that the 2012/13 capex is a cost estimate, Parsons Brinckerhoff is of the view that this contingency portion should not be allowed.

In accordance with our review findings as set out above, Parsons Brinckerhoff recommends the adjustments set out in Table 6.7.

Table 6.7 Purchase two mobile substations and switchboards (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	-	6.44	4.71	2.64
Adjustment					
Unspecified contingency	-	-	-	-	(0.80)
Remove PRD39534 (Mobile Switchboards)	-	-	(1.50)	-	-
Recommended capex	-	-	4.94	4.71	1.84

Source: Parsons Brinckerhoff analysis

6.1.7 Rebuild Weddell – Archer 66kV Line

In their pass through application, PWC are claiming the capital expenditure as set out in Table 6.8 in relation to the rebuild of the Weddell – Archer 66kV line (PRD30002). In support of this claim PWC submitted the following documentation:

- Business Case: Rebuild 66kV Weddell-Archer Transmission Line 1, Board Meeting of 7 December 2011.
- Capital Investment, Asset Management and Fuel Supply Committee Paper, Variation to Approved Business Case Value: Rebuild Weddell to Archer 66kV Transmission Line 1, 21 August 2012.

¹² Business Case: Purchase of Two Mobile Substations, Board Meeting of 16 June 2010, p. 9.

The business case for the rebuild of the Weddell – Archer 66kV line notes that this line is not fully constructed to cyclone standards, and states the objectives of the project as¹³:

- reduce likelihood of a long term power outage caused by cyclonic damage to the transmission system
- provide a significant amount of Generation and Network transmission capacity in the event of a major cyclone.
- secure supply to customers not effected by a major cyclone event
- aid post cyclone recovery efforts.

While not noted in the business case, the PWC’s Network Cost Pass Through application letter (28 February 2013) adds that a condition assessment found that the line was in poor condition with severe cross-arm corrosion problems.

In Parsons Brinckerhoff's opinion the primary driver of this project is "... Power Networks' mitigation strategy for the current cyclone risk to the transmission system ..."¹⁴, and not the recommendations of the Davies Report.

However, we note that while the Davies Report related to the examination of zone substation maintenance practices across Darwin, Davies extended its terms of reference to consider substation maintenance more broadly and also made broader recommendations. Hence, while the condition of sub-transmission line assets is not strictly within the scope of the Davies Report or its recommendations, nonetheless, it is Parsons Brinckerhoff's opinion that the condition of such a critical line that supplies zone substations is of concern and consideration of the condition of this asset accords with the generally more relaxed view taken by Davies.

Accordingly, while we consider that the overall Weddell – Archer 66kV line rebuild is not attributable to the Davies Report Recommendations, we are of the view that the condition related capital costs should nonetheless be allowed, as they generally accord with the broader principles of the Davies Report. Hence, Parsons Brinckerhoff recommends the adjustments set out in Table 6.8.

Table 6.8 Rebuild Weddell – Archer 66kV Line (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	-	-	1.93	12.00
Adjustment					
Remove (PRD30002) (Rebuild Weddell – Archer 66kV line)	-	-	-	(1.93)	(12.00)
Add cross-arm replacement cost	-	-	-	0.30	-
Recommended capex	-	-	-	0.30	-

Source: Parsons Brinckerhoff analysis

¹³ Business Case, Rebuild 66kV Weddell-Archer Transmission Line 1, Board Meeting of 7 December 2011, p.p. 3-4.

¹⁴ *ibid*, p. 3.

6.1.8 Replacement 22kV Katherine Switchboard

In their pass through application, PWC are claiming the capital expenditure set out in Table 6.9 in relation to the replacement of the 22kV Katherine switchboard (PXK32080). In support of this claim PWC submitted the following documentation:

- Business Case: Replacement of 22kV Switchboard at Katherine Power Station, Board Meeting – TBA.
- Capital Investment, Asset Management and Fuel Supply Committee Paper, Variation to Approved Business Case Value: Replacement of 22kV Switchboard at Katherine Power Station, 2 February 2011.
- Capital Investment and Asset Management Committee Paper, Further Variation to Approved Business Case Value: Replacement of 22kV Switchboard at Katherine Power Station, 12 October 2011.

The Katherine business case notes that the Yorkshire YSF6 22kV switchboard has had numerous failures over the preceding 5 years, and has high partial discharge levels. This issue with Yorkshire YSF6 22kV switchboards was noted in the Davies Report and was discussed briefly in section 6.1.3 above.

PWC has undertaken the replacement of the Katherine 22kV switchboard due to these condition issues, and in the business case notes the scope of works as including replacement of the 22kV switchboard in a new separate modular building due to the existing building requiring extensive modification to accommodate the new physically larger switchboard. The business case also includes the installation of a capacitor bank to provide system voltage support in the area, and in the subsequent Capital Investment and Asset Management Committee Papers, this scope is extend to move a capacitor originally planned for Batchelor zone substation to Katherine, and to install a new Generation Board in the existing switchroom.

Parsons Brinckerhoff notes that as Katherine is outside the Darwin area, work associated with the maintenance of this zone substation is strictly be beyond the geographical scope of the Davies Report. Nonetheless, in keeping with the broader view taken by Davies, Parsons Brinckerhoff is of the opinion, the replacement of the 22kV switchboard at Katherine is reasonably attributable to the Davies Report recommendations. However, the installation of the capacitors at Katherine is a system issue and hence is unrelated to the management of the condition of the zone substation assets and the Davies Report. In addition, given the installation of a new Generation Board in the existing switchroom appears to be for the benefit of the Generation business unit, it too, in our opinion is not related to the Davies Report recommendations as they apply to the management PWC's Networks assets. Parsons Brinckerhoff also understands that under the Northern Territory Electricity Ring-fencing Code requires costs to be appropriately allocated where a project runs across more than one business unit. Accordingly, Parsons Brinckerhoff recommends the adjustments set out in Table 6.9.

Table 6.9 Replacement 22kV Katherine Switchboard (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13
Capex claimed	-	1.18	5.03	3.34	-
Adjustment					
Remove capacitor banks	-	(0.70)	-	-	-
Remove generation assets	-	-	-	(1.00)	-
Recommended capex	-	0.48	5.03	2.34	-

Source: Parsons Brinckerhoff analysis

6.2 Operational expenditure review

In their pass through application, PWC set out the operating costs associated with the recommendations of the Davies Report. These costs are summarised in Table 6.10.

Table 6.10 PWC's Operating Expenditure Claim

OPEX \$M (actual/ forecast)		2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Remedial Works Program Opex	RAMP ¹⁵	15.30	5.00	8.56	5.68	-	-	34.54
	Substation Services Group ¹⁶	-	-	-	-	10.11	5.00	15.11
Step change in Networks' workforce levels		-	1.39	1.43	4.09	4.22	4.34	15.47
TOTAL \$M		15.30	6.39	9.99	9.77	14.33	9.34	65.11

Source: PWC's Network Cost Pass Through application letter, 28 February 2013, p. 2.

In support of their operating cost claim PWC submitted the following documentation:

- Attachment 1 –Internal Memo, recruitment of new positions within the Service Delivery section (power Networks) to support the restructure
- Attachment 2 - Extract Structure, Process and Capability Review
- Attachment 3 - Power and Water, Delivering the Program of Works - sustainably
- Attachment 4 - Workforce Business Case, Service Delivery positions outlined in Huegin Report
- Attachment 4 - Workforce Business Case, 2 x Senior Project Manager (from Huegin Report)
- Attachment 4 - Workforce Business Case, 2 x Senior Project Manager (from Huegin Report)
- MODEL 2 - 2013-14 Cost Pass Through Application –Directly Attributed to Davies Recommendations.xls
- Network Management Plan 2011/12 to 2016/17
- Power Networks LTAP and RAMP Progress Report
- Power Networks Maintenance Operations Long Term Action Plan Version 0.9
- Power Networks Asset Strategies Procedure

Parsons Brinckerhoff has undertaken a review of the information provided to assess whether the identified operational costs are reasonably attributable to the Davies Report. In particular, this review focused on the cost build-up as set out in the 'opex cost model'¹⁷ and the degree to which these costs could be explained by PWC's supporting documentation and the Davies Report.

¹⁵ The variance in RAMP opex can be explained as follows:

- In 2008-09 there was a once-off expenditure of \$10.7m on the hire of gensets to provide power while Casuarina Zone Substation was being restored.
- In 2010-11, there was a significant increase in personnel.

¹⁶ The 2013-14 Opex Forecast of \$5m for the Substations Services group within Power Networks does not include internal expenses e.g. corporate overheads and internal consumption, as internal expenses for the 2013-14 SCI forecast have not yet not been finalised (i.e. allocated down to this level).

¹⁷ MODEL 2 - 2013-14 Cost Pass Through Application –Directly Attributed to Davies Recommendations.xls

The opex cost model sets out a range of costs associated with the Remedial Asset Maintenance Program (RAMP) which we understand was a short term special purpose program to address the specific findings of the Davies Report. It is also understood that the RAMP team transitioned into the Substation Services Group within Power Networks during 2012/13. Hence the costs associated with the RAMP team, including their ongoing substations maintenance works, have also transitioned into the Substation Services Group. These costs and this transition are reflected in the opex cost model.

Within the opex cost model, further adjustments are applied in 2009/10 and 2011/12 to accommodate additional labour and associated costs that PWC are claiming as related to the Davies Report. Table 6.11 sets out the additional labour requirements that are set out in the opex cost model.

Table 6.11 Additional labour requirements

Additional resource	Number	Commencement Year
SCADA Engineer	1	2009/10
SCADA & Comms - SCADA Engineer	2	2011/12
SCADA & Comms - Comms Engineer	1	2011/12
Senior Telecommunications Engineer	1	2009/10
Telecommunications Officer	1	2009/10
Underground Scheduler	1	2009/10
Planning/Scheduling Officer	2	2009/10
Scheduler/Co-Ordinator	1	2009/10
Resource Co-Ordinator (Opex)	1	2009/10
Network Performance Co-Ordinator	1	2009/10
Program Delivery Manager	1	2009/10
T&D Maintenance Planner	1	2009/10
Training Manager	1	2009/10
Workplace Health & Safety Officer	1	2009/10
Contracts & Projects - Senior Project Manager	2	2011/12
Substation Services (Ramp) - Project Manager	1	2011/12
Program Delivery - Project Manager	2	2011/12
Substation Services (Ramp) - Electrician	6	2011/12
Test & Protection - Tester	2	2011/12
Field Services - Electrician	2	2011/12
Field Services - Dedicated HV Operator	1	2011/12
Southern Region - Line Worker	4	2011/12
Admin Officer	2	2009/10

Source: MODEL 2 - 2013-14 Cost Pass Through Application –Directly Attributed to Davies Recommendations.xls

While the specific additional resources contemplated by Davies are not explicitly set out in the report's recommendations, the report does state that an additional six craft employees should be allocated to substation maintenance¹⁸, and makes the following observations in relation to resourcing levels based on high level benchmarking:

“On this basis PAWC’ would require a total of somewhere between 10 and 17 “hands on field workers” (with the right mix and range of skills), depending upon locational factors.

¹⁸ Mervyn Davies, 4 February 2009, Independent Enquiry Into Casuarina Substation Events And Substation Maintenance across Darwin, Final Report, p. 17.

Given PAWC's onerous operating conditions and environment, a figure at the upper end of this range, or even somewhat higher would be appropriate.

Given also, that PAWCs present workforce requires considerable up skilling and the likelihood that new recruits will as well, it is considered appropriate that, at least initially, the target workforce level be set at 19 workers, i.e. an additional 6 over and above the present actual numbers.”¹⁹

And:

“It would be appropriate to review Protection and Testing numbers, once the full extent of the use of advanced testing techniques is decided. Any additional recruitment into this area would be offset by a comparable reduction in the maintenance delivery area.”

The Davies Reports recommendation 11.8.2 also states that PWC should:

“Initially recruit an additional 6 electrically trades qualified personnel. (Ideally such additional recruits would be experienced in condition monitoring techniques.)

Annually review the five year forecast of substation maintenance requirements and reassess the manning level required to deliver the programme. Implement appropriate manpower planning (a mix of recruitment and apprentice intake) to ensure the sustained level of manning required to match the forecast works programme.”²⁰

It is our opinion, that the Davies Report contemplated a strong focus on appropriate field resources targeted to the improvement of zone substation maintenance activities, plus the essential additional resources to achieve the ongoing maintenance of the zone substation assets. Further to this the Davies Report also places a strong emphasis on training as set out in recommendation 11.8.1. However, the resourcing levels claimed by PWC, in our opinion, go beyond the recommendations and intentions of the Davies Report and we are of the view that the additional labour requirements set out in Table 6.11 exceed the reasonable additional labour required to achieve the requirements of the Davies Report.

Table 6.12 sets out Parsons Brinckerhoff's opinion on the additional labour required to achieve the outcomes of the Davies Report over the medium term. In our view, much of the additional labour set out in Table 6.11 does not have a strong focus on appropriate field resources targeted to the improvement of zone substation maintenance activities, as it provides significant additional capability that is traditionally associated with capital development projects. For example, the six additional staff in the SCADA and telecommunications area would be excessive for the zone substation maintenance needs, and similar conclusions can be drawn for the 4 line workers, or the underground scheduler.

¹⁹ *ibid.* p. 46.

²⁰ *ibid.* p. 81.

Table 6.12 Recommended additional labour commensurate with the Davies Report

Additional resource	Number	Commencement Year
SCADA & Comms - SCADA Engineer	1	2011/12
T&D Maintenance Planner	1	2009/10
Training Manager	1	2009/10
Substation Services (Ramp) - Project Manager	1	2011/12
Substation Services (Ramp) - Electrician	6	2011/12
Test & Protection - Tester	2	2011/12
Field Services - Electrician	2	2011/12
Field Services - Dedicated HV Operator	1	2011/12

Source: Parsons Brinckerhoff analysis

In addition the claimed labour costs, PWC has also claimed vehicle and other costs that are generally a function of the number of employees and the associated number of vehicles and IT equipment. Hence, commensurate with the recommended reduction in labour, there should also be an appropriate adjustment in these associated costs. As Parsons Brinckerhoff does not have sufficiently detailed information on the basis of PWC calculations of these costs, we have used per annum benchmark estimates of \$12,000 per vehicle, and \$18,000 per employee for ‘other costs’ as the basis of our recommend adjustments of these costs.

Plant and equipment operating leases are being claimed for the hire of back-up generators across Darwin’s northern suburbs after the Casuarina incident, whilst Davies was undertaking his review. As this event pre-dates the Davies Report, and the back-up generators would have been required to restore power, irrespective of the report, it is our belief that the hire and installation of back-up generators is unrelated to the implementation of the recommendations of the Davies report.. PWC’s application notes that

“In 2008-09 there was a once-off expenditure of \$10.7m on the hire of gensets to provide power while Casuarina Zone Substation was being restored.”²¹

We note that the amount of \$10.7M accounts for both the hire of plant and equipment and other RAMP costs including recruitment, conference fees and general expenses²² and suggest that the \$9.926M for plant and equipment operating leases in the opex expenditure for 2008-09 be the basis for the adjustment.

In undertaking this review Parsons Brinckerhoff has also given consideration to the trade-off between capex and opex. In our view this is particularly relevant where new assets are replacing old assets, and as a consequence the associated maintenance costs are distinctly different. As PWC is undertaking a significant program of zone station refurbishment, we would anticipate a corresponding reduction in the associated operating costs from the efficient base level of ongoing maintenance costs²³. However, while PWC has noted opex cost reductions in some business cases, this is not uniformly addressed, nor has it been accounted for in aggregate in the PWC costs pass through application or the supporting information. While Parsons Brinckerhoff would recommend that the value of the capex/opex trade-off is assessed and appropriately accounted for, we been unable to reasonably assess an appropriate value of the aggregate capex/opex trade-off with the currently available information.

Based on our assessment of the information provided by PWC, Parsons Brinckerhoff recommends the adjustments set out in Table 6.13 to PWC’s operational expenditure claim.

²¹ PWC’s Network Cost Pass Through application letter, 28 February 2013, p. 2..

²² MODEL 2 - 2013-14 Cost Pass Through Application –Directly Attributed to Davies Recommendations.xls

²³ That is, assuming that PWC’s zone substation maintenance cost was first adjusted to an efficient level appropriate for the ongoing maintenance of these assets at an accepted industry standard.

Table 6.13 Recommended opex (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Opex claimed	15.30	6.39	9.99	9.77	14.33	9.34
Adjustment						
Remove non Davies Labour	-	(1.22)	(1.26)	(2.96)	(3.05)	(3.14)
Fleet and Other Costs Adjustment	-	(0.17)	-	(0.19)	-	-
Back-up gensets	(9.93)	-	-	-	-	-
Total adjusted opex	5.37	5.00	8.73	6.62	11.28	6.20

Source: Parsons Brinckerhoff analysis



7. Conclusions and Recommendations

Parsons Brinckerhoff has undertaken a high-level review of the documentation provided by PWC, considering the Davies Report recommendations as the basis for PWC's projects and expenditures.

Based on this review, we recommend that the Commission considers the adjustments to the claimed capex and opex presented in Table 7.1 and Table 7.2.

Table 7.1 Recommended capex adjustments (\$m, real 2012/13)

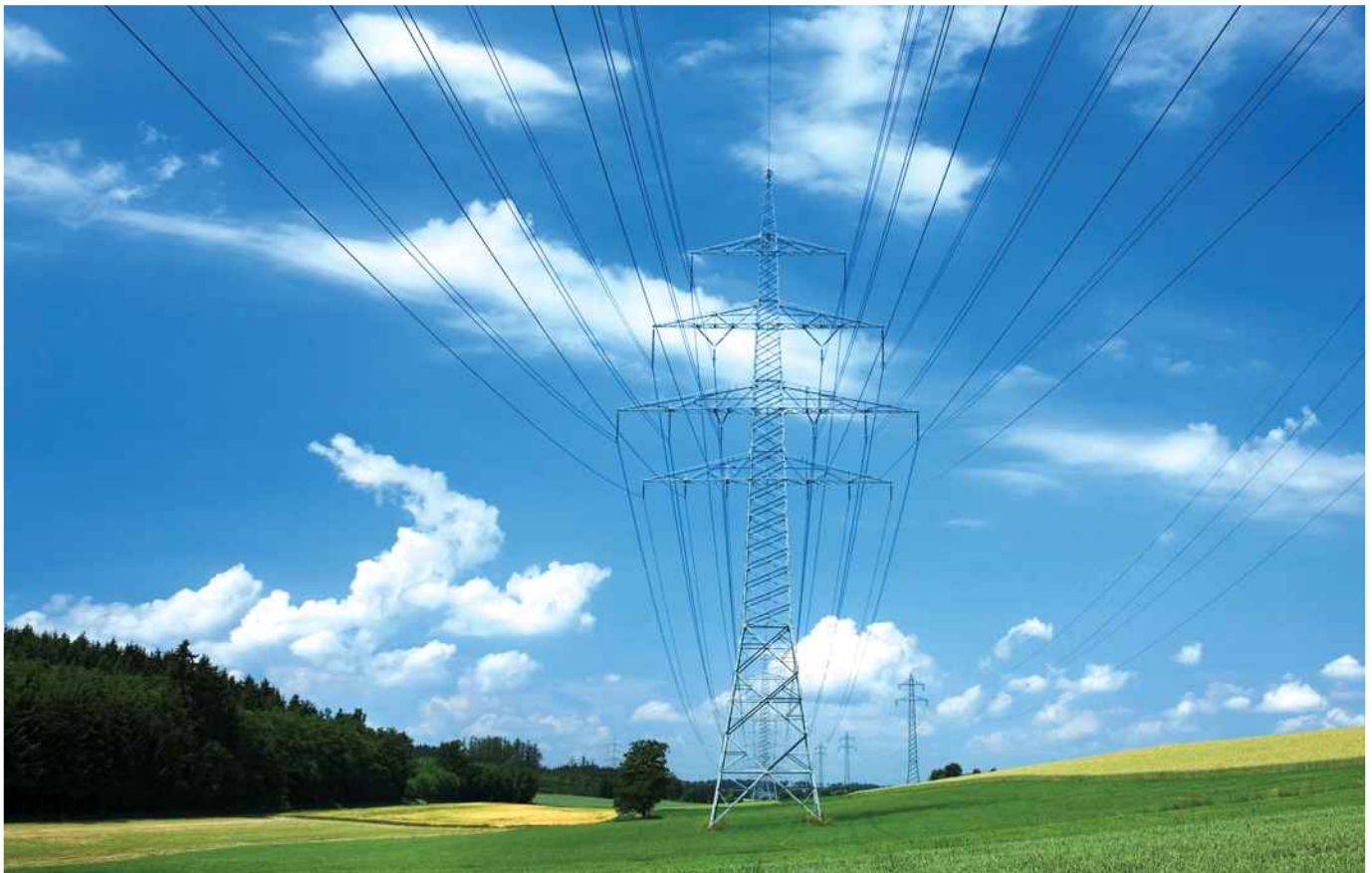
Project	2008/09	2009/10	2010/11	2011/12	2012/13
Restoration of Casuarina Zone Substation Section 6.1.1					
Capex claimed	3.07	4.67	(0.97)	1.03	-
Adjustments	-	(1.70)	-	-	-
Recommended capex	3.07	2.97	(0.97)	1.03	-
Rebuild Snell Street 66/11kV Zone Substation Section 6.1.2					
Capex claimed	-	1.31	5.55	14.18	12.50
Adjustments	-	-	-	-	(3.00)
Recommended capex	-	1.31	5.55	14.18	9.5
Replace Manton 22kV Switchboard Section 6.1.3					
Capex claimed	-	-	0.39	1.21	2.00
Adjustments	-	-	-	-	-
Recommended capex	-	-	0.39	1.21	2.00
Reinforce Winnellie – Berrimah 11kV Network Section 6.1.4					
Capex claimed	-	-	0.01	0.80	1.80
Adjustments	-	-	(0.01)	(0.80)	(1.80)
Recommended capex	-	-	-	-	-
Purchase spare zone substation transformers Section 6.1.5					
Capex claimed	-	0.77	2.18	0.67	0.19
Adjustments	-	-	(1.90)	-	-
Recommended capex	-	0.77	0.28	0.67	0.19
Purchase two mobile substations and switchboards Section 6.1.6					
Capex claimed	-	-	6.44	4.71	2.64
Adjustments	-	-	(1.50)	-	(0.80)
Recommended capex	-	-	4.94	4.71	1.84
Rebuild Weddell – Archer 66kV Line Section 6.1.7					
Capex claimed	-	-	-	1.93	12.00
Adjustments	-	-	-	(1.63)	(12.00)
Recommended capex	-	-	-	0.30	-
Replacement 22kV Katherine Switchboard Section 6.1.8					
Capex claimed	-	1.18	5.03	3.34	-
Adjustments	-	(0.70)	-	(1.00)	-
Recommended capex	-	0.48	5.03	2.34	-
Recommended total capex (\$m, 2012/13)	3.07	5.53	15.22	24.44	13.53

Table 7.2 Recommended opex adjustments (\$m, nominal in year claimed)

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Opex claimed	15.30	6.39	9.99	9.77	14.33	9.34
Adjustment						
Remove non Davies Labour	-	(1.22)	(1.26)	(2.96)	(3.05)	(3.14)
Fleet and Other Costs Adjustment	-	(0.17)	-	(0.19)	-	-
Hire of gensets (\$M, nominal)	(9.93)	-	-	-	-	-
Total Adjustments	(9.93)	(1.39)	(1.26)	(3.15)	(3.05)	(3.14)
Recommended total opex	5.37	5.00	8.73	6.62	11.28	6.20

Appendix A

Documents Reviewed



A1. Documents Reviewed

Table A–1: Documents Reviewed

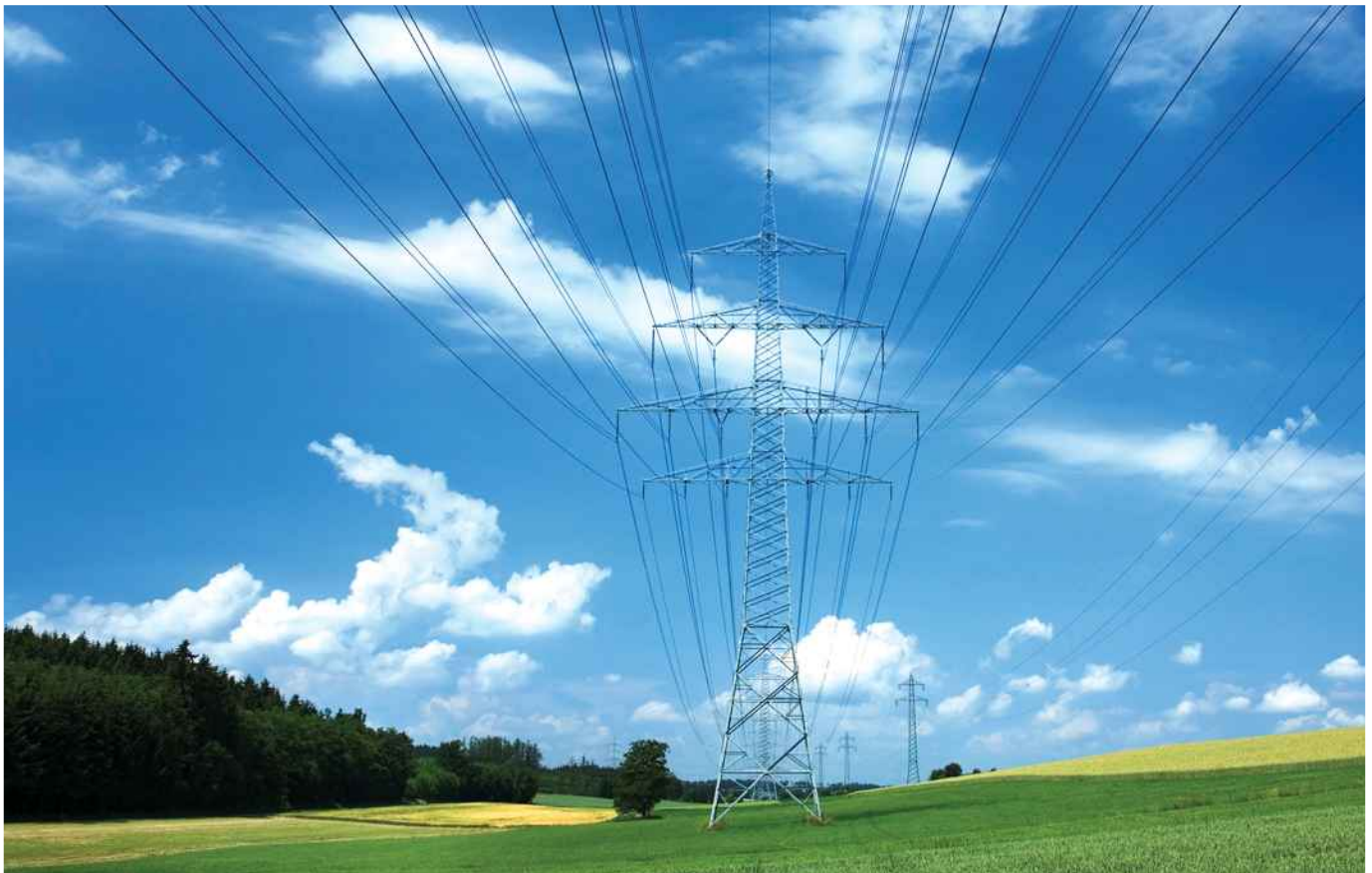
Source	Document	Date	Author/Reference
The Davies Report	Independent Enquiry Into Casuarina Substation Event and Substation Maintenance Across Darwin – Final Report – Chairman:	4 February 2009	Mervin Davies
PWC Application	Network Cost Pass Through Application	5 February 2013	PWC
	Network Cost Pass Through Application – additional information	28 February 2013	PWC
PWC Application Attachments	Attachment 1 –Internal Memo, recruitment of new positions within the Service Delivery section (power Networks) to support the restructure	17 September 2009	PWC
	Attachment 2 - Extract Structure, Process and Capability Review	February 2008	Price Waterhouse Coopers
	Attachment 3 - Power and Water, Delivering the Program of Works - sustainably	2010	Huegin
	Attachment 4 - Workforce Business Case, Service Delivery positions outlined in Huegin Report	18 January 2011	WBC0056
	Attachment 4 - Workforce Business Case, 2 x Senior Project Manager (from Huegin Report)	18 January 2011	WBC0057
	Attachment 4 - Workforce Business Case, 2 x Senior Project Manager (from Huegin Report)	18 January 2011	WBC0058
	Attachment 5: Capital Projects – Business Cases	13 February 2013	PWC
	Attachment 6 – Extract 2008-2009 Statement of Corporate Intent, Capital Investment – Power Networks Projects	2009	PWC
Business Cases	Capital Investment, Asset Management and Fuel Supply Committee Paper, Variation to Approved Business Case Value: Rebuild Weddell to Archer 66kV Transmission Line 1	21 August 2012.	30002
	Business Case: Rebuild 66kV Weddell-Archer Transmission Line 1, Board Meeting of 7 December 2011	7 December 2011	30002
	Capital Investment, Asset Management and Fuel Supply Committee Paper, Variation to Approved Business Case Value: Woolner Zone Substation	12 October 2011.	39541
	Business Case: Rebuild Snell Street 66/11kV Zone Substation, Board Meeting of 29 April 2010	29 April 2010	39541
	Business Case: Purchase of Two Mobile Substations, Board Meeting of 16 June 2010.	16 June 2010.	39738
	Business Review Committee, Business Case: Supply 2 x 22kV Mobile Switchboards Able to be Utilised for Both 11kV and 22kV Emergency use and Temporary Supply Use	19 June 2009	39534

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	Business Review Committee, Business Case: Purchase System Spare 132kV 20/27MVA Transformer	4 December 2009	39703
	Business Case: Purchase System Spare 132/66kV 35MVA Transformer	4 December 2009	39707
	BRC Business Case: Supply and Delivery of a Spare 7.5MVA 66/22kV Transformer	5 November 2010	39713
	Business Case: Replacement of 22kV Switchboard at Katherine Power Station, Board Meeting – TBA.	3 February 2010	32080
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	Business Review Committee, Business Case: Manton Zone Substation 22kV Switchgear Replacement	4 December 2009	39501
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	Mervyn Davies' Enquiry: Power and Water's Sixth Progress Report, Summary	October 2010	PWC
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Additional Information	MODEL 2 - 2013-14 Cost Pass Through Application –Directly Attributed to Davies Recommendations	1 March 2013	PWC
	Network Management Plan 2011/12 to 2016/17	2011	PWC
	Power Networks LTAP and RAMP Progress Report	11 May 2011	Aecom
	Power Networks Maintenance Operations Long Term Action Plan Version 0.9	July 2009	PWC
	Power Networks Asset Strategies Procedure	2 March 2010	PWC

Appendix B

Davies Report Full Recommendations



B1. Davies Report Full Recommendations

The following are the recommendations, in full, as outlined in the Davies report:

11. Recommendations

It is recommended that PAWC should:

11.1. Substation Maintenance Approach

- 11.1.1. Accelerate the implementation of its documented planning intention of adopting a “framework of objective need” as the basis for maintenance, progressively implement systemic and rigorous condition monitoring, and adopt asset condition as the prime basis for determining “objective need”.
- 11.1.2. Take into account the circumstances of size, remoteness, climate and the lasting effects of past legacies when implementing this, its new condition based approach, and not attempt to emulate too closely the maintenance arrangements implemented in the much larger distribution businesses elsewhere in Australia.

11.2. Strategy for Implementing Condition Based Maintenance - In the PAWC Substations Context

- 11.2.1. Negotiate and implement arrangements with one or more of the larger distribution businesses in Australia to be supplied with access to “failure mode” data, inspection and test regimes, conditional failure criteria, and requirements for corrective action. In selecting a partner choose a distributor who is well advanced in the implementation of condition based maintenance, and has the best matched asset set.
- 11.2.2. Develop the “in house” maintenance policy resource to be a pragmatic adopter of what other distributors are doing. Adapt what other distributors are doing, to the specific environmental conditions and asset set of PAWC, with the minimum sufficient resort to analysis.
- 11.2.3. Specialise in monitoring and diagnostics. Develop the “in house” maintenance delivery resource to be a specialist in monitoring, testing and diagnostics.
- 11.2.4. Utilise the “in house” maintenance delivery resource for most routine preventative tasks and common corrective tasks, but engage outside resources for specialist and uncommonly needed skills, (as is currently done for tap changer maintenance). Negotiate and implement arrangements with external providers to undertake the highly specialised tasks, within appropriate time frames. Either as “fly in fly out” contractors or by shipping to other parts of Australia.
- 11.2.5. Foster a culture of local ownership by:
 - Providing an appropriate level of autonomy and status to the Maintenance Supervisor.
 - Providing adequate resourcing, and placing the responsibility and accountability for: the delivery of the substation maintenance works programme and; for maintenance task outcomes, with the Maintenance Delivery section.
 - Enforcing accountability through measurement and reporting.
 - Routinely involving the delivery team in the maintenance policy decision process. (By systemically seeking feedback regarding failure modes and the effectiveness of corrective actions.)

- Placing responsibility and accountability for asset condition and performance with the Asset Management section.
 - Enforcing accountability through measurement and reporting.

11.2.6. Implement its new condition based approach at the maximum possible pace, consistent with circumstances, and prioritise implementation to address areas of greatest benefit first.

11.3. Organisation

- 11.3.1. In implementing the organisational changes, currently underway, ensure the following outcomes, or alternatively make changes which do:
- 11.3.1.1. Work priorities are managed so as to ensure continuity of an adequate resource allocation to routine substation maintenance.
- 11.3.1.2. The Maintenance Delivery group, are empowered by providing them with a sense of control and an environment which ensures a sense of ownership, pride in the assets and their performance.
- 11.3.1.3. The Asset Management group, are able to focus on asset management, without becoming embroiled in works and resource management issues. Ensure that this group can focus on integrating policies for the “what” of maintenance with replacement/refurbishment and whole of life cycle cost optimisation.
- 11.3.1.4. Works management and scheduling are kept simple.
- 11.3.1.5. Seamless integration of the routine condition based substation maintenance activity with the test activity is achieved.
- 11.3.1.6. System access for routine maintenance and protection testing is optimally coordinated.
- 11.3.2. Consider making the following changes to the organisational arrangements, currently in the course of implementation:
- 11.3.2.1.1. Establish “Substation Maintenance, Protection and Test” as a separate dedicated resource with direct reporting responsibility to the General Manager Power Networks.
- 11.3.2.1.2. Operate “Substation Maintenance” and “Protection and Test” as two separate sections, within that accountability.
- 11.3.2.1.3. Place responsibility for routine testing with the Substation Maintenance Section and upskill the workers in the Section. Advanced diagnostic testing (partial discharge, dielectric dissipation factor and high voltage withstand) should remain with the Protection and Test Section.
- 11.3.2.1.4. Place the responsibility for works planning as well as scheduling with the Substation Maintenance, Protection and Test Section.

11.4. Systems and Processes

- 11.4.1. Ensure that the next phase of the AMC project, does as it is expected to do, and:
- Deliver outcomes that are in keeping with PAWC’s size, and so far as possible, avoids complexity.
 - Embrace the possibility of a continuing role for suitably controlled local PC systems and avoids the pedantic pursuit of a single enterprise system.
 - Address the disempowering aspects of the current WIMS system.
- 11.4.2. Ensure that the systems and processes delivered by the AMC, do as they are expected to do and, provide capabilities for substation maintenance management and asset condition management, that support the recommendations of this report regarding:
- Substation Asset condition recording.
 - Substation maintenance planning and programme works development.
 - Substation maintenance works programme reporting.
 - Substation Asset condition reporting.

And incorporate:

- Condition as well as time based triggers.
- Enforcement of condition reporting and other job closure procedures.

11.5. Policies and Policy Documentation.

- 11.5.1. Adopt a three tier approach to substation maintenance policy documentation, as described in Technical Appendix T2.2 Evaluation of Policies.
- 11.5.2. Either renegotiate the arrangements with ETSA, for the acquisition of a set of documentation that is more suitable to PAWCs requirements, or negotiate to acquire a set from another Australian distributor. Such negotiations should make provision for the routine updating of the documentation.
- 11.5.3. Adapt the acquired documentation to the PAWC environment and asset set.

11.6. Substations Maintenance Planning and Works Programme Development

- 11.6.1. Ensure that quantum planning is separate from delivery planning.
- 11.6.2. Set quantum plans for substation maintenance on a one and five year basis and resource to deliver.
 - Ensure that firm preventative maintenance and condition monitoring programmes are set annually
 - Ensure that the plan makes adequate provision for corrective tasks, based on expected conditional failure rates.
 - Ensure that the plan makes adequate provision for “breakdown maintenance” tasks, based on historical breakdown rates and trends.
 - Ensure that the planning process makes adequate provision for resourcing and that the assessment of resource requirements is informed by industry benchmarks and past reporting of task times.
 - Five year plans should be set on an indicative basis, suitable for use in forecasting and workforce planning.

In the longer term (five to ten years) introduce 15 year planning as well.

11.7. Reporting Systems

- 11.7.1. Substations Maintenance Works Programme Reporting
 - Develop simple multi level reporting of work delivery targets and delivery progress against targets.
 - Three levels of reporting are suggested – supervisor/coordinator; Management and; Board
 - Report quantum (as well as dollars) progressively aggregated over tasks for the higher level upstream reporting.
 - Report risk consequences of backlogs, monthly.
- 11.7.2. Substations Asset Condition Reporting
 - Systematize condition data recording:
 - Maintain condition data records at the individual asset level.
 - Analyse and summarise the data by asset class.
 - Develop simple multi level reporting of asset class condition, structured by asset class and reporting level:
 - Three levels of reporting are suggested – asset planners; Management and; Board.
 - Make reports available to the Maintenance Delivery. Section, as well as the Asset Management Section.
 - Report key condition measures and risks, suitably aggregated or truncated for different reporting levels. For the higher level reports, highlight trends and forecast the outcomes of remediation programmes.

- Incorporate asset failure reporting, at all reporting levels. Board level reporting of all failures involving risk to personnel and public safety is suggested.

11.7.3. Reporting Medium

Implement ad hoc paper/PC based reporting systems, in the interim, before new AMC systems and reporting capability is developed.

11.8. Resources

11.8.1. Workforce Capabilities - Training and Development

- Provide training to refresh the craft skills of the current substation maintenance personnel. Engage an industry training provider to undertake a training needs analysis and provide tailored training.
- Provide training to refresh the testing skills of the current Protection and Test personnel. Provide specific training in the operation of all new test equipment and in the interpretation of results. Negotiate with other Australian distributors and test equipment suppliers, for assistance with the provision of such training.
- Provide specific condition monitoring training. Negotiate with other Australian distributors for assistance with the provision of such training.
- Provide generic Supervision training to supervisors (Coordinators).
- Negotiate opportunities for employee exchanges or secondments with the other Australian distributors, for trades worker, apprentices and engineering staff.
- Provide opportunities for ongoing participation by engineering staff, in relevant industry forums.

11.8.2. Workforce Levels

Initially recruit an additional 6 electrically trades qualified personnel. (Ideally such additional recruits would be experienced in condition monitoring techniques.)

Annually review the five year forecast of substation maintenance requirements and reassess the manning level required to deliver the programme. Implement appropriate manpower planning (a mix of recruitment and apprentice intake) to ensure the sustained level of manning required to match the forecast works programme.

11.8.3. Equipment

Upgrade and progressively acquire additional new condition monitoring equipment, as required to keep pace with the progress in implementing condition monitoring techniques and matched to the particular techniques adopted. Make a thorough review, of the equipment available and of the equipment in use in other distribution business around Australia.

Undertake the review with the involvement of personnel who are to use the equipment, after they have received the specific training in condition monitoring techniques recommended in 11.8.1.

11.9. Human Resources Development

Devise and implement a Human Resources Development programme, incorporating the following key elements:

- Communication and Interpersonal skills development training, for all personnel, (structured to their role).
- Specific Leadership and/or mentoring programmes for those in “people management” roles.
- Personal development opportunities for those in key roles.
- Role and job requirements clarification.
And having the objective of delivering the following outcomes:
- A more inclusive and collaborative supervision and leadership style.
- Improved communication and collaboration between functional areas, and up and down the responsibility hierarchy.
- Strong personal ownership of roles and PAWC initiatives.
- All personnel are confident in their role and in their personal authority within the role.
- Acceptance of individual accountability.

- Improved performance measurement and recognition.
- All personnel are all in jobs which match their individual skills sets and personal relationship styles.

11.10. Miscellaneous

11.10.1. Incident Management System and Accountabilities.

Review the current incident management arrangements to ensure that the system of incident management provides for:

- Incident organisational and accountability structures.
- Intelligence gathering, consolidation and reporting arrangements.
- Escalation procedures.
- Resourcing flexibility.
- Stakeholder communication procedures.
- Procedures for coordinating with the Territory's other Emergency Management Agencies.
- Formal documentation.

That will provide PAWC with the credibility to manage its own system incidents.

11.10.2. Asset Failure Investigation Accountabilities

Assign responsibility for investigating asset failure incidents as follows:

- Asset Management be assigned accountability for deciding what incidents to investigate, for coordinating the investigation, and for "close out" and reporting. (Oversight by the "Power Technical Committee" would also be appropriate.)
- Assessment and diagnoses of the incident be assigned to the testing accountability of the Protection and Test Section.
- Assessment of OH&S issues be assigned to Employee and Organisation Services.

11.10.3. The Manton Investigation

Pursue further the Manton Investigation, and undertake investigation work in an attempt to establish the root cause of the failure and to assess whether better environmental controls would help to mitigate the risk of further failures. (This recommendation is strictly beyond ToR, as it concerns substation equipment which is only installed outside of Darwin. It was nevertheless drawn to the attention of the Enquiry and represents an asset condition risk that warrants a more conclusive resolution.)

11.10.4. Residual Casuarina Incidents Investigation

As soon as access conditions at Casuarina permit, perform the access dependent residual outstanding investigation work and attempt to resolve the outstanding aspects of the failure investigations.

11.10.5. RISQ Hazard/Incident Report System

- Complete the investigation of Hazard/Incident No 1768, without further delay.
- Implement a system of routine monthly reporting of the number of incidents logged and resolved and of backlogs of outstanding Hazard/Incidents.

11.11. Remedial Programmes

11.11.1. Initiate a programme of rigorous condition assessment of all Zone Substation equipment immediately. Undertake a high level risk analysis to determine programme priorities and set a timetable. (The original recommendation of the Preliminary Report has been extended from Distribution Switchboards to all Zone Substation equipment, for both 11 and 22kV zones. The inclusion of 22kV Zone Substations is strictly beyond the Terms of Reference, as all 22kV Zone Substations are outside of Darwin. Aspects of their condition were nevertheless drawn to the attention of the Enquiry and rigorous condition assessment of them is warranted.)

11.11.2. Implement a programme to verify the efficacy of all frame leakage protection systems (or other high speed busbar protection systems) and remediate, if necessary. Also review the associated earthing system designs, to verify their adequacy under all feasible fault conditions.

11.11.3. Take immediate action to replace the Casuarina Zone Substation 11kV switchboard.

- 11.11.4. Undertake a rigorous condition assessment of all Distribution Substation Equipment. (Nb: Arguably, this recommendation is beyond the scope of the enquiry, which has been interpreted to be limited to zone substations. However, as Distribution Substation Equipment is subject to similar asset condition risks and maintenance needs the recommendation is warranted. A high level risk analysis should be undertaken to determine programme priorities and timetable.)