Utilities Commission of the Northern Territory

2014-2019 Network Price Determination

Review of Power and Water Corporation's regulatory proposal for the 2014-2019 regulatory period

18 December 2013

PARSONS BRINCKERHOFF

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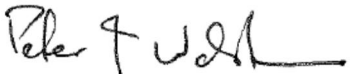
Approved by:	P Walshe	Date: 18/12/2013	Signature: 

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Abbreviations

ABC	Aerial Bundled Cable
Capex	Capital Expenditure
CAM	Cost Allocation Method
CBD	Central Business District
CBR	Cost Benefit Ratio
DNSP	Distribution Network Service Provider
FTE	Full Time Employee
HDPE	High Density Polyethylene
IRP	Initial Regulatory Proposal
IT	Information Technology
LV	Low Voltage
OH&S	Occupational Health and Safety
Opex	Operating Expenditure
NER	Neutral Earth Resistor
NPV	Net Present Value
PWC	Power and Water Corporation
RAB	Regulated Asset Base
RIN	Regulatory Information Notice
The Code	Electricity Networks (Third Party Access) Code 2012
The Commission	The Utilities Commission of the Northern Territory
UG	Underground
UV	Ultra Violet
WACC	Weighted Average Cost of Capital
ZSS	Zone substation

Executive Summary

The Utilities Commission of the Northern Territory (the Commission), in accordance with its responsibilities under the *Electricity Networks (Third Party Access) Code 2012* (the Code), is required to make a network price determination for the period 1 July 2014 to 30 June 2019 in relation to the regulated electricity networks in the Northern Territory. The network service provider for all regulated networks in the Northern Territory is the network business division (Power Networks) of Power and Water Corporation (PWC).

The forecast expenditures outlined the Regulatory Information Notice (RIN) Templates are expressed in nominal dollars[1]. For the purposes of this review, Parsons Brinckerhoff has used real 2013/14 dollars (exclusive of real cost escalation) unless otherwise specifically indicated. Values presented in tables may not add due to rounding in the decimal places that are not displayed.

Power Networks proposes to invest capital expenditure (capex) of $308.863m in its electricity network, $13.487m of capital expenditure in non-network assets and spend $522.384m on operations and maintenance. Parsons Brinckerhoff has been engaged to provide an independent view on the prudency and efficiency of these proposed expenditures, and to review the service standards proposed to be delivered for these expenditures.

In undertaking this review Parsons Brinckerhoff has adopted a phased approach to provide broad coverage of the expenditure proposal while enabling a more detailed examination of key issues as required. The three stages of the Parsons Brinckerhoff review are: a high level 'portfolio' review; a more detailed 'focused' review of specific areas identified in the high-level review; and a reporting stage.Overall, Parsons Brinckerhoff found that:

- The proposed network capex of $308.863m has not been demonstrated to be prudent and efficient. Parsons Brinckerhoff has recommended a reduction of $56.412m (18%) for a range of reasons as described below. Parsons Brinckerhoff's advice is that a prudent and efficient expenditure in the 2014–19 regulatory period would be $252.451m.
- The proposed non-network capital investment of $13.487m has not been demonstrated to represent a prudent and efficient level of expenditure. Parsons Brinckerhoff recommends no reduction to the proposed non-network capex. Although the quantity of expenditure and the timing has not been justified, Parsons Brinckerhoff does not have a specific recommendation for a reduction in expenditure, thus any adjustment would be an arbitrary adjustment.
- The proposed operational and maintenance expenditure of $522.384m has not been demonstrated to be prudent and efficient. Parsons Brinckerhoff recommends a reduction of $32.088m (6%) for a range of reasons as described below. Parsons Brinckerhoff's advice is that a prudent and efficient expenditure in the 2014–19 regulatory period would be $490.295m.
- Power Networks' capitalised overheads are subject to the same escalation process as all other capex expenditure.
- In general, while the principles and practices set out in Power Networks' policies and procedures broadly accord with good industry practice, the evidence of the implementation of those principles and practices is quite limited within the capex and opex supporting documentation.

Parsons Brinckerhoff's detailed findings for each expenditure category are set out below.

1 Refer to 3.1.1

Network capital expenditure

Power Networks proposes to invest capex of $308.863m on its electricity network over the 2014–19 regulatory period. Parsons Brinckerhoff's key findings are as follows:

- The options analyses included in Power Networks' business case documentation lack robustness, generally do not consider non-network alternatives, and include limited net present value (NPV) analysis to demonstrate the efficiency of the selected options.
- With regards to demand forecasting, Power Networks' review and preparation of historical data as well as the business' weather normalisation practice generally aligns with industry practice. However, the adjustments applied exhibit an upward bias in the trend derived directly from the least squares fit process. No evidence is provided to support this upward bias and the documentation does not demonstrate how expert judgement has been applied to achieve these results.
- Power Networks' customer connection forecasts are biased and overestimated. While an increase in the average number of customers connecting per annum might be reasonable, the basis for the significant increase in annual average connections and the implied connections per head of population has not been demonstrated.
- An adjustment in expenditure is recommended in the following categories for the reasons outlined:
  - A reduction of $8.287m to the network user-initiated capex forecast as Parsons Brinckerhoff is of the view that the forecast has not been sufficiently substantiated.
  - A reduction of $13.995m to the augmentation capex forecast as Parsons Brinckerhoff is of the view that the forecast has not been sufficiently substantiated.
  - A reduction of $31.482m to the asset replacement capex forecast consisting of:
    - $15.875m as Parsons Brinckerhoff's view is that some components of work are not demonstrated to be prudent and the unit rates underpinning the forecasts are upwardly biased.
    - $15.606m as Parsons Brinckerhoff's view is that the Mitchell St Switching Station Replacement is a contingent project, dependent on the decision by Darwin City Council not to extend the lease on the Mitchell Street site.
  - A reduction of $2.648m to the capex forecast relating to reliability and quality of supply, as Parsons Brinckerhoff's view is that some components of work are not demonstrated to be prudent.

Parsons Brinckerhoff recommends that the network capex allowance for the 2014–19 regulatory period be reduced by 18% from the levels proposed by Power Networks. Table E1 presents the recommended network capex.

Table E1 – Recommended network capex ($'000 real 2013/14)

	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Power Networks Initial Regulatory Proposal	76,601	73,258	56,603	46,827	55,574	308,863
Parsons Brinckerhoff Adjustments	(10,542)	(24,724)	(17,169)	(912)	(3,064)	(56,412)
Parsons Brinckerhoff Recommendation	66,059	48,533	39,435	45,915	52,510	252,451

Non-network capital expenditure

Power Networks proposes to invest capex of $13.487m on non-network assets in the 2014–19 regulatory period, a reduction of 15% compared to the current regulatory period.

Parsons Brinckerhoff recommends that the non-network capex allowance for the 2014–19 regulatory period should not be reduced from the levels proposed by Power Networks. This recommendation reflects the findings of our specific reviews and in particular our view that although the quantity of expenditure and the timing has not been justified, any adjustment would be an arbitrary adjustment.

Table E2 presents Parsons Brinckerhoff's recommended non-network capex.

Table E2 – Recommended non network capex ($'000 real 2013/14)

	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Power Networks Initial Regulatory Proposal	6,845	2,939	1,234	1,234	1,234	13,487
Parsons Brinckerhoff Adjustments	-	-	-	-	-	-
Parsons Brinckerhoff Recommendation	6,845	2,939	1,234	1,234	1,234	13,487

Operational and maintenance expenditure

Power Networks proposes to spend $522.384m on operations and maintenance in the 2014–19 regulatory period - an increase of 10% when compared to the current regulatory period. Parsons Brinckerhoff has found this level of proposed expenditure not to be prudent and efficient. Parsons Brinckerhoff's key findings are as follows:

- A reduction of $8m to the Service Delivery operating expenditure (opex) forecast as Parsons Brinckerhoff is of the view that some components of work are not demonstrated to be prudent.
- A reduction of $5.750m to the Strategy and Planning opex forecast as Parsons Brinckerhoff is of the view that some components of work are not demonstrated to be prudent.
- A reduction of $0.240m to the System Operations opex forecast to remove works associated with non-regulated assets
- A reduction of $1.080m to the Metering opex forecast as Parsons Brinckerhoff is of the view that basing the forecast on the creation of new roles to support the metering activity, rather than workloads, has overestimated the required resources.
- A reduction of $4.920m to the GSL Costs opex forecast as Parsons Brinckerhoff is of the view that the forecast used is an overestimate.
- A reduction of $0.682m to the Regulatory Costs opex forecast as Parsons Brinckerhoff is of the view that many of the regulatory functions are already undertaken by the Network Management group and one Full Time Employee (FTE) will be sufficient to address any new requirements
- An increase of $2.995m to the Preventative Maintenance opex forecast to align the preventative maintenance of zone substation assets with the recommended deferral of some zone substation replacement works and to reallocate some testing works that had been proposed as capex.
- A reduction of $4.158m to the Planned Maintenance opex forecast as Parsons Brinckerhoff is of the view that the forecast growth rate of defects has not been justified. Parsons Brinckerhoff has included an increase to align the planned maintenance of zone substation assets with the recommended deferral of some zone substation replacement works.

- An increase of $0.138m to the Unplanned Maintenance opex forecast to align the unplanned maintenance of zone substation assets with the recommended deferral of some zone substation replacement works
- A reduction of $10.057m to the Vegetation Management opex forecast as Parsons Brinckerhoff is of the view that the need to increase the vegetation management program from historical levels has not been established.
- A reduction of $0.335m to the Specific Maintenance opex forecast to align the decommissioning of zone substation assets with the recommended deferral of some zone substation replacement works.

Parsons Brinckerhoff recommends that the operations and maintenance expenditure allowance for the 2014–19 regulatory period should be reduced by $32.088m (6%) from the levels proposed by Power Networks. Table E3 presents Parsons Brinckerhoff's recommended operations and maintenance expenditure.

Table E3 – Recommended operations and maintenance expenditure ($'000 real 2013/14)

	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Power Networks Initial Regulatory Proposal	107,124	104,457	105,261	103,385	102,158	522,384
Parsons Brinckerhoff Adjustments	(7,020)	(6,048)	(5,675)	(6,840)	(6,505)	(32,088)
Parsons Brinckerhoff Recommendation	100,103	98,408	99,586	96,545	95,653	490,295

Overheads

In our review of the application of cost escalators in Power Networks' capex model we note that:

- the forecast capex expenditure figures presented in the 'RIN Template 3.1' are expressed in nominal dollars rather than in real dollars
- for capex, actual 2012/13 cost escalation rates have been used as the base year for compounding forecast escalation
- the same weighting across internal labour, external labour and materials has been applied throughout the capex modelling to the network user initiated, augmentation, replacement, compliance as well as reliability and quality categories.
- Power Networks' capitalised overheads are subject to the same escalation process as all other capex expenditure.

Notwithstanding the above observations, Parsons Brinckerhoff is of the view that Power Networks' overall capex escalation process is reasonable.

In our review of the application of cost escalators in Power Networks' opex model we note that:

- the forecast opex expenditure figures presented in the 'RIN Template 2.1' and 'RIN Template 2.2' are expressed in nominal dollars rather than in real dollars
- the use of estimated 2013/14 cost escalation rates as the base year for forecast compounding differs from the capex approach

Notwithstanding the above observations, Parsons Brinckerhoff is of the view that Power Networks' overall opex escalation process is reasonable.

Parsons Brinckerhoff has found the allocation of overheads is in accordance with the required cost allocation model.



1. Introduction

The Commission has engaged Parsons Brinckerhoff to undertake a review of PWC's proposed capital and operating expenditure forecasts for the 2014–19 regulatory period. This report sets out the details of Parsons Brinckerhoff review, findings and recommendations to the Commission.

In this introductory section we describe the background to the review and provide details of our terms of reference. We also provide an overview of the structure of this report.

1.1 Background to the review

The Commission, in accordance with its responsibilities under the *Electricity Networks (Third Party Access) Code 2012* (the Code), is required to make a network price determination for the period 1 July 2014 to 30 June 2019 in relation to the regulated electricity networks in the Northern Territory. The network service provider for all regulated networks in the Northern Territory is the network business division of PWC (Power Networks)[2].

In undertaking the 2014–19 Network Price Determination the Commission has engaged the services of Parsons Brinckerhoff to provide an independent review of Power Networks' forecast capital and operating expenditure, growth forecasts and relevant policies, strategies and procedures. This review is primarily concerned with providing technical advice as to whether Power Networks' forecast capital and operating expenditure is consistent with a service provider acting efficiently and in accordance with good industry practice to achieve the lowest sustainable cost of providing network services. The advice from Parsons Brinckerhoff will assist the Commission in making its determination in respect of Power Networks' expenditure forecasts for the 2014–19 regulatory period.

1.1.1 Staged submission

For the 2014–19 Network Price Determination, the Commission and PWC agreed to a staged provision of preliminary information as part of the PWC Regulatory Proposal to allow earlier review by the Commission and Parsons Brinckerhoff. Details of the staged approach are provided in Schedule 3 of the Regulatory Information Notice[3]. The RIN requires information to be provided to the Commission in stages, followed by a formal submission of the Initial Regulatory Proposal (IRP).

[2] Throughout this report a reference to PWC is a reference to the Power and Water Corporation, Power Networks is a reference to the network business division of Power and Water Corporation.

[3] Utilities Commission of the Northern Territory, April 2013, 'Regulatory Information Notice - Under Section 25 of the Utilities Commission Act and Clause 22 of Network Licence', p.56 - 59

These stages were provided to the Commission as follows:

- Stage 1 Submission on 7 May 2013
- Stage 2 Submission on 27 May 2013
- Stage 3 Submission on 28 June 2013
- Stage 4 Submission on 30 July 2013
- Stage 5 submission on 19 August 2013
- IRP on 16 September 2013

Parsons Brinckerhoff was provided with a copy of the staged submission as follows:

- Stage 2 Submission (demand forecasts) on 4 July 2013
- Stage 3 Submission (capital expenditure) on 4 July 2013
- Stage 4 Submission (operating expenditure) on 30 July 2013
- IRP on 17 September 2013

Parsons Brinckerhoff based its initial review on the information provided in Stages 2, 3 and 4 of the staged submission. Subsequent to the initial review, PWC submitted its IRP. Parsons Brinckerhoff has reviewed the changes between the IRP submission and the previous staged submission and taken these into consideration in its final findings and recommendations.

The Commission will make its draft determination on 18 December 2013, followed by its final determination.

1.2 Terms of reference (summary)

The main objective of Parsons Brinckerhoff's review is to provide the Commission with independent technical advice in relation to:

1. forecast expenditure – including both operating and capital expenditure
2. growth forecasts
3. relevant policies, strategies and procedures (including, but not limited to, asset management plans, Network Technical Code and Network Planning Criteria[4])

The focus of this review is to provide advice to the Commission on:

- whether the proposed levels of capital and operating expenditure are prudent
- the prudency and efficiency of past capital and operational expenditure
- whether costs are attributed appropriately to the regulated services
- the reasonableness of demand forecasts and projected growth scenarios
- whether policies, strategies and procedures are consistent with accepted industry standards, and where different, are these differences appropriately justified

It should be noted that Parsons Brinckerhoff's terms of reference do not include the review of external factors and obligations[5], cost pass-through items or the review of submissions from interested parties on Parsons

[4] The review of Power and Water Corporation's revised Network Technical Code and Network Planning Criteria is the subject of a separate report by Parsons Brinckerhoff (see section 1.5 for further details).

Brinckerhoff's report or on the Commissions' draft or final determination. Reviews of equity raising, superannuation costs, the value of cost escalators applied[6], weighted average cost of capital (WACC) and similar financial matters are also outside of the scope of Parsons Brinckerhoff's engagement. In addition, while Parsons Brinckerhoff has been engaged to review the reasonableness of demand forecasts and projected growth scenarios, our terms of reference do not include the development of alternative forecasts.

While Parsons Brinckerhoff has reviewed the application of cost escalators across Power Networks' pricing submission, an assessment of the value applied to escalate costs has not been undertaken. It is assumed that the Commission will conduct its own analysis in relation to the quantum of the cost escalation increases included in Power Networks' submission.

Parsons Brinckerhoff's full terms of reference have been included in Appendix A for reference.

In undertaking this review, Parsons Brinckerhoff acknowledges the Commission's view that the generally accepted regulatory practice for electricity network price determinations is the process undertaken by the Australian Energy Regulator (AER) in accordance with the National Electricity Rules (NER), and that working towards alignment with national arrangements is in the long-term interest of Northern Territory electricity consumers. Accordingly our review approach considers the NER and is based upon the principles and practices that the AER has applied in its previous regulatory reviews. Whilst the NER is prescriptive in its treatment of any expenditure that is not fully justified by the Distribution Network Service Provider (DNSP), the Code provides the Commission with flexibility in its approach to the Network Price Determination (NPD). As directed by the Commission, Parsons Brinckerhoff's review takes into consideration the context in which Power Networks is operating, specifically the recent development of appropriate processes and procedures and thus the limited availability of documentation and data. This has resulted in Parsons Brinckerhoff recommending that the Commission accept some expenditure items that it would not recommend to the AER under the NER.

We also note that the Northern Territory's regulatory framework makes no specific or statutory distinction between transmission and distribution services and that both transmission and distribution services are regulated under the Code.

1.3 Report Structure

In Section 2 of this report we set out the overarching methodology Parsons Brinckerhoff adopted for this review. Section 3 discusses the application of cost escalation to the forecast expenditures and the allocation of overheads. Section 4 discusses the benchmarking of Power Networks' capex and opex against other industry participants. Section 5 outlines our review of Power Networks' policies and procedures, whilst section 6 considers Power Networks' demand forecasts. Section 7 and 8 deal with Power Networks' capex and opex forecasts respectively, including recommendations in respect of PWC's proposed Service Standards. Generic limitations of this report are provided in Section 9.

[5] Other than to the extent required to develop an independent recommendation on the prudence and efficiency of the expenditure proposed by PWC.

[6] Parsons Brinckerhoff's scope does however include a review of the application of cost escalators across PWC's pricing submission.



2. Review

In this section of the report we describe the overarching methodology Parsons Brinckerhoff adopted in the review of Power Networks' expenditure forecasts. It includes an outline of our approach to the review and details of the aspects of Power Networks' forecast we examined.

2.1 Specific aspects under review

Significant aspects of Parsons Brinckerhoff's review of the proposed expenditures are the assessments of:

- Capital governance
- Policies and procedures
- Projects and programs of work

Each of these aspects is described below.

2.1.1 Capital governance

Parsons Brinckerhoff recognises sound capital governance is an important cornerstone of prudent and efficient asset management, as it acts to establish and define the business's investment approach. For this reason Parsons Brinckerhoff has undertaken a high-level review of Power Networks' capital governance framework as an integral element of assessing the prudency and efficiency of the proposed network capital investment for the 2014–19 regulatory period.

In our view, good practice in capital governance in the context of an asset manager involves both good practice in asset management principles as well as good practice in investment management principles. In forming a view on the soundness of capital governance practices, Parsons Brinckerhoff relies upon our industry experience and our knowledge of the broader principles of sound business management practice. We also draw upon the principles set out in asset management standards such as PAS 55[7], IIMM[8], and TAM[9], as well a range of Australian and International Standards[10]. Broadly, these asset management standards define an approach that starts with the overarching strategy, devolving this through policies, procedures and plans into all aspects of the business's operations. Parsons Brinckerhoff anticipates that good asset governance practice, as set out through such standards, would be evidenced by a well-developed and integrated framework of documentation that forms part of the business's culture.

[7] British Standards 2008, 'Publicly Available Standard 55 — Asset management. Specification for the optimized management of physical assets'

[8] Association of Local Government Engineering NZ Inc., 2006, 'International infrastructure management manual'

[9] NSW Treasury, 2006, 'Total asset management'

[10] For example, AS/NZS 4360 (risk management), AS/IEC 60300 (dependability management), ISO 9001 (quality management)

Further to this, Parsons Brinckerhoff expects sound capital governance to embody the principles of good practice in investment management as evidenced through prudent business management practices — specifically, formal delegations from the Board level through to the business' operational levels, supporting policies and procedures to control capital investment (including audit practices), as well as control of capital investment as evidenced through business documentation which establishes the business case for investment throughout the entire asset lifecycle. These practices should be integrated with the business's risk management practices, quality practices, compliance practices, occupational health and safety (OH&S) practices, and environmental management practices, amongst others.

2.1.2 Policies and procedures

Power Networks has been asked to specify the policies and procedures by which it makes its operational and investment decisions. Such policies are expected to relate to, for example, augmentation, replacement, opex, cost allocation, capitalisation and demand management. Parsons Brinckerhoff has made a detailed review of these policies and procedures. This has included a review of network performance targets and associated forecasts, augmentation models, and opex and replacement models where applicable. In making our assessment and recommendation Parsons Brinckerhoff has considered the extent to which we believe Power Networks' policies and procedures align with good electricity industry practice.

Parsons Brinckerhoff considers this aspect of the review as critical to its assessment of the prudency and efficiency of expenditure. Electricity distribution businesses engage in a large volume of activities — particularly when compared with gas or electricity transmission businesses. This large volume of activities results in many investment decisions, particularly involving minor network augmentation and asset replacement activities. As it is impractical to individually assess the reasonableness of each of these expenditure decisions; it is necessary to review the framework within which the decisions are made to determine whether the approach taken by the business is likely to result in appropriate expenditure.

2.1.3 Projects and programs of work

It is recognised that there is a notable difference between the approach required for the review of electricity distribution and that for electricity transmission. A significant difference is the predominance of distribution 'programs' of expenditure as compared to transmission 'projects' and the significantly higher number of lower value assets managed by distribution businesses. Parsons Brinckerhoff's review recognises the importance of these differences in the context of reviewing the proposed Power Networks expenditure. Planned programs of work can apply to high-volume asset fleets, and can extend over many years. The link between strategic priorities, policies and procedures, and programs of work is therefore an important aspect of developing an opinion on prudency and efficiency. Planned work programs can have a significant impact on opex as well as on investment decision-making.

A significant proportion of capex is associated directly with the implementation of major distribution projects. As distinct from programs of work, project work often results in large one-off expenditures to establish a large asset such as a major substation. Equally, project expenditure can comprise a large number of smaller discrete projects.

2.2 An overview of Parsons Brinckerhoff's approach

In undertaking the review of Power Networks, Parsons Brinckerhoff has adopted a phased approach. The process has been specifically designed to provide broad coverage of the expenditure forecast while enabling a more detailed examination of key issues — as required. In summary, the three key stages of the Parsons Brinckerhoff review are:

- a high-level review
  - review of technical code and planning criteria

  - review of relevant supporting documents
  - benchmarking
- a focused review
  - interviews with key staff of Power Networks
  - review of capex models
  - review of opex models
- reporting
  - final review and draft report
  - final report.

The first two stages of the review process allow consideration of the complete expenditure forecast while supporting and facilitating a more detailed examination of selected aspects of the forecast. The process recognises and allows for the need to undertake a high-level review of the entire regulatory submission *before* being able to determine which aspects warrant further review and scrutiny.

In this way Parsons Brinckerhoff has been able to ensure that effort is expended in areas of the forecast likely to be important in providing credible and robust independent advice on the prudency and efficiency of Power Networks' regulatory forecast.

The phased approach adopted by Parsons Brinckerhoff involved the following steps:

- a detailed desk-top review of the information provided in the Regulatory Proposal
- a high level review of expenditure in the RIN to identify any step changes
- development of a preliminary view on key issues at a portfolio level; and discussion and agreement with the Commission to a scope of works for the focused review stage
- focused review of particular projects and programs
- formulation of detailed questions for Power Networks on its expenditure forecasts
- consideration of Power Networks' responses
- onsite meetings with Power Networks staff to discuss essential elements of the Regulatory Proposal, key issues and Parsons Brinckerhoff's preliminary views and findings on the expenditure forecasts
- further questions and responses to establish a full understanding of specific expenditure items.

In meeting its primary objective of providing an independent view on the prudency and efficiency of Power Networks' expenditure forecast, Parsons Brinckerhoff has given due regard to the opex and capex objectives, criteria and factors set out in clauses 63, 74 and Schedule 6 of the Code.

The forecast expenditures outlined the RIN Templates are expressed in nominal dollars[11]. We understand that this approach has been agreed between PWC and the Commission; however this results in the forecasts not being suitable for addition across the regulatory period and prevents expenditure from being

11 In RIN Template 3.1, Power Networks' states in point 3 of its 'Notes for the UC' that "… Power Networks has escalated the forecasts for the forthcoming regulatory period (in real 2013/14 dollars) by real cost escalators …". The opex expenditure figures presented in the 'RIN Template 2.1' and 'RIN Template 2.2' worksheets for the 2014–19 period are real 2013/14 costs escalated using compounded yearly real labour and materials escalation rates. Consequently, as a result of the application of these escalators the forecast capex costs in RIN Template 3.1 and the forecast opex costs in these RIN Templates 2.1 and 2.2 are expressed in nominal dollars rather than in real dollars as indicated in the worksheet column heading.

expedited/deferred in the state that it has been provided. As such, for the purposes of this review, Parsons Brinckerhoff has used real 2013/14 dollars (exclusive of real cost escalation) unless otherwise specifically indicated. The recommendations provided in this report are in real 2013/14 dollars and may require the commission to apply real-cost escalators to be consistent with the RIN templates completed by PWC.

2.2.1 Escalation and allocation of overheads

Parsons Brinckerhoff's review of the method used by Power Networks to escalate forecast costs in order to account for escalation in materials and labour costs has relied upon the information contained in the capex and opex forecast models provided by Power Networks. This review also considers Power Networks' allocation of overhead costs across expenditure categories.

2.2.2 Policies and procedures

Parsons Brinckerhoff has developed our view on Power Networks' policies and procedures through a desk-top review of documentation, through discussions with Power Networks staff, and through our focused review of specific programs of work and projects.

The review of policy and procedure has been for opex, capex and service standards.

Reviewing policy and procedure in the context of proposed expenditure has provided the opportunity to confirm appropriate application and implementation of these policies and procedures.

2.2.3 Demand Forecast

Parsons Brinckerhoff has undertaken a review of the reasonableness of demand forecasts and projected growth scenarios, against the terms of reference and using the principles set out in the NER as a guide.

Through a desktop review of the documentation provided by Power Networks Parsons Brinckerhoff has reviewed the reasonableness of the growth forecast, customer number forecast, projected customer usage, and the growth scenarios employed in terms of:

- the drivers of growth
- the reasonableness of forecasting practices and methods used
- the relationship of the forecast capital and operating expenditure to forecast growth

Parsons Brinckerhoff has utilised the demand forecast review to determine the reasonableness of Power Networks demand and growth scenarios and associated costs to inform our advice in terms of recommended cost adjustments.

Parsons Brinckerhoff based its review of Power Networks' forecasts on the definitions and approach generally applied by the AER and by the NER. In particular, for a forecast to be accepted by the AER it must be 'reasonable'. In its recent Aurora determination[12], the AER considered the requirements of a reasonable forecast and stated that 'to develop realistic expectations of the future, forecasting techniques should include the following characteristics'[13]:

- Accuracy and unbiasedness of data – an unbiased forecast of demand should include careful management of data quality (e.g. removal of outliers, spurious values, data normalisation), and the

[12] Australian Energy Regulator, 2011, 'Draft Distribution Determination Aurora Energy Pty Ltd 2012 13 to 2016–17'

[13] Australian Energy Regulator, 2011, 'Draft Distribution Determination Aurora Energy Pty Ltd 2012 13 to 2016–17', p. 76

forecasting model construction should be based on sound theoretical grounds that closely fits the observed data.

- Transparency and repeatability – as evidenced by good documentation, including documentation of the use of judgment, which ensures consistency and minimises subjectivity in forecasts.
- Appropriate incorporation of key drivers (inputs) of demand and exclusion of spurious drivers.
- Model validation and testing – including, where appropriate, assessment of statistical significance of explanatory variables, 'goodness of fit', in-sample forecasting performance of the model against actual data, diagnostic checking of the old models, out of sample forecast performance.
- Accuracy and consistency of forecasts at different levels of aggregation – affects the overall reasonableness of the forecasts, as accuracy at the total level may mask errors at lower levels that cancel each other out.
- Use of the most recent input information.

We note that these characteristics are consistent with Parsons Brinckerhoff's view of industry best practice for forecasting. It should be noted that the characteristics and principles set out above have been applied to the review of all of Power Networks' forecasts including in the capex and opex expenditure forecasts. For details of our review of Power Networks' capex and opex expenditure forecasts reference should be made to sections 7 and 8 respectively.

2.2.4 Projects and programs of work

Parsons Brinckerhoff's review of Power Networks' work programs has been informed by the Regulatory Submission and supporting documentation as well as through discussions with Power Networks staff. Some work programs have been subject to a more focused examination following the portfolio-level review of proposed expenditures.

Parsons Brinckerhoff's review of specific projects includes a high-level review of all significant projects and a focused review of a number of projects. Parsons Brinckerhoff's review has examined links between projects and larger work programs, and also the association with particular business strategies and policies.

2.2.5 Capex review

In assessing whether proposed capital investments are prudent and efficient, Parsons Brinckerhoff has:

- assessed whether Power Networks is acting efficiently in accordance with good industry practice through a review of capital governance, policy and procedures, cost estimating practices, specific reviews of certain expenditures, and the deliverability of the proposed works program
- assessed whether there is a justifiable need for the proposed investment within each expenditure category
- assessed whether all reasonable options have been considered and the most efficient investment selected to satisfy that need after confirming the need for an investment
- assessed whether those assumptions are reasonable where an investment is based on assumptions about future conditions[14]

The projects and programs selected for review are outlined in Table 2.1. Table 2.2 below shows the proportion of capex by each category included in the detailed review.

[14] Parsons Brinckerhoff's review did not extend to assumptions made about the future demand for electricity.

Table 2.1 Projects/programs included in detailed review ($'000 real 2013/14)

Project/ Sub No.	Project	2014-19 Staged submission capex ($'000)	Split	Category
		19,662		
PRD30309	Darwin: Construct East Arm ZSS	15,729	80%	Augmentation
		3,932	20%	Reliability
PRD30513	Darwin: Construct Archer - Palmerston 66kV line	**12,796**	100%	Augmentation
Sub8272	Customer Augmentation and Network Extension Program	**39,715**	100%	Customer
PRD30115	Darwin: Replace Casuarina ZSS 66kv Outdoor Switchyard	**17,256**	100%	Replacement
		10,298		
PRD30117	Darwin: Replace McMinns 66/22kV ZSS	7,209	70%	Replacement
		3,089	30%	Augmentation
		27,976		
PRD30402	Darwin: Replace Berrimah ZSS	19,583	70%	Replacement
		8,393	30%	Augmentation
PRD30600	Darwin: New Mitchell Street Switching Station	**15,687**	100%	Replacement
		21,435		
Sub8274	Asset Replacement and Upgrade Programs	14,981	70%	Replacement
		3,196	15%	Reliability
		3,258	15%	Augmentation
		12,457		
Sub8276	Meters/Metering Program	5,606	55%	Replacement
		6,852	45%	Customer
PRD30003	Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing	**15,995**	100%	Reliability
Sub8255	Capital Items & Essential Spares Program	**6,218**	100%	Non-Network P&E
Total		**199,495**		

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

Table 2.2 Expenditure breakdown of detailed review ($'000 real 2013/14)

Category	Selected 2014-19 Staged submission capex	Proportion of total category	2014-19 Staged submission capex
Replacement	81,568	54%	151,439
Customer	45,321	76%	59,894
Augmentation	43,265	82%	52,866
Reliability	23,123	74%	31,210
Non-Network P&E	6,218	100%	6,218
Compliance	-	0%	3,925
Total	**199,496**	**65%**	**305,551**

Source: Parsons Brinckerhoff analysis

2.2.6 Opex review

Parsons Brinckerhoff's review of PWC's proposed opex included an assessment of:

- the efficiency of the forecast opex for each year of the 2014–19 regulatory period, and whether there is any further scope for efficiencies
- the appropriateness of the allocation of opex costs to specific activities
- the effectiveness of operating practices, procedures, and asset management systems at ensuring only necessary and efficient opex occurs
- the major factors (drivers) that may affect the level of efficient opex required over the 2014–19 regulatory period
- the appropriateness of the opex forecasting methodology, including:
  - reviewing the opex by cost category in both the current and 2014–19 regulatory period, including trends and changes in each line item[15]
  - reviewing the variations between the opex in the final year of the current regulatory period and opex in the first year of the next period (step changes in expenditures)
  - the reasonable application of escalation factors used to forecast expenditures
  - assessing the appropriateness of efficiency factors used to reflect the impact of economies of scale and scope
  - assessing the efficiency of labour and material costs used to forecast expenditures
  - the impact of proposed capital works to be commissioned during the 2014–19 regulatory period on forecast opex

A two-stage process has been carried out covering an initial high-level review, followed by a more detailed investigation into areas of particular materiality or variance. Fundamentally, the objective of the process was to:

- review and understand the business-as-usual asset management approach and practice, including relevant policies and procedures, from both a technical and commercial perspective
- review and understand the expenditure forecasting methodology and modelling used, with a strong view to being informed of the scope of work proposed; understanding changes proposed by the business; and the drivers presented by the business for any notable and material changes
- form an independent view on the prudency and efficiency of the proposed scope of work and expenditure, to advise and assist the Commission in determining how the opex complies with the requirements and objectives of the Code and good industry practice

During the review process, the forecasts were tested for duplication of forecasts expenditures, validity of underlying assumptions, process to develop the forecast, data used and source of data. Where issues were identified, Parsons Brinckerhoff first sought additional information from Power Networks, and if still not satisfied, substituted an alternative forecast and recommended the Commission increase or decrease the proposed expenditure accordingly.

[15] This included escalating historical nominal costs to real 2013/14 dollars and removing the impacts of labour and material escalation in the next regulatory control period to test the sensitivity of the real labour and material escalation built into the forecasts, and to provide more insight into the volumes of work in the next regulatory control period compared with historical levels.

Throughout the assessment, we considered the effect of any adjustments to the capital program of works that have been recommended as part of this review (see section 7), and have reflected any capex/opex trade off back into our assessment and recommendations.

Parsons Brinckerhoff's review of Power Networks' forecast opex has specifically excluded the following elements:

- self-insurance arrangements and allowances
- costs of debt-raising
- costs of equity raising
- the magnitude of the labour and material escalation factors applied to the forecast opex (noting that the application methodology is included in Parsons Brinckerhoff's review)
- a high-level review of historical expenditure variations in the current regulatory period compared with regulatory allowances (to be undertaken by the Commission)
- a detailed review of the identified external factors and obligations (to be undertaken by Commission) and identification of external factors and obligations that have been omitted and may be material
- systematic and formal comparative review or analysis of unit costs informing opex
- review of submissions from interested parties



3. Escalation and overhead allocation

In this section we set out our review of the method used by Power Networks to escalate forecast costs in order to account for escalation in materials and labour costs. This section also considers Power Networks' allocation of overhead costs across expenditure categories.

3.1 Cost escalation

Power Networks has developed aggregate financial models that present forecast capex and opex cost estimates for the 2014–19 regulatory period. These models escalated real 2012/13 cost estimates using real cost escalation rates for forecast materials and labour expenditure, with the exception of PWC's operating expenditure forecasts, which were developed in real 2013/14 dollars. Power Networks engaged Deloitte Access Economics (Deloitte) to derive the real labour cost escalators and Sinclair Knight Mertz (SKM) to derive the real material escalators that are used in the forecast capex and opex models.

In undertaking this review of the application of cost escalation rates, Parsons Brinckerhoff has relied upon the information contained in the capex and opex forecast models provided by Power Networks. The key model worksheets and supporting documentation used in this review are:

- 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', 2013 (the capex model)
- 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.4, 5.1 & 5.4 - Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ (Stage 4)', 2103 (the opex model)
- Sinclair Knight Mertz, 'Power and Water Corporation – Annual Real Material Cost Escalation Forecast 2012/13 – 2018/19', 18 June 2013
- Deloitte Access Economics, 'Labour cost escalators in the Northern Territory 2013', 11 May 2013

The following sections set out our review of the application of cost escalation to the capex forecast and the opex forecast, respectively.

3.1.1 Capex cost escalation

Power Networks' capex model details the application of labour and materials escalation rates applicable to the capex forecast for the 2014–19 regulatory period. In this model Power Networks has applied escalation rates to each of the asset categories within network capex and non-network capex. Specifically, in the 'RIN Template 3.1' worksheet for 2014–19, Power Networks has escalated the relevant costs for the 2014–19 period using compounded real cost escalation rates based on actual 2012/13 cost escalation rates weighted for internal labour, external labour and materials for each of the asset categories. These escalators are

compounded on a yearly basis using the real cost escalation rates recommended in the Deloitte and SKM reports and applied to the real 2013/14 dollars presented the in '3.1– Working' worksheet.

We note that the actual 2012/13 cost escalation rates (described above) used as the basis and weighted for internal labour, external labour and materials, include an additional weighted category called 'Residual (to be escalated by consumer price index (CPI) only)'. However as this 'Residual' is zero throughout for all asset categories, CPI escalation is effectively zero and has no effect on cost escalation over the forecast period.

In our review of the application of cost escalators in Power Networks' capex model we also note that:

- In RIN Template 3.1, Power Networks states in point 3 of its 'Notes for the UC' that "… Power Networks has escalated the forecasts for the forthcoming regulatory period (in real 2013/14 dollars) by real cost escalators …". Consequently, as a result of the application of these escalators the forecast capex costs in RIN Template 3.1 are expressed in nominal dollars rather than in real dollars as indicated in the worksheet column heading.
- Negatively compounded real cost escalation rates (decreasing costs) have been applied to the materials category from 2015/16 to 2018/19 for zone substations, transmission terminal stations and transmission lines. This is consistent with SKM's material cost escalator recommendations, which forecast annual escalation in 2015/16 for these three materials categories to decline at an average of 4.0%, while in 2016/17 and 2017/18 relatively lower average increases of 0.6% and 0.8% are forecast, with an average forecast decline of 0.1% in 2018/19. Hence the compounded rates over the period are consistently negative due to the relatively large decrease forecasted in 2015/16[16].
- The highest allocation of internal labour cost is applied to the distribution mains, distribution substations, metering and secondary systems asset categories. In our opinion this is consistent with Power Networks' asset management and project management practices, the nature of these asset categories and industry practice in general.
- For non-network plant and equipment capex, 90% of costs are allocated to materials, 10% to internal labour, and 0% to external labour. While Power Networks' material component is high compared to industry practice in general, Parsons Brinckerhoff is of the view that this is reasonable given that this expenditure relates entirely to plant and equipment.
- Actual 2012/13 cost escalation rates have been used as the base year for compounding forecast escalation and this reflects the historical actual weighting between material and labour cost allocation for each asset category. However, this breakdown of weighted categories is limited to internal labour, external labour and overall materials categories with no further breakdown into cost subcategories (e.g. un-skilled labour, skilled labour, etc. or copper, aluminium, oil, steel, etc.) In SKM's report on materials escalators we note that it considers commodity prices for aluminium, copper, oil and steel as cost drivers in its forecasting approach. However, Deloitte's report does not consider un-skilled and skilled labour. Instead Deloitte derives internal and external labour based on proportions (provided by Energeia – an energy research consultant) of labour between utilities workers, administrative workers and other services workers. For internal labour, 88% is allocated to utilities workers, while for external labour, 75% is allocated to other services workers. We note that as the information provided regarding utilities and other services workers is quite limited, we have been unable to assess the reasonableness of these allocations. Based on the review of the SKM and Deloitte reports, Parsons Brinckerhoff is of the opinion that the forecasting approach used in both cases is reasonable as it appears soundly based, is reasonably well documented, and reflects the underlying breakdown of the primary cost components.
- The same weighting across internal labour, external labour and materials has been applied throughout the capex modelling to the network user initiated, augmentation, replacement, compliance as well as reliability and quality categories. In our view, in practice the weighting associated with internal labour, external labour and materials will vary across these categories. For example, augmentation works tend to have a higher material weighting than compliance works. However, despite the inherent assumptions

[16] Sinclair Knight Mertz, 2013, 'NT Material Cost Escalators Report', Table 19, page 23

regarding the consistency of labour and material cost components across the different expenditure categories, the lack of evidence to support the approach used, and the lack of sensitivity analysis to demonstrate the reasonableness of this simplified approach, we are of the view that that the impact is immaterial given the composition of the forecast capex portfolio is predominantly replacement capex.

- Power Networks has bundled corporate and divisional overhead costs into the base cost estimates entered into the capex escalation model[17]. Hence Power Networks' capitalised overheads are subject to the same escalation process as all other capex expenditure. That is overheads have a material, internal labour and external labour cost escalation applied in the same proportions as all other capex expenditure categories (e.g. augmentation, replacement, etc.). In Parsons Brinckerhoff's opinion escalation of overheads should reflect the drivers of escalation in this cost category, and hence we are of the view that Power Networks' escalation of overhead costs is not reasonable. The preferred approach would be for Power Networks to remodel the IRP with overhead costs removed from the capex and separately escalated using an appropriate escalator. We note that Power Networks is unable to separately identify the internal management time allocated to capital projects or split out this cost from the project cost. We consider that the impact of the approach taken by Power Networks is not likely to be material.

Parsons Brinckerhoff has reviewed the application of escalation in Power Networks' forecast capex model and has confirmed that the rates applied are those relevant to the capex forecast for the 2014–19 regulatory period as recommended in the Deloitte[18] and SKM[19] reports. Notwithstanding the above observations, Parsons Brinckerhoff is of the view that Power Networks' overall capex escalation process is reasonable.

3.1.2 Opex cost escalation

Power Networks' opex and maintenance model breaks down cost categories (network management, service delivery, preventative, planned and unplanned maintenance etc.) into a number of sub-categories that comprise the cost inputs of; in-house (internal PWC labour), related party and non-related contractors,, and cost type of, labour, materials, unallocated and other.

The model presents basic cost figures as costs for each of the seven sub-categories for the operating and maintenance cost categories. The costs for each of these seven sub-categories are then escalated using the relevant escalation rates recommended in the Deloitte and SKM reports. Cost escalation across the 2014–19 period is achieved by compounding the real cost escalation rates over the period using an identical approach to that applied in the capex model (outlined above).

In our review of the application of cost escalators in Power Networks' opex model we note that:

- The following errors, which do not impact on the forecast period figures, were found in the opex model:
  - the actual opex presented for 2009/10 under column J in Table 2.1.4 on the '2.1 – Working ($13-14)' worksheet incorrectly sum at the sub-total level
  - actual maintenance expenditure presented for 2009/10 under column J in Table 2.2.4 of '2.2 – Working ($13-14)' worksheet incorrectly sum at the sub-total level
  - Parsons Brinckerhoff notes that these errors have been rectified in the IRP.
- The opex figures presented in the 'RIN Template 2.1' and 'RIN Template 2.2' worksheets for the 2014–19 period are real 2013/14 costs escalated using compounded yearly real labour and materials escalation rates. Consequently, as a result of the application of these escalators the forecast opex in

[17] Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13 - Regulatory Information Notice - Regulatory Templates 1.1 to 5.4.XLS', Capex - spend (3.1) worksheet, note 5

[18] Deloitte Access Economics, 2013, 'Labour cost escalators in the Northern Territory', Table 2.2, p.13

[19] Sinclair Knight Mertz, 2013, 'NT Material Cost Escalators Report', Table 19, p.23

these RIN Templates is expressed in nominal dollars rather than in real dollars as indicated in the relevant worksheet column headings.

- The use of estimated 2013/14 cost escalation rates as the base year for forecast compounding differs from the capex approach, which is based on the actual 2012/13 cost escalation rates. While the use of estimated 2013/14 rates contains a degree of uncertainty, Parsons Brinckerhoff is of the opinion that the values of the estimated 2013/14 rates are not significantly large enough to cause inaccuracies in the compounding of labour and materials for the forecast period.
- Overheads are included in the opex model under two sub-categories: 'operating cost – direct costs: corporate and shared services' and 'operating cost – unallocated: corporate and shared services'.
  - The first sub-category covers 'related party labour' and is escalated by commensurate 'labour: related party contractor' cost increases. Parsons Brinckerhoff notes the application of labour cost increase effectively expresses the forecast corporate and share services costs in nominal dollars.
  - The second sub-category covers 'unallocated' costs which includes all non-labour related corporate and shared services costs and is escalated by commensurate 'other' cost increases, which is zero in all cases and consequently no escalation is applied to the 'unallocated' overheads. Power Networks was unable to accurately separate out material and other costs within unallocated and hence zero escalation were applied. Parsons Brinckerhoff is of the opinion that this treatment is reasonable given the miscellaneous nature of the sub-category.

Parsons Brinckerhoff has reviewed the application of escalation in Power Networks' forecast opex model and found the following with respect to rates applied to the opex forecast for the 2014–19 regulatory period.

- For 2013/14, the nominal rate of 4.5% is not equivalent to the 2013/14 'personnel – direct' cost increase as provided in the 'Power and Water Corporation Statement of Corporate Intent 2013-14'[20] (SCI), which shows a nominal increase of 5.4%. However for 2014/15, the nominal rate of 4.5% is equivalent to the 2014/15 'personnel – direct' cost increase as provided in the same SCI.
- From 2015/16 to 2018/19, the rates applied are the same as recommended in the Deloitte[21] and SKM[22] reports.

Notwithstanding the above observations, Parsons Brinckerhoff is of the view that Power Networks' overall opex escalation process is reasonable.

[20] Power and Water Corporation, 2013, 'Statement of Corporate Intent 2013-14', Appendix 1, p. 16

[21] Deloitte Access Economics, 2013, 'Labour cost escalators in the Northern Territory', Table 2.2, p. 13

[22] Sinclair Knight Mertz, 2013, 'NT Material Cost Escalators Report', Table 19, p. 23

Overhead allocations

Power Networks has applied two broad categories of overheads, Corporate and Shared Services overheads (corporate overheads), and Power Networks Operating Division overheads (divisional overheads). Power Networks has set out the details of its allocation of these corporate and divisional overhead costs in its 'Cost Allocation Method'[23] (CAM) and in its 'Opex Category Justification'[24,25] documents.

Table 3.1 provides an overview of the corporate and divisional overheads allocated to the Power Networks Operating Division[26].

Table 3.1 Summary of staged submission Power Networks overheads ($m real 2013/14)

	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Corporate and Shared Services – Standard Control Services	23,788	22,534	20,756	20,220	20,230	**107,528**
Divisional Overheads						
Service Delivery Group	16,650	16,635	16,750	16,735	16,750	**83,521**
Strategy and Planning Group	12,833	12,833	12,833	12,833	12,833	**64,164**
System Operations Service	4,790	4,790	4,790	4,790	4,790	**23,951**
Network Management Services	2,030	2,030	2,030	2,030	2,030	**10,150**
Total Divisional Overhead	**36,303**	**36,288**	**36,403**	**36,388**	**36,403**	**181,785**
Total Corporate & Divisional Overheads	**60,091**	**58,822**	**57,159**	**56,608**	**56,634**	**289,313**

Source: Power and Water Corporation, July 2014 (sic), "Opex Category Justification, Power Networks' Opex Category: Corporate and Shared Services", p. 11 and Appendix B.

Divisional Overheads: Power and Water Corporation, July 2013, "Power and Water Corporation, Opex Category Justification, Power Networks, Opex Category: Service Delivery", p. 9. Power and Water Corporation, July 2013, "Power and Water Corporation, Opex Category Justification, Power Networks, Opex Category: Strategy & Planning", p. 9. Power and Water Corporation, July 2013, "Power and Water Corporation, Opex Category Justification, Power Networks, Opex Category: System Operations", p. 6. Power and Water Corporation, July 2013, "Power and Water Corporation, Opex Category Justification, Power Networks, Opex Category: Network Management", p. 6.

The corporate overheads comprise all costs associated with the Corporate Business Units that provide services across the divisions of the corporation (i.e. Power Networks, Generation, Water, Sewerage, etc.). The Corporate Business Units consist of the functions associated with the:

- Managing Director's office
- Financial Services
- Program and Portfolio Management
- Strategy and Corporate Affairs
- Company Secretary/General Counsel

[23] Power and Water Corporation, June 2013, 'Power Network - Cost Allocation Method'

[24] Power and Water Corporation, Submission date July 2014, 'Opex Category Justification - Power Networks' Opex Category: Corporate and Shared Services'

[25] Due to the number of documents involved they have not been individually reference here, however they are referenced in Appendix B.

[26] Power and Water Corporation, Submission date July 2014, 'Opex Category Justification - Power Networks' Opex Category: Corporate and Shared Services', p. 11 and Appendix B

- Employee and Organisational Services – this includes Procurement and Contract, Project Management, as well as Business Systems and Information Management (BSIM)

As set out in Power Networks' CAM, costs associated with the Corporate Business Units are allocated across the divisions based on a causal allocation framework. A proportion of the corporate overhead costs are allocated to the Power Networks Operating Division[27] as set out in the CAM and as further defined in Power Networks' "Opex Category Justification, Power Networks' Opex Category: Corporate and Shared Services" document[28]. The 'Corporate and Shared Services – Standard Control Services' costs set out in Table 3.1 are Power Networks' share of the corporate overhead costs.

Divisional overheads are the second broad category of overheads. The definition and details of the divisional overheads are set out in the service delivery, strategy and planning, system operations, and network management 'Opex Category Justification' documents[29]. These divisional overheads comprise the costs set out in Table 3.1, and include the costs associated with the following functions:

- Service Delivery Group – this Business Section is responsible for all field works, including providing resources for the opex and capex programs.
- Strategy and Planning Group – this Business Section is responsible for the functions of asset management, network planning, customer connections and investment analysis as well as being substantially responsible for the delivery of the major capital program.
- System Operations Services – these services primarily include network control and operating functions and are governed by a Service Level Agreement between Power Networks and System Control Division.
- Network Management Services – which cover general management of the Power Networks Business Unit as well as the management of related legislative requirements.

Parsons Brinckerhoff notes that Power Networks' corporate and divisional overheads have been identified in its opex forecasts, with no details regarding allocation of overheads included in the capex forecast. Power Networks clarified that they allocate internal management time to capital projects where the labour is capitalised. The costs are included in the capital expenditure forecast but they are unable to separately identify and split out the capitalised overhead costs from the project costs[30].

Parsons Brinckerhoff notes that the explanation provided by Power Networks is in line with the general industry practice of recognising a proportion of overhead costs as attributable to the development and management of the capital programs, and hence being capitalised. Power Networks provided a sample of the labour allocations of various positions within the service delivery group[31]. Parsons Brinckerhoff is of the view that the sample provided utilises an appropriate allocation methodology.

In relation to Power Networks' CAM, Parsons Brinckerhoff has reviewed the CAM document and we are of the opinion that the principles set out in the CAM are generally reasonable and align with industry practices. However we note that the CAM contains little detail in regards to the principles relating to the treatment of overheads as capital of operating expenses.

[27] Power and Water Corporation, June 2013, 'Power Network - Cost Allocation Method'

[28] Power and Water Corporation, Submission date July 2014, 'Opex Category Justification - Power Networks' Opex Category: Corporate and Shared Services'

[29] Due to the number of documents involved they have not been individually reference here, however they are referenced in Appendix B

[30] Power and Water Corporation, 2013, 'Response to Issue 53 –- Overhead Costs', Section (a)

[31] Power and Water Corporation, 2013, 'Response to Issue 54 – Service Delivery Justification', Section (a)



4. Benchmarking

A review of cost trends against historical costs, and benchmarks against industry peers, can reveal inefficiency in expenditures and can provide a basis for assessment of forecast expenditure. Parsons Brinckerhoff's approach has utilised trend analysis and benchmarking to identify where we should focus our detailed review and to support any recommended cost adjustments.

Trend analysis is most useful when considered in the context of the expenditure category being discussed and is closely linked to the detailed review. When examining each regulatory category, any unusual expenditure patterns over time such as step changes that may indicate strategy changes or profiles that are "front loaded" indicating expenditure timing issues, are identified and given a more targeted detailed examination. Therefore, Parsons Brinckerhoff has utilised trend analysis of Power Networks' historical and forecast costs throughout the report.

High level benchmarking is used to identify broad issues and to identify where we should focus our detailed review. The following sections discuss the findings of our benchmarking study, with a focus on the most material categories.

4.1 Our approach

The following sections outline the data sources used by Parsons Brinckerhoff to undertake the benchmarking study, and the methodologies applied.

4.1.1 Identifying peers

Benchmarking results are more easily interpreted when the businesses including in the benchmarking are peers. Power Networks is unique in that it operates both transmission and distribution networks as a single business. Other businesses that operate both transmission and distribution assets have some separation of functions and report their costs separately for the different functions. Hence in identifying peers, Parsons Brinckerhoff has considered:

- All businesses should be electricity network service businesses that provide a similar range of regulated services; non-regulated services are excluded.
- As most Power Networks assets (zone substations, sub transmission lines and distribution lines) are similar to those operated by distribution network service providers (DNSPs), benchmarking against DNSPs should be included.
- As a very small proportion of Power Networks assets are similar to the transmission assets of other transmission network service providers (TNSPs), it is unlikely that benchmarking against TNSPs will offer a like for like comparison; hence TNSPs are excluded.

4.1.2 Data sources

The data utilised to present the benchmarking has been sourced from Parsons Brinckerhoff internal database and external sources. A table of specific external resources is provided in Appendix D.

As the information available for each DNSP varies and does not always cover the complete set of information utilised for the benchmarking, some charts contain only the data for a sub-set of the DNSPs.

The identity of the peer businesses used in each chart has been concealed and they are only identified as 'Other'. Power Networks has been clearly identified separately for both the current and forecast regulatory control periods.

4.1.3 Partial Performance Indicator

Partial Performance Indicators (PPI) uses a ratio analysis of part (but not all) of a business's inputs or outputs. The key assumption is that a linear relationship exists between the input and output measured. To undertake this type of analysis, Parsons Brinckerhoff has used cost data by category, customer data, network usage and asset data to normalise the data to identify any relationships. PPI has been used extensively for benchmarking by regulators, including the AER.

PPI can then be used in two key ways to assess efficiency. Firstly, it provides a relative ranking of the businesses against each other, and secondly, it identifies the strength of the relationship between the parameters.

The relationship is identified as the trend line between the parameters being tested with the R^2 factor indicating its strength. A higher R^2 indicates that a stronger relationship exists. The relative efficiency of each business can be determined by its position relative to the trend line.

In our analysis, the trend line has been created using the result for the peer businesses only. The results for Power Networks are then plotted on the chart as a comparison to the trend line without affecting the trend. Where data is not available for certain categories, or there is a clear outlier that distorts the trend, the data has been excluded from the charts. Only charts with a strong correlation, showing a relationship exists between the parameters and therefore enabling conclusions to be made, have been displayed in the following sections.

4.1.4 Limitations of benchmarking

Each of the DNSPs around Australia is a unique business so it is reasonable to also expect their cost structures to be different. Hence, it is imprudent to compare the costs of two businesses as the sole method to assess efficiency, and the underlying reasons for any deviations must also be considered in order to draw informed conclusions from the results. Factors affecting Power Networks which may result in departures from what would appear to be efficient costs include:

- A low density network. Power Networks' network covers a significant area of the Northern Territory, yet it has less than 80,000 customers of which 75% are located in the Darwin region[32]. The overall network customer density is shown to be approximately 10 customers per kilometre. If the Darwin region is excluded, the customer density over the remaining network is approximately 7 customers per kilometre. This is comparable to other DNSPs in the benchmark group with three other DNSPs having customer densities in the range 4 to 11 customers per kilometre. However, Power Networks' customers tend to be grouped into three areas (Darwin, Katherine and Alice Springs) whereas the other DNSPs customers tend to be more widely dispersed.

[32] Power and Water Corporation, July 2013, 'Material Project/Program Justification – Power Networks Repairs and Maintenance - Unplanned Corrective Maintenance', p. 7

- The climate has only two seasons – the wet and the dry – and is prone to cyclones. Only one other DNSP is subject to similar weather conditions for part of its network.
- The Power Networks business is one division of PWC rather than being a stand-alone company like most other DNSPs. This means it has a different corporate cost structure to its peers.
- Power Networks includes both transmission and distribution networks.

These factors lead to different asset management requirements and approaches. As a result, what may initially appear to be inefficient may actually be an efficient cost, but higher due to Power Networks' unique situation.

As a result, the benchmarking analysis should only be viewed in context of the wider review of the business and an understanding of the business' characteristics, and decisions that affect the determination of the regulatory allowance should not be based solely on the outcomes of the benchmarking.

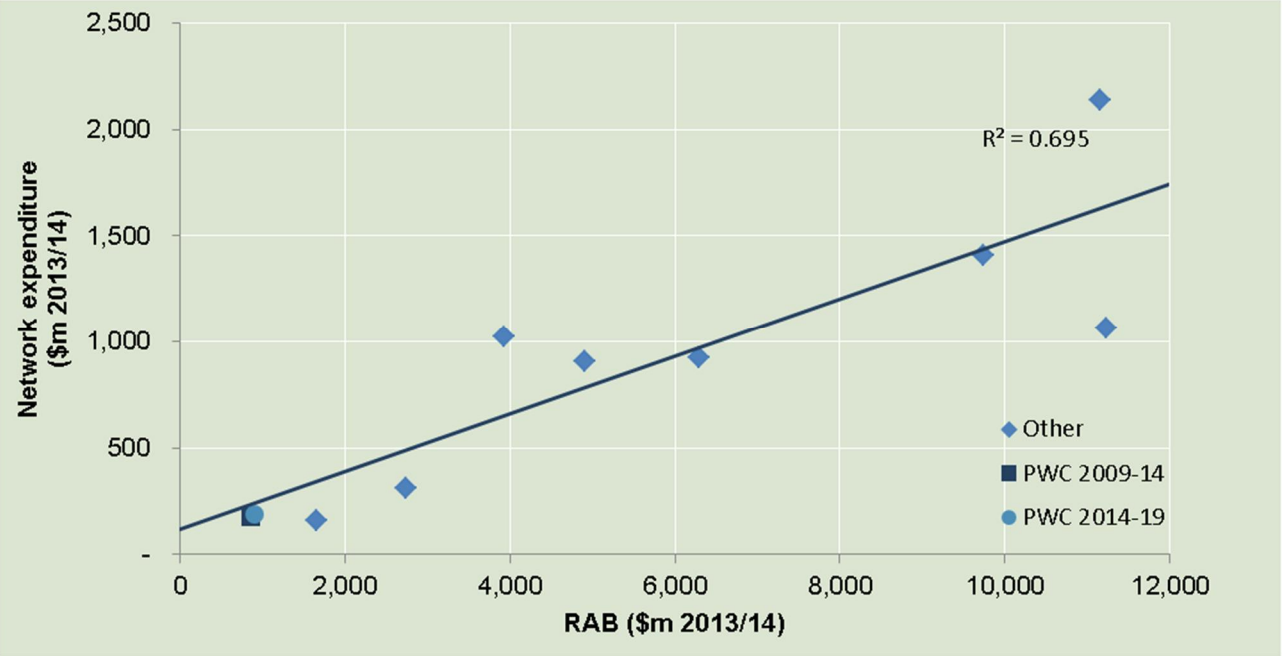
Specific findings of the benchmarking study are displayed in the following sections. Our approach is to start with a high level view of total expenditure then review each major category.

4.2 Total expenditure

Generally, a larger network requires a higher level of expenditure to ensure that performance and safety are maintained. As a result, the total expenditure required for a network is expected to be proportional to its size.

The Regulated Asset Base (RAB) represents the current value of the entire network, it is therefore proportional to network size and is used to represent network size in the following analyses[33]. Figure 4-1 shows the total network expenditure compared to the RAB for the sample group of DNSPs. The network expenditure consists of capital, operating and maintenance expenditure. The values exhibit a reasonable correlation with an R^2 of 69%, and Power Networks' proximity to the trend line indicates that its total network expenditure is consistent with its peers relative to the size of its network.

[33] Following the incident at Casuarina Zone Substation in 2008, Power Networks undertook a large asset replacement program. This program had the effect of increasing the value of the RAB by 150%. Power Networks' assets are now likely to be younger on average than its peers, and the value of the RAB correspondingly greater. In our view, the average asset age was likely to be older than its peers pre-2008 and slightly younger after the replacement program. A sensitivity analysis found that this is unlikely to materially affect the use of RAB as a normaliser in benchmarking expenditures in the period post 2009, i.e. the current and next regulatory periods.



Source: See section 4.1.2

Figure 4-1 Total network expenditure vs. RAB

An alternative view is given by testing the normalised (by network length) total expenditure against the customer density. A higher density of customers means that higher capacity assets and/or a higher number of assets are required, therefore resulting in increased expenditure requirements for replacement and/or maintenance. Figure 4-2 shows a strong relationship between expenditure per kilometre and customer density with an R^2 of 96%. Power Networks is shown to be above the trend line, but the forecast expenditure for the next regulatory control period is shown to be moving towards the trend and is reasonably consistent with the peer businesses.

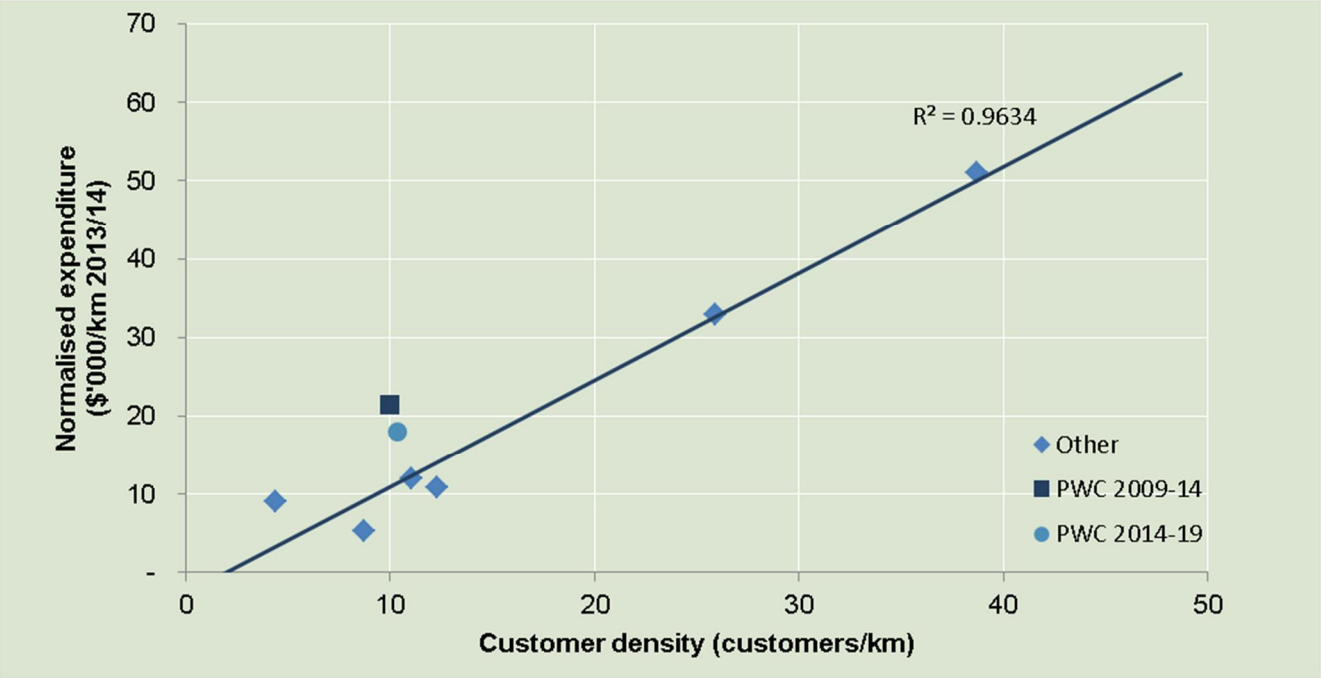


Figure 4-2 Normalised total expenditure vs. customer density

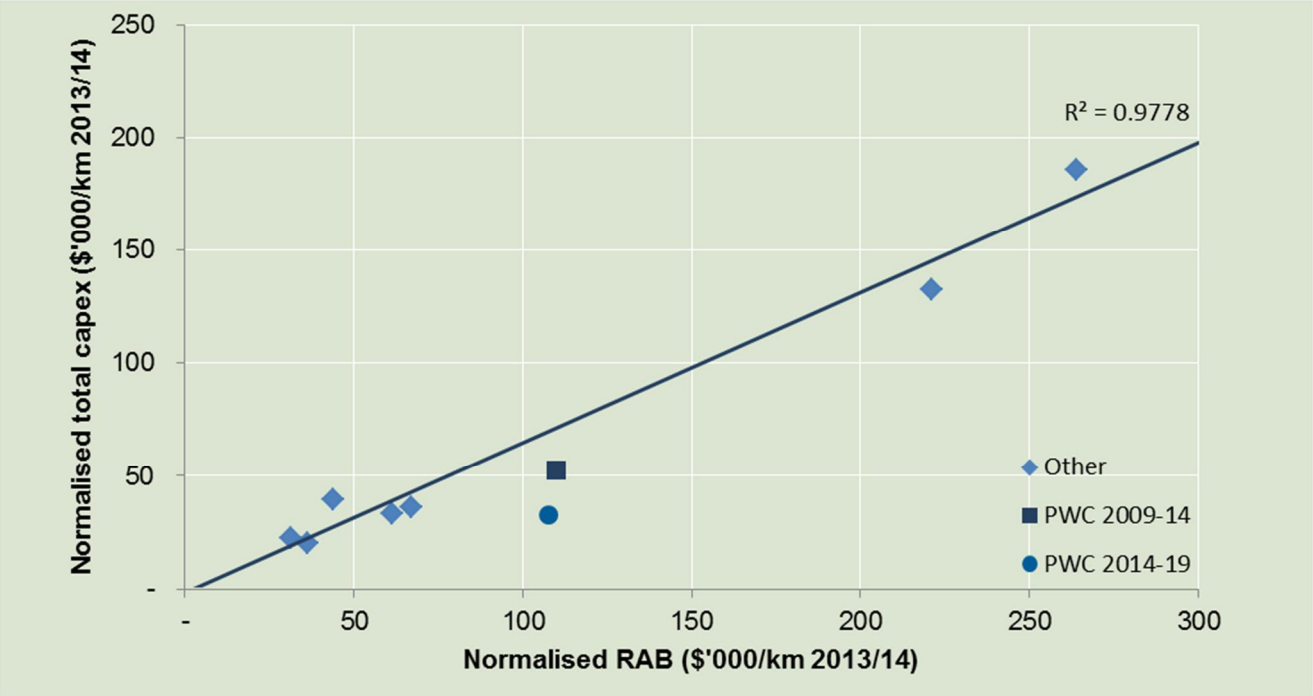
Figure 4-1 and Figure 4-2 indicate that, at a macro level, Power Networks' overall expenditure appears to be consistent with its peer businesses but slightly high on a per unit basis. Parsons Brinkerhoff notes that given the remoteness of assets, the higher costs incurred by Power Networks may be reasonable.

The following sections look at the major categories covered by capex, opex and maintenance to provide further insight into how well Power Networks compares to its peers in individual categories.

4.3 Capital expenditure

The amount of capex required is related to the size of the network and is generally undertaken to meet two key drivers: increasing demand on the network due to customer growth and increases in peak demand; and replacement of assets that have deteriorated in condition.

The relationship between capex and RAB is shown in Figure 4-3. It has been normalised using the network line length to show all businesses on a per unit basis. The values exhibit a very high degree of correlation with an R^2 of 98%. The chart indicates Power Networks' normalised total capex compared to normalised RAB is below the trend line, and the forecast for the 2014-19 regulatory control period has decreased relative to the current period.



Source: See section 4.1.2

Figure 4-3 Normalised total capex vs. normalised RAB

Capex is also related to the customer density, such that a higher customer density requires more or larger assets per unit distance and therefore will require higher replacement expenditure as the assets deteriorate. Figure 4-4 also shows a strong correlation of 85% between the normalised capex and customer density.

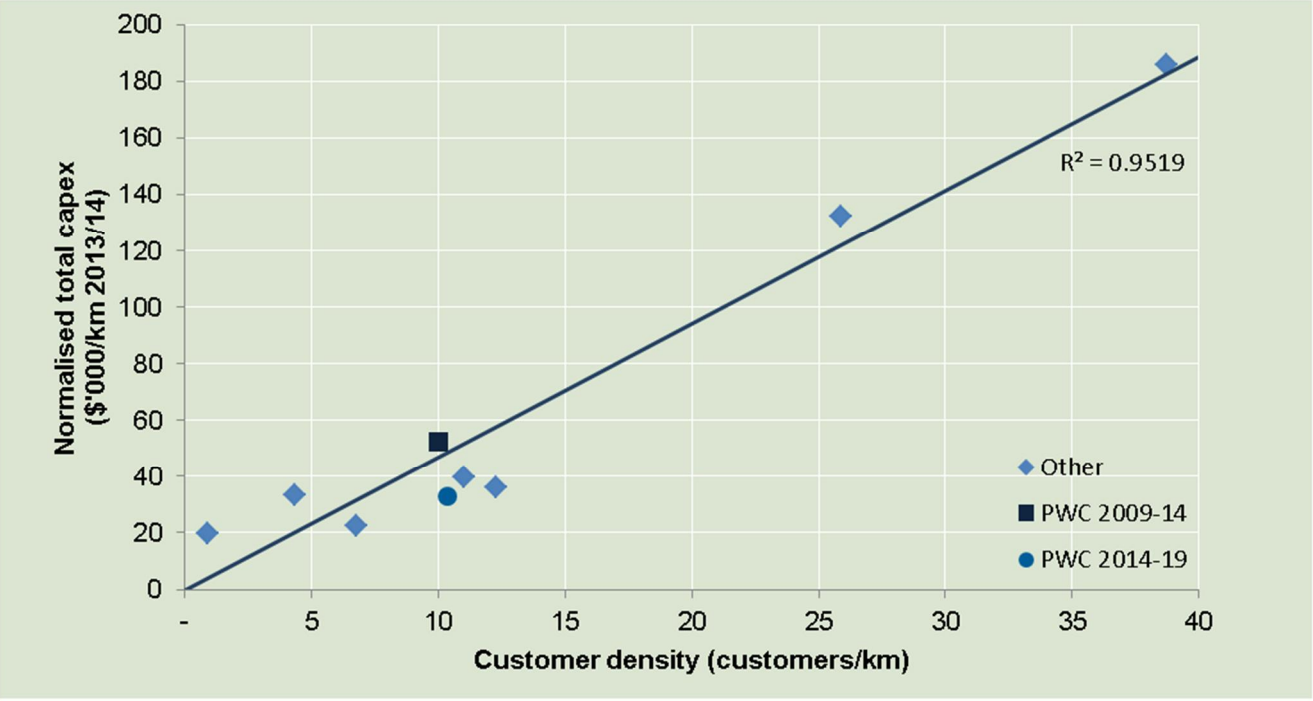


Figure 4-4 Normalised total capex vs. Customer density

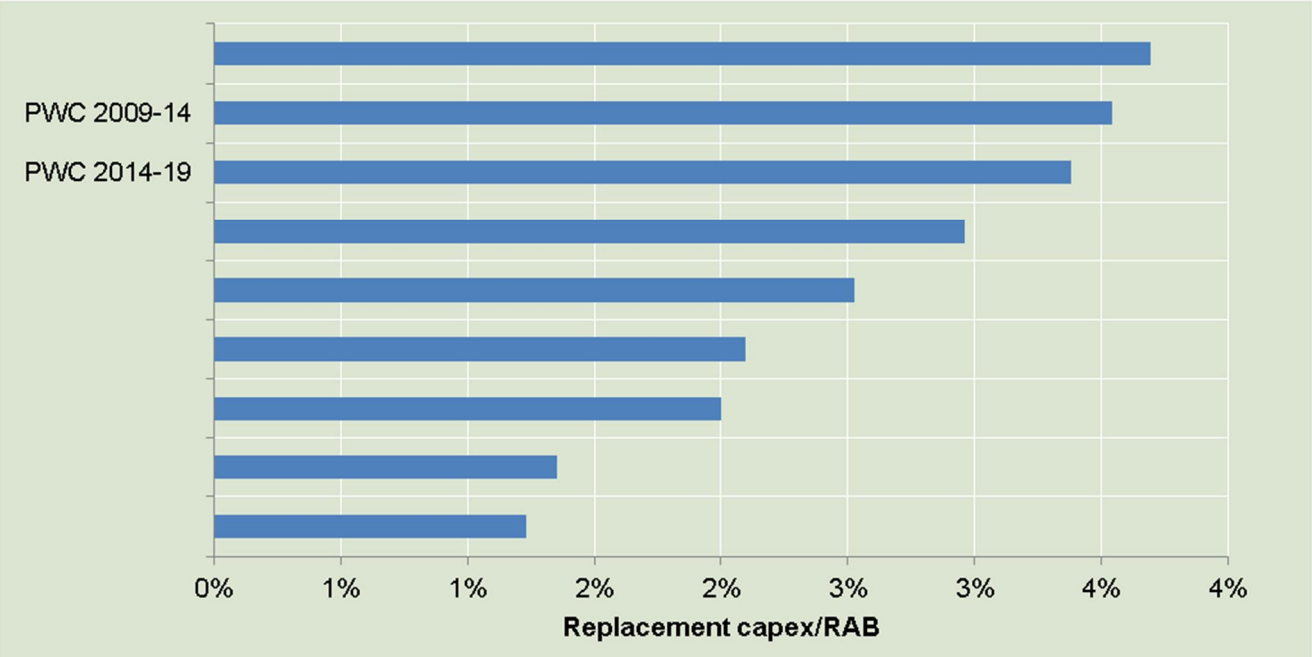
Figure 4-4 shows that the capex spend per customer density is forecast to decrease in the next regulatory control period but remains consistent with peer businesses.

Since the total capex includes replacement and augmentation, these subcategories are examined separately to identify the driver of the deviation from the trend line and to assess if that deviation is reasonable for Power Networks.

4.3.1 Replacement capex

The amount of replacement expenditure required is also related to the size of the network and undertaken to address the deterioration of assets. Historically, Power Networks has implemented a run to failure regime, meaning most assets would only be replaced once they had failed in service. Recently, as a result of the Casuarina Zone Substation failure and the recommendations set out by the Davies Report[34], Power Networks has replaced, or is planning to replace, a number of assets and has also moved to a proactive replacement regime, i.e. assets are now replaced prior to failure.

Figure 4-5 shows replacement capex as a percentage of the RAB for the sample group of DNSPs. It shows that Power Networks' replacement expenditure is at the upper end of the ranking compared to peer businesses, but is expected to decrease slightly in the next regulatory period. This is consistent with the increased focus on replacement since 2008 and the expected decrease in the need for replacement once the general network condition has been improved.

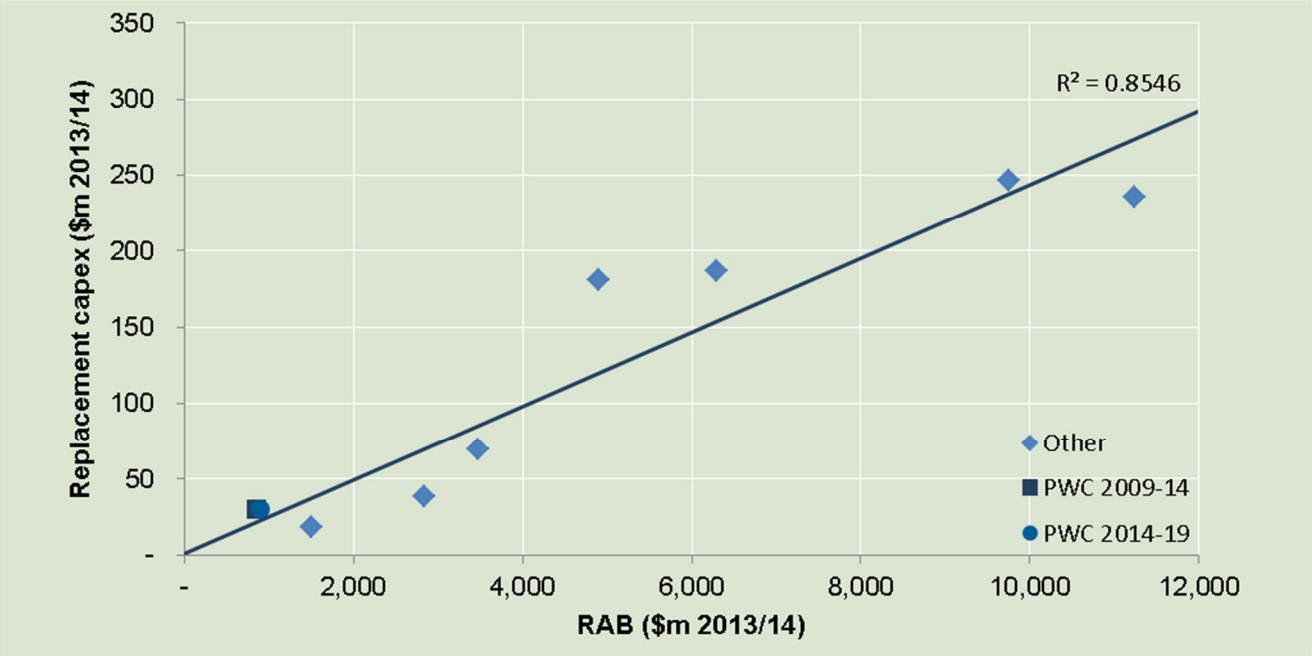


Source: See section 4.1.2

Figure 4-5 Replacement capex/RAB

However, although the replacement is high as a percentage of the RAB, Figure 4-6 shows it is consistent with the peer businesses.

[34] Davies, 4 February 2009, 'The Independent Enquiry into Casuarina Substation Event and Substation Maintenance across Darwin (Final Report)'



Source: See section 4.1.2

Figure 4-6 Replacement capex vs. RAB

Overall, the replacement capex appears to be consistent with peer businesses and reasonably close to the trend line.

4.3.2 Augmentation capex

Augmentation expenditure is related to installation of new assets, or replacement of existing ones with assets of higher capacity, to meet increased demand on the network. Augmentation is driven by external forces, such as population growth and the economy of the state which are generally outside of the control of the DNSP. Often networks contain growth areas which have an increasing demand even when the peak demand of the network as a whole is decreasing.

To provide a useful comparison, we considered the increase in peak demand as a driver and the growth related capex (augmentation and user initiated) as the expenditure required to meet the growth. DNSPs expecting negative growth in peak demand, but requiring augmentation capex, were excluded from this analysis as we do not have the data relating to the specific growth areas within those networks. The result is shown in Figure 4-7.

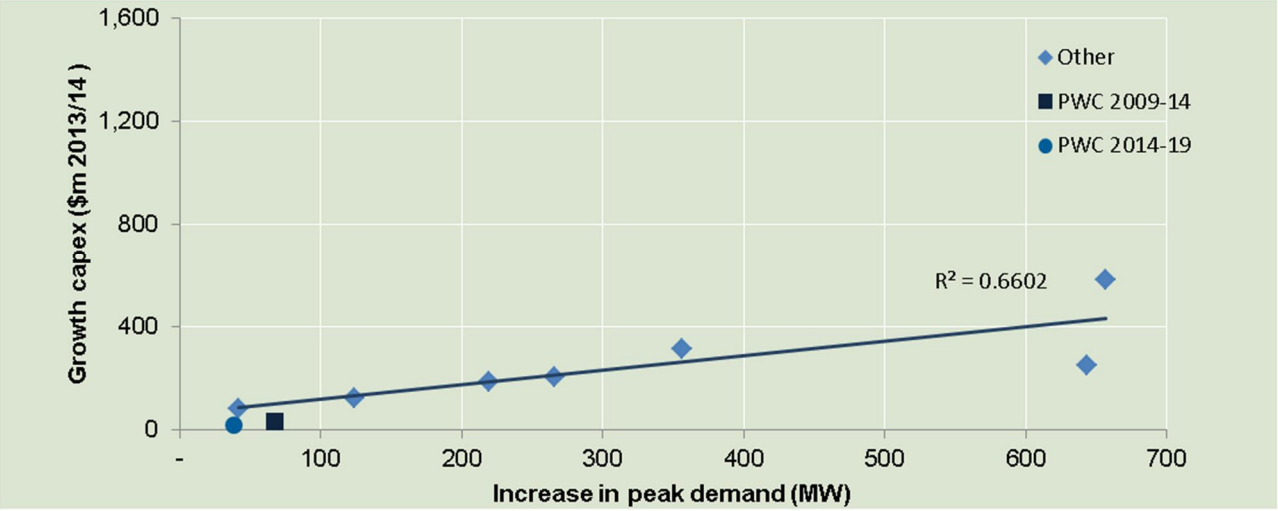


Figure 4-7 Growth capex vs. increase in peak demand

Figure 4-7 shows a reasonable correlation between the parameters, with an R^2 of 66%. Power Networks' growth capex is marginally below the trend line but consistent with its peers.

The augmentation capex is largely comprised of unit costs for assets, and therefore this comparison indicates that on average, the peer businesses have a consistent industry unit cost per unit of demand increase.

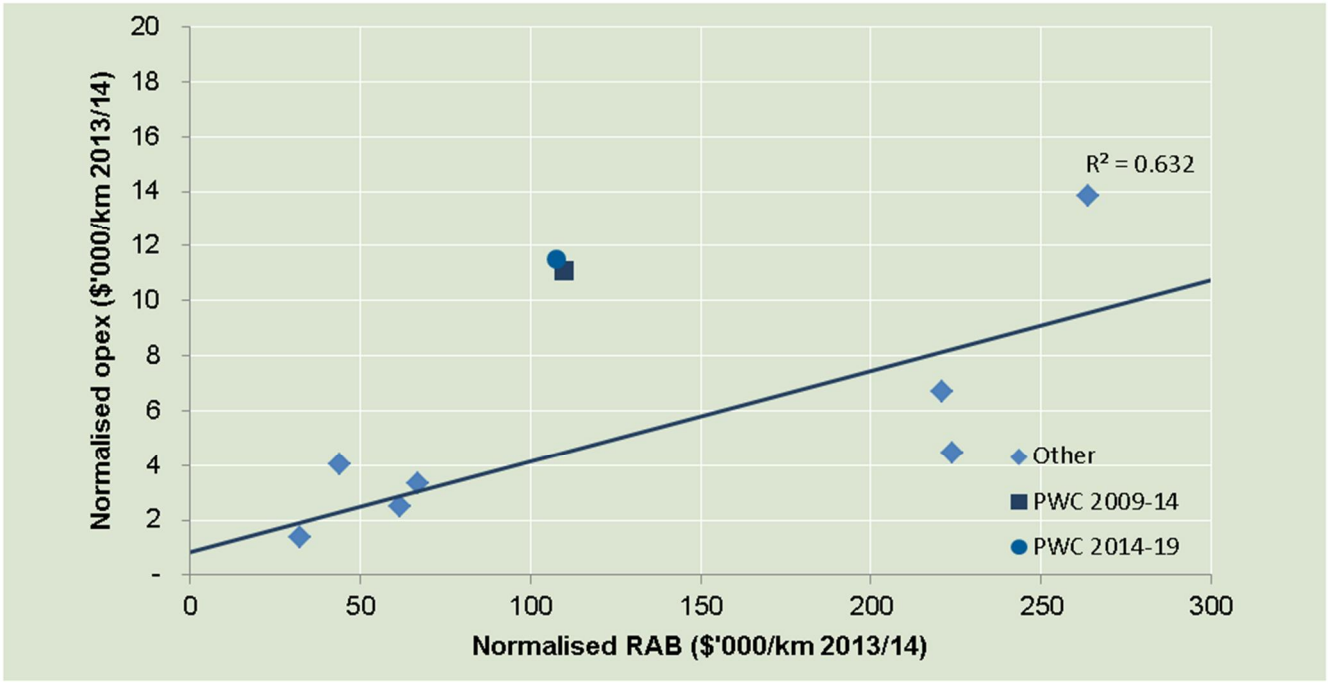
Parsons Brinckerhoff notes that where augmentation and replacement projects are combined, i.e. replacement of a transformer with a larger capacity one, the approach to allocation of costs between the augmentation and replacement categories maybe different between business, therefore distorting the results. We note that Power Networks is undertaking a number of these types of projects which could account for the slightly higher replacement and slightly lower augmentation expenditure compared to the peer businesses.

4.4 Operational and maintenance expenditure

This section considers the proposed operational and maintenance expenditure. To maximise the data set available for the benchmarking[35], we consider the total opex (that is, operational plus maintenance expenditure) against a number of metrics. The following charts were selected as they display a meaningful relationship.

Figure 4-8 shows Power Networks' normalised total opex compared to normalised RAB for a sample of DNSPs, using total network line length as the normalising factor. The values exhibit a reasonable degree of correlation with an R^2 of 63%. It illustrates Power Networks' normalised total opex compared to normalised RAB is significantly above the trend line.

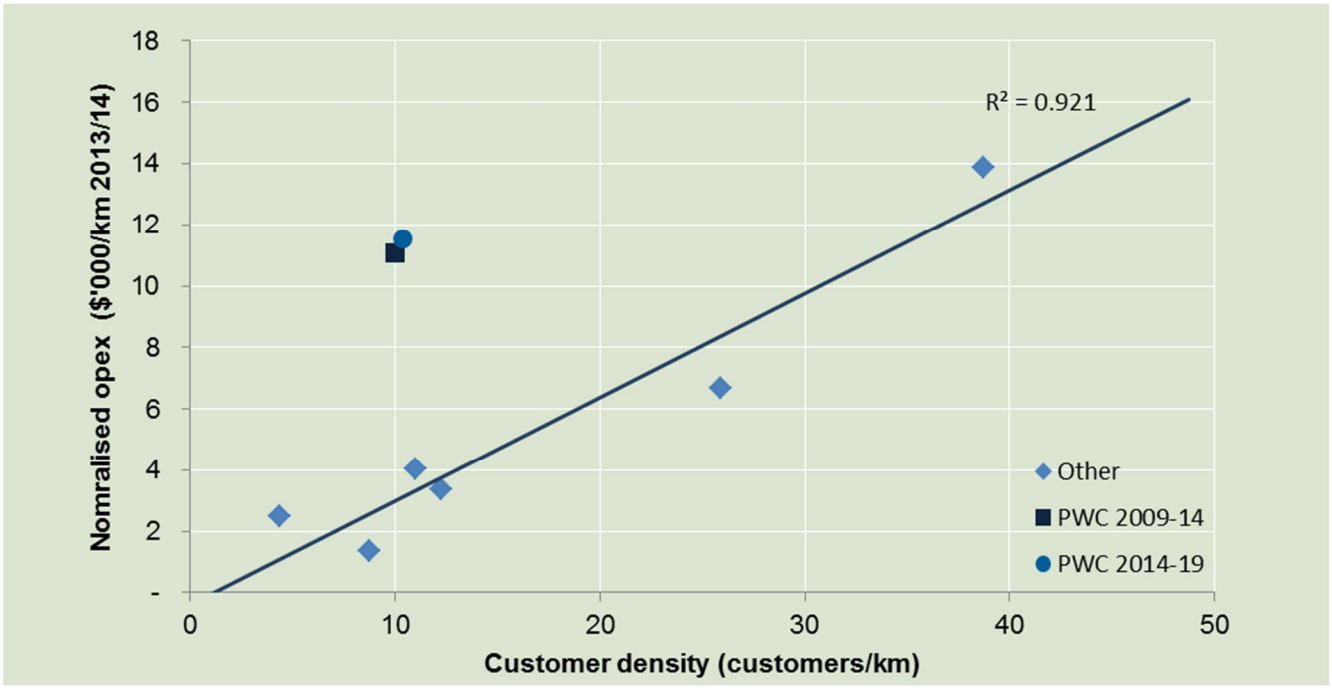
[35] Not all businesses publish data broken down to the same level of granularity or into categories that are easily comparable between the businesses.



Source: See section 4.1.2

Figure 4-8 Normalised total opex vs. normalised RAB

Figure 4-9 shows normalised total opex compared to the customer density for a sample of DNSPs. It shows a high degree of correlation with an R^2 of 92%. Again, this indicates the total opex is high compared to peer businesses.



Source: See section 4.1.2

Figure 4-9 Normalised total opex vs. customer density

The analysis of total opex has found that Power Networks appears to require a high level of opex compared to its peers on a per unit basis, approximately three times the cost of the DNSPs with similar customer densities.

To assess if the high expenditure is driven by operational or maintenance expenditure, Parsons Brinckerhoff undertook benchmarking using maintenance expenditure versus line length[36]. Four peer businesses published data that was identified to be comparable to Power Network's maintenance categories and one of these was a clear outlier and therefore was excluded from the analysis.

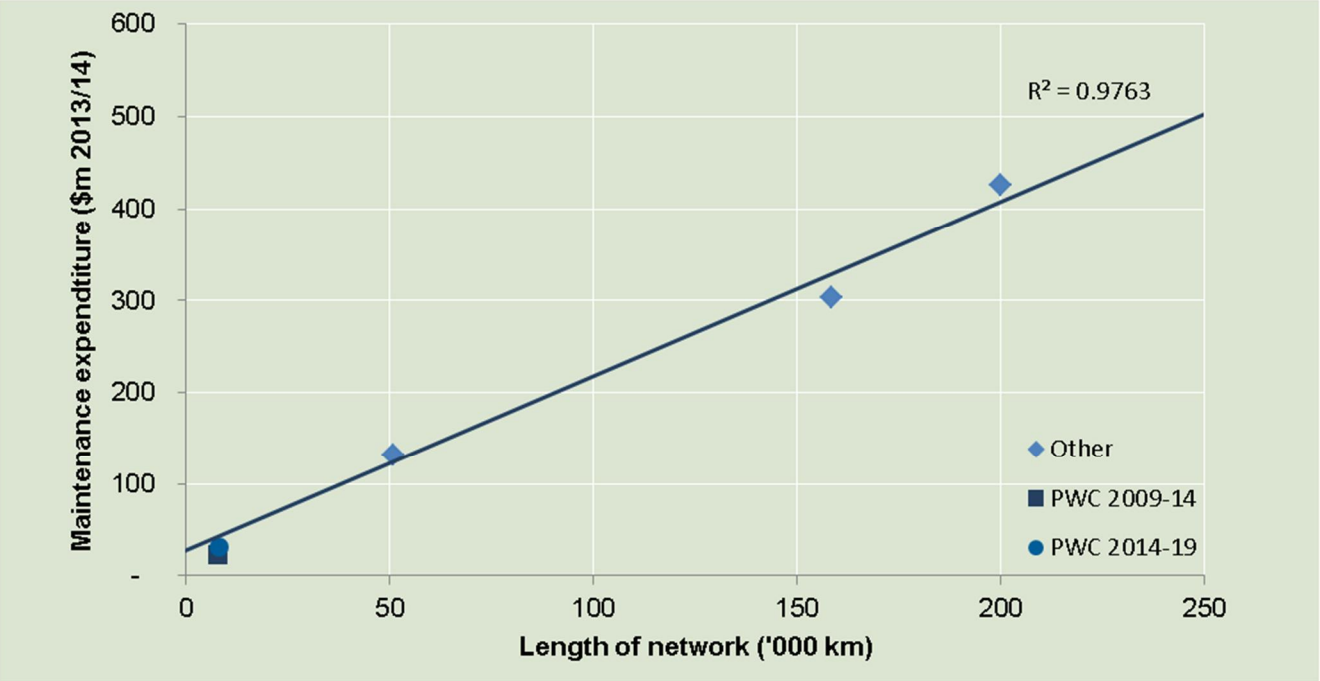


Figure 4-10 Maintenance vs. network line length

Figure 4-10 shows a strong correlation, with R^2 of 97%, and demonstrates that Power Networks' maintenance expenditure in the current period and next regulatory period is consistent with its peers and close to the trend line. Parsons Brinckerhoff considers that this indicates the expenditure is efficient, pending the detailed review of the expenditure.

Further, this indicates that the inefficiency shown in Figure 4-8 and Figure 4-9 is likely to be a result of operational expenditure. Parsons Brinckerhoff could not assemble benchmarking data for operational expenditure on a like for like basis, so was not able to validate this view. However, Parsons Brinckerhoff notes the following aspects of Power Network's situation which may contribute to a higher operational expenditure:

- The network covers four connected regions that are separated by long distances, which is likely to result in additional labour time incurred for travel.
- Rawlinsons Australian Construction Handbook 2012 shows that the average of the regional indices that apply in Power Networks areas of operations are 30% higher than the base[37]. This will have a direct impact on the overhead (labour) costs incurred by Power Networks.
- The corporate overheads account for approximately 22% of the total opex for both the current and next regulatory period. These fixed costs are largely independent of the network size, and since Power

[36] Parsons Brinckerhoff notes that during the current regulatory period PWC increased its focus on accurate allocation of time between the Service Delivery category and the maintenance categories. We adjusted for the change by increasing the expenditure in the first half of the current regulatory period to reflect the true labour allocation.

[37] Rawlinsons Publishing, 2012, 'Rawlinsons Australia Construction Handbook'. Rawlinsons used Adelaide as the base for assessing the regional uplift factors in the Northern Territory.

Networks is the smallest of the benchmarked businesses, they are likely to have a more noticeable effect on the per unit analysis and contribute strongly to the deviation from the trend line.

Parsons Brinckerhoff is of the view that, pending detailed analysis, Power Networks' forecast opex is high and is likely to include inefficient expenditure.

4.5 Summary of findings

Parsons Brinckerhoff's benchmarking study has revealed that Power Networks' overall forecast expenditure is consistent with other businesses, although some differences are evident in the expenditure categories. We found that:

- Total capex, both in the current and forecast periods, compares favourably with peer businesses, with both replacement capex and augmentation capex consistent with other DNSPs.
- The level of total opex appears to be high.
  - Maintenance expenditure appears to be consistent with peer businesses and on the trend line. Parsons Brinckerhoff is of the view that the maintenance expenditure appears to be efficient.
  - Operational expenditure appears to be high, although specific benchmarking information is not available to confirm this view.

With respect to operational expenditure, Parsons Brinckerhoff is of the view that Power Networks' unique circumstances and the uplift in costs incurred in the Northern Territory may account for part of the higher costs; however, we consider that operational expenditure is likely to be inefficient due most likely to a lack of economies of scale. The detailed analysis will identify any inefficient expenditure in a more accurate and targeted manner.

Further analysis into the capital, operational and maintenance expenditure has been undertaken and is discussed in sections 7 and 8.



5. Policy & procedures review

This section sets out Parsons Brinckerhoff's high level review of the reasonableness of Power Networks' relevant capex and opex policies and procedures when compared with good industry practice. In making this assessment Parsons Brinckerhoff has relied upon our experience in reviewing a broad range of similar documents across DNSPs, TNSPs and within the utility industries in general.

In its staged submission and in the IRP, Power Networks submitted a range of policy and procedural documentation relating to the governance, management, and development of its assets from both a capital and operating expenditure perspective. In particular the:

- 2013/14 Confidential Statement of Corporate Intent
- Power Networks Business Plan 2012/13 Confidential
- Power Networks Cost Allocation Method
- Network Connection Technical Code
- System Control Technical Code
- Network Planning Criteria
- Power Networks' Network Demand and Customer Connections Forecast Procedure
- Power Networks Demand Management Procedure
- Capital Investment and Delivery Framework
- Structure for the Purposes of Financial Delegations
- Network Management Plan (2011/12 to 2016/17)
- Distribution System Extension Policy
- Power Networks Capital Contributions Policy
- Power Networks Asset Strategies Procedure
- Power Networks Maintenance Policy
- Corporate Asset Management Manual

It should be noted that Parsons Brinckerhoff undertook a detailed review of Power Networks' revised Network Technical Code and Network Planning Criteria as well as Power Networks' System Control Technical Code and these reviews are the subject of separate reports[38,39]. For the remainder of these

[38] Parsons Brinckerhoff, 3 July 2013, 'RE: 2014-2019 Network Price Determination - Review of Power and Water Corporation's revised Network Technical Code and Network Planning Criteria', 2189282A-DMS LTR-001 Draft Version 2

documents Parsons Brinckerhoff has undertaken a high level review to inform our views in our review of PWC's proposed capex and opex for the 2014–19 regulatory period.

In our detailed review of Power Networks' revised Network Technical Code and Network Planning Criteria as well as Power Networks' System Control Technical Code we made a number of specific comments and recommendations. For details of these reviews reference should be made to the separate reports noted above. Similarly, in our review of PWC's proposed capex and opex we have also made specific observations in relation to aspects of certain policy and procedure documents that highlight particular issues that are relevant to Power Networks' capex and opex forecasts (e.g. Power Networks' demand forecasting practices).

However, notwithstanding our specific observations, and based on our high level review of these documents, Parsons Brinckerhoff is of the opinion that in general the principles and practices set out in the policies and procedures we reviewed broadly accord with good industry practice. We are also of the view that while many of the documents reviewed set out principles and practices that broadly accord with good industry practice, the evidence of the implementation of the principles and practices is limited, within the capex and opex supporting documentation (e.g. Business Needs Identification documents, Opex Category Justification documents).

We note that the practical implementation of these policies does not result in the expected outcomes in the following circumstances:

- the replacement programs do not align with the Power Networks Asset Strategies Procedure (see sections 7.5.4.1,7.5.4.2 and 7.5.4.3)
- Power Networks Cost Allocation Method contains little detail in regards to the principles relating to the treatment of overheads as capital or operating expenses (see section 0)
- Power Networks' Network Demand and Customer Connections Forecast Procedure notes that the forecasting process includes consideration of 'adjustments for changes in key drivers'[40], however details of the method by which such adjustments are achieved are not provided (see section 6 and 7.3.3)

In making this observation Parsons Brinckerhoff also notes that many of the policy and procedure documents are recently dated or recently revised, and hence this lack of evidence for implementation reflects Power Networks' position in the early stages of implementing improved policies and procedures.

5.1.1 Capital governance

Parsons Brinckerhoff has undertaken a high-level review of Power Networks' capital governance framework as an integral element of assessing the prudency and efficiency of the proposed system capital investment for the next regulatory control period, as outlined in section 2.1.1 As discussed above, the policies and procedures that contribute to the capital governance framework are in the early stages of implementation, and as such the investment approach outlined by these documents is also in the early stages of implementation.

The capital governance process is outlined in the 'Capital Investment and Delivery Framework', May 2012. It is based on decision gates, as summarised in the process, and is implemented through the use of document templates.

[39] Parsons Brinckerhoff, 3 July 2013, 'RE: 2014-2019 Network Price Determination - Review of potential conflicts between Power and Water Corporation's revised Network Technical Code, Network Planning Criteria and System Control Technical Code', 2189282A-DMS LTR-002 Draft Version 1

[40] Power and Water Corporation, June 2013, 'Network Demand and Customer Connections Forecasting Procedure', section 4.4.1, n.p.

Throughout our review we have noted that, in some cases, Power Networks does not display good practice in asset management. For example, the proposal to replace the 11kV switchboard, and the circuit breakers contained within, at Berrimah Zone Substation (section 7.5.4.3) when the circuit breakers were replaced in 2009 with new units. This suggests that Power Networks' asset management strategic planning is not effective.

Further to this, Parsons Brinckerhoff has noted that in some cases the proposed capital investment does not align with the policies, procedures and business management practices. This is evidenced by contradictions between the proposed replacement projects and the Power Networks Asset Strategies Procedure, refer to the specific reviews of PRD30115 - Darwin: Replace Casuarina ZSS 66kv Outdoor Switchyard (section 7.5.4.1) and PRD30402 - Darwin: Replace Berrimah ZSS (section 7.5.4.3).

We note that in some cases the decision making process does not appear to be aligned with the policies, procedures and business management practices. This is evidenced by the deferral by 2 years of PRD30003 - Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing (section 7.6.4.1) by the PWC board although the CIAMC document provides robust justification that this is a prudent and efficient project that provides the least cost and most cost effective mitigation of risk when implemented at the proposed time. This suggests that the integrity of the decision gates has been compromised and that the decision making process does not align with the purpose of the specific gateways as outlined in the 'Capital Investment and Delivery Framework'.



6. Demand forecast review

Parsons Brinckerhoff has reviewed the documentation and forecasts provided by Power Networks to assess their reasonableness, as outlined above. We note that a number of forecasts are prepared by Power Networks, including:

- regional demand and energy forecasts
- transmission level demand forecasts
- zone substation demand forecasts
- high voltage feeder demand forecasts
- customer connection forecasts (addressed in section 7.3.3).

The forecasting methodology used by Power Networks to develop each of the forecasts above is set out in the 'Network Demand and Customer Connections Forecasting Procedure'[41] (the Forecasting Procedure). While the methodology used for each of the above forecasts involves different specific details, in general the forecasting methodology for demand forecasts broadly involves:

- review and preparation of historical demand data that includes adjustments for abnormal circumstances (e.g. switching events, spot loads, etc.)
- weather normalisation
- forecast of demand using least squares regression
- adjustments to the forecasts based on expert judgement in order to account for the future impact of factors that influence demand (e.g. economic factors, technology, social factors, spot loads, network configuration, etc.)
- reconciliation and validation of the forecast with the forecasts at different levels of aggregation across the network.

For the customer connection forecasts the procedure set out in the documentation is less clear regarding the details of the methodology employed. However, based on the information set out in the 'Internal Memo Re: Customer Connections Forecast'[42] and discussions with Power Networks, it seems that a least squares regression approach was employed along with adjustments based on expert judgement to account for factors that impact on customer number growth (e.g. forward economic conditions, etc.). Further consideration of the customer connection forecasts is provided in section 7.3.3.

In Parsons Brinckerhoff's opinion, Power Networks' review and preparation of historical data as well as the business' weather normalisation practice as described by the Forecasting Procedure are generally in line

[41] Power and Water Corporation, June 2013, 'Network Demand and Customer Connections Forecasting Procedure'

[42] Power and Water Corporation, 19 June 2013, 'Internal Memo Re: Customer Connections Forecast'

with the characteristics and principles set out in section 2.2.2 and industry practice. However, we have specific concerns regarding Power Networks' general application of a least squares regression model and the associated adjustments based on expert judgement. Specifically, the use of a least squares regression model to project the linear trend component of the historical data inherently assumes that the underlying drivers of this linear trend continue, unmodified, for the forecast period. To account for this inherent limitation, Power Networks applies adjustments based on expert judgement to derive resultant forecasts that consider factors such as expected economic conditions, technology, social impacts, spot loads, network configuration changes, etc.

We note that for spot loads and network configuration, details of adjustments are documented at the time of the forecast through the 'load log table'[43] and the 'transfer log table'[44] respectively. This practice provides transparency, repeatability and supports independent objective review of the forecast. However, while Power Networks' Forecasting Procedure notes that the forecasting process includes consideration of 'adjustments for changes in key drivers'[45], and that the 'projection of regional demand is made after the consideration of economic indicators'[46], details of the method by which such adjustments are achieved are not provided. Examination of the network maximum demand forecasts set out in RIN Template 6.3[47], as well as the examples of the forecasting process shown in figures 3[48] and 6[49] of the Forecasting Procedure, are indicative of this practice and exhibit adjustments being made to the forecast rate of change derived from the least squares fit. The supporting documentation does not provide specific justification for these adjustments, the methodology used to apply the adjustments, details of the judgements employed or their impact on the forecasts. In our opinion Power Networks' forecasting methodology is not reasonably transparent or repeatable as details of the expert judgements employed are not clearly documented. Furthermore, in our view this lack of documented detail regarding the expert judgements employed makes it impossible to objectively assess if there has been appropriate incorporation of key drivers of demand and exclusion of spurious drivers. Consequently model validation and testing cannot be objectively undertaken or demonstrated.

Parsons Brinckerhoff has also examined a number of forecasts and the supporting information provided, and in our opinion the adjustments applied exhibit an upward bias in the trend derived directly from the least squares fit process. For example, we note that the indicative forecast shown in figure 2 of the demand Forecasting Procedure[50] shows a forecast that grows at approximately 1.5MW per annum (or about 22%) faster on average than the historical trend derived from the least squares fit process. While we acknowledge this forecast is 'indicative', Parsons Brinckerhoff has also analysed the forecast presented in Figure 2 of the Archer to Palmerston 66kV Transmission Line Business Need Identification[51] (BNI) and found a similar

[43] Power and Water Corporation, 2013, 'Attachment D - RIN Instructions - Section 12 (2014 NPD Stage 2) - Load Log Table.XLS'

[44] Power and Water Corporation, 2013, 'Attachment C - RIN Instructions - Section 12 (2014 NPD Stage 2) - Transfer Log Table.XLS'

[45] Power and Water Corporation, June 2013, 'Network Demand and Customer Connections Forecasting Procedure', section 4.4.1, n.p.

[46] Power and Water Corporation, June 2013, 'Network Demand and Customer Connections Forecasting Procedure', section 7, n.p.

[47] Power and Water Corporation, June 2013, 'RIN Template Worksheet 6.3 - System MD (2014 NPD - Stage 2).XLS'

[48] Power and Water Corporation, June 2013, 'Network Demand and Customer Connections Forecasting Procedure', section 7, n.p.

[49] Power and Water Corporation, June 2013, 'Network Demand and Customer Connections Forecasting Procedure', section 10, n.p.

[50] Power and Water Corporation, March 2013, 'Network Demand Forecasting Procedure, Power Networks', Version 2.0, n.p.

[51] Power and Water Corporation, 17 June 2013 (Revised – August 2013), 'Business Need Identification, PRD30513, REVISED Darwin - Construct Archer to Palmerston 66kV Transmission Line', p. 3

result. Specifically, this forecast grows at approximately 1.0MW per annum (or about 25%) faster on average than the historical trend derived from the least squares fit process. This same bias is also apparent at the regional level as demonstrated in analysis of the Darwin-Katherine System Forecast shown as figure 1 in the Archer to Palmerston BNI[52]. Specifically, this regional forecast grows at approximately 3.0MW per annum (or about 55%) faster on average than the historical trend. We note that similar observations can be made for other forecasts.

While an increasing linear rate of growth in the forecast above the historical trend may be appropriate where the underlying drivers of demand are in the main expected to increase, no evidence is provided to support this upward bias, and the documentation does not set out how expert judgement has been applied to achieve these results. Hence it is unclear how Power Networks balances factors that result in increased growth rates with factors that result in reduced growth rates. For example, the cost of air conditioning is reducing which is driving the adoption of this technology and its associated electrical demand. However, the efficiency of this technology is also improving at the same time as building design and insulation standards are being revised to promote passive energy efficiency, potentially driving a reduction in future demand for air conditioning. That is, a potentially slower rate of growth than historically evident. Similarly, solar photovoltaic technology with its reducing cost and increasing capacity is a further example of the need to balance the relative impacts of demand drivers on the forecast. Given the lack of transparency with regards to how Power Networks balances such competing factors, we are of the view that it is not possible to objectively assess if there has been appropriate incorporation of key drivers of demand and exclusion of spurious drivers.

In making the above observations regarding undocumented adjustments and the upward bias exhibited in Power Networks' forecasts, we note that these aspects of Power Networks' forecasting practices materially impact on the business' capital planning, and that this is also indicative of the reasonableness (or otherwise) of Power Networks' demand forecasts. This impact on the capital planning practice of Power Networks' is clearly illustrated by considering the timing details of the Archer to Palmerston 66kV Line project. In the original Archer to Palmerston BNI dated 17 June 2013, Power Networks states in reference to the demand forecast that "… constraints on the existing transmission lines may occur from approximately 2016/17"[53]. However, in the revised Archer to Palmerston BNI[54] dated August 2013, Power Networks notes in relation to the demand forecast that "… constraints on the existing transmission lines may occur from this 2013/14 wet season". In our discussions with Power Networks we noted that, despite the forecast presented in the original Archer to Palmerston BNI, Power Networks was proposing to deliver the project in early 2019/20[55]; a deferral of about three years on the forecast timing. Parsons Brinckerhoff was advised that this deferral assisted with resource levelling and that Power Networks was of the view that the demand forecast is likely to be overestimated. In the revised Archer to Palmerston BNI[56], Power Networks has again deferred the Archer to Palmerston line stating that "…some of these developments have been delayed and experience has shown that peak demand information provided by developers is usually above actual demand. On this basis, the timing of the requirement for a new transmission line has been adjusted to 2015/16."[57]; a deferral of two years from the revised forecast timing. Hence in the two months between the original BNI and the

[52] Power and Water Corporation, 17 June 2013 (Revised – August 2013), 'Business Need Identification, PRD30513, Revised Darwin - Construct Archer to Palmerston 66kV Transmission Line', p. 3

[53] Power and Water Corporation, 17 June 2013, 'Business Need Identification, PRD30513, Darwin - Construct Archer to Palmerston 66kV Line', p. 4

[54] Power and Water Corporation, 17 June 2013 (August 2013), 'Business Need Identification PRD30513 - Revised Darwin - Construct Archer to Palmerston 66kV Line'.

[55] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line', p. 6

[56] Power and Water Corporation, 17 June 2013 (August 2013), 'Business Need Identification PRD30513 - Revised Darwin - Construct Archer to Palmerston 66kV Line', p. 4

[57] Power and Water Corporation, 17 June 2013 (August 2013), 'Business Need Identification PRD30513 - Revised Darwin - Construct Archer to Palmerston 66kV Line', p. 4

revised BNI, despite the delayed developments and overstated developers demand expectations, significant variation in the forecasts has resulted in the constraint timing moving forward by three years and the project timing moving forward by four years. In our opinion this reflects on the significant uncertainty inherent in Power Networks' forecasting practices, the expert judgement applied, and demonstrates that Power Networks' demand forecasts cannot be relied upon to reasonably support the timing of demand driven capex.

Given the lack of information to demonstrate how expert judgement has been applied to the forecasts and the upward bias exhibited in the forecasts, Parsons Brinckerhoff is of the opinion that Power Networks' demand forecasts, when reviewed in the context of the definitions and requirements of the NER, are biased and overestimated. Hence we cannot conclude that these demand forecasts are reasonable.

While our terms of reference do not include the development of an alternative forecast, we have examined a number of demand forecasts[58] and note that approximately two or three years of deferral in forecast demand would be observed if historical temperature-adjusted growth trends were applied. In our opinion, given the softening demand being experienced in all other Australian jurisdictions over recent years, and the corresponding reduction in demand forecasts across the industry, a deferral of forecast demand by three years is a reasonable expectation. In making this observation we also note that upward bias in the linear trend has the effect of increasing the error in the forecast over time. That is, forecast values close to the start of the forecast period will have a smaller error than forecast values at the end of the forecast period. Nonetheless, we are of the view that a three year deferral in demand, particularly in the mid to latter part of the forecast period, should be applied when interpreting Power Networks' demand forecasts.

[58] Power and Water Corporation, 17 June 2013 (Revised – August 2013), 'Business Need Identification, PRD30513, REVISED Darwin - Construct Archer to Palmerston 66kV Transmission Line', p. 3 and Power and Water Corporation, March 2013, 'Network Demand Forecasting Procedure, Power Networks', Version 2.0, Figure 2, n.p.



7. Capital expenditure review

This section presents Parsons Brinckerhoff's review of PWC's proposed network and non-network capex for the 2014-19 regulatory period. A high level overview is provided followed by a review of each capex category and their trends. For each category, targeted detailed reviews of specific capex projects or programs are presented. A summary of Parsons Brinckerhoff's findings and recommendations is provided in the conclusion of each section.

Each section of this capex review firstly considers Power Networks' staged review submission and then considers, at a high level, Power Networks' IRP submission (see section 1.1.1) and its impact on our assessments and recommendations.

7.1 Total capex

In its staged submission Power Networks submitted a proposed total network and non-network capital expenditure of $305.551m (real 2013/14) for the 2014-19 regulatory period. A summary of the proposed total capex is set out in Table 7.1.

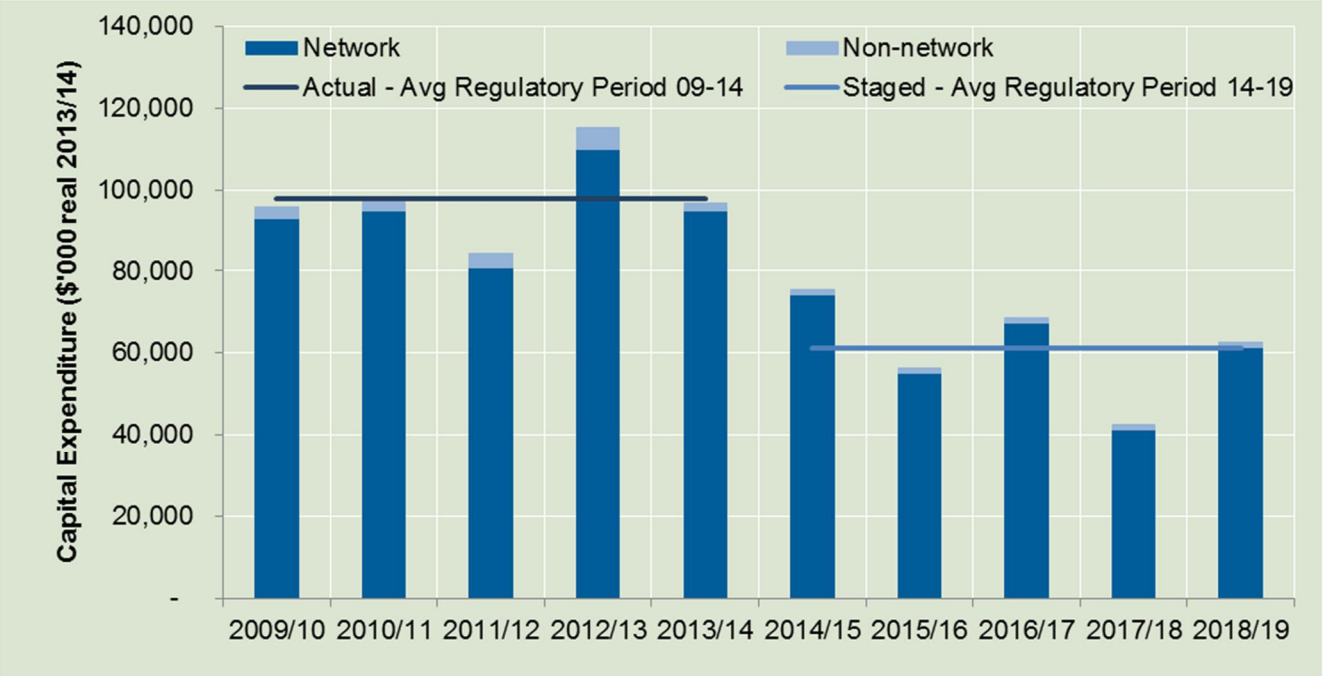
Table 7.1 Total capex – Staged submission ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Network	92,849	94,769	80,842	110,039	94,775	74,134	55,110	67,390	41,402	61,296
Non-network	3,023	2,313	3,292	5,180	1,993	1,244	1,244	1,244	1,244	1,244
Total	**95,872**	**97,082**	**84,134**	**115,219**	**96,768**	**75,378**	**56,354**	**68,634**	**42,646**	**62,540**
Regulatory Period	**489,075**					**305,551**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

Figure 7-1 shows the historical and forecast combined network and non-network capital expenditure from the staged submission. It illustrates that the network and non-network capital expenditure is forecast to decrease by 37.5% in real terms compared with the current regulatory period expenditure of $489.075m (real 2013/14).

In its IRP submission, Power Networks proposed a total capex 5.5% higher than in its staged review submission.



Source: Table 7.2

Figure 7-1 Capital expenditure – Staged submission ($'000 real 2013/14)

The prudency and efficiency of historical capex is discussed in the following section, while forecast capex is discussed in sections 7.2 to 7.10.

7.1.1 Prudency and efficiency of historical capex

Parsons Brinckerhoff reviewed the prudency and efficiency of the historical capital expenditure for the 2009-2014 regulatory period by examining the major expenditure categories of replacement and augmentation. In undertaking this review, we note that the 2009-2014 regulatory price determination was developed using a top-down approach (total factor productivity approach as opposed to a building blocks approach); hence the expenditure items that were proposed to be undertaken in the current regulatory period were not detailed. The service improvements, performance and efficiencies intended to be addressed with the expenditure were also not detailed on an expenditure item basis and so it is not possible for Parsons Brinckerhoff to assess whether the expenditure has been used to meet the specific network constraints or service levels that they were intended to address. As such, we have focused our review of historical expenditure on the documented prudency and efficiency of individual items of the expenditure, rather than the outcomes achieved.

For augmentation capex, work is driven by both new customer connections and work to address network constraints identified thru the network planning process. We are of the view that although the historical capex has not been well-documented or justified, Power Networks has taken the reasonable course of action to connect customers and to address the network constraints as they have arisen. The utilisation of many of the transmission lines is low[59], however it is apparent that these low utilisation on normal ratings are to account for load transfers in contingency events[60] and to suit the installation of standard 'increments' of capacity, as is normal practice for NSPs.

[59] Power and Water Corporation, 2013, 'Network Management Plan 2011/12 to 2016/17', Appendix B2, p.117

[60] Power and Water Corporation, 2013, 'Network Management Plan 2011/12 to 2016/17', Appendix B2, p.118

For replacement capex, Parsons Brinckerhoff notes that a significant amount of the expenditure was associated with implementing the recommendations of the Davies report[61]. We make reference to our previous report 'Review of Capital and Operating Expenses related to the 2009 Network Price Determination Cost Pass Through Application"[62], which examined the prudency of these works. We found that:

- The scope of some of the works undertaken includes components that have not been justified[63], i.e. no need, related to the Davies report or otherwise, has been documented and there is no evidence that the chosen solution is the most efficient to address the need. Whilst it is possible that the un-justified components of work were required to resolve un-specified constraints, the documentation available did not provide justification of the need to undertake the works.
- The combination of all the spare transformers, switchboards and mobile substations purchased, in the context of other works and the size of the overall network, is excessive[64]. This is reflective of an immature spares and logistics program, which considers the purchase of spares on a case-by-case basis. Parsons Brinckerhoff would expect that a robust spares and logistics framework would take an holistic view of the whole network and consider a fleet of spares to meet the needs across the network.
- The reported capex includes installation of assets for the benefit of the Generation business unit. Parsons Brinckerhoff understands that the Northern Territory Electricity Ring-fencing Code requires costs to be appropriately allocated where a project runs across more than one business unit, and as such notes that some components of the expenditure have not been allocated to the appropriate business unit.

Parsons Brinckerhoff is of the view that the historical expenditure for the 2009-2014 regulatory control period was prudent but not efficient, in that the need for the expenditure has a clear driver but the timing, scoping, allocation of costs and delivery efficiency of the projects and programs could have been improved.

7.2 Network capex - high level review

In its staged submission Power Networks submitted a proposed network capex of $299.333m (real 2013/14) for the 2014-19 regulatory period, which represents 98% of the total proposed capex. A summary of the proposed network capex is set out in Table 7.2.

[61] Davies, 4 February 2009, 'The Independent Enquiry into Casuarina Substation Event and Substation Maintenance across Darwin (Final Report)'

[62] Parsons Brinckerhoff, 26 March 2013, 'Review of Capital and Operating Expenses related to the 2009 Network Price Determination Cost Pass Through Application'

[63] Parsons Brinckerhoff, 26 March 2013, 'Review of Capital and Operating Expenses related to the 2009 Network Price Determination Cost Pass Through Application', Section 6.1.1, p.12

[64] Parsons Brinckerhoff, 26 March 2013, 'Review of Capital and Operating Expenses related to the 2009 Network Price Determination Cost Pass Through Application', Section 6.1.5, p.15-16

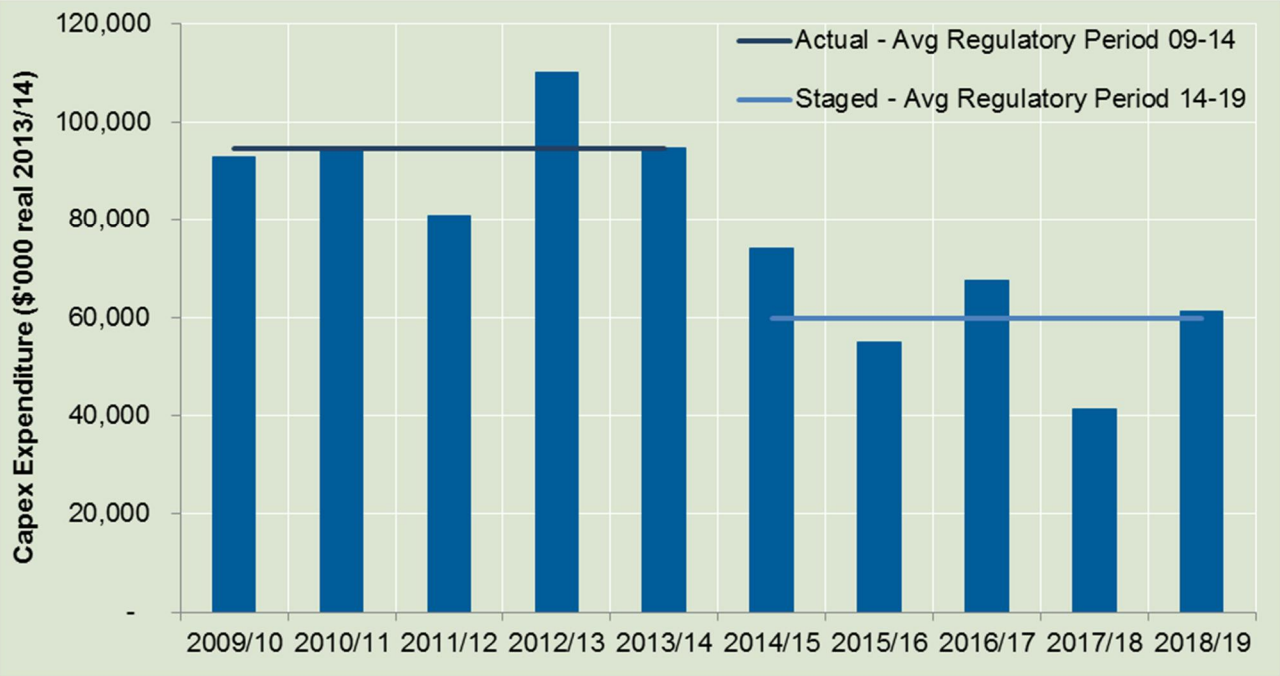
Table 7.2 Network capex overview – Staged submission ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Network User Initiated	11,999	10,241	10,433	24,311	12,241	9,733	10,663	11,162	12,169	16,167
Augmentation	47,320	45,453	20,321	26,999	26,396	8,292	5,881	7,339	11,257	20,095
Replacement	16,739	21,241	37,536	43,312	52,159	51,744	24,446	40,813	15,312	19,124
Reliability and quality of supply	16,363	17,392	12,140	14,899	2,904	3,548	13,308	7,367	1,855	5,132
Compliance	429	442	413	518	1,074	817	812	708	809	778
Total	**92,849**	**94,769**	**80,842**	**110,039**	**94,775**	**74,134**	**55,110**	**67,390**	**41,402**	**61,296**
Regulatory Period	**473,273**					**299,333**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

7.2.1 Trends and comparative analysis

Figure 7-2 shows the historical and forecast network capex from the staged submission and illustrates that the network capex is forecast to decrease by 36.8% in real terms compared with the current regulatory period expenditure of $473.273m (real 2013/14).



Source: Table 7.2

Figure 7-2 Network capex overview– Staged submission ($'000 real 2013/14)

7.2.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed total network capex for this category is shown in Table 7.3 which represents an increase of 3.2% compared to the staged submission.

Table 7.3 Network capex overview – IRP submission ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	74,134	55,110	67,390	41,402	61,296	**299,333**
IRP submission proposed capex	76,601	73,258	56,603	46,827	55,574	**308,863**
Difference	**3.33%**	**32.93%**	**-16.01%**	**13.10%**	**-9.34%**	**3.18%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

7.3 Network user initiated capex

7.3.1 Proposed expenditure

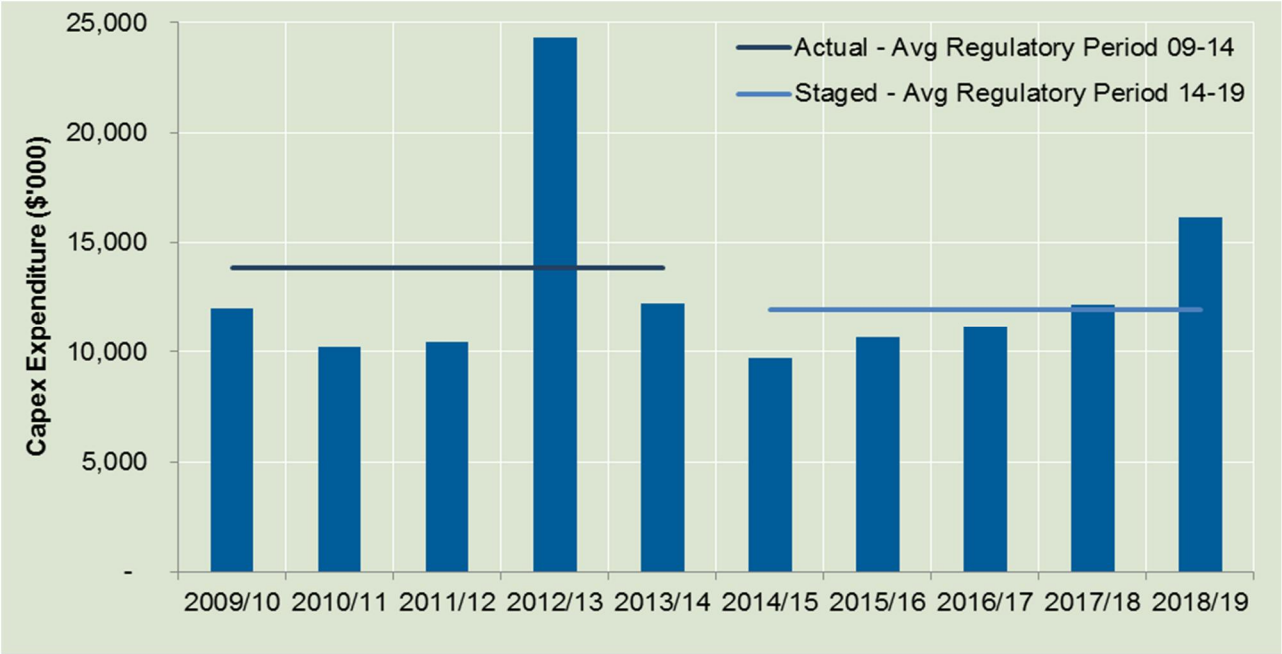
Table 7.4 shows that the staged submission proposed network user initiated capex for the 2014-19 regulatory period is $59.894m.

Table 7.4 Network user initiated capex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Zone Substations	-	-	276	2,610	314	-	-	-	-	-
Distribution Mains	11,723	10,089	9,968	21,421	11,610	9,099	9,729	9,929	10,349	15,182
Metering	276	152	189	280	317	634	934	1,233	1,820	985
Total	**11,999**	**10,241**	**10,433**	**24,311**	**12,241**	**9,733**	**10,663**	**11,162**	**12,169**	**16,167**
Regulatory Period	**69,225**					**59,894**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

Figure 7-3 shows the historical and forecast network user initiated capex. It illustrates that the average network user initiated capex is forecast to decrease by 13.5% in real terms compared with the current regulatory period expenditure of $69.225m. This apparent decrease is mainly due to the absence of the high expenditure levels experienced in 2012/13. Ignoring 2012/13, the average expenditure forecast for the 2014-19 period is only slightly more than for the current period.



Source: Table 7.4

Figure 7-3 Network User Initiated capex – Staged submission ($'000 real 2013/14)

7.3.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.5. This is a reduction of 1.4% compared to the staged submission.

Table 7.5 Network User Initiated IRP capex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	9,733	10,663	11,162	12,169	16,167	**59,894**
IRP submission proposed capex	9,966	10,481	11,204	11,663	15,726	**59,039**
Difference	**2.39%**	**-1.71%**	**0.38%**	**-4.16%**	**-2.73%**	**-1.43%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff notes that the change to the forecast network user initiated capex as set out in the IRP is primarily related to the following matters:

- reduction of expenditure of Sub8276 NT Wide (Regulated Network) Meters/Metering Program
- reduction and forward loading of expenditure of Sub8272 NT Wide (Regulated Network) Customer Augmentation and Network Extension Program
- an updated escalator[65] applied to the real 2012/13 forecast cost estimate.

[65] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

7.3.3 Network user initiated capex drivers

This section provides a brief review of the customer connection forecast as the primary cost driver of the forecast network user initiated capex.

As briefly discussed in section 6, Power Networks' customer connection forecast is developed using similar techniques to the demand forecasts; specifically least squares regression and adjustments based on expert judgement to account for factors that impact on customer number growth (e.g. forward economic conditions, etc.). Further specific details of this forecast can be found in the 'Internal Memo Re: Customer Connections Forecast'[66].

In section 6, we set out the review of Power Networks' forecasting methodology and found that the methodology is not reasonably transparent or repeatable as details of the expert judgements employed are not clearly documented, i.e. what specific judgements have been applied, their rationale, and the impacts on the forecast. In addition, we noted an upward bias exhibited in the demand forecasts, and also found that it is not possible to objectively assess if there has been appropriate incorporation of key drivers of demand and exclusion of spurious drivers in Power Networks' forecasting process. Based on these findings we concluded that Power Networks' demand forecasts are biased and overestimated, hence we could not conclude that these forecasts are reasonable. With regards to Power Networks' customer connection forecast, Parsons Brinckerhoff notes that similar observations can be made, as this forecast is also subject to adjustments based on expert judgements that are not clearly documented.

Parsons Brinckerhoff notes that the Australian Bureau of Statistics (ABS) demographics data shows that the population of the Northern Territory grew by 4,297 persons per annum on average across the five years from 2007/08 to 2011/12[67]. Over the forecast period from 2011 to 2021, the ABS is projecting a population increase of 3,600 persons per annum on average[68]; a reduction in population growth of about 16% on average. In contrast, analysis of Power Networks' customer connection forecast shows that over the five years from 2008/09 to 2012/13 Power Networks connected 1,718 customers per annum on average. However, over the five years of the forecast period (2014/15 to 2018/19) Power Networks is forecasting the connection of 2,075 customers per annum on average; a 21% increase over the historical average. Based on these numbers, historically there was one connection made for each 2.5 persons, while Power Networks' forecast reflects one connection made for each 1.7 persons; an average 31% change in this ratio over five years. While an increase in the average number of customers connecting per annum might be reasonable, the basis for the significant increase in annual average connections and the implied connections per head of population has not been demonstrated by Power Networks. Consequently, we are of the opinion that Power Networks' customer connection forecasts are biased and overestimated; hence we cannot conclude that this forecast is reasonable.

While the development of a customer connection forecast is not within Parsons Brinckerhoff's scope, we are nonetheless of the opinion that such a forecast should reflect the expected growth in population as a key driver of connection numbers as well as the related economic conditions. From our analysis, we are of the opinion that Power Networks' customer connection forecast does not reflect a reasonable expectation of future growth. Given that the ABS expects the projected rate of population growth to reduce from 4,297 persons to 3,600 persons on average over the forecast period; in our view it is more likely that the growth in forecast connections will be closer to historical averages. Consequently, even where the ABS's expected reduction in population growth is ignored, in our opinion we would anticipate that the forecast of customer connections for the 2014/15 to 2018/19[69] period would about 1,700 connections per annum on average. That

[66] Power and Water Corporation, 19 June 2013, 'Internal Memo Re: Customer Connections Forecast'

[67] Australian Bureau of Statistics, 26 September 2013, '3101.0, March quarter 2013, Australian Demographic Statistics', p. 14

[68] Australian Bureau of Statistics, 26 September 2013, '3101.0, March quarter 2013, Australian Demographic Statistics', p. 25, series B (medium) projection

[69] Power and Water Corporation, 2013, 'Customer Connections Forecast Model', 2008/09 – 2012/13

is, we are of the view that a reasonable forecast is more likely to reflect numbers in the order of 1,700 connections per annum on average as opposed to Power Networks' 2075 annual average number of connections.

In addition to the above observations, Parsons Brinckerhoff also notes that Power Networks' customer connection forecast does not consider the various types of customer connections. That is, there is one forecast that incorporates all customer connection types into one overall number of customer connections.This approach not account for the mix of customer types and hence the associated mix of connection types (e.g. small commercial, large commercial, industrial, residential, etc.). As connection cost varies considerably by connection type, forecasting the total number of connections does not allow the mix of customer connection types to be reflected into the network user initiated capex forecast and introduces additional variance into the forecast's unit cost estimate. Additionally, Power Networks' forecast network user initiated capex does not reflect changes in the mix of customer types that arise as the economy and local demographics change. In our opinion this introduces further uncertainty into the network user initiated capex forecast. The implications of this on the capex forecasts are considered further in the following sections:

- Section 7.3.4.1 Sub8272 - Customer Augmentation and Network Extension Program
- Section 7.3.5 Findings and recommendations
- Section 7.5.4.6 Sub8276 - Meters/Metering Program.

7.3.4 Specific reviews

In relation to the $59.894m network user initiated capex, Parsons Brinckerhoff sought to examine a range of planning documentation (e.g. business cases, board papers, etc.) in order to establish Power Networks' justification for the proposed expenditure forecasts. In our opinion, in demonstrating the prudency and efficiency of proposed expenditure it is essential to demonstrate both the need and timing of the proposed capex, as well as a consideration of options, selection of the most efficient option, and the relationship of the scope of proposed works to the identified need. To support this demonstration Parsons Brinckerhoff would expect that robust business cases (or similar documentation) would be available for projects/programs at least in the earlier years of the forecast period, while later years may have preliminary business cases (or similar documentation) as the basis of demonstrating the prudency and efficiency of proposed expenditure.

To undertake this review, Parsons Brinckerhoff considered the supporting documentation for the largest network user initiated capex projects; specifically:

- Sub8272 - Customer Augmentation and Network Extension Program (66% of network user initiated capex)

In addition to these project reviews, in our reviews of Power Networks other capex categories Parsons Brinckerhoff also undertook further specific reviews of the following projects with network user initiated capex components:

- Sub8276 - Meters/Metering Program (9% of network user initiated capex) – refer Section 7.5.4.6.

The following section sets out Parsons Brinckerhoff's review of the largest network user initiated capex projects noted above.

7.3.4.1 Sub8272 - Customer Augmentation and Network Extension Program

Power Networks is forecasting capex to construct assets where customers seek network extensions and upgrades in accordance with Power Networks' Distribution System Extension Policy and Power Networks Capital Contributions Policy. No specific quantity or type of work has been forecast.

To address these requirements, Power Networks is proposing a program of works at the cost set out in Table 7.6. The forecast cost of this project represents 66% of the proposed network user initiated capex.

Table 7.6 Staged submission forecast expenditure for Sub8272 - Customer Augmentation and Network Extension Program ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Customer	7,145	7,775	7,985	8,300	8,510	**39,715**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Customer Augmentation and Network Extension Program Power Networks submitted the following documentation:

- Business Need Identification - Power Networks Customer Augmentation/Network Extension Program
- 2014 NPD: Stage 3 - RIN Instructions Section 7 New Network User Connections and Contributions
- Letter to UC – Distribution System Extension Policy (DESP)
- 2009 Networks Regulatory Reset - Capital Contributions Policy 1 July 2009 to 30 June 2014
- Power Networks Capital Contributions Policy Effective From 1 July 2013[70]
- PB Issue 41(d) - Power Networks Customer Augmentation Network Extension Program - Revised Capex Forecasts.XLS
- Customer Augmentation and Network Extension MNW Program 2012/13 Total.XLS

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

Power Networks has advised that the forecast expenditure is based on historical expenditure adjusted for changes in the capital contributions policy that take effect during the forecast period. The capex forecast was derived by scaling historical expenditure by a growth factor. Parsons Brinckerhoff was unable to determine the correlation between this growth factor and the factor that has been used to forecast customer connections to account for economic and social impacts (see section 7.3.3). Power Networks addressed the alignment of these two growth factors in the IRP submission.

In its network user initiated capex forecast, Power Networks made adjustments to account for the implementation of the new capital contributions policy[71]. Power Networks forecast these adjustments by applying the new capital contributions policy to historical data for 2012/13 to identify the policy's impact. It then removed this amount from the forecast as a step change in 2014/15. We note that the policy title suggests that it is effective from July 2013, which should result in the step change occurring in 2013/14 rather than 2014/15; however, we note that the Policy will actually take effect 1 July 2014, following legal advice that the Code requires the Commission to approve this at the start of each regulatory control period for use during that regulatory period, and that the Commission is not authorised to approve a revised version within the regulatory period. Accordingly the existing policy (listed immediately above) remains in effect until 30 June 2014. Consultation on and approval of the new policy will form part of the 2014 NPD. This does not affect the proposed expenditure for the 2014-19 regulatory period. We are of the opinion that an adjustment based on more than one year's data would have produced a more accurate forecast. Nonetheless, Parsons Brinckerhoff is of the view that Power Networks has made a reasonable estimation of the impact of the new policy.

[70] Contrary to the document title, we note that the Policy will take effect 1 July 2014

[71] Power and Water Corporation, 2013, 'Power Networks Capital Contributions Policy Effective From 1 July 2013'

Parsons Brinckerhoff noted that the forecast expenditure for this program was based on a forecast for 2013/14 which is an average of actual expenditure data for 2008/09 to 2011/12 and an estimate of expenditure for 2012/13. In response to our enquiries Power Networks provided the actual cost of the program for the 2012/13 financial year[72]. The actual cost was significantly less than the estimated cost. The forecast cost was higher than the previous 3 year trend, and the actual was much lower than the previous 3 year trend. Power Networks provided no explanation for the variation between the forecast and the actual cost for 2012/13. Given the historical expenditure is a primary driver of the forecast expenditure, Parsons Brinckerhoff recommends that the Customer Augmentation and Network Extension Program is adjusted to reflect the actual 2012/13 cost.

As Power Networks is obligated to provide customer connections, Parsons Brinckerhoff is of the opinion that expenditure associated with Power Networks' Customer Augmentation and Network Extension Program is prudent. However, as we are of the opinion that Power Networks' capex forecast for this program is biased and overestimated, we are of the view that the proposed capex forecast is not efficient. Hence we recommend the adjustments set out in Table 7.8.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.7. This is a reduction of 0.8% compared to the staged submission.

Power Networks has explained that the changes to the program are due to a calculation error in the staged submission[73]. Parsons Brinckerhoff has identified that the changes are:

- alignment of the growth multiplier with the Power Networks forecast growth in customer connection
- an updated escalator[74] applied to the real 2012/13 forecast cost estimate.

This change addresses Parsons Brinckerhoff's finding that the growth factors used did not align with the new customer connections in the staged submission. Parsons Brinckerhoff notes that there is a rounding error of 1% in the IRP submission.

Table 7.7 IRP forecast expenditure for Sub8272 - Customer Augmentation and Network Extension Program ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Customer	7,460	7,670	7,880	8,090	8,300	39,400
Total	**7,460**	**7,670**	**7,880**	**8,090**	**8,300**	**39,400**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

In our review of the customer connections forecast set out in section 7.3.3, we concluded that the customer connection forecast is overstated and found that the average annual number of new connections over the forecast period was more likely to reflect the historical average. Given this forecast is a primary driver of this

[72] Power and Water Corporation, 2013, 'Customer Augmentation and Network Extension MNW Program 2012-13 Total.XLS"

[73] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Customer Augmentation/Network Extension Program', Section 1, p.2

[74] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

expenditure, Parsons Brinckerhoff recommends that the Customer Augmentation and Network Extension Program is adjusted to reflect our conclusions regarding Power Networks' customer connection forecast.

Parsons Brinckerhoff has revised the capex forecast utilising Power Networks' forecasting methodology, the actual cost for 2012/13 and our conclusions regarding Power Networks' customer connection forecast as noted above. As a result of this revised forecast, Parsons Brinckerhoff recommends the adjustments set out in Table 7.8.

Recommendations

The adjustments shown in Table 7.8 are recommended in respect of the forecast capex for the 2014/15-18/19 period. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

Table 7.8 Recommended capex adjustments – Customer Augmentation and Network Extension Program ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**7,145**	**7,775**	**7,985**	**8,300**	**8,510**	**39,715**
IRP proposed capex	**7,460**	**7,670**	**7,880**	**8,090**	**8,300**	**39,400**
Adjusted customer connections and unit costs	(982)	(1,192)	(1,402)	(1,613)	(1,823)	(7,012)
Recommended adjustment to IRP proposed capex	**(982)**	**(1,192)**	**(1,402)**	**(1,613)**	**(1,823)**	**(7,012)**
Adjustment - Customer component	(982)	(1,192)	(1,402)	(1,613)	(1,823)	(7,012)
Recommended capex	**6,478**	**6,478**	**6,478**	**6,478**	**6,478**	**32,388**

Source: Parsons Brinckerhoff analysis

7.3.5 Findings and recommendations

Parsons Brinckerhoff has undertaken a specific detailed review of a user initiated capex project and has recommended the reduction of the Customer Augmentation and Network Extension Program (Sub8272). These recommendations reflect the findings of our specific review and in particular our view that Power Networks' customer connections forecast is overstated.

While not subject to a detailed review, we note that the forecast expenditure of the Customer Connection Program (Sub8275) is also impacted by our conclusions in regards to Power Networks' customer connections forecasting practices (refer to 7.3.3). Consequently we recommend an adjustment to the capex associated with the Customer Connections Program to account for the overestimate.

Additionally, in our review of PWC's proposed replacement capex (see section 7.5), we make a number of recommendations that impact PWC's proposed network user initiated capex in regards to the reduction in expenditure of Sub8276 - Meters/Metering Program (see section 7.5.4.6). For further details of these recommendations reference should be made to our review of Power Networks' replacement capex in section 7.5.

Parsons Brinckerhoff recommends that network user initiated capex for the 2014-19 regulatory period is $50.752m as shown in Table 7.9. This recommendation reduces the network user initiated capex by 14.0% in real terms compared with the IRP proposed expenditure of $59.039.

Table 7.9 Recommended Network user initiated capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	9,733	10,663	11,162	12,169	16,167
IRP submission proposed capex	9,966	10,481	11,204	11,663	15,726
Reduction of Customer Augmentation Program	(982)	(1,192)	(1,402)	(1,613)	(1,823)
Reduction of Customer Connection Program	(120)	(143)	(161)	(180)	(199)
Reduction of Metering Program	(47)	(81)	(107)	(141)	(97)
Recommended adjustment to IRP proposed capex	**(1,148)**	**(1,416)**	**(1,671)**	**(1,934)**	**(2,118)**
Recommended capex	**8,818**	**9,065**	**9,533**	**9,729**	**13,608**
Regulatory Period	**50,752**				

Source: Parsons Brinckerhoff analysis

7.4 Augmentation capex

7.4.1 Proposed expenditure

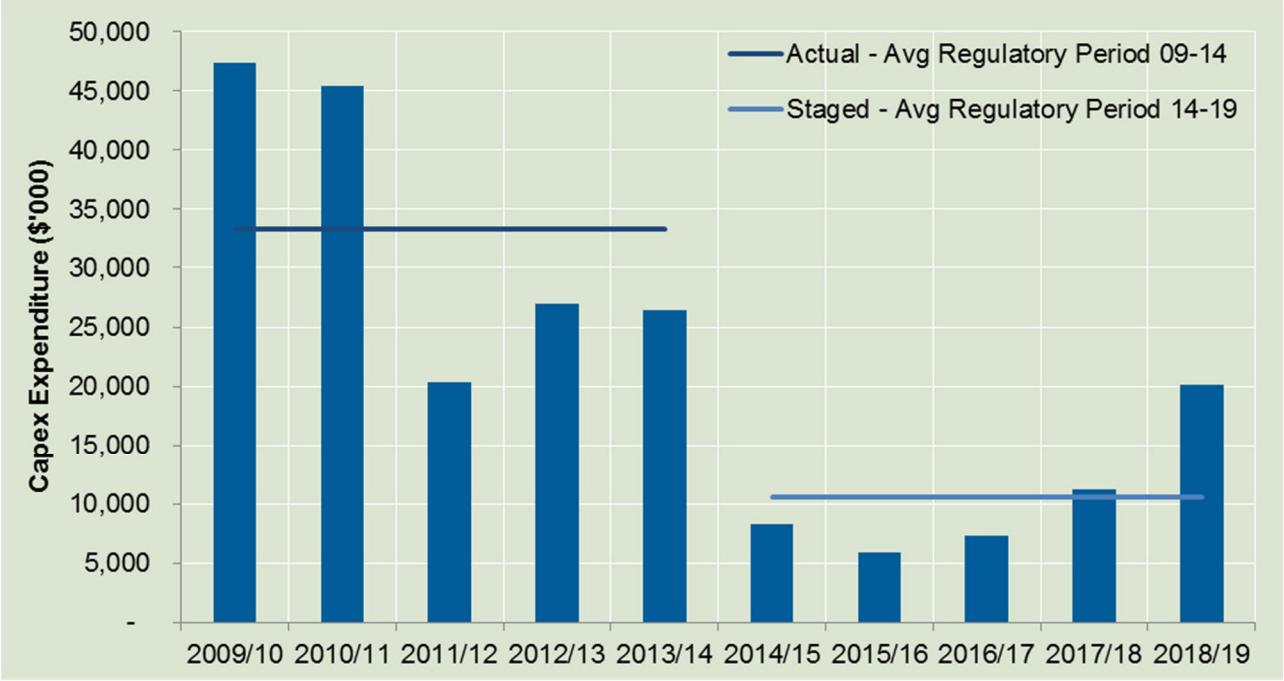
Table 7.10 shows the network augmentation capex for the 2014-19 regulatory period of $52.886m as proposed in the staged submission.

Table 7.10 Augmentation capex overview – staged submission ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission terminal station	8,188	9,311	1,651	-	-	-	-	-	-	-
Zone substations	20,071	20,134	11,930	19,460	21,254	5,908	4,602	5,825	3,974	15,478
Transmission lines	17,333	15,778	6,229	3,703	2,691	1,360	1,280	1,514	7,283	4,617
Distribution mains	1,728	230	511	3,836	2,451	1,024	-	-	-	-
Distribution substations	-	-	-	-	-	-	-	-	-	-
Metering	-	-	-	-	-	-	-	-	-	-
Land and easements	-	-	-	-	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Total	**47,320**	**45,453**	**20,321**	**26,999**	**26,396**	**8,292**	**5,881**	**7,339**	**11,257**	**20,095**
Regulatory Period	**166,488**					**52,866**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

The historical and forecast network augmentation capex from the staged submission is illustrated in Figure 7-4, which shows that the network augmentation capex is forecast to decrease by 68.2% in real terms compared with the current regulatory period expenditure of $166.488m. The high expenditure in 2009/10 and 2010/11 is predominantly because of a single large project[75].The quantity of Augmentation expenditure is directly linked to growth in area demands and asset utilisation, as discussed in section 7.4.3.



Source: Table 7.10

Figure 7-4 Augmentation capex– Staged submission ($'000 real 2013/14)

7.4.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.11. The IRP augmentation capex represents an increase of 2.6% compared to the staged submission.

Table 7.11 Augmentation IRP capex overview – IRP submission ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	8,292	5,881	7,339	11,257	20,095	**52,866**
IRP submission proposed capex	13,694	16,635	8,171	308	15,457	**54,264**
Difference	**65.13%**	**182.84%**	**11.33%**	**-97.26%**	**-23.08%**	**2.65%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff notes that the change to the forecast augmentation capex as set out in the IRP are primarily related to the following matters:

- Deferral by one year of PRA30730 Alice Springs: Brewer to Sadadeen 22kV Express Feeder
- Deferral by one year of initial stage of PRA30750 Alice Springs: Lovegrove Transformer 1 & 2 Upgrade

[75] PRA32000 (previously PXA32000)Alice Springs: Owen Springs to Lovegrove Network

- Bringing forward two years PRD30511 Darwin: Palmerston ZSS Third Transformer
- Changing the forecast expenditure profile and bringing forward PRD30513 Darwin: Construct Archer - Palmerston 66kV line
- Increased cost and delay of expenditure of PRD30117 Darwin: Replace McMinns 66/22kV ZSS
- Reduction of expenditure of PRD30309 Darwin: Construct East Arm ZSS
- Increased cost and forward loading of expenditure of Sub8274 NT Wide (Regulated Network) Asset Replacement and Upgrade Programs
- an updated escalator[76] applied to the real 2012/13 forecast cost estimate.

7.4.3 Augmentation capex drivers

The primary driver of the augmentation capex forecast proposed by Power Networks is the demand forecasts that demonstrate the expected demand of the forecast period and hence support the need and timing of the proposed capex. Parsons Brinckerhoff has undertaken a review of Power Networks' demand forecasting practices and is of the opinion that the demand forecasts are biased and overstated (refer section 6).Consequently we are unable to conclude that Power Networks' demand forecasts are reasonable. Furthermore, we are of the view that the bias in Power Networks' demand forecasts is approximately three years in the mid to latter years of the forecast period, with lesser bias in the early to mid-years of the forecast period. As Power Networks' demand forecasts are the primary driver of the proposed augmentation capex, we have taken our conclusions in relation to the forecasts into account in undertaking the specific reviews set out below and in our recommendations concerning PWC's proposed augmentation capex.

Further to the expected demand, the utilisation of existing assets drives the need to undertake augmentation works. Power Networks uses the utilisation factor of the transmission elements of the network to determine the capacity constraints in normal operation and in contingency events. Parsons Brinckerhoff has undertaken a review of Power Networks' asset utilisation forecasting practices, through examination of specific examples[77] and discussions with PWC staff, and is of the view that the approach taken by Power Networks is appropriate to optimise the utilisation of substation and transmission assets, whilst ensuring that security of supply is maintained.

7.4.4 Specific reviews

In relation to the $52.866m augmentation capex, Parsons Brinckerhoff sought to examine a range of planning documentation (e.g. business cases, board papers, etc.) in order to establish Power Networks' justification for the proposed expenditure forecasts. In our opinion, in demonstrating the prudency and efficiency of proposed expenditure it is essential to demonstrate both the need and timing of the proposed capex, as well as a consideration of options, selection of the most efficient option, and the relationship of the scope of proposed works to the identified need. To support this demonstration Parsons Brinckerhoff would expect that robust business cases (or similar documentation) would be available for projects/programs at least in the earlier years of the forecast period, while later years may have preliminary business cases (or similar documentation) as the basis of demonstrating the prudency and efficiency of proposed expenditure.

To undertake this review, Parsons Brinckerhoff considered the supporting documentation for the two largest augmentation capex projects; specifically:

[76] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

[77] Power and Water Corporation, 2013, 'Network Management Plan 2011/12 to 2016/17', Appendix B2, p.117 -118

- PRD30309 – Darwin – Construct East Arm Zone Substation (30% of augmentation capex).
- PRD30513 – Darwin – Construct Archer to Palmerston 66kV Line (24% of augmentation capex).

In addition to these project reviews, in our reviews of Power Networks other capex categories Parsons Brinckerhoff also undertook further specific reviews of the following projects with augmentation capex components:

- PRD30117 - Darwin: Replace McMinns 66/22kV Zone Substation (6% of augmentation capex) – refer to Section 7.5.4.2 for details of this review
- PRD30402 - Darwin: Replace Berrimah ZSS (16% of augmentation capex) – refer to Section 7.5.4.3 for details of this review
- Sub8274 - Asset Replacement and Upgrade Programs (6% of augmentation capex) – refer to Section 7.5.4.5 for details of this review.

The following sections set out Parsons Brinckerhoff's review of each of the two largest augmentation capex projects noted above.

7.4.4.1 PRD30309 – Darwin – Construct East Arm Zone Substation

The East Arm area is supplied by Berrimah ZSS with standby supply from Palmerston ZSS. Power Networks' demand forecast for this area reflects an expected growth rate of 720 kVA per year[78], but also notes that there may be additional unidentified spot loads of 1 to 2 MVA with no related timing that impact the forecast[79]. Based on this forecast, Power Networks expects Berrimah ZSS to exceed its firm capacity of 38.1 MVA in 2014/15[80], and Palmerston ZSS to exceed its firm capacity of 38 MVA in 2015/16[81].

The East Arm Business Need Identification (BNI) outlines an additional constraint on the 11kV feeders that results in quality of supply issues (i.e. under voltage) under contingency conditions[82]. During discussions with the business, Power Networks confirmed that it is the quality of supply issue that is driving the timing of the overall investment. Power Networks is proposing to undertake preliminary design immediately, with construction to be staged for completion in 2019/20.

To address the unspecified total forecast load at risk in 2014/15, Power Networks is proposing to construct a new East Arm ZSS at the cost set out in Table 7.12. The forecast cost of this project represents 30% of the total proposed augmentation capex.

[78] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 2.2.2, p. 7

[79] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 2.2.2, p. 7

[80] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 2.3, p. 8

[81] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 2.3, p. 8

[82] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation', Section 2, p. 3

Table 7.12 East Arm Zone Substation – staged submission forecast expenditure ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Augmentation	2,343	-	-	-	13,387	15,729
Reliability	586	-	-	-	3,347	3,932
Total	**2,928**	**-**	**-**	**-**	**16,733**	**19,662**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the East Arm ZSS Power Networks submitted the following documentation:

- Business Need Identification PRD30309 - Darwin East Arm Zone Substation
- Response to Issue 27 – PRD30309 – Darwin – Construct East Arm Zone Substation
- Demand Forecast for Berrimah ZSS 2012/13 (BERRIMAH ZSS MD FORECAST 2012/13.XLS).

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

We note that the East Arm ZSS is scheduled for completion in 2019/20[83] which is five years later than expected under Power Networks' Berrimah ZSS demand forecast. Power Networks advised that the installation of a 10 MVA Nomad skid mounted substation has been planned for early in the regulatory period as part of the scope of this project, and that this additional capacity addresses the quality of supply and the forecast capacity constraint until 2019/20. In addition to the 10 MVA Nomad substation we also note that the proposed replacement of Berrimah ZSS will provide an additional 16 MVA of capacity in 2016/17 (see section 7.5.4.3).

In our review of Power Networks' demand forecasting practices in section 6 we concluded that Power Networks' demand forecasts are likely to be overstated by approximately three years, particularly in the mid to latter years of the forecast period. Consequently, as Power Networks has forecast the constraints on Berrimah ZSS and Palmerston ZSS to occur in the early years of the forecast period, we are of the view that this timing is at least one to two years too early. Moreover, with load growth in the area of 720 kVA per year, and given the 10 MVA of additional capacity proposed in 2014/15 from the installation of the Nomad substation, Parsons Brinckerhoff is of the opinion that the timing of the constraint on Berrimah ZSS is more likely to be post 2024[84].

In its BNI[85] document, Power Networks has identified four options it considers address the demand driven constraint and provided cost estimates for these options[86]. In considering the options, Power Networks did not consider demand management to be practical due to the large size of the expected shortfall in capacity

[83] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation', Section 8.1, p. 6

[84] The capacity of Berrimah ZSS will be increased to 54MVA. The demand forecast for Berrimah ZSS in 2024 is below 50MVA according the graph shown in Demand Forecast for Berrimah ZSS 2012/13 (BERRIMAH ZSS MD FORECAST 2012-13.XLS)

[85] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 3, p. 10

[86] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Appendix G, p. 31

(10 MW)[87]. Parsons Brinckerhoff notes that the proposed works have not been scoped[88], however, Power Networks has selected the highest cost network option as the preferred solution based on the assumption that it will be necessary in the long term to construct a zone substation in the area[89]. Furthermore Power Networks states that a "Feasibility study will be conducted to consider the least cost solution including a staged/deferred works program, potentially using temporary works for a period[90] (i.e. the Nomad substation). It is understood that this feasibility study to identify the least cost solution and potential deferral of the works will not be undertaken until after the 2014/15 – 2018/9 regulatory determination.

Based on our review of the information provided, we are of the opinion that the proposed installation of the Nomad substation is prudent at the 2014/15 timing proposed as it occurs very early in the forecast period. In addition, while we would expect a reasonably detailed estimate for proposed expenditure in the early years of the forecast period, and despite the lack of such an estimate, we are nonetheless of the view that the forecast expenditure is likely to be efficient. However, given that we are of the view that the demand forecast is overstated by three years towards the later part of the forecast period, that the proposed works have not been reasonably scoped, and that the highest cost network solution has been selected with a yet to be undertaken feasibility study that will identify a least cost solution and potential deferral, we are of the opinion that Power Networks has not demonstrated the prudency or efficiency of the proposed East Arm ZSS prior to 2018/19. Consequently, based on our analysis of the information provided as well as the demand forecast we recommend the deferral of the East Arm ZSS until post 2024.

Initial Regulatory Proposal

Subsequent to our review of Power Networks' staged submission, Parsons Brinckerhoff has reviewed the revisions in Power Networks' IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.13 and represents a reduction of 4.7% on the staged submission forecast.

Table 7.13 East Arm Zone Substation - IRP submission forecast expenditure ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Augmentation	1,914	-	-	-	13,068	14,982
Reliability	479	-	-	-	3,267	3,746
Total	**2,393**	**-**	**-**	**-**	**16,335**	**18,728**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Power Networks has explained that the changes to this program are due to updated costs provided by an options study[91]. The further difference in the forecast costs is due to the application of an updated escalator[92]

[87] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix A, Section 6.5.7(a), p. 8

[88] Power and Water Corporation, 2013, 'Response to Issue 27 – PRD30309 – Darwin – Construct East Arm Zone Substation', Section d.ii

[89] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 4, p. 12

[90] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation', Appendix A, Clause 6.5.7(c)(2), p.9

[91] Power and Water Corporation, August 2013, 'Business Need Identification PRD30309 - Revised Darwin East Arm Zone Substation', Section 8, p. 6

[92] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

applied to the real 2012/13 forecast cost estimate.. Hence these changes do not impact on Parsons Brinckerhoff's review of this project.

Recommendations

Based on our review of this project Parsons Brinckerhoff recommends the adjustments to the forecast capex for the 2014/15-18/19 period shown in Table 7.14. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

Table 7.14 Recommended capex adjustments – East Arm Zone Substation ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**2,928**	**-**	**-**	**-**	**16,733**	**19,661**
IRP proposed capex	**2,393**	**-**	**-**	**-**	**16,335**	**18,728**
Deferral of East Arm	(2,393)	-	-	-	(16,335)	(18,728)
Installation of Nomad	6,750[93]					6,750
Recommended adjustment to IRP proposed capex	**4,357**	**-**	**-**	**-**	**(16,335)**	**(11,978)**
Adjustment - Augmentation component	3,486	-	-	-	(13,068)	(9,582)
Adjustment - Reliability component	871	-	-	-	(3,267)	(2,396)
Recommended capex	**6,750**	**-**	**-**	**-**	**-**	**6,750**

Source: Parsons Brinckerhoff analysis

7.4.4.2 PRD30513 – Darwin – Construct Archer to Palmerston 66kV Line

Power Networks' demand forecast for the Palmerston, McMinns and Humpty Doo area reflects an expected growth rate of 3.23%[94]. Based on this demand forecast Power Networks expects the Weddell to McMinns 66kV line to exceed its thermal capacity in 2016/17 with the loss of the Hudson Creek to Palmerston line, and the Hudson Creek to Palmerston 66kV line to exceed its thermal capacity with the loss of the Weddell to McMinns line in 2017/18[95].

To address the 89 MW forecast load at risk in 2016/17 under this credible contingency scenario, Power Networks is proposing to construct a new 66kV line form Archer to Palmerston at the cost set out in Table 7.15. The forecast cost of this project represents 24% of the total proposed augmentation capex.

Table 7.15 Archer to Palmerston 66kV Line - staged submission forecast expenditure ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Augmentation	213	320	1,066	6,931	4,265	12, 796

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Archer to Palmerston 66kV Line Power Networks submitted the following documentation:

[93] Power and Water Corporation, 17 May 2013, 'Business Need Identification PRD30309 - Darwin East Arm Zone Substation ', Appendix B, Section 3.5, p. 12

[94] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line', Section 2, p. 3

[95] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line', Section 2, p. 4

- Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line
- Response to Issue 28 – PRD30513 – Darwin – Construct Archer to Palmerston 66kV Line
- Network Performance Report – Proposal to Mitigate Hudson Creek – Palmerston Line Overloading
- Preliminary Project Implementation Assessment - PRD30513 Construct Archer to Palmerston 66kV line
- PRD30513 Construct Archer - Palmerston 66kV line - Initial Project Estimate.XLS

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

We note that the Archer to Palmerston 66kV Line is scheduled for completion in 2019/20[96] which is three years later than expected under Power Networks' demand forecast. Power Networks has advised that it has deferred this project for three years to match resources to the proposed works program and is of the view that this project is forecast too early as the demand forecast is likely to be an overestimate. Based on our review of Power Networks' demand forecasting practices (see section 6), Parsons Brinkerhoff is of the view that the timing of this constraint is more likely 2019/20 and hence Power Networks' deferred timing seems reasonable.

In its BNI[97] Power Networks' has set out the options considered to address the identified demand driven constraint and has selected as the preferred solution the least cost technically feasible option[98]. In considering the options, Power Networks' has dismissed demand management as not practical describing it as "… unlikely to be economically feasible …"[99], noting that the solution needs to be produced for less than $380/kW[100] to be cost effective.

Parsons Brinckerhoff notes that the proposed scope of the preferred option includes 5.2km of overhead transmission line that utilises an existing double circuit tower line, and 6.4km of underground cabling that in new underground conduits[101]. Whilst cost estimates have not been provided for each of the options considered, Parsons Brinckerhoff considers that the proposed shorter route length utilising existing towers[102] is likely to be the more efficient option of those identified. In addition, we are also of the opinion the scope addresses the identified need.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the Archer to Palmerston 66kV Line is prudent when commissioned in 2019/20, and that the forecast capex proposed is likely to be efficient with this timing.

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96 Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line', Section 5, p. 6

97 Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line'

98 Power and Water Corporation, April 2013, 'Network Performance Report – Proposal to Mitigate Hudson Creek – Palmerston Line Overloading', p. 7

99 Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line', Section 3, p. 5

100 Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30513 - Darwin - Construct Archer to Palmerston 66kV Line', Section 3, p. 5

101 In examining the Initial Project Estimate (Power and Water Corporation, 2013, 'PRD30513 Construct Archer - Palmerston 66kV line - Initial Project Estimate') we note that an unsubstantiated upward rounding of 1% has been applied.

102 Power and Water Corporation, April 2013, 'Network Performance Report – Proposal to Mitigate Hudson Creek – Palmerston Line Overloading', p. 6

Initial Regulatory Proposal

Subsequent to our review of Power Networks' staged submission, Parsons Brinckerhoff has reviewed the revisions in Power Networks' IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.16 and represents a reduction of 2.3% on the staged submission forecast.

Table 7.16 Archer to Palmerston 66kV Line – IRP forecast expenditure ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Augmentation	4,553	7,942	-	-	-	12,496

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Power Networks has explained that the changes to the program are due to changes in the forecast maximum demand[103]. Parsons Brinckerhoff notes that Power Networks' has revised its forecast such that the constraint is now forecast to occur in 2013/14, and Power Networks has again deferred the project stating in relation to the forecast that "…some of these developments have been delayed and experience has shown that peak demand information provided by developers is usually above actual demand. On this basis, the timing of the requirement for a new transmission line has been adjusted to 2015/16[104]; a deferral of two years from the revised forecast timing. Hence in the two months between the original BNI and the revised BNI, Power Networks' revisions have resulted in the constraint timing moving forward by three years and the project timing moving forward by four years. As discussed in section 6, we are of the opinion that such changes reflect the significant uncertainty inherent in Power Networks' forecasting practices, the expert judgement applied, and that it demonstrates that Power Networks' demand forecasts cannot be relied upon to reasonably support the timing of demand driven capex. Moreover, in our review of Power Networks' demand forecast we also concluded that in our opinion Power Networks' forecasts are likely to be overstated by about 3 years, particularly from the mid to latter years of the forecast period.

Given that we consider Power Networks' forecasts to contain significant uncertainty, that they are likely to be overstated by 3 years, and cannot be relied upon to reasonably demonstrate the timing of proposed capex, we are of the opinion the revised forecast for this project should be rejected. Consequently, we recommend that the original timing of the capex forecast for this project is retained. Hence, we remain of the opinion that the proposed capital expenditure associated with the Archer to Palmerston 66kV Line is prudent when commissioned in 2019/20, and that the forecast capex proposed is likely to be efficient with this same timing.

Recommendations

Based on our review of this project Parsons Brinckerhoff recommends the adjustments to the forecast capex for the 2014/15 to 2018/19 period shown in Table 7.17. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

[103] Power and Water Corporation, August 2013, 'Business Need Identification PRD30513 - Revised Darwin - Construct Archer to Palmerston 66kV Line', Section 1, p. 2

[104] Power and Water Corporation, 17 June 2013 (August 2013), 'Business Need Identification PRD30513 - Revised Darwin - Construct Archer to Palmerston 66kV Line', p. 4

Table 7.17 Recommended capex adjustments – Archer to Palmerston 66kV Line ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**213**	**320**	**1,066**	**6,931**	**4,265**	**12,796**
IRP proposed capex	**4,553**	**7,942**	**-**	**-**	**-**	**12,496**
Timing	(4,340)	(7,622)	1,066	6,931	4,265	300
Recommended adjustment to IRP proposed capex	**(4,340)**	**(7,622)**	**1,066**	**6,931**	**4,265**	**300**
Adjustment - Augmentation component	(4,340)	(7,622)	1,066	6,931	4,265	300
Recommended capex	**213**	**320**	**1,066**	**6,931**	**4,265**	**12,796**

Source: Parsons Brinckerhoff analysis

7.4.5 Findings and recommendations

Parsons Brinckerhoff has undertaken a number of specific detailed reviews of augmentation capex projects and has recommended the deferral of the capex associated with the Darwin East Arm Zone Substation project (PRD30309 – see section 7.4.4.1) and the Archer to Palmerston 66kV Line (PRD30513 – see section 7.4.4.2). These recommendations reflect the findings of our specific reviews and in particular our view that Power Networks' demand forecasts are overstated by 3 years in the mid to latter years of the forecast period (see section 6).

While not subject to a detailed review, we note that the timing of the Lovegrove Transformer Upgrade (PRA30750), forecast for completion in the last year of the regulatory period, is also impacted by our conclusions in regards to Power Networks' demand forecasting practices. Consequently we also recommend the deferral of the capex associated with the Lovegrove Transformer Upgrade (PRA30750) into the next regulatory period (i.e. post 2018/19).

Additionally, in our review of PWC's proposed replacement capex (see section 7.5), we also make a number of recommendations that impact PWC's proposed augmentation capex in regards to the:

- deferral by two years of PRD30402 – Darwin: Replace Berrimah ZSS (see section 7.5.4.3)
- removal of certain sub-programs from Sub8274 - Asset Replacement and Upgrade Programs (see section 7.5.4.5).

For further details of these recommendations reference should be made to our review of Power Networks' replacement capex in section 7.5.

Table 7.18 summarises Parsons Brinckerhoff's recommended adjustments to PWC's proposed network augmentation capex for the next regulatory period. The recommended capex of $40.270m reduces the network augmentation capex by 26% in real terms compared with the IRP proposed regulatory period expenditure of $54.264m.

Table 7.18 Recommended Augmentation capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	**8,292**	**5,881**	**7,339**	**11,257**	**20,095**
IRP submission proposed capex	**13,694**	**16,635**	**8,171**	**308**	**15,457**
Deferral of East Arm Zone Substation	3,486	-	-	-	(13,068)
Deferral of Archer to Palmerston 66kV Line	(4,340)	(7,622)	1,066	6,931	4,265
Deferral of Lovegrove Transformer Upgrade	-	(208)	(2,081)	-	(1,873)
Deferral and reduction of Berrimah Zone Substation	(265)	(2,497)	(5,322)	2,497	5,347
Removal of components of Asset Replacement and Upgrade Program	(594)	(408)	100	296	296
Recommended adjustment to IRP proposed capex	**(1,714)**	**(10,735)**	**(6,236)**	**9,724**	**(5,033)**
Recommended capex	**11,980**	**5,899**	**1,935**	**10,032**	**10,424**
Regulatory Period	**40,270**				

Source: Parsons Brinckerhoff analysis

7.5 Replacement capex

7.5.1 Proposed expenditure

Table 7.19 shows that the staged submission proposed network replacement capex for the 2014-19 regulatory period is $151.439m.

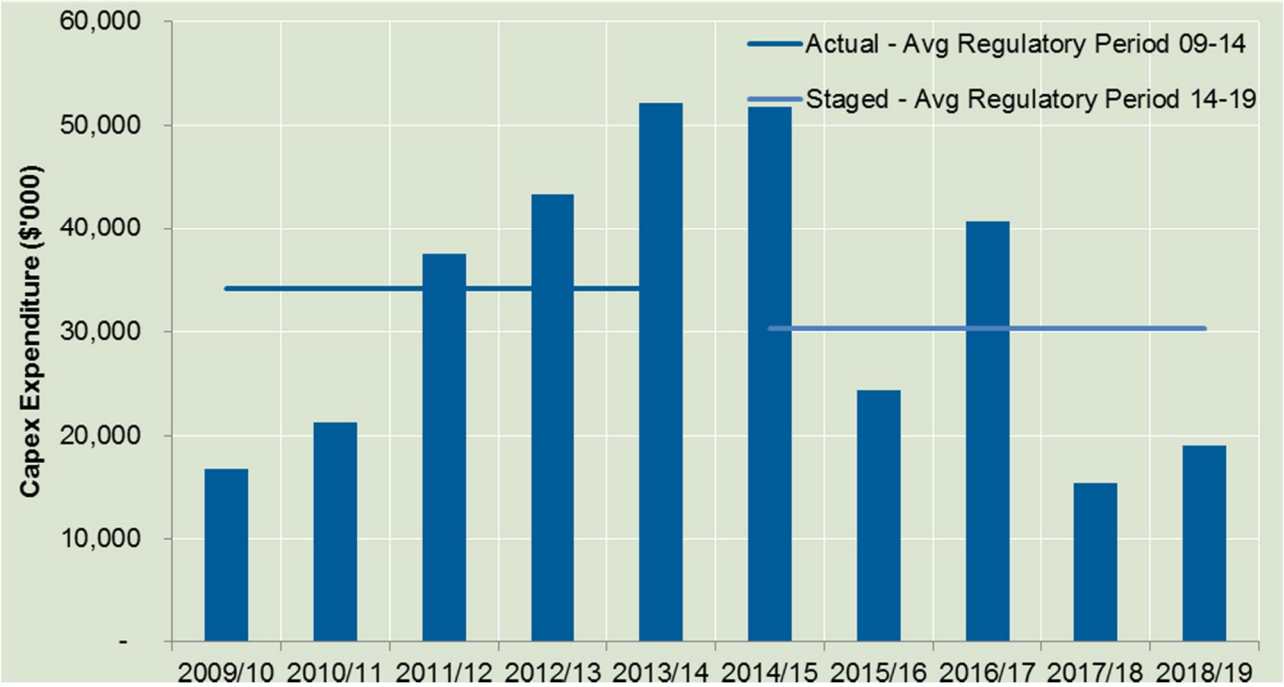
Table 7.19 Replacement staged submission capex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission terminal station	-	-	-	-	-	-	-	-	-	-
Zone Substations	8,347	14,254	23,346	25,158	41,384	35,203	11,766	29,890	3,347	5,020
Transmission lines	-	-	1,031	5,371	-	-	-	-	-	-
Distribution Mains	3,279	3,643	9,344	6,536	6,458	11,204	7,150	4,731	4,410	4,370
Distribution substations	2,470	1,082	1,222	1,140	1,485	2,355	2,100	2,631	3,649	4,158
Metering	337	185	231	342	388	775	1,141	1,507	2,224	1,203
Land and easements	-	-	-	-	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	2,306	2,077	2,362	4,766	2,444	2,206	2,289	2,054	1,682	4,372
Other	-	-	-	-	-	-	-	-	-	-
Total	**16,739**	**21,241**	**37,536**	**43,312**	**52,159**	**51,744**	**24,446**	**40,813**	**15,312**	**19,124**
Regulatory Period	**170,987**					**151,439**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

Figure 7-5 shows the historical and forecast network replacement capex and illustrates that the system replacement capex is forecast to decrease by 11.4% in real terms compared with the current regulatory period expenditure of $170.987m.

The catastrophic failure at Casuarina Zone Substation in 2008 increased Power Networks' awareness of the condition of their zone substation assets and the risks associated with poor condition assets. This event resulted in Power Networks' new focus on asset maintenance, moving away from a run to failure approach. Power Networks did not have the detail of asset data required to analyse the condition of their assets or to quantify the risk associated with the poor condition assets on the network. Power Networks took the approach of replacing assets that were in poor condition to eliminate risk. As a result replacement volumes, and the associated expenditure, were abnormally high during 2011 – 2013 and are forecast to be high in 2013/14. The level of expenditure forecast for the 2014-19 regulatory period is higher than the historical levels of 2009-11 and is displaying a forward loaded profile which reflects the business approach of removing potential risk from the network as soon as practicably possible.



Source: Table 7.19

Figure 7-5 Replacement capex – Staged submission ($'000 real 2013/14)

7.5.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.20. This is an increase of 4.3% compared to the staged submission.

Table 7.20 Replacement IRP capex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	51,744	24,446	40,813	15,312	19,124	**151,439**
IRP submission proposed capex	45,537	32,048	29,504	32,238	18,607	**157,934**
Difference	**-12.00%**	**31.10%**	**-27.71%**	**110.54%**	**-2.70%**	**4.29%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff notes that the change to the forecast replacement capex as set out in the IRP are primarily related to the following matters:

- Deferral of PRA30520 Alice Springs: Install Sadadeen 11kV Switchboard by two years
- Deferral of PRA30730 Alice Springs: Brewer to Sadadeen 22kV Express Feeder by one year
- Deferral of PRD30600 Darwin: New Mitchell Street Switching Station by one year
- Reduction of expenditure of Sub8276 NT Wide (Regulated Network) Meters/Metering Program
- Delay of expenditure by smoothing of PRD30115 Darwin: Replace Casuarina ZSS 66kV Outdoor Switchyard
- Increased cost and delay of expenditure of PRD30117 Darwin: Replace McMinns 66/22kV ZSS
- Increased cost and forward loading of expenditure of Sub8274 NT Wide (Regulated Network) Asset Replacement and Upgrade Programs
- Extending the duration of PXD39031 Darwin: CBD Replace Switching Station - West Bennett by one year
- Inclusion of a new program PRD30625 Darwin: Interval Meter Rollout
- Cancellation of PRD30485 Darwin: Mandorah Network Upgrade, which had begun in the 2009 – 2014 regulatory period
- an updated escalator[105] applied to the real 2012/13 forecast cost estimate.

7.5.3 Replacement capex drivers

The primary driver of the replacement capex forecast is the condition of assets and the increased risk that is introduced by the poor condition of assets. Parsons Brinckerhoff has undertaken a high level review of Power Networks' condition assessment practices and is of the opinion that Power Networks has poor quality and limited asset data, which results in difficulty predicting the failure rates of assets and hence the required timing of replacement of these assets. Consequently we are unable to conclude that Power Networks' use of asset condition forecasts to inform its forecast expenditures is reasonable. Furthermore, we are of the view that the observed practice of using the age of assets to determine the required replacement of assets does not align with good industry practice or the principles of prudent and efficient expenditure.

We note that the forecast is a forward loaded program that has the potential to cause resourcing and deliverability issues. We are of the opinion that the timing of the proposed replacement works is arbitrary and that Power Networks' forecast expenditure does not reflect an efficient and optimised solution at a portfolio level. As Power Networks' asset condition assessments are the primary driver of the proposed replacement capex, we have taken our conclusions in relation to the asset condition into account in undertaking the specific reviews set out below and in our recommendations concerning PWC's proposed replacement capex.

7.5.4 Specific reviews

In relation to the $151.439m replacement capex, Parsons Brinckerhoff sought to examine a range of planning documentation (e.g. business cases, board papers, etc.) in order to establish Power Networks' justification for the proposed expenditure forecasts. In our opinion, in demonstrating the prudency and efficiency of proposed expenditure it is essential to demonstrate both the need and timing of the proposed capex, as well as a consideration of options, selection of the most efficient option, and the relationship of the scope of proposed works to the identified need. To support this demonstration Parsons Brinckerhoff would

[105] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

expect that robust business cases (or similar documentation) would be available for projects/programs at least in the earlier years of the forecast period, while later years may have preliminary business cases (or similar documentation) as the basis of demonstrating the prudency and efficiency of proposed expenditure.

To undertake this review, Parsons Brinckerhoff considered the supporting documentation for the six largest replacement capex projects; specifically:

- PRD30115 - Darwin: Replace Casuarina ZSS 66kv Outdoor Switchyard (11% of replacement capex)
- PRD30117 - Darwin: Replace McMinns 66/22kV ZSS (5% of replacement capex)
- PRD30402 - Darwin: Replace Berrimah ZSS (13% of replacement capex)
- PRD30600 - Darwin: New Mitchell Street Switching Station (10% of replacement capex)
- Sub8274 - Asset Replacement and Upgrade Programs (10% of replacement capex)
- Sub8276 - Meters/Metering Program (5% of replacement capex).

The following sections set out Parsons Brinckerhoff's review of each of the six largest replacement capex projects noted above.

7.5.4.1 PRD30115 - Darwin: Replace Casuarina ZSS 66kv Outdoor Switchyard

Power Networks has outlined the occurrences of recent major asset failures at Casuarina ZSS[106]. Based on these events Power Networks identified a risk of failure of the 66kV equipment at Casuarina ZSS. To address the risk of failure, Power Networks is proposing to replace the 66kV switchgear and the existing transformers at the forecast cost set out in Table 7.21. This forecast cost represents 11% of the proposed replacement capex proposal.

Table 7.21 Staged submission forecast expenditure for PRD30115 - Darwin: Replace Casuarina ZSS 66kv Outdoor Switchyard ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	14,119	3,137	-	-	-	**17,256**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for Casuarina ZSS 66kv Outdoor Switchyard replacement Power Networks submitted the following documentation:

- Business Need Identification PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard
- Response to Issue 36 - PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard
- Attachment E - PWC Response - PWC ~ McMinns, Berrimah & Casuarina ZSS.XLS
- Aurecon, 27 November 2012, Project : Casuarina Zone Substation Redevelopment Feasibility Study Report
- Power Networks Asset Strategies Procedure, DRAFT (No Date).

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

[106] Power and Water Corporation, 28 June 2013, 'Business Need Identification PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section 2, p. 2

Power Networks has expressed the need for replacement of the 66kV equipment at Casuarina ZSS in terms of the age of this substation (i.e. 35 – 40 years old)[107] and consequent potential 'reliability issues' at this site. In particular, Power Networks has identified reliability issues with the equipment[108] at the site as well as the three power transformers, noting that the transformers have reached "end of life".[109] Parsons Brinckerhoff is of the view that the age of an asset does not justify its replacement timing, and that it is more prudent to justify this timing based on the risk of failure as indicated by demonstration of the asset's condition. In making this observation we note that Power Networks has stated that the available data does not allow the business to predict asset failure[110]. In Parsons Brinckerhoff's view, this appears to be consistent with the stage of development of Power Networks' asset management capability.

In support of its proposed replacement of the 66kV equipment at Casuarina ZSS, Power Networks has provided evidence of the condition of the substations primary assets and the increased failure rates of this type of equipment[111]. We have reviewed this condition information provided. In relation to the transformers we are of the view that they have some condition related problems, but we are not of the opinion that this information clearly demonstrates the need to replace the transformers. Moreover we note that Power Networks assessed the condition of these transformers in their draft Power Networks Asset Strategies Procedure[112], and recommended increased inspection rates and 5-yearly maintenance[113] as the appropriate solution to managing the condition of these transformers.

In response to our enquiries regarding the proposed timing of the Casuarina ZSS replacement project Power Networks advised that this timing reflects the assessed condition of this substation relative to others proposed for replacement (i.e. McMinns ZSS and Berrimah ZSS) as well as the need to smooth out the resource requirements across these projects. Parsons Brinckerhoff notes that the forecast replacement capex profile shown in Figure 7-5 is relatively 'front loaded' (i.e. most expenditure occurs in the first two to three years of the forecast period), and given the proposed timing is intended to smooth out resource requirements, we are of the opinion that there is further opportunity to achieve a less resource intensive forecast.

In considering the options to address the condition of Casuarina ZSS, Power Networks has considered three options[114]. Parsons Brinckerhoff notes that the options considered relate to substation layout options for the replacement substation, and are not options to address the fundamental need; that is, options to address the risk of loss of supply due to a major failure at Casuarina ZSS. We also note that Power Networks states:

[107] Power and Water Corporation, 2013, 'Response to Issue 36 - PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section (c)

[108] Power and Water Corporation, 2013, 'Response to Issue 36 - PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section (a)

[109] Power and Water Corporation, 28 June 2013, 'Business Need Identification PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section 8, p. 5

[110] Power and Water Corporation, 2013, 'Response to Issue 36 - PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section (c)

[111] Power and Water Corporation, 2013, 'Attachment E - PWC Response - PWC ~ McMinns, Berrimah & Casuarina ZSS.XLS'

[112] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT

[113] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT, Section 2.6, p. 48 - 58

[114] Aurecon, 27 November 2012, Project : Casuarina Zone Substation Redevelopment Feasibility Study Report

> "Feasibility study will be conducted to consider the least cost solution including a staged/deferred works program, potentially using temporary works for a period." [115]

As noted above, the least cost solution is yet to be identified, and as a result of a yet to be undertaken analysis there is the potential for temporary works, staging, or deferral of the forecast capex. For capex proposed in the early stages of the regulatory period, Parsons Brinckerhoff would expect an options analysis (or similar) to have been undertaken in order to demonstrate the efficiency of the proposed forecast expenditure. In our opinion, Power Networks has not demonstrated the efficiency of the proposed capex forecast, and, in stating that temporary works or deferral are possible options, acknowledges that other options may be more efficient, including the deferral of the proposed capex.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that replacement of the 66kV switchgear at Casuarina ZSS is prudent. However we are not of the view that replacement of all transformers is justified. Additionally, given the apparent 'front loading' in the forecast replacement capex profile, we consider that further deferral of this capex would improve the allocation of resources across the forecast period. This is also supported by Power Networks' observation that deferred (or temporary works) will be considered in the feasibility study. Hence, while we consider that the proposed capex is generally prudent (excluding the transformers), we are not of the view that the proposed capex is efficient, or that the timing of the proposed expenditure is prudent or efficient given the need to smooth out the resource requirements across the replacement projects. Consequently, Parsons Brinckerhoff recommends adjustments to the proposed capex as set out in Table 7.23.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.22. This is a reduction of 0.5% compared to the staged submission.

Power Networks has explained that the changes to the program are due to an updated forecast cash flow[116]. The difference in the total forecast expenditure is due to an updated escalator[117] applied to the real 2012/13 forecast cost estimate..

The changes to this project do not impact on the findings of the staged submission review.

Table 7.22 IRP submission forecast expenditure for PRD30115 - Darwin: Replace Casuarina ZSS 66kv Outdoor Switchyard ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	8,844	8,323	-	-	-	17,167

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

[115] Power and Water Corporation, 28 June 2013, 'Business Need Identification PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Appendix A, Section 6.5.7(c)(2), p. 8

[116] Power and Water Corporation, September 2013, 'Business Need Identification PRD30115 -Revised Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section 1, p. 2

[117] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

Recommendations

The adjustments shown in Table 7.23 are recommended to the forecast capex for the 2014/15-18/19 period. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

Table 7.23 Recommended capex adjustments – Casuarina ZSS 66kv Outdoor Switchyard ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**14,119**	**3,137**	**-**	**-**	**-**	**17,256**
IRP proposed capex	**8,844**	**8,323**	**-**	**-**	**-**	**17,167**
Deferral by 1 year	(8,844)	520	8,323	-	-	-
Recommended adjustment to IRP proposed capex	**(8,844)**	**520**	**8,323**	**-**	**-**	**-**
Adjustment - Replacement component	(8,844)	520	8,323	-	-	-
Recommended capex	**-**	**8,844**	**8,323**	**-**	**-**	**17,167**

Source: Parsons Brinckerhoff analysis

7.5.4.2 PRD30117 - Darwin: Replace McMinns 66/22kV Zone Substation

Power Networks has outlined the occurrences of recent asset failures at McMinns ZSS[118] which have resulted in increased maintenance, constrained operations and reduced reliability. Based on these recent failures Power Networks identified a risk of future failure of the 66kV equipment at McMinns ZSS. To address this risk, Power Networks is proposing to replace the 66kV and 22kV switchgear as well as the existing transformers at a total cost of $10.298m as set out in Table 7.24. The forecast replacement cost to complete this project represents 5% of the proposed replacement capex.

Table 7.24 Staged submission forecast expenditure for PRD30117 - Darwin: Replace McMinns 66/22kV Zone Substation ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	7,209	-	-	-	-	7,209
Augmentation	3,089	-	-	-	-	3,089
Total	**10,298**	**-**	**-**	**-**	**-**	**10,298**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the McMinns 66/22kV ZSS replacement Power Networks submitted the following documentation:

- Preliminary Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation
- Response to Issue 37 - PRD30117 - Darwin: Replace McMinns 66/22kV Zone Substation
- Attachment E - PWC Response - PWC ~ McMinns, Berrimah & Casuarina ZSS.XLS
- Investment Assessment Preliminary Business Case PRD30117 Rebuild McMinns Zone Substation
- PRD30117 Rebuild McMinns 66 22kV Zone Substation - RACE Model (Preliminary Business Case).XLS

[118] Power and Water Corporation, 14 December 2012, 'Preliminary Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation', Section 3, p. 3

- Aurecon, 18 May 2012, Feasibility Study Report McMinn Zone Substation Redevelopment Power and Water Corporation, NT, Version 1
- Power Networks Asset Strategies Procedure, DRAFT (No Date).

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

Power Networks has expressed the need for replacement of major equipment at McMinns ZSS in terms of the age of this substation (i.e. 47 years old)[119] and has identified 'reliability issues'[120] at this site. In particular, Power Networks has identified reliability issues with equipment[121] at the site, including the 66kV switchgear, 22kV switchgear as well as the power transformers. As noted above Parsons Brinckerhoff is of the view that the age of an asset does not justify its replacement timing and that assessment of the asset's condition is a more prudent approach. In support of its proposed replacement of major equipment at McMinns ZSS, Power Networks has provided failure data information. We have reviewed this information and we are of the opinion that the failure data provided indicates unacceptable levels of failures that we consider require addressing.

In response to our enquiries regarding the proposed timing of the McMinns ZSS replacement works Power Networks advised that this timing reflects the assessed condition of this substation relative to others proposed for replacement (i.e. Casuarina ZSS and Berrimah ZSS) as well as the need to smooth out the resource requirements across these projects. As noted in section 7.5.4.1, while we are of the view that there is further opportunity to smooth out resource requirements associated with replacement capex, we are also of the opinion that the failure rates information and the condition of McMinns ZZS is such that early timing of this works is likely to be justified.

In the McMinns ZZS Preliminary Business Case, Power Networks states that the three transformers are in satisfactory condition[122]. However, examination of the details of the condition of these transformers indicates that two transformers have condition related problems, while the third transformer is in reasonable condition[123]. Review of Power Networks' draft Power Networks Asset Strategies Procedure[124] also supports this view. Hence we are of the opinion that the need to replace two of the power transformers is demonstrated. We note however that Power Networks is also proposing to replace the third transformer with a standard design, and has 'bundled' this replacement into the overall scope of the project. In our view, given the extent of the works proposed, we consider that this 'bundled' approach is likely to be efficient.

Power Networks has set out the four options it considered to address the need in its Preliminary Business Case[125], along with cost estimates and benefit scores for each option considered. This business case recommends the least cost option with the highest weighted benefit score as the preferred option. Based on our review of this information, we are of the opinion that the preferred option is likely to be the most efficient option.

[119] Power and Water Corporation, 2013, 'Response to Issue 36 - PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section (c)

[120] Power and Water Corporation, 2013, 'Response to Issue 36 - PRD30115 - Darwin - Replace Casuarina 66kV Outdoor Switchyard', Section (a)

[121] Power and Water Corporation, 2013, 'Response to Issue 37 - PRD30117 - Darwin: Replace McMinns 66/22kV Zone Substation', Section (b)

[122] Power and Water Corporation, 14 December 2012, 'Preliminary Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation', Section 3, p. 3

[123] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT, Section 2.6, p.48 - 58

[124] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT

[125] Power and Water Corporation, 14 December 2012, 'Preliminary Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation', Section 6, p. 6-8

We note however that the scope[126] of the preferred option includes some minor works to bring the existing site up to current standards as well as the installation of greater transformer capacity than the current site capacity. Power Networks has explained that it is applying a new design that is aimed at standardising the asset fleet and reducing the required spares. In Parsons Brinckerhoff's opinion, while this scope deviates from the efficient scope required to address the identified need (i.e. condition issues), we consider that the additional forecast costs are not significant and the benefits of standardisation within the asset fleet are likely to outweigh this additional expenditure. Hence we do not consider that the scope is inefficient.

In our examination of the Initial Project Estimate[127], Parsons Brinckerhoff noted that the estimate includes a 4.4% contingency as well as 5.2% design risk allowance. In our opinion unjustified non-specific contingencies at the project level are inefficient as they tend to overestimate the outturn cost variance at the portfolio level[128]. Hence contingencies for estimated outturn cost error should be accounted for at the portfolio level, and not the project level.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the McMinns 66/22kV Zone Substation is prudent. Moreover, notwithstanding the 9.6% contingency, we are of the opinion that the selected option is the efficient solution to the identified need.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.25. This is an increase of 79% compared to the staged submission.

The total project cost across both regulatory periods has increased by 11.5% from $24.533m in the staged submission to $27.352m in the IRP submission Power Networks has explained that the changes to the program are due to updated project costs provided by the contractor[129] and a change to the timing of the capital expenditure. Parsons Brinckerhoff suggests that the options analysis be updated to ensure that the proposed solution is still the most efficient option to address the identified constraint; however we are of the opinion that this is likely to be the case.

The IRP forecast expenditure does not include risk and contingency.

[126] Power and Water Corporation, 14 December 2012, 'Preliminary Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation', Section 5, p. 5

[127] Power and Water Corporation, 14 December 2012, 'Preliminary Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation', Section 7.2.1, p. 9 - 10

[128] Contingencies do not arithmetically add across a portfolio of expenditure. Rather, overspends and underspends tend to cancel across a portfolio, and hence any net overspent or underspend can only be calculated and supported at the portfolio level.

[129] Power and Water Corporation, August 2013, 'Business Case PRD30117 - Rebuild McMinns 66/22kV Zone Substation', Section 10.1, p. 17

Table 7.25 IRP submission forecast expenditure for PRD30117 - Darwin: Replace McMinns 66/22kV Zone Substation ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	12,900	-	-	-	-	12,900
Augmentation	5,529	-	-	-	-	5,529
Total	**18,429**	**-**	**-**	**-**	**-**	**18,429**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Recommendations

There are no adjustments recommended to the IRP forecast capex for the 2014/15 to 2018/19 period.

7.5.4.3 PRD30402 - Darwin: Replace Berrimah ZSS

Power Networks has outlined increased maintenance, poorer system security and reliability, increased safety risks and increased operational cost due to the management of these risks at Berrimah ZSS[130].

Power Networks also outlines that Berrimah ZSS has exceeded its firm capacity for a number of years, due to semi-permanent load transfers after the 2008 Casuarina failure[131]. Power Networks forecast Berrimah ZSS to exceed firm rating in 2014/15.

To address the condition based constraint, Power Networks is proposing to replace the 66kV switchgear, the power transformers and 11kV switchgear. To address the demand driven constraint, Power Networks is proposing that the existing two 38 MVA power transformers are replaced with three 27 MVA units, increasing the firm capacity from 38.1 MVA to 54 MVA. The replacement project is proposed at the cost set out in Table 7.26. The forecast cost of this project represents 13% of the proposed replacement capex.

Table 7.26 Staged submission forecast expenditure for PRD30402 - Darwin: Replace Berrimah ZSS ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	622	5,857	13,104			19,583
Augmentation	267	2,510	5,616			8,393
Total	**889**	**8,367**	**18,720**			**27,976**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Berrimah ZSS replacement submitted the following documentation:

- Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation
- Response to Issue 38 - PRD30402 – Darwin: Replace Berrimah Zone Substation
- Attachment E - PWC Response - PWC ~ McMinns, Berrimah & Casuarina ZSS.XLS
- BERRIMAH ZSS MD FORECAST 2012/13.XLS
- PB Issue 41(q) Working Document - Transformer Condition Summary & Spare Transformers.XLS

[130] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 2, p. 2

[131] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 2, p. 3

- Power Networks Asset Strategies Procedure, DRAFT (No Date).

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

Power Networks has expressed the need for replacement of the of the 66kV equipment at Berrimah ZSS in terms of the age of this substation (i.e. 33 years old)[132] and consequent 'reliability issues' at this site. In particular, Power Networks has identified reliability issues with the equipment[133] at the site as well as the two power transformers, noting that the transformers have reached "end of life"[134]. Parsons Brinckerhoff is of the view that the age of an asset does not justify its replacement timing, and that it is more prudent to justify this timing based on the risk of failure as indicated by demonstration of the asset's condition. In making this observation we note that Power Networks has stated that the available data does not allow the business to predict asset failure[135]. In Parsons Brinckerhoff's view, this appears to be consistent with the stage of development of Power Networks' asset management capability.

In support of its proposed replacement of the Berrimah ZSS, Power Networks has provided evidence of the condition of the substations primary assets and the increased failure rates of this type of equipment[136]. We have reviewed this condition information provided. In relation to the transformers, we are of the view that they have some condition related problems, but we are not of the opinion that this information clearly demonstrates the need to replace the transformers. Power Networks has provided further detail of the condition of the Berrimah ZSS transformers in the Transformer Condition Summary[137]. This summary assigns a code for DGA, Fluid and an overall condition score to each transformer. The two power transformers at Berrimah ZSS have condition scores of 1 (green) and 2 (amber), which we are unable to interpret as suggesting that the power transformers require replacement. The Transformer Condition Summary notes a requirement to continue analysing oil samples for both transformers. No other remarks are recorded against either transformer. Moreover we note that Power Networks assessed the condition of these transformers in their draft Power Networks Asset Strategies Procedure[138], does not record any condition related problems, or suggested remedial actions for the power transformers at Berrimah ZSS[139].

We note that the 11kV switchboard is being replaced because it is "aged"[140]. As the switchboard is not arc-fault contained, Power Networks is proposing to replace it due to operational staff safety concerns. Power Networks has not been able to disclose any information that demonstrates that the operational costs and risks are greater than the replacement cost of the switchboard, and hence we are unable to conclude the

[132] Power and Water Corporation, 2013, 'Response to Issue 38 - PRD30402 – Darwin: Replace Berrimah Zone Substation', Section (a)

[133] Power and Water Corporation, 2013, 'Response to Issue 38 - PRD30402 – Darwin: Replace Berrimah Zone Substation', Section (a)

[134] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 2, p. 3

[135] Power and Water Corporation, 2013, 'Response to Issue 38 - PRD30402 – Darwin: Replace Berrimah Zone Substation', Section (e)

[136] Power and Water Corporation, 2013, 'Attachment E - PWC Response - PWC ~ McMinns, Berrimah & Casuarina ZSS.XLS'

[137] Power and Water Corporation, 2013, 'PB Issue 41(q) Working Document - Transformer Condition Summary & Spare Transformers.XLS'

[138] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT

[139] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT, Section 2.6, p. 48 - 58

[140] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 2, p. 3

replacement of the switchboard is prudent. We also note that the oil filled circuit breakers that rack into the switchboard were replaced in 2009 with vacuum units. This suggests that Power Networkss asset management strategic planning is not effective. Parsons Brinkerhoff is of the view that the replacement of the recently installed circuit breakers has not been justified, is not prudent and that such expenditure is not likely to be efficient.

In response to our enquiries regarding the proposed timing of the Berrimah ZSS replacement project Power Networks advised that this timing reflects the assessed condition of this substation relative to others proposed for replacement (i.e. McMinns ZSS and Casuarina ZSS), the need to smooth out the resource requirements across these projects and the demand constraint on Berrimah ZSS. We note that the replacement of Berrimah ZSS, which will produce increased capacity, is scheduled for completion in 2016/17[141] which is one year later than expected under Power Networks' demand forecast for the Berrimah ZSS. Power Networks advised that the network operators have the capacity to transfer 5 – 10 MVA of load without specific direction to deal with contingency events. Taking the conservative 5 MVA transfer capability, this delays the constraint on Berrimah ZSS until 2018/2019. Based on this and our review of Power Networks' demand forecasting practices (see section 6), Parsons Brinkerhoff is of the view that the timing of the constraint on Berrimah ZSS is likely to be 2018/19. Parsons Brinckerhoff notes that the forecast replacement capex profile shown in Figure 7-5 is relatively 'front loaded' (i.e. most expenditure occurs in the first two to three years of the forecast period), and given the proposed timing is intended to smooth out resource requirements, we are of the opinion that there is further opportunity to achieve a less resource intensive forecast.

In considering the options to address the condition of Berrimah ZSS, Power Networks has considered three options[142]. Parsons Brinckerhoff notes that the options considered relate to substation location options for the replacement substation, and are not options to address the fundamental need; that is, options to address the risk of loss of supply due to a major failure at Berrimah ZSS. We also note that Power Networks states:

> "An options study will be conducted to determine the most cost effective solution"[143]

As noted above, the most cost effective solution is yet to be identified. For capex proposed in the early stages of the regulatory period, Parsons Brinckerhoff would expect an options analysis (or similar) to have been undertaken in order to demonstrate the efficiency of the proposed forecast expenditure. In our opinion, Power Networks has not demonstrated the efficiency of the proposed capex forecast, and acknowledges that other options may be more efficient. We also note that demand management has not been considered as a practical alternative as "the renewal is for the entire load with a peak approaching 40 MVA"[144]. As the replacement of the transformers has not been justified, it is the auditor's view that demand management should be considered as a practical alternative to address the demand growth constraint.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the Berrimah ZSS 66kv Outdoor Switchyard is prudent. However we are not of the view that replacement of all transformers or the 11kV CBs is justified. Additionally, given the apparent 'front loading' in the forecast replacement capex profile, we consider that further deferral of this capex would improve the allocation of resources across the forecast period. This is also supported by our view that the demand constraint is likely to occur in 2018/19. Hence, while we consider that the proposed capex is generally prudent (excluding the transformers and 11kV CBs), we are not of the view that the

[141] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 8.1, p. 6

[142] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 3, p. 4

[143] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Section 3, p. 4

[144] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30402 - Darwin - Replace Berrimah Zone Substation', Appendix A, Section 6.5.7(a)(1), p. 8

proposed capex is efficient, or that the timing of the proposed expenditure is prudent or efficient given the need to smooth out the resource requirements across the replacement projects and the likely delay of the demand constraints. Consequently, Parsons Brinckerhoff recommends adjustments to the proposed capex as set out in Table 7.28.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.27. This is a reduction of 0.5% compared to the staged submission.

There is no material change to this project; the difference in the total forecast expenditure is due to an updated escalator[145] applied to the real 2012/13 forecast cost estimate.

The changes to this project do not impact on the findings of the staged submission review.

Table 7.27 IRP submission forecast expenditure for PRD30402 - Darwin: Replace Berrimah ZSS ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	619	5,826	13,037	-	-	19,482
Augmentation	265	2,497	5,587	-	-	8,349
Total	**884**	**8,323**	**18,624**	**-**	**-**	**27,831**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Recommendations

The adjustments shown in Table 7.28 are recommended to the forecast capex for the 2014/15 to 2018/19 period. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

Table 7.28 Recommended capex adjustments – PRD30402 - Darwin - Replace Berrimah Zone Substation ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**889**	**8,367**	**18,720**	**-**	**-**	**27,976**
IRP proposed capex	**884**	**8,323**	**18,624**	**-**	**-**	**27,831**
Deferral by 2 years	(884)	(8,323)	(17,739)	8,323	18,624	-
Removal of 11kV circuit breakers from scope	-	-	-	-	(800)	(800)
Recommended adjustment to IRP proposed capex	**(884)**	**(8,323)**	**(17,739)**	**8,323**	**17,824**	**(800)**
Adjustment - Replacement component	(619)	(5,826)	(12,417)	5,826	12,477	(560)
Adjustment - Augmentation component	(265)	(2,497)	(5,322)	2,497	5,347	(240)
Recommended capex	**-**	**-**	**884**	**8,323**	**17,824**	**27,031**

Source: Parsons Brinckerhoff analysis

[145] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

7.5.4.4 PRD30600 - Darwin: New Mitchell Street Switching Station

Power Networks' states that, as a condition of the sale of the existing switching station site and purchase of the proposed third Darwin CBD Zone Substation site in 2008, it agreed to vacate the existing switching station site by 2018[146]. Power Networks also outlines the need to replace the Mitchell Street switching station assets based on the age of the assets.

To address the vacation requirement, Power Networks is proposing to construct a new 11kV indoor metal clad vacuum switchboard adjacent to the existing site, at the cost set out in Table 7.29. The forecast cost of this project represents 10% of the proposed replacement capex.

Table 7.29 Staged submission forecast expenditure for PRD30600 - Darwin: New Mitchell Street Switching Station ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	209	941	14,537	-	-	**15,687**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Mitchell Street switching station Power Networks submitted the following documentation:

- 'Business Need Identification PRD30600 - Darwin - New Mitchell St Switching Station
- Response to Issue 39 - PRD30600, Darwin - New Mitchell St Switching Station.

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

Power Networks states that:

> "The assets on this site are approaching their expected end of service life in the coming years with a current age of approximately 30 years. As the circuit breakers and associated equipment approaches 35 years old, maintenance costs increase, manufacturers support becomes limited in terms of both technical support and in the provision of maintenance spares and components largely due to the equipment obsolescence." [147]

Parsons Brinckerhoff is of the view that the service life and age of the asset does not justify the replacement of the asset. Power Networks has provided no evidence of failure of the assets or of poor condition. As such we cannot conclude that the replacement of the assets is prudent based on their condition.

However, we note the requirement to vacate the land by 2018. Power Networks states that it "will revisit the issue with Darwin City Council to seek an extension of the lease to defer works if possible" [148]. The need to undertake this project is contingent on the decision made by Darwin City Council. In the event that the lease can be renegotiated, scope and timing of the project will be determined by the condition of the assets and the required replacement timing.

[146] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30600 - Darwin - New Mitchell St Switching Station', Section 2, p. 3

[147] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30600 - Darwin - New Mitchell St Switching Station', Section 2, p. 4

[148] Power and Water Corporation, 17 June 2013, 'Business Need Identification PRD30600 - Darwin - New Mitchell St Switching Station', Section 3, p. 4

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the Mitchell Street switching station is not prudent. We recommend that the Commission treat this as a contingent project.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.30. This is a reduction of 0.5% compared to the staged submission.

Power Networks explained that the change to the project is a deferral by one year to align with the requirement to vacate the site by 2018[149]. The difference in the total forecast expenditure is due to an updated escalator[150] applied to the real 2012/13 forecast cost estimate.

The changes to this project do not impact on the findings of the staged submission review.

Table 7.30 IRP submission forecast expenditure for PRD30600 - Darwin: New Mitchell Street Switching Station ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	**-**	**208**	**936**	**14,462**	**-**	**15,606**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Recommendations

The adjustments shown in Table 7.31 are recommended to the forecast capex for the 2014/15-18/19 period. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

Table 7.31 Recommended capex adjustments – Darwin: New Mitchell Street Switching Station ($'000 real 2013/14)

	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**209**	**941**	**14,537**	**-**	**-**	**15,687**
IRP proposed capex	**-**	**208**	**936**	**14,462**	**-**	**15,606**
Contingent project	-	(208)	(936)	(14,462)	-	(15,606)
Recommended adjustment to IRP proposed capex	**-**	**(208)**	**(936)**	**(14,462)**	**-**	**(15,606)**
Adjustment - Replacement component	-	(208)	(936)	(14,462)	-	(15,606)
Recommended capex	**-**	**-**	**-**	**-**	**-**	**-**

Source: Parsons Brinckerhoff analysis

[149] Power and Water Corporation, August 2013, 'Business Need Identification PRD30600 - Revised Darwin - New Mitchell St Switching Station', Section1, p. 2

[150] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

7.5.4.5 Sub8274 - Asset Replacement and Upgrade Programs

Power Networks' Asset Replacement and Upgrade Program is composed of 19 sub-programs:

- 66 kV Line Clearance Rectifications
- BBC Replacement
- Cast Iron Pothead Upgrade
- Darwin-Katherine Transmission Line Reliability Improvements
- LV ABC Replacement - Defective Batch UV Degradation
- Neutral Earthing Resistor (NER) Installation in Zone Substations
- Nightcliff Pillar Box replacements
- Integral Pillar Replacements – Palmerston
- Manton Terminal Substation 132kV CB Replacement
- Replacement of Underrated Switchgear – Darwin CBD
- Service Dead-ends
- Substation Gate Upgrade for Emergency Egress
- Palmerston Distribution System Earthing
- Miscellaneous ZSS Equipment Upgrades/Replacements
- Transmission Tower Earthing Improvements
- Channel Island 132kV Crossing Pylon Refurbishment
- Miscellaneous Distribution Equipment Upgrades/Replacements
- Dehumidification of Indoor Switchgear in Zone Substations and Major Switching Stations Distribution Pole Life Extension.

Power Networks is proposing to undertake this program at the cost set out in Table 7.32. The forecast cost of this project represents 10% of the proposed replacement capex.

Table 7.32 Staged submission forecast expenditure for Sub8274 - Asset Replacement and Upgrade Programs ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	5,273	4,413	2,059	1,618	1,618	14,981
Augmentation	1,147	960	448	352	352	3,258
Reliability	1,125	941	439	345	345	3,196
Total	**7,545**	**6,314**	**2,946**	**2,315**	**2,315**	**21,435**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Asset Replacement and Upgrade Programs Power Networks submitted the following documentation:

- Business Need Identification - Power Networks Asset Replacement and Upgrade Programs
- Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs

- 66kV Line Clearance Summary
- Darwin 66kV Transmission Lines Thermal Rating Study
- Power Networks - Darwin 132kV Transmission Towers
- List of Nightcliff Pillars to be replaced
- Power Networks Asset Replacement & Upgrade Programs: Distribution Pole Life Extension
- Sub8274 Power Networks Asset Replacement and Upgrade Programs BNI: Individual Programs.

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

The following details the findings of reviews of the specific subprograms followed by Parsons Brinckerhoff's findings for the Asset Replacement and Upgrade Programs.

66 kV Line Clearance Rectifications

Power Networks have identified that 9 of 13 66kV transmission lines are at risk of breaching clearance standards under normal operation[151]. Parsons Brinckerhoff is of the opinion that it is prudent to undertake works to address these clearance issues.

Power Networks has confirmed that the forecast expenditure was a judgement call made by the transmission planners. Power Networks states "Specific network constraints or capital deferrals have not been identified in the analysis performed to date"[152]. Parsons Brinckerhoff would expect to see some evidence of prioritisation of the feeders based on their likelihood of reaching nominal rating, the constraint placed on the performance of the network and the capital costs associated with reinforcing the network to address the constraint. Whilst we consider that the forecast expenditure is reasonable to address the high priority spans in this regulatory period, Parsons Brinckerhoff cannot conclude that the forecast expenditure is efficient.

BBC Switchgear Replacement

Power Networks has identified operational constraints and increased maintenance of BBC switchgear as a result of poor condition[153]. No evidence has been provided to support this claim. Parsons Brinckerhoff would expect to see some analysis that shows that the increased cost of operational constraints and maintenance are greater than the replacement costs of the assets. Whilst we are unable to conclude that this subprogram is prudent, we are of the opinion that there is likely to be a need to replace this switchgear. As there is no evidence of the expected failure rate of the equipment or the level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Cast Iron Pothead Upgrade

Power Networks has identified unacceptable levels of catastrophic failures of cast iron potheads that place the public and operators at risk of injury[154]. Whilst Power Networks has not provided any data to support the occurrence of any safety incidents, we are aware that this asset is being targeted for replacement in other

[151] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (a)

[152] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (a)

[153] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[154] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

jurisdictions for similar reasons and that data exists to demonstrate the high failure rates of this equipment. As these failures are not related to the environment in which the potheads are installed, it would be reasonable to apply these failure rates to the population of assets on Power Networks' network. As such, we are of the opinion that the Cast Iron Pothead Upgrade Program is prudent.

Power Networks has explained that the timing of expenditure is based around removing the risk from the network[155]. Parsons Brinckerhoff would expect to see some evidence of prioritisation of the sites based on the likelihood of the public being at risk and the frequency of energisation. As there is no evidence of the expected failure rate of the equipment or the level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Darwin-Katherine Transmission Line Reliability Improvements

Power Networks states that "the reliability of the 132kV Darwin to Katherine transmission line is significantly affected by earthing of the towers through particular sections of the line". [156] The reliability issue associated with the Darwin-Katherine transmission line has been addressed by the installation of counterpoise earthing[157]. Power Networks has concerns over the possibility of failure and the safety of the earthing, given that it has been installed on the surface of the ground and crosses over 4WD tracks[158]. Parsons Brinckerhoff is of the view that this program is prudent given that the failure of the earthing system will impact on the reliability of the transmission line.

Power Networks states "The timing is based on the existing level of deterioration and a reasonable expectation that this will continue to worsen to a point where it may begin to affect line reliability in the middle of the forthcoming regulatory period." [159]No evidence was available to support this expectation and as such, Parsons Brinckerhoff cannot conclude that the timing of the forecast expenditure is efficient.

LV ABC Replacement - Defective Batch UV Degradation

Power Networks has identified a risk to maintainers due to a batch of defective LV ABC with inferior ultraviolet rating[160]. As the cable was installed 6 years ago, Power Networks have not considered this a warranty issue[161].

The issue was identified by Prysmian (cable supplier) in 2011/12[162]. Based on our knowledge of this issue in other jurisdictions, we are aware that this specific issue is not something that can identified until the failure rates of the population of assets are very high and shocks and tingles are reported. Power Networks' failure

[155] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (g)(i)

[156] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[157] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (b)

[158] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (b)

[159] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (b)

[160] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[161] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (c)

[162] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

rates are not yet at this rate. We would not expect that Power Networks would have picked up this fault any sooner even with more robust asset management practices.

Power Networks states "the point at which this degradation becomes a risk to maintainers working on the cable cannot be quantified. The intention is to remove the hazard from the network in a reasonable timeframe and prior to the insulation degrading to a point where it is hazardous to maintainers". [163] Parsons Brinckerhoff is of the opinion that more cost efficient options should be considered (e.g. constraints placed on procedures for the maintenance of the whole batch of this cable until the replacement is scheduled into the works program). We are of the opinion that although this replacement is prudent, the timing has not been justified.

Neutral Earthing Resistor (NER) Installation in Zone Substations

Power Networks has identified increased safety risk and increased risk of equipment damage due to earth faults in the distribution network[164]. No evidence has been provided to support this claim. Whilst we are unable to conclude that this subprogram is prudent, we are of the opinion that there is likely to be a need to install NERs in zone substations to limit the earth faults. As there is no evidence of the expected level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Nightcliff Pillar Box replacements

Power Networks has identified that these pillar boxes have "degraded significantly in a short time since installation, presenting an increased risk to the public". [165] Power Networks has provided a list of defective pillars identified through inspection[166] and evidence of the nature of this degradation[167]. However, Power Networks has confirmed that no formal report or risk assessment has been undertaken for this project.

Parsons Brinckerhoff would expect to see some evidence that the deterioration of the pillar boxes poses a risk to the public as claimed, and as such Parsons Brinkerhoff cannot conclude that replacement of these pillars is prudent; however, we accept that there may be a safety requirement to undertake these replacements. We would expect to see some evidence of prioritisation of the sites based on the likelihood of the public being at risk. As there is no evidence of the expected level of risk present, Parsons Brinckerhoff cannot conclude that the timing of the forecast expenditure is efficient.

Integral Pillar Replacements – Palmerston

Power Networks has identified that the pillars "are unreliable and subject to repeated internal failures". [168] Power Networks has not been able to provide any evidence to support this claim, and as such Parsons Brinkerhoff cannot conclude that replacement of these pillars is prudent; however, we accept that there may be a safety requirement to undertake these replacements.

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[163] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (g)(iii)

[164] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[165] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[166] Power and Water Corporation, No Date,' List of Nightcliff Pillars to be replaced'

[167] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (d)

[168] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

Power Networks states "the timeline for the replacement program was developed based on an assessment of internal resource availability for works on the LV Network" [169]. As this program is forecast for the first two years of the period and is driven by availability of resources rather than the failure rate and level of risk present, we are of the opinion that the proposed replacement timing is not justified.

Manton Terminal Substation 132kV CB Replacement

Power Networks has identified reliability issues with the 132kV circuit breakers at Manton Terminal Station [170]. No evidence has been provided to support this claim. Whilst we are unable to conclude that this subprogram is prudent, we are of the opinion that there is likely to be a need to replace these circuit breakers to address a reliability issue. As there is no evidence of the expected failure rate of the equipment, we are unable to conclude that the timing of this sub-program is justified.

Replacement of Underrated Switchgear – Darwin CBD

Power Networks has identified rating constraints and increased safety risks of switchgear as a result of increased 3 phase fault ratings in the CDB[171]. No evidence has been provided to support this claim. Whilst we are unable to conclude that this subprogram is prudent, we are of the opinion that there is likely to be a need to replace this switchgear. As there is no evidence of the expected failure rate of the equipment or the level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Service Dead-ends

Power Networks has identified increased safety risks of degraded service wires due to metal dead-ends[172]. No evidence has been provided to support this claim. Whilst we are unable to conclude that this subprogram is prudent, we are of the opinion that there is likely to be a need to replace the dead-ends. As there is no evidence of the expected failure rate of the equipment or the level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Substation Gate Upgrade for Emergency Egress

Power Networks has not provided any evidence to justify the need to undertake this sub-program. There is no requirement to retrospectively apply standards to previously constructed equipment and Power Networks has not demonstrated any requirement to update the existing emergency egress. Hence we are of the opinion that this sub-program is not prudent and recommend an adjustment to the forecast expenditure.

Palmerston Distribution System Earthing

Power Networks has not provided any evidence to justify the need to undertake this sub-program; however, we accept the safety driver mentioned[173]. Power Networks states that "detailed assessments of the problem will be carried out in 2013/14 to determine the scope of the upgrades required"[174]. We note that there is no

[169] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (g)(iv)

[170] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[171] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[172] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[173] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 4

[174] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 4

scope of works, estimated volumes or unit costs and that the forecast expenditure is a nominal amount to undertake some works to address the safety driver. Hence we are unable to conclude that this sub-program program is efficient or that the timing of this program is justified.

Miscellaneous ZSS Equipment Upgrades/Replacements

Power Networks has stated that this is an "allowance for the replacement or upgrade of ZSS equipment" [175]. Power Networks has provided details of specific equipment replacements that they foresee over the regulatory period[176]; however, this includes a line item for "Unforeseen Equipment Replacements" that constitutes 70% of the subprogram. We note that 14 ZSS replacement projects amounting to $108m were undertaken in the previous regulatory period and that a program of works equating to $85m is forecast to be undertaken this period; Power Networks should have the asset data and knowledge to be able to predict the programs of work required to be undertaken for ZSS replacements. We are of the view that the "Unforeseen Equipment Replacements" component of this sub-program is not prudent and hence recommend an adjustment to the forecast expenditure.

Transmission Tower Earthing Improvements

Power Networks has identified increased risk of damage to transmission towers due to failed earthing[177]. Power Networks has provided evidence that suggests that 33% of the transmission towers will require earthing replacement or improvement[178]. Parsons Brinckerhoff is of the view that this estimate is sound and addresses those towers with an unacceptable risk of damage; we are of the opinion that this program is prudent. Although there is no evidence of the expected failure rate of the equipment, we are of the view that the timing of this sub-program is reasonable.

Channel Island 132kV Crossing Pylon Refurbishment

Power Networks has identified increased risk of future failure of transmission pylons due to corrosion[179]. Power Networks has provided evidence that shows very high levels of corrosion on the pylons[180]. Although no formal assessment of the risk associated with the corrosion has been prepared, Parsons Brinckerhoff is of the view that this program is prudent. As there is no evidence of the expected failure rate of the equipment or the level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Miscellaneous Distribution Equipment Upgrades/Replacements

Power Networks has stated that this is an allowance for "unforeseen equipment replacements"[181]. Power Networks has provided details of specific equipment replacements that they foresee over the regulatory

[175] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 4

[176] Power and Water Corporation, 28 June 2013, 'Sub8274 Power Networks Asset Replacement and Upgrade Programs BNI: Individual Programs'

[177] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[178] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (g)(ii)

[179] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[180] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (f)(iii)

[181] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 4

period[182]; however, this includes a line item for "Unforeseen Replacements" that constitutes 56% of the subprogram. Under the principles of the NER such an allowance for an unspecified need would not be approved; however we accept that there is a need to maintain distribution equipment. We would expect to see some analysis of the failure rates of specific asset components and the future failure rate expected throughout the regulatory period to justify the quantity of replacements. As there is no evidence of the expected failure rate of the equipment or the level of risk present, we are unable to conclude that the timing of this sub-program is justified.

Dehumidification of Indoor Switchgear in Zone Substations and Major Switching Stations

Power Networks has not provided evidence to justify the need to undertake this sub-program. However, recognising that the Power Networks network is situated in the tropics and is prone to humidity issues, we understand that there is a need to address humidity problems in switchrooms and are of the opinion that this sub-program is prudent. We are unable to conclude that the proposed solution is the most efficient solution or that the timing of the program is justified.

Distribution Pole Life Extension

Power Networks has identified increased risk of pole failure due to below ground corrosion of steel poles[183]. Parsons Brinckerhoff is of the view that this program is prudent. Whilst Power Networks has not provided evidence that the expected failure rate of the poles is justified, we accept that the failure rate is reasonable. Power Networks has provided a weighted unit cost that considers the average cost of treatment based on the expected rate of implementation of each type of treatment[184]. Parsons Brinckerhoff is of the view that this is a reasonable approach and that the resultant forecast expenditure is an efficient cost.

In our opinion, the testing program should be included in the opex submission; we have recommended an adjustment to account for this.

Findings

As noted above, Power Networks has not been able to justify or provide evidence of the need to replace many of the assets included in this program. We are of the opinion that there is likely to be a genuine need to undertake most the above sub-programs, and hence only suggest the removal of:

- Substation Gate Upgrade for Emergency Egress
- Unforeseen Equipment Replacements component of Miscellaneous ZSS Equipment Replacements
- Distribution Pole Life Extension testing program from the capex submission.

We have undertaken a comparison of accepted industry unit rates and the unit rates used to develop the expenditure associated with this program. As can be seen from the figures in Table 7.33, Power Networks' unit rates are on weighted average 8% higher when compared to a comparative unit rate for a similar network. As such, we recommend an adjustment to the replacement expenditure, see section 7.5.5.

[182] Power and Water Corporation, 28 June 2013, 'Sub8274 Power Networks Asset Replacement and Upgrade Programs BNI: Individual Programs'

[183] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Asset Replacement and Upgrade Programs', Section 2, p. 3 - 5

[184] Power and Water Corporation, 2013, 'Power Networks Asset Replacement & Upgrade Programs: Distribution Pole Life Extension'

Table 7.33 Unit rate comparison - Asset Replacement and Upgrade Program ($'000 nominal 2012/13)

Component	Description	PWC qty	Unit	PWC cost	PWC implied unit rate	Accepted unit rate	Difference
66 kV Line Clearance Rectifications	Transmission line upgrades to increase ground clearance	32[185]	span	1,500	46.875	50.000	-6%
BBC Replacement	BBC switchgear replacement in the Darwin urban and CBD network.	4	sites	2,200	550.000	125.000	340%
Cast Iron Pothead Upgrade	Cast Iron Potheads replacements	33	sites	1,400	42.424	15.000	183%
LV ABC Replacement	Inspecting 50km of line	50	km	100	2.000	1.500	33%
LV ABC Replacement	Replacing the 10km	10	km	500	50.000	125.000	-60%
NER Installation in Zone Substations	Installation of NERs in three Zone Substations	5	sites	370	74.000	65.000	14%
Nightcliff Pillar Box replacements	220 pillar boxes in the Nightcliff area - replace the cover and the HDPE plinth.	220	sites	500	2.273	0.600	279%
Integral Pillar Replacements – Palmerston	Integral Pillars - replacement of pillars including protection devices	200	sites	780	3.900	3.000	30%
Manton Terminal Substation 132kV CB Replacement	Replacement of compressed air operated 132kV Circuit Breakers CBs	4	units	950	237.500	225.000	6%
Replacement of Underrated Switchgear – Darwin CBD	Replace twelve switchgear installations with higher rated switchgear	12	units	1,500	125.000	125.000	0%
Service Dead-ends	Replace Service metal dead-ends on overhead services	6,500[186]	units	2,000	0.308	0.300	3%
Transmission Tower Earthing	Upgrades of earthing systems	167[187]	towers	500	2.994	3.000	0%
Channel Island 132kV Crossing Pylon Refurbishment	Access ladders and safety rails replacement, transmission tower repainting	4[188]	towers	500	125.000	125.000	0%
Dehumidification of Indoor Switchrooms	Install dehumidifiers in existing indoor switch rooms	8[189]	units	900	112.500	112.500	0%
Distribution Pole Life Extension	Refurbishing 14% of all regulated steel poles that haven't been inspected since the program began in 2010-11.	4,559[190]	poles	2,195[191]	0.481	0.481	0%
Weighted average difference							**8%**

Source: Parsons Brinckerhoff analysis

[185] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (a), Table 1

[186] Average of 5000-8000 units

[187] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (f)(ii)

[188] Power and Water Corporation, 2013, 'Response to Issue 40 – Power Networks Asset Replacement & Upgrade Programs', Section (f)(iii)

[189] Average of 6 - 10

[190] Power and Water Corporation, 2013, 'Power Networks Asset Replacement & Upgrade Programs: Distribution Pole Life Extension'

[191] Power and Water Corporation, 2013, 'Power Networks Asset Replacement & Upgrade Programs: Distribution Pole Life Extension'

We note that the forecast expenditure is heavily weighted toward the beginning of the regulatory period. As noted above, the timing of many of the sub-programs lack justification. There is no evidence that a practice of prioritisation has been undertaken in this program of works. Parsons Brinkerhoff is of the view that individual elements of this program, and its sub-programs, should be prioritised and optimised, and hence the timing of the expenditure should be adjusted to smooth out the resource requirements. This will improve the deliverability of the program.

We note that no options have been analysed to address the individual sub-programs.

Based on our review of the information provided, Parsons Brinckerhoff is unable to conclude that the proposed capital expenditure associated with the Asset Replacement and Upgrade Program is prudent; however, we are of the view that there is likely to be a need to address most of the components of this program. We are also unable to conclude that the program is the efficient solution to the identified constraints.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.34. This is an increase of 2.5% compared to the staged submission.

Power Networks explained that the change to the project is an increase in the cost of the pole replacement program based on an updated pole failure rate and removal of the poles from the unregulated network[192]. The further difference in the total forecast expenditure is due to an updated escalator[193] applied to the real 2012/13 forecast cost estimate.

The changes to this project do not impact on the findings of the staged submission review.

Table 7.34 IRP submission forecast expenditure for Sub8274 - Asset Replacement and Upgrade Programs ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	5,533	4,674	2,326	1,423	1,423	15,378
Augmentation	1,198	1,012	503	308	308	3,329
Reliability	1,177	994	495	303	303	3,270
Total	**7,907**	**6,680**	**3,324**	**2,034**	**2,034**	**21,977**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Recommendations

The adjustments shown in Table 7.35 are recommended to the forecast capex for the 2014/15-18/19 period. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

[192] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Asset Replacement and Upgrade Programs', Section1, p. 2

[193] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

Table 7.35 Recommended capex adjustments – Asset Replacement and Upgrade Program ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**7,545**	**6,314**	**2,946**	**2,315**	**2,315**	**21,435**
IRP proposed capex	**7,907**	**6,680**	**3,324**	**2,034**	**2,034**	**21,977**
Substation Gate Upgrade for Emergency Egress	(68)	(57)	(28)	(17)	(17)	(188)
Miscellaneous ZSS Equipment Replacements	(260)	(220)	(109)	(67)	(67)	(724)
Distribution pole inspection	(341)	(288)	(144)	(88)	(88)	(949)
Timing	(3,214)	(2,091)	981	2,162	2,162	-
Recommended adjustment to IRP proposed capex	**(3,883)**	**(2,656)**	**700**	**1,990**	**1,990**	**(1,861)**
Adjustment - Replacement component	(2,716)	(1,858)	491	1,393	1,393	(1,297)
Adjustment - Augmentation component	(594)	(408)	100	296	296	(311)
Adjustment - Reliability component	(573)	(390)	109	301	301	(253)
Recommended capex	**4,023**	**4,023**	**4,023**	**4,023**	**4,023**	**20,117**

Source: Parsons Brinckerhoff analysis

7.5.4.6 Sub8276 - Meters/Metering Program

Power Networks' metering program is composed of four sub-programs:

- New meter installations
- Meter replacements
- Pre-payment meter replacements
- Smart metering trial.

Power Networks' new customer connection forecast for the total network reflects an expected growth rate of approx. 3 % (see section 7.3.5). Power Networks confirmed that it is proposing to install one new meter for each new customer[194].

Power Networks has assessed that there are 5,847 obsolete meters in the field, and have estimated that 95% of meters are on asbestos boards. Power Networks is proposing to replace these meters and provide asbestos monitoring during the replacement[195].

Power Networks provides a prepayment metering service as part of its existing business practices[196]. The manufacturers of Ampy prepayment meters will no longer be manufacturing these meters or the magnetic disposable tokens used to operate them[197]. Power Networks is proposing to replace all of the 2606 pre-payment meters in urban areas during the 2014-19 regulatory period[198].

[194] Power and Water Corporation, 2013, 'Response to Issue 19 – Metering Growth', Section (a)

[195] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 3, p. 4

[196] Power and Water Corporation, 2013, 'Response to Issue 22 – Metering Prepayment Solution', Section (a)

[197] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 3, p. 3

[198] Power and Water Corporation, 2013, 'Response to Issue 22 – Metering Prepayment Solution', Section (c)

Power Networks is proposing to undertake a smart metering trial to identify whether there would be a net benefit to Power Networks and their customers from a wide-spread roll out[199].

Power Networks is proposing to undertake this program at the cost set out in Table 7.36. The forecast cost of this program represents 5% of the proposed replacement capex.

Table 7.36 Staged submission forecast expenditure for Sub8276 - Meters/Metering Program ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	775	1,141	1,507	2,224	1,203	6,852
Customer	634	934	1,233	1,820	985	5,606
Total	**1,409**	**2,075**	**2,741**	**4,044**	**2,188**	**12,457**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Metering Program submitted the following documentation:

- 'Business Need Identification - Power Networks Meters/Metering Program
- KPMG, 2 May 2013, 'Water and Electricity Metering Strategy', Final Report
- Response to Issue 19 – Metering growth
- Response to Issue 20 – Metering replacements
- Response to Issue 21 – Smart metering pilot
- Response to Issue 22 – Metering prepayment solution.

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

New meter installations

We note that the metering growth timing does not align with the new customer connections[200]. Power Networks has advised that the forecast numbers have been rounded to the nearest multiple of 50. Based on our review of Power Networks' customer number forecasting (see section 7.3.3), Parsons Brinkerhoff is of the view that the timing of and quantity of the new meters should align with the recommended new customer connections average of 1,700 per year, as outlined in our review.

Whilst no options analysis is set out in the Business Need Identification, Parsons Brinckerhoff considers that the installation of a new meter using the current meter supply contract is likely to be a cost effective option.

Parsons Brinckerhoff's examination of the initial project estimate[201] identified a unit cost that did not align with the unit costs discussed elsewhere in the Business Need Identification[202]. Power Networks have since

[199] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 2, p. 3

[200] Power and Water Corporation, 2013, 'RIN Template Worksheet 6.1 - Customer Numbers & New Customer Connections (2014 NPD - Stage 3)'

[201] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 3, p. 3

[202] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 2, p. 2

proposed that a blended unit cost based on the existing meter purchase contracts should be used[203]. In our opinion twelve months history is not sufficient to forecast a blended unit cost, however the unit rate derived is not unreasonable. Consequently we recommend the forecast capex utilise this blended unit rate.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with metering growth is prudent when aligned with the recommended new customer connections numbers. Moreover, notwithstanding the correction required to the unit rate, we are of the opinion that the selected option is the efficient solution to the identified constraint.

Metering replacements

We note that 5,201 of the proposed replacement boards have been identified for replacement based on meter age. Power Networks has confirmed that this is based on the manufacturer's design life. In Parsons Brinckerhoff's view, age alone does not justify the replacement of an asset. In particular, the manufacturer's design life is chosen such that the rate of failure before the end of design life is extremely low, which may lead to inefficient replacement. After the design life of an asset is met, the population will see an increase in failure rates. However, an unacceptable rate of failures may not be seen until the population is well past the manufacturer's design life. As such, asset owners require data on their population of assets to determine the probability of failure across the population and determine the appropriate time for replacement based on this failure rate. Power Networks has confirmed that they do not have this level of data for their metering population and are unable to undertake this type of analysis. In the absence of this information, based on our knowledge of the industry, Parsons Brinckerhoff accepts an expected life of a population of electronic meters, before failure rates become unsustainable, of 15-20 years. As such, we suggest that the meter batches installed after 1999 being replaced based on age, will not require bulk replacement in the 2014-19 regulatory period. This accounts for 217 of the proposed replacements.

We note that the metering replacements are scheduled to replace all of the identified meters by the end of the 2014-19 regulatory period[204]. Power Networks has advised that the progressive ramp up of replacements has been aligned to the field resources available. Power Networks has not provided any information that supports the required timing of the replacements of batches of meters. Parsons Brinkerhoff is of the view that although the timing has not been justified, any adjustment to the timing would be an arbitrary adjustment and hence we accept Power Networks' timing.

Whilst no options analysis is set out in the Business Need Identification, Parsons Brinckerhoff considers that the installation of a replacement meter using the current meter supply contract is likely to be a cost effective option.

We note that Power Networks has allowed for asbestos monitoring for every meter replacement, in contradiction to the statement that Power Networks expects that 95%[205] of boards will contain asbestos. Further information suggests that only boards installed before the mid-eighties will contain asbestos[206].This accounts for 4,970 of the proposed replacement meters. Consequently we recommend the adjustment of the forecast to accommodate asbestos monitoring for only this portion of the board.

Parsons Brinckerhoff's examination of the initial project estimate[207] identified a unit cost that did not align with the unit costs discussed elsewhere in the Business Need Identification[208]. Power Networks have since

[203] Power and Water Corporation, 2013, 'Response to Issue 19 – Metering growth', Section (b)

[204] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 4, p. 4

[205] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 3, p. 4

[206] Power and Water Corporation, 2013, 'Response to Issue 20 – Metering replacements', Section (c)

[207] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 3, p. 4

proposed that a blended unit cost based on the existing meter purchase contracts should be used[209]. In our opinion twelve months history is not sufficient to forecast a blended unit cost, however the unit rate derived is not unreasonable. Consequently we recommend the forecast capex utilise this blended unit rate.

Based on our review of the information provided, Parsons Brinckerhoff cannot conclude that the proposed capital expenditure associated with the metering replacement is prudent. However, we note that there will be a requirement to replace a subset of the proposed meters, based on condition and performance, during the regulatory period and as such suggest an adjustment to the proposed capex reflective of our findings above.

Parsons Brinckerhoff is of the opinion that notwithstanding the correction required to the unit rate and the overestimate of the quantity of asbestos boards, the selected option is the efficient solution to address metering replacements.

Smart metering pilot

We note that there is no documented case that justifies Power Networks' implementation of the smart meter trial and outlines the expected benefits to the business of this trial. However, we are of the opinion that there is a reasonable expectation of the trial providing a benefit to Power Networks and its customers, based on the smart meter experiences of businesses in other jurisdictions.

We note that the smart metering trial is scheduled for completion in 2018/19[210] which is based on timing for planning the logistics of the installation. Parsons Brinkerhoff is of the view that the timing of this trial is arbitrary and hence we agree with Power Networks' timing based on practical and logistical issues.

No alternative options have been outlined for the smart metering trial. Power Networks has confirmed that the design of the trial has not been finalised, but is intended to provide a representative sample across the different type of customers to best inform the business. Parsons Brinckerhoff considers that a diverse sample of the size chosen is reasonable to conduct such a trial.

The scope[211] of the proposed works includes 1000 smart meters, each including communications equipment, one hour of installation and software licenses. The scope also includes licensing, project management and consulting works to analyse the outcomes of the trial. In Parsons Brinckerhoff's opinion the scope is reasonable to undertake such a trial.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the smart meter trial is prudent. Moreover, we are of the opinion that the selected option is the efficient solution undertaking the trial.

Metering prepayment solution

We note that the prepayment meter replacement is scheduled for completion in 2018/19[212]. Power Networks has advised that this is based on replacing the population of prepayment meters in urban areas this regulatory period, followed in later periods by the replacement of remote prepayment meters. The rate of replacement will result in replacement of the whole population over 14 years. Whilst there is no formal justification provided for the specific timing of the replacements, Parsons Brinkerhoff is of the view that the timing of this program is reasonable.

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[208] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 2, p. 3

[209] Power and Water Corporation, 2013, 'Response to Issue 20 – Metering replacements', Section (d)

[210] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program ', Section 3, p. 4

[211] Power and Water Corporation, 2013, 'Response to Issue 21 – Smart metering pilot', Section (c)

[212] Power and Water Corporation, 2013, 'Response to Issue 22 – Metering repayment solution', Section (c)

The options considered to address the identified constraint are set out in the 'Water and Electricity Metering Strategy'[213]. Power Networks has selected the proposed option as the only option adopting proven technology[214]. Whilst a cost benefit analysis of the five options has not been provided, Parsons Brinckerhoff considers that the cost of the preferred option is reasonable.

Parsons Brinckerhoff's examination of the initial project estimate identified a unit cost that did not align with the unit costs discussed elsewhere in the Business Need Identification[215]. The unit cost of a meter with an integral disconnect relay is outlined as $137[216]. The unit cost used to develop the project estimate was $145 per meter. Power Networks have confirmed that the rate of $137 is the correct rate[217]. Consequently we recommend the forecast capex utilise this unit rate.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the prepayment meter replacement is prudent. However, we are of the opinion that the selected option is not necessarily the most efficient solution to the identified constraint and that a cost benefit analysis of the identified options should be undertaken. Nonetheless, we are of the view that the magnitude of the proposed expenditure is reasonable.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.37. This is a reduction of 9.1% compared to the staged submission.

Power Networks has explained that the changes to the program are due to changes in inputs[218].

Parsons Brinckerhoff has identified that the changes are:

- New meter blended unit cost based on the existing meter purchase contracts[219]
- Replacement meter blended unit cost based on the existing meter purchase contracts[220]
- Reduction in meter replacements of 173 meters, to be included in the interval meter program[221]
- Reduction in allocation of asbestos costs to only 95% of boards
- Reduction in unit cost of asbestos boards based on average of Power Networks' recent invoices[222]

[213] KPMG, 2 May 2013, 'Water and Electricity Metering Strategy', Final Report

[214] KPMG, 2 May 2013, 'Water and Electricity Metering Strategy', Final Report

[215] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program'

[216] Power and Water Corporation, 24 June 2013, 'Business Need Identification - Power Networks Meters/Metering Program', Section 2, p. 3

[217] Power and Water Corporation, 2013, 'Response to Issue 22 – Metering repayment solution', Section (b)

[218] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 1, p. 2

[219] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.1.2, p. 5

[220] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.2.2, p. 7

[221] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.2.1, p. 7

[222] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.2.2, p. 7

- Reduction in unit cost of prepayment meters based on Power Networks' current contract[223]
- Addition of once-off cost of software package license and installation[224]
- an updated escalator[225] applied to the real 2012/13 forecast cost estimate.
- Reduction in the prepayment meter replacements
- Change in the timing of the capex associated with the smart meter trial.

The changes to this project address a large portion of the findings of the staged submission review.

The smart metering trial has been expedited compared to the staged submission. Power Networks states that:

"In order to inform the capital expenditure forecasts for the subsequent regulatory control period, Power Networks' proposes that the smart meter trial is held in the 2016-17 and 2017-18 financial years of the 2014-19 regulatory control period" [226]

Parsons Brinckerhoff is of the view that this is a reasonable and practical approach.

Table 7.37 IRP forecast expenditure for Sub8276 - Meters/Metering Program ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement	680	1,052	1,692	1,868	939	6,231
Customer	556	861	1,384	1,528	768	5,098
Total	**1,236**	**1,913**	**3,077**	**3,396**	**1,707**	**11,329**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Recommendations

The adjustments shown in Table 7.38 are recommended to the forecast capex for the 2014/15-18/19 period. For clarity, these are the further adjustments required to the IRP submission; Power Networks has made some of the adjustments identified by Parsons Brinkerhoff in the staged submission. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

[223] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.3.2, p. 8

[224] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.3.2, p. 8

[225] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

[226] Power and Water Corporation, August 2013, 'Business Need Identification - Revised Power Networks Meters/Metering Program', Section 3.4.1, p. 10

Table 7.38 Recommended capex adjustments Sub8276 - Meters/Metering Program ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**1,409**	**2,075**	**2,741**	**4,044**	**2,188**	**12,458**
IRP proposed capex	**1,236**	**1,913**	**3,077**	**3,396**	**1,707**	**11,329**
Alignment of new meters with new customer connections	(74)	(89)	(104)	(134)	(148)	(549)
Reduction of replacement meters	(4)	(11)	(16)	(22)	(8)	(61)
Removal of asbestos monitoring for boards installed after 1980s	(26)	(79)	(118)	(158)	(59)	(440)
Recommended adjustment to IRP proposed capex	**(104)**	**(179)**	**(238)**	**(314)**	**(215)**	**(1,050)**
Adjustment - Replacement component	(57)	(99)	(131)	(173)	(118)	(577)
Adjustment - Customer component	(47)	(81)	(107)	(141)	(97)	(472)
Recommended capex	**1,132**	**1,734**	**2,838**	**3,083**	**1,492**	**10,279**

Source: Parsons Brinckerhoff analysis

7.5.5 Findings and recommendations

Parsons Brinckerhoff has undertaken a number of specific detailed reviews of replacement capex projects and has recommended the deferral of the capex associated with Casuarina ZSS 66kV Outdoor Switchyard by one year (PRD30115 - see section 7.5.4.1) and Berrimah ZSS by two years (PRD30402 - see section 7.5.4.3). These recommendations reflect the findings of our specific reviews and in particular our view that the timing of the zone substation replacement works has not been justified and has been forward loaded (see section 7.5.3). It is our view that zone substation replacement works should be smoothed across the period. We also recommend that the timing of the remaining zone substation works be adjusted to smooth out the resource requirements. This will improve the deliverability of the program.

Based on our review of Power Networks' draft Power Networks Asset Strategies Procedure[227], Parsons Brinkerhoff is of the view that the need to replace the power transformers at both Casuarina ZSS and Berrimah ZSS has not been justified and that replacement based on age alone is not prudent. We note that Power Networks does not have the detail of asset data required to predict the failure of assets at this stage. We also note the movement of one transformer, that has no condition related problems[228], from McMinns ZSS to the essential spares. We are of the view that the replacement of all five transformers is not prudent or efficient. We accept that there may be some condition issues with some of the transformers which may require their refurbishment or replacement in the future, but this has not been proven or justified by Power Networks at this stage. As such we suggest the removal of expenditure related to the power transformer replacements for one of the sites from the overall replacement program capex.

Parsons Brinckerhoff has also recommended the removal of capex associated with the New Mitchell Street Switching Station (PRD30600 -see section 7.5.4.4). This recommendation reflects the findings of our specific review and in particular our view that the New Mitchell Street Switching Station is a contingent project dependant on the decision by Darwin City Council not to extend the lease on the Mitchell Street site.

Based on our detailed review of replacement capex projects parsons Brinckerhoff has recommended the removal of the capex associated certain sub-programs from the Asset Replacement and Upgrade Programs (Sub8274 - see section 7.5.4.5).These recommendations reflect the findings of our specific reviews and in particular our view that the timing of the replacement works has not been justified and has been forward

[227] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT

[228] Power and Water Corporation, No Date, 'Power Networks Asset Strategies Procedure', DRAFT, Section 2.6, p. 48 - 58

loaded. It is our view that replacement works should be smoothed across the period. This will improve the deliverability of the program.

In our review of the asset replacement and upgrade program (see 7.5.4.5), Parsons Brinckerhoff found that the unit costs used to develop the replacement capex forecasts were over estimated by an average 8%. We note that McMinns ZSS replacement and the Metering replacements forecasts were based on Contractor pricing and existing contracts, not unit price estimates. Hence we recommend a reduction of 8% of estimates based on unit costs, i.e. the overall replacement capex excluding McMinns ZSS replacement and metering replacements, to address the overestimate in unit costs.

Parsons Brinckerhoff also recommends a reduction of expenditure associated with the Meters/Metering Program (Sub8276 -see section 7.5.4.6). This reflects our specific review and in particular our view that Power Networks' customer connections forecast is overstated (see section 7.3.3).

While not subject to a detailed review, we note the inclusion of a new program of work, PRD30625 Darwin: Interval Meter Rollout in the IRP submission. Power Networks did not submit a BNI[229] in support of the forecast capex for the Interval Meter Rollout. Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with Interval Meter Rollout is prudent. However, we note that no options analysis has been provided, and hence cannot conclude that the proposed expenditure is efficient. Nonetheless we are of the view that the proposed scope and units costs are reasonable to address the need outlined.. As such, we recommend no adjustments to the expenditure associated with the Interval Meter Rollout in the forecast capex for the 2014/15-18/19 period.

Table 7.39 shows that the recommended network replacement capex for the 2014-19 regulatory period is $126.452m. This recommendation reduces the network replacement capex by 20% in real terms compared with the IRP proposed regulatory period expenditure of $157.439m.

Table 7.39 Recommended Replacement capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	**51,744**	**24,446**	**40,813**	**15,312**	**19,124**
IRP submission proposed capex	**45,537**	**32,048**	**29,504**	**32,238**	**18,607**
Deferral of Casuarina Zone Substation	(8,844)	520	8,323	-	-
Deferral and reduction of Berrimah Zone Substation	-	-	-	(1,218)	(3,654)
Removal of excessive power transformer replacements	(619)	(5,826)	(12,417)	5,826	12,477
Deferral and smoothing of ZSS works	-	-	-	(1,218)	(3,654)
Removal of Mitchell St Switching Station	(4,146)	2,715	1,240	1,136	(945)
Removal of components of Asset Replacement and Upgrade Program	-	(208)	(936)	(14,462)	-
Reduction in replacement unit rates	(2,186)	(1,767)	(1,011)	(1,506)	(2,100)
Reduction of Metering Program	(57)	(99)	(131)	(173)	(118)
Recommended adjustment to IRP proposed capex	**(18,568)**	**(6,523)**	**(4,441)**	**(9,003)**	**7,053**
Recommended capex	**26,969**	**25,525**	**25,062**	**23,235**	**25,660**
Regulatory Period	**126,452**				

Source: Parsons Brinckerhoff analysis

[229] Power and Water Corporation, August 2013, 'Business Need Identification – PRD30625 Interval Meter Rollout',

The benchmarking of Replacement capex vs. RAB (refer to Figure 4-6) demonstrates that Power Network's proposed IRP replacement capex is slightly more than average of its peers, but consistent with the variation of its peers as it is close to the trend line.

Figure 7-6 below shows the recommended replacement capex superimposed on the benchmarking of Replacement capex vs. RAB (refer to Figure 4-6). The recommended 20% reduction brings Power Networks slightly closer to the trend. The lower capex is consistent with the relatively younger age of the asset base that resulted from the large asset replacement program in the current period.

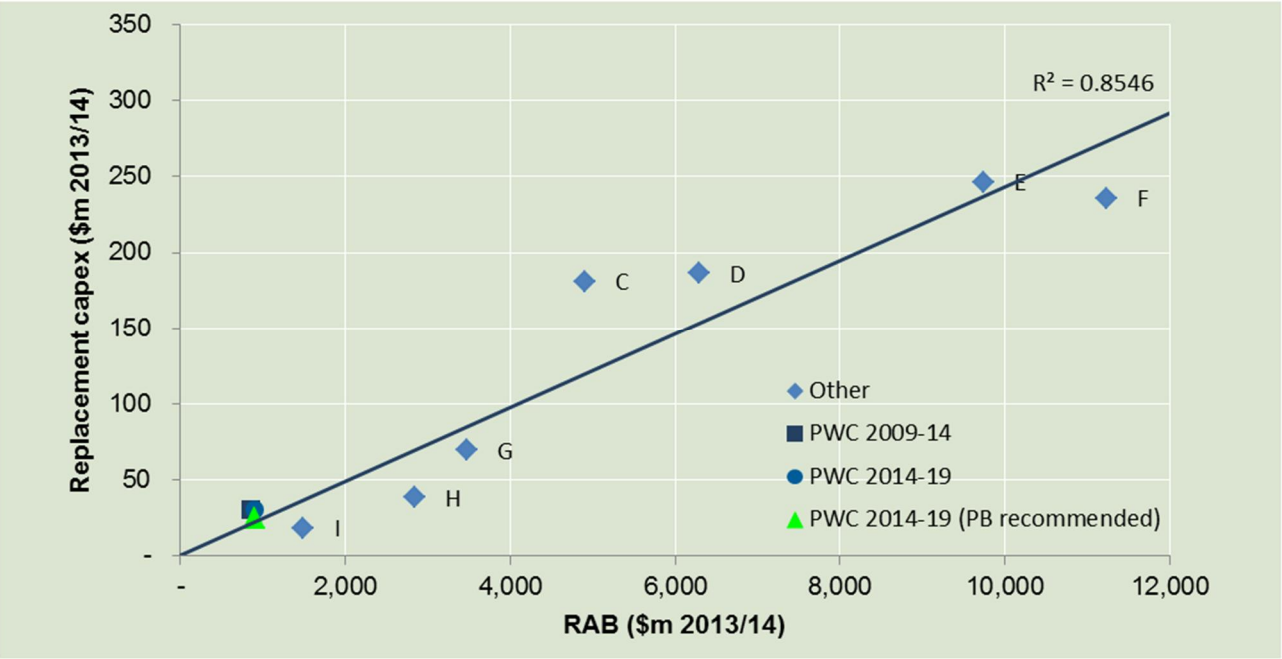


Figure 7-6 Recommended replacement capex vs. RAB

7.6 Reliability and quality of supply capex

7.6.1 Proposed expenditure

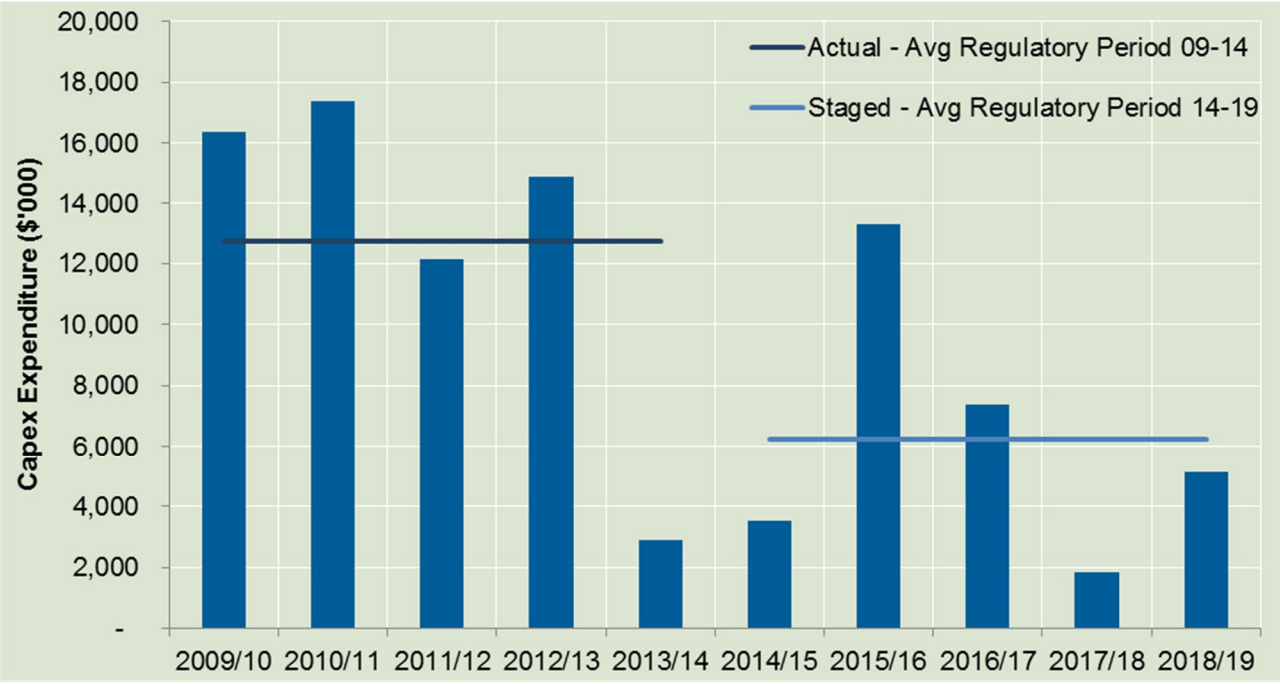
Table 7.40 shows that the staged submission proposed network reliability and quality of supply capex for the 2014-19 regulatory period is $31.210m.

Table 7.40 Reliability and quality of supply staged submission capex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission terminal station	-	4	90	542	-	-	-	-	-	-
Zone Substations	7,338	13,895	8,817	3,354	1,328	1,710	941	439	345	3,692
Transmission lines	2	193	1,304	5,540	-	-	10,663	5,332	-	-
Distribution Mains	9,022	3,301	1,929	5,464	1,576	1,838	1,703	1,596	1,510	1,440
Distribution substations	-	-	-	-	-	-	-	-	-	-
Metering	-	-	-	-	-	-	-	-	-	-
Land and easements	-	-	-	-	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Total	**16,363**	**17,392**	**12,140**	**14,899**	**2,904**	**3,548**	**13,308**	**7,367**	**1,855**	**5,132**
Regulatory Period	**63,698**					**31,210**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

Figure 7-7 shows the historical and forecast network reliability and quality of supply capex and illustrates that the system reliability and quality of supply capex is forecast to decrease by 51% in real terms compared with the current regulatory period expenditure of $63.698m. This reduction in expenditure is reflective of the move away from run to failure asset management, as discussed in section 7.5.3.



Source: Table 7.40

Figure 7-7 Reliability & Quality capex – Staged submission ($'000 real 2013/14)

7.6.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.41. This is an increase of 4.7% compared to the staged submission.

Table 7.41 Reliability and Quality of Supply IRP capex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	3,548	13,308	7,367	1,855	5,132	**31,210**
IRP submission proposed capex	5,560	13,283	7,016	1,809	5,007	**32,676**
Difference	**56.71%**	**-0.19%**	**-4.76%**	**-2.47%**	**-2.44%**	**4.70%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff notes that the change to the forecast reliability and quality of supply capex as set out in the IRP are primarily related to the following matters:

- Reduction of expenditure of PRD30309 Darwin: Construct East Arm ZSS
- Increased cost and forward loading of expenditure of PRD30003 Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing
- Increased cost and forward loading of expenditure of Sub8274 NT Wide (Regulated Network) Asset Replacement and Upgrade Programs
- Inclusion of a new program PRD30307 Darwin: Integrated Distribution Management System
- an updated escalator[230] applied to the real 2012/13 forecast cost estimate.

7.6.3 Reliability and quality of supply capex drivers

The primary driver of the reliability and quality of supply capex forecast proposed by Power Networks is the requirements set out in the Network Technical Code and Network Planning Criteria, the System Control Technical Code, and the Northern Territory of Australia Electricity Standards of Service Code and Determination – Approval of Electricity Network Performance Target Standards for the Regulatory Control Period 1 July 2014 to 30 June 2019.

It should be noted that Parsons Brinckerhoff undertook a detailed review of PWC's revised Network Technical Code and Network Planning Criteria as well as PWC's System Control Technical Code. These reviews are the subject of separate reports[231,232].

[230] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

[231] Parsons Brinckerhoff, 3 July 2013, "RE: 2014-2019 Network Price Determination - Review of Power and Water Corporation's revised Network Technical Code and Network Planning Criteria", 2189282A-DMS LTR-001 Draft Version 2

[232] Parsons Brinckerhoff, 3 July 2013, "RE: 2014-2019 Network Price Determination - Review of potential conflicts between Power and Water Corporation's revised Network Technical Code, Network Planning Criteria and System Control Technical Code", 2189282A-DMS LTR-002 Draft Version 1

7.6.4 Specific reviews

In relation to the $31.210m reliability and quality of supply capex, Parsons Brinckerhoff sought to examine a range of planning documentation (e.g. business cases, board papers, etc.) in order to establish Power Networks' justification for the proposed expenditure forecasts. In our opinion, in demonstrating the prudency and efficiency of proposed expenditure it is essential to demonstrate both the need and timing of the proposed capex, as well as a consideration of options, selection of the most efficient option, and the relationship of the scope of proposed works to the identified need. To support this demonstration Parsons Brinckerhoff would expect that robust business cases (or similar documentation) would be available for projects/programs at least in the earlier years of the forecast period, while later years may have preliminary business cases (or similar documentation) as the basis of demonstrating the prudency and efficiency of proposed expenditure.

To undertake this review, Parsons Brinckerhoff considered the supporting documentation for the largest reliability and quality of supply capex project; specifically:

- PRD30003 - Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing (51% of reliability and quality of supply capex).

In addition to these project reviews, in our reviews of Power Networks other capex categories Parsons Brinckerhoff also undertook further specific reviews of the following projects with reliability and quality of supply capex components:

- PRD30309 – Darwin – Construct East Arm Zone Substation(13% of reliability and quality of supply capex) – refer Section 7.4.4.1
- Sub8274 - Asset Replacement and Upgrade Programs(10% of reliability and quality of supply capex) – refer Section 7.5.4.5.

The following section sets out Parsons Brinckerhoff's review of the largest reliability and quality of supply capex project noted above.

7.6.4.1 PRD30003 - Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing

Power Networks has identified that the existing 132kV transmission line from Channel Island Power Station (CIPS) to the Hudson Creek Terminal Station (HCTS), that supplies the Darwin area, is structurally inadequate to withstand a Category 2 cyclone[233]. Based on this assessment Power Networks expects the Darwin area to lose 132kV transmission supply in the event of a Category 2 or above cyclone. In the event of a category 2 cyclone 150 MVA[234], is at risk.

To address the 150 MVA at risk in the event of a category 2 cyclone, Power Networks is proposing to construct a new section of 132kV double circuit transmission line, with each line having a capacity of

[233] Power and Water Corporation, 2013, 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status', Attachment 1, p. 1

[234] PWC expects that the distribution network will withstand a category 2 cyclone and the area demand will be the full Darwin area demand, estimated at 300MVA (Power and Water Corporation, 2013, 'Network Management Plan 2011/12 to 2016/17', Appendix B, p.129), of which 150MVA will be provided by the 66kV transmission, which is rated withstand a Category 4 cyclone (Power and Water Corporation, 2013, 'Network Management Plan 2011/12 to 2016/17', Appendix B, p.130). PWC expects that the overhead distribution network will not withstand a category 4 cyclone and the area demand will be limited to the underground network, estimated at 150MVA, able to be supplied by the 66kV transmission line.

280 MVA[235], across the Elizabeth River[236] at the cost set out in Table 7.42. The forecast cost of this project represents 51% of the proposed reliability and quality capex.

Table 7.42 Staged submission forecast expenditure for PRD30003 - Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Reliability	-	10,663	5,332	-	-	15,995

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the rebuild of the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing Power Networks submitted the following documentation:

- Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status
- Network Management Plan 2011/12 to 2016/17
- Response to Issue 35 - PRD30003 –Transmission Cyclone mitigation
- Sinclair Knight Mertz, Power and Water Corporation Elizabeth River 132kV Line Crossing Options - Options Study Report Rev B, 31 May 2102
- Sinclair Knight Mertz, Power and Water Corporation 132 kV Transmission Line – Hudson Creek to Channel Island Strenghtening (sic) Options, 15 August 2011
- Entura, Darwin 132kV Power Line Route Options Constructability Report E301867.03, 5 October 2011
- Darwin and Palmerston Overhead vs. Underground Assets (GIS Map)
- Transmission Lines: Cyclone Rating
- Sinclair Knight Mertz, Darwin Transmission System Cyclone Study, WP0-3689-EC-CA-001, 27 May 2009

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast , using as a guide the principles of prudency and efficiency as required by the NER.

We note that the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing is scheduled for completion in 2016/17 which is three years later than expected under Power Networks' economic and risk analysis237. Power Networks has advised that it has deferred this project because the PWC Board, in consultation with Power Networks, deferred the construction of the Elizabeth River Crossing by two years.. Based on our review of Power Networks' economic analysis[238], Parsons Brinkerhoff is of the view that the timing of this project was most efficient with a completion date of 2013/14 and that the efficiency decreases as the delivery of this project is deferred.

[235] Power and Water Corporation, 2013, 'Network Management Plan 2011/12 to 2016/17', Appendix B5, p.131

[236] Power and Water Corporation, 2013, 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status', Attachment 1, Section 4.1.4, p. 6

[237] Power and Water Corporation, 2013, 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status', Attachment 1, Section 4.2.2, p. 8

[238] Power and Water Corporation, 2013, 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status', Attachment 1, Section 4.2.1, p. 7

The options considered to address the identified constraint are set out in the Internal Memo[239] and its attachments. Power Networks has selected the proposed option[240] as the least cost and most cost effective option, based on a detailed NPV and CBR for each of the four options. Parsons Brinckerhoff considers that the proposed option is the most cost effective option.

We note that the proposed expenditure is greater than double the initial estimate of $7.6m[241]. Power Networks have explained that the original estimate was of a magnitude level only; the current estimate was derived through a facilitated workshop bringing together subject matter experts to better identify the scope, risks and costs. The cost and risk data prepared was then used for the RACE analysis. As this is a significant cost increase, Parsons Brinckerhoff is of the opinion that the economic analysis should be recalculated with the updated cost estimates to ensure that the proposed option is still the most cost effective option.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing is prudent when commissioned as soon as practically possible, to ensure that optimal risk mitigation is achieved. Moreover, we are of the opinion that the selected option is the efficient solution to the identified constraint.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.43. This is an increase of 0.3% compared to the staged submission.

Power Networks explained that the change to the project is a reduction in cost based on a risk adjusted cost estimate[242]. We also note that the IRP submission brings forward the costs of design work. The further difference in the total forecast expenditure is due to an updated escalator[243] applied to the real 2012/13 forecast cost estimate.

The changes to this project do not impact on the findings of the staged submission review.

Table 7.43 IRP submission forecast expenditure for PRD30003 - Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Reliability	529	10,589	4,929	-	-	16,048

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

[239] Power and Water Corporation, 2013, 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status'

[240] PWC has confirmed that the proposed option (option 2c) that has been included in the proposed capex is not the preferred option (option 2b) outlined in the supporting documentation. The preferred option outlined in Attachment 1, Section 4.2.3, p. 7 of 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status' is option 2b, which provides greater risk reduction at a much higher cost. The economic analysis does not support the selection of option 2b

[241] Power and Water Corporation, 2013, 'Internal Memo Re: Darwin Transmission Cyclone Mitigation Strategy Summary of Status', Attachment 1, Section 4.1.4, p. 6

[242] Power and Water Corporation, 2013, 'PRD30003: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing ', Section1, p. 2

[243] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

Recommendations

The adjustments shown in Table 7.44 are recommended to the forecast capex for the 2014-2019 regulatory period. These adjustments are broken down into the capex categories, by the proportion that the project was broken down into each category in the IRP submission.

Table 7.44 Recommended capex adjustments – Darwin – CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	**-**	**10,663**	**5,332**	**-**	**-**	**15,995**
IRP proposed capex	**529**	**10,589**	**4,929**	**-**	**-**	**16,048**
Expedite construction	10,589	(5,660)	(4,929)	-	-	-
Recommended adjustment to IRP proposed capex	**10,589**	**(5,660)**	**(4,929)**	**-**	**-**	**-**
Adjustment - Reliability component	10,589	(5,660)	(4,929)	-	-	-
Recommended capex	**11,119**	**4,929**	**-**	**-**	**-**	**16,048**

Source: Parsons Brinckerhoff analysis

7.6.5 Findings and recommendations

Parsons Brinckerhoff has undertaken a specific detailed review of an augmentation capex project and has recommended the expedition of PRD30003 - Darwin: Rebuild the CIPS to Hudson Creek 132kV Transmission Line - Elizabeth River Crossing (see section 7.5.5.1). This recommendation reflects the findings of our specific review and in particular our view that Power Networks' cost benefit analysis demonstrates that the implementation of the project is more efficient if commissioned sooner.

While not subject to a detailed review, we note that the Feeder Upgrade Program (Sub8262) is impacted by Power Networks' reliability analysis practices. Power Networks demonstrated a robust analysis of the cost of lost generation to determine the quantum of expenditure proposed for feeder upgrade. Parsons Brinckerhoff is of the opinion that the quantum of expenditure is prudent in addressing the reliability of the feeders; consequently we do not recommend any adjustment of the capex associated with the Feeder Upgrade Program. Power Networks has not demonstrated that the utilisation of the expenditure is efficient. Power Networks expressed a drive to identify the impact of individual asset classes on the reliability indicator SAIDI; however, this is currently not the case. Power Networks has confirmed that the quality of the reliability data only allows the business to focus on a particular set of assets but is not granular enough to complete a full root-cause analysis. We are of the opinion that this is likely to result in an inefficient allocation of expenditure even within asset classes. There is a limited focus on the frequency of outages. Power Networks confirmed that the frequency performance is mainly addressed in planning. Parsons Brinckerhoff is of the view that targeting works to focus on the duration component of the reliability performance is not an efficient allocation of the proposed expenditure.

While not subject to a detailed review, we note the inclusion of a new program of work, PRD30307 Darwin: Integrated Distribution Management System (IDMS), in the IRP submission. Power Networks submitted a Business Case[244] in support of the forecast capex for the Integrated Distribution Management System. Parsons Brinckerhoff is of the view that the proposed capital expenditure associated with Integrated Distribution Management System is prudent. A high level options analysis has been provided suggesting that the IDMS is likely to be the efficient solutions to the identified issues. As such, we recommend no adjustment to the expenditure associated with the Integrated Distribution Management System in the forecast capex for the 2014/15-18/19 period.

[244] Power and Water Corporation, September 2013, 'Business Case (Initial Regulatory Proposal) PRD30307 - Integrated Distribution Management System'

In addition to the above recommendations, in our review of PWC's proposed augmentation capex (see section 7.4), we also make a number of recommendations that impact PWC's proposed reliability and quality of supply capex in regards to the:

- Deferral of PRD30309 - Darwin East Arm Zone Substation (see section 7.4.4.1).

For further details of these recommendations reference should be made to our review of Power Networks' augmentation capex in section 7.4.

In our review of PWC's proposed replacement capex (see section 7.5), we also make a number of recommendations that impact PWC's proposed reliability and quality of supply capex in regards to the:

- reduction of Sub8274 - Asset Replacement and Upgrade Programs (see section 7.5.4.5).

For further details of these recommendations reference should be made to our review of Power Networks' replacement capex in section 7.5.

Table 7.45 shows that the recommended network reliability and quality of supply capex for the 2014-19 regulatory period is $30.027m. This recommendation reduces the network reliability and quality of supply capex by 8% in real terms compared with the IRP proposed regulatory period expenditure of $32.676m.

Table 7.45 Recommended Reliability and quality of supply capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	**3,548**	**13,308**	**7,367**	**1,855**	**5,132**
IRP submission proposed capex	**5,560**	**13,283**	**7,016**	**1,809**	**5,007**
Deferral of East Arm Zone Substation	871	-	-	-	(3,267)
Removal of components of Asset Replacement and Upgrade Program	(573)	(390)	109	301	301
Expedition of Elizabeth River Crossing	10,589	(5,660)	(4,929)	-	-
Recommended adjustment to IRP proposed capex	**10,888**	**(6,051)**	**(4,820)**	**301**	**(2,966)**
Recommended capex	**16,448**	**7,232**	**2,196**	**2,110**	**2,041**
Regulatory Period	**30,027**				

Source: Parsons Brinckerhoff analysis

7.7 Compliance – environmental, safety and statutory capex

7.7.1 Proposed expenditure

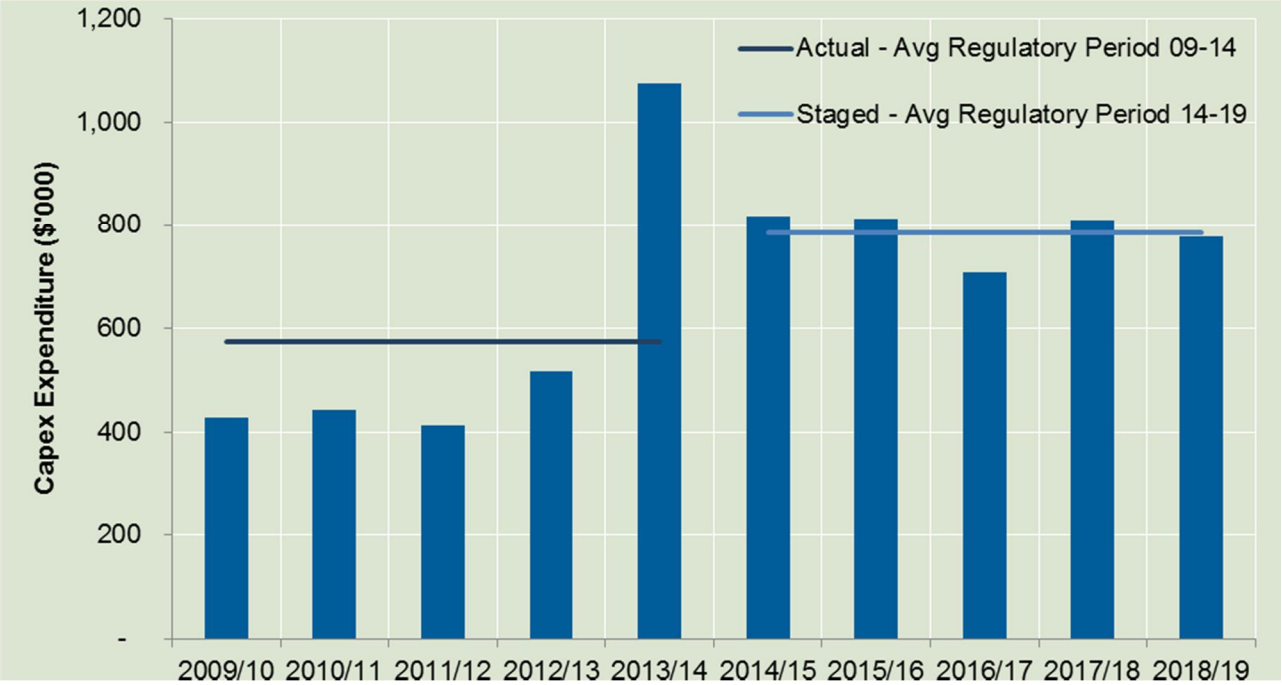
Table 7.46 shows that the staged submission proposed network compliance capex for the 2014-19 regulatory period is $3.925m.

Table 7.46 Compliance (environmental, safety and statutory) staged submission capex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission terminal station	-	-	-	-	-	-	-	-	-	-
Zone Substations	-	-	-	-	-	-	-	-	-	-
Transmission lines	-	-	-	-	-	-	-	-	-	-
Distribution Mains	-	-	-	-	-	-	-	-	-	-
Distribution substations	-	-	-	-	-	-	-	-	-	-
Metering	-	-	-	-	-	-	-	-	-	-
Land and easements	-	-	-	-	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	-	-	-	-	659	505	501	501	497	466
Other	429	442	413	518	416	312	312	208	312	312
Total	**429**	**442**	**413**	**518**	**1,074**	**817**	**812**	**708**	**809**	**778**
Regulatory Period	**2,876**					**3,925**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

Figure 7-8 shows the historical and forecast network compliance capex and illustrates that the system compliance capex is forecast to increase by 36.5% in real terms compared with the current regulatory period expenditure of $2.876m. This increase is reflective of the change in compliance requirements.



Source: Table 7.46

Figure 7-8 Compliance capex – Staged submission ($'000 real 2013/14)

7.7.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.47. This is an increase of 26.1% compared to the staged submission.

Table 7.47 Compliance IRP capex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	817	812	708	809	778	**3,925**
IRP submission proposed capex	1,844	812	708	809	777	**4,949**
Difference	**125.73%**	**-0.09%**	**-0.10%**	**-0.09%**	**-0.08%**	**26.10%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff has identified that the changes are:

- inclusion of a new program PRD30307 Darwin: Integrated Distribution Management System
- an updated escalator[245] applied to the real 2012/13 forecast cost estimate.

[245] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p. 7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

7.7.3 Compliance – environmental, safety and statutory capex drivers

The primary driver of the Compliance – environmental, safety and statutory capex forecast proposed by PWC are the legislation and compulsory standards that apply to the development and maintenance of the network and the business. We note the requirement from the Australian Communications and Media Authority (ACMA) to relocate frequencies of operation of Power Networks' UHF Radio systems[246].

7.7.4 Findings and recommendations

The compliance capex items and their relative proportion of the compliance capex are:

- Sub8257 - SCADA and Communication Systems Replacement and Upgrade Program (63% of compliance capex)
- Long Service Levy (37% of compliance capex).

While not subject to a detailed review, we note that the SCADA and Communication Systems Replacement and Upgrade Program (Sub8257), is impacted by the requirement from the Australian Communications and Media Authority (ACMA) to relocate frequencies of operation of Power Networks' UHF Radio systems[247]. In our opinion the step change seen in the capex expenditure is appropriate to address this requirement.

While not subject to a detailed review, we note the inclusion of a new program of work, PRD30307 Darwin: Integrated Distribution Management System (IDMS), in the IRP submission. Power Networks submitted a Business Case[248] in support of the forecast capex for the Integrated Distribution Management System. Parsons Brinckerhoff is of the view that the proposed capital expenditure associated with Integrated Distribution Management System is prudent. A high level options analysis has been provided suggesting that the IDMS is likely to be the efficient solutions to the identified issues. As such, we recommend no adjustment to the expenditure associated with the Integrated Distribution Management System in the forecast capex for the 2014/15-18/19 period.

Table 7.48 shows that the recommended network compliance capex for the 2014-19 regulatory period is $4.949m. This recommendation does not reduce the compliance capex in real terms compared with the IRP proposed regulatory period expenditure.

[246] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks SCADA and Communications Networks Replacement and Upgrade Program', Section 2, p. 5

[247] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks SCADA and Communications Networks Replacement and Upgrade Program', Section 2, p. 5

[248] Power and Water Corporation, September 2013, 'Business Case (Initial Regulatory Proposal) PRD30307 - Integrated Distribution Management System'

Table 7.48 Recommended Compliance (environmental, safety and statutory) capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	**817**	**812**	**708**	**809**	**778**
IRP submission proposed capex	**1,844**	**812**	**708**	**809**	**777**
Recommended adjustment to IRP proposed capex	**-**	**-**	**-**	**-**	**-**
Recommended capex	**1,844**	**812**	**708**	**809**	**777**
Regulatory Period	**4,949**				

Source: Parsons Brinckerhoff analysis

7.8 Non-network capex - high level review

In its staged submission PWC submitted a proposed non-network capex of $6.218m (real 2013/14) for the 2014-19 regulatory period which represents 2% of the total proposed capex expenditure. A summary of the proposed non-network capex is set out in Table 7.49.

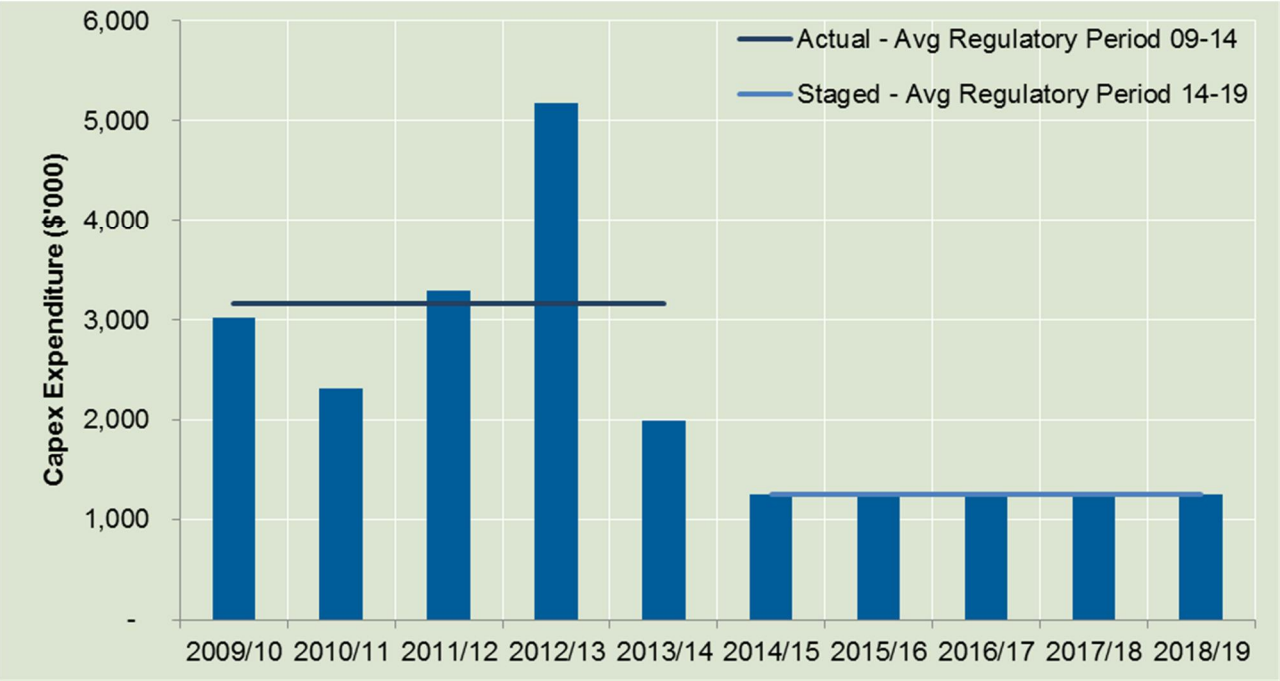
Table 7.49 Non-network staged submission capex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
IT and Communications Capex	-	-	-	-	-	-	-	-	-	-
Motor Vehicles Capex	-	-	-	-	-	-	-	-	-	-
Property Capex	-	-	-	-	-	-	-	-	-	-
Plant & Equipment Capex	2,578	2,180	3,292	3,833	1,295	1,244	1,244	1,244	1,244	1,244
Other Capex	445	133	-	1,347	698	-	-	-	-	-
Total	**3,023**	**2,313**	**3,292**	**5,180**	**1,993**	**1,244**	**1,244**	**1,244**	**1,244**	**1,244**
Regulatory Period	**15,801**					**6,218**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

7.8.1 Trends and comparative analysis

Figure 7-9 shows the historical and forecast non-network capex and illustrates that the non-network capex is forecast to decrease by 60.6% in real terms compared with the current regulatory period expenditure of $15.801m.



Source: Table 7.49

Figure 7-9 Non-Network capex overview – Staged submission ($'000 real 2013/14)

We note that there is no expenditure proposed for the 2014-19 regulatory period in the following non-network categories:

- Motor vehicle capex
- Property capex
- Other capex.

The staged submission proposed capex is flat across the 2014-19 regulatory period with no variation over time.

7.8.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed total non-network capex for this category is shown in Table 7.50 which represents an increase of 117% compared to the staged submission.

Table 7.50 Non-network capex overview – IRP submission ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	1,244	1,244	1,244	1,244	1,244	**6,218**
IRP submission proposed capex	6,845	2,939	1,234	1,234	1,234	**13,487**
Difference	**450.37%**	**136.35%**	**-0.76%**	**-0.76%**	**-0.76%**	**116.89%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

7.9 IT and communications capex

7.9.1 Proposed expenditure

The staged submission proposed no IT and communications non-network capex for the next regulatory period[249].

7.9.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.51.

Table 7.51 IT and Communications IRP capex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	-	-	-	-	-	**-**
IRP submission proposed capex	5,611	1,705	-	-	-	**7,316**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff notes that the change to the forecast IT and communications capex as set out in the IRP are primarily related to the following matters:

- Inclusion of a new program PRD30604 Darwin: Metering IT Systems Upgrade

7.9.3 IT and communications capex drivers

The primary driver of the IT and communications capex forecast proposed by PWC are the requirements for IT and communications infrastructure inherent in other programs of capex works, specifically the metering program.

7.9.4 Specific reviews

In relation to the $7.316m proposed IRP IT and communications capex, Parsons Brinckerhoff sought to examine a range of planning documentation (e.g. business cases, board papers, etc.) in order to establish Power Networks' justification for the proposed expenditure forecasts. In our opinion, in demonstrating the prudency and efficiency of proposed expenditure it is essential to demonstrate both the need and timing of the proposed capex, as well as a consideration of options, selection of the most efficient option, and the relationship of the scope of proposed works to the identified need. To support this demonstration Parsons Brinckerhoff would expect that robust business cases (or similar documentation) would be available for projects/programs at least in the earlier years of the forecast period, while later years may have preliminary business cases (or similar documentation) as the basis of demonstrating the prudency and efficiency of proposed expenditure.

To undertake this review, Parsons Brinckerhoff considered the supporting documentation for the IT and communications capex project; specifically:

- PRD30604 Darwin: Metering IT Systems Upgrade (100% of IT and communications capex).

[249] Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Table 3.1.1

The following sections set out Parsons Brinckerhoff's review of the IT and communications capex project noted above.

7.9.4.1 PRD30604 Darwin: Metering IT Systems Upgrade

Subsequent to our review of Power Networks' staged submission, Parsons Brinckerhoff has reviewed the revisions in Power Networks' IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.13.

Power Networks' has outlined the potential to breach of compliance with electricity metering regulations[250]. To address the potential breach, Power Networks is proposing to undertake a Metering IT systems upgrade.

Table 7.52 Metering IT Systems Upgrade - IRP submission forecast expenditure ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Non-network IT	5,611	1,705	-	-	-	7,316
Total	**5,611**	**1,705**	**-**	**-**	**-**	**7,316**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

In support of the forecast capex for the Metering IT Systems Upgrade Power Networks submitted the following documentation:

- Business Need Identification PRD30604 - Metering IT Systems Upgrade
- KPMG, 2 May 2013, 'Water and Electricity Metering Strategy', Final Report.

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

The scope of works provided for this program does not detail the specific components required to develop the metering IT system. We also note that there are no options outlined and no options analysis provided to demonstrate that the proposed solutions are the efficient solutions.

Based on our review of the information provided, Parsons Brinckerhoff is of the opinion that the proposed capital expenditure associated with the Metering IT Systems Upgrade is required to address the potential breach of metering regulations and hence is prudent. However, we are unable to conclude that the selected option is the efficient solution to the identified constraint. Parsons Brinkerhoff is of the view that although the quantity of expenditure and the timing has not been justified, any adjustment would be an arbitrary adjustment and hence we accept Power Networks' quantity of expenditure and timing, therefore no adjustments are recommended to the forecast capex for the 2014/15-2018/19 period.

Recommendations

No adjustments are recommended to the forecast capex for the 2014/15-2018/19 period

7.9.5 Findings and recommendations

Parsons Brinckerhoff has undertaken a specific detailed review of the IT and communications capex project and although Parsons Brinkerhoff is of the view that although the quantity of expenditure and the timing has not been justified, any adjustment would be an arbitrary adjustment and hence we accept Power Networks'

[250] Power and Water Corporation, August 2013, 'Business Need Identification PRD30604 - Metering IT Systems Upgrade', Section 2, p. 2

quantity of expenditure and timing, therefore no adjustments are recommended to the forecast capex for the 2014/15-2018/19 period.

Table 7.53 shows that the recommended IT and communications capex for the 2014-19 regulatory period is $7.316m. This recommendation does not reduce the non-network IT and communications capex in real terms compared with the IRP proposed regulatory period expenditure.

Table 7.53 Recommended IT and communications capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	-	-	-	-	-
IRP proposed capex	**5,611**	**1,705**	-	-	-
Recommended adjustment to IRP proposed capex	-	-	-	-	-
Recommended capex	**5,611**	**1,705**	-	-	-
Regulatory Period	**7,316**				

Source: Parsons Brinckerhoff analysis

7.10 Plant and equipment capex

7.10.1 Proposed expenditure

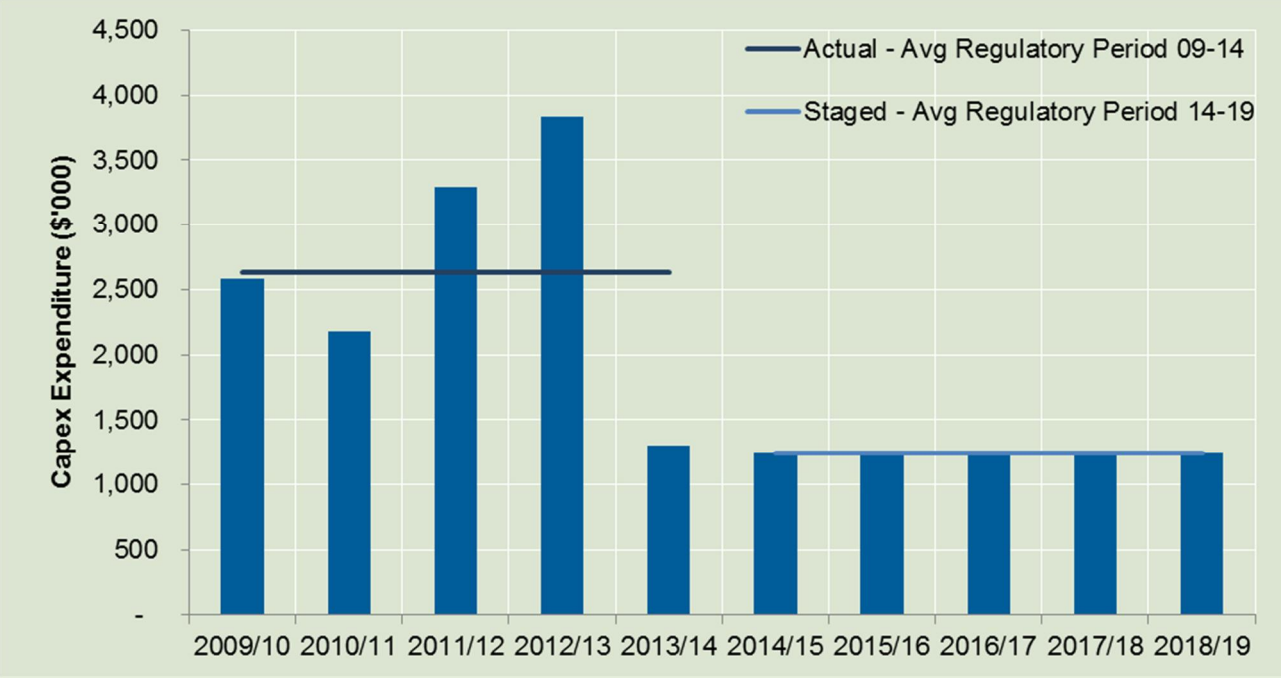
Table 7.54 shows that the staged submission proposed plant and equipment non-network capex for the 2014-19 regulatory period is $6.218m.

Table 7.54 Plant and equipment staged submission capex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Plant & Equipment Capex	2,578	2,180	3,292	3,833	1,295	1,244	1,244	1,244	1,244	1,244
Total	**2,578**	**2,180**	**3,292**	**3,833**	**1,295**	**1,244**	**1,244**	**1,244**	**1,244**	**1,244**
Regulatory Period	**13,178**					**6,218**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working, cost escalators applied to 2009/10 – 2012/13, see C1 Cost Escalators

Figure 7-10 shows the historical and forecast plant and equipment non-network capex and illustrates that the plant and equipment non-network capex is forecast to decrease by 52.8% in real terms compared with the current regulatory period expenditure of $13.178m.



Source: Table 7.54

Figure 7-10 Plant and equipment capex – Staged submission ($'000 real 2013/14)

7.10.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this category is shown in Table 7.55. This is a reduction of 0.8% compared to the staged submission.

Table 7.55 Plant and equipment IRP capex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Staged submission proposed capex	1,244	1,244	1,244	1,244	1,244	**6,218**
IRP submission proposed capex	1,234	1,234	1,234	1,234	1,234	**6,171**
Difference	**-0.76%**	**-0.76%**	**-0.76%**	**-0.76%**	**-0.76%**	**-0.76%**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)'), 3.1 – Working , Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14), Parsons Brinckerhoff analysis

Parsons Brinckerhoff notes that there is no material change to the forecast plant and equipment as set out in the IRP; the difference in the total forecast expenditure is to an updated escalator[251] applied to the real 2012/13 forecast cost estimate.

7.10.3 Plant and equipment capex drivers

The primary driver of the plant and equipment capex forecast proposed by PWC are testing and condition assessments that require specialist tools and equipment. The poor condition of previously neglected assets and the 2008 Casuarina incident has led to a focus on condition based assessment; which has increased the

[251] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p.7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

requirements for specialist tools and training. Parsons Brinckerhoff has undertaken a review of Power Networks' preventative maintenance practices (see section 8.12) and is of the opinion that the forecast testing and condition assessments are reasonable.

7.10.4 Specific reviews

In relation to the $6.218m plant and equipment capex, Parsons Brinckerhoff sought to examine a range of planning documentation (e.g. business cases, board papers, etc.) in order to establish Power Networks' justification for the proposed expenditure forecasts. In our opinion, in demonstrating the prudency and efficiency of proposed expenditure it is essential to demonstrate both the need and timing of the proposed capex, as well as a consideration of options, selection of the most efficient option, and the relationship of the scope of proposed works to the identified need. To support this demonstration Parsons Brinckerhoff would expect that robust business cases (or similar documentation) would be available for projects/programs at least in the earlier years of the forecast period, while later years may have preliminary business cases (or similar documentation) as the basis of demonstrating the prudency and efficiency of proposed expenditure.

To undertake this review, Parsons Brinckerhoff considered the supporting documentation for the plant and equipment capex project; specifically:

- Sub8255 - Capital Items & Essential Spares Program (100% of plant and equipment capex).

The following sections set out Parsons Brinckerhoff's review of the two largest plant and equipment capex project noted above.

7.10.4.1 Sub8255 - Capital Items & Essential Spares Program

Power Networks' has outlined that the move toward condition based assessment has increased the requirements for specialist tools and training[252]. Based on the Casuarina incident of 2008 Power Networks has realised that their essential spares were insufficient. No specific quantity or type of equipment has been forecast.

To address the insufficient spares and requirement for specialist tools and training, Power Networks is proposing to undertake a capital items and essential spares program Table 7.56.

Table 7.56 Staged submission forecast expenditure for Sub8255 - Capital Items & Essential Spares Program ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Non-network plant and equipment	1,244	1,244	1,244	1,244	1,244	6,218
Total	**1,244**	**1,244**	**1,244**	**1,244**	**1,244**	**6,218**

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', Forecast ($13-14)

In support of the forecast capex for the Capital Items & Essential Spares Program Power Networks submitted the following documentation:

- Business Need Identification - Power Networks Capital Items and Essential Spares Program
- Sub8255 Capital Items & Essential Spares MNW Program Cost Breakdown.XLS

[252] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Capital Items and Essential Spares Program', Section 2, p. 2

Parsons Brinckerhoff has examined the documentation submitted by Power Networks and made enquiries with the business to assess the reasonableness of the proposed capex forecast, using as a guide the principles of prudency and efficiency as required by the NER.

Parsons Brinckerhoff's examination of the initial program estimate[253] for this project identified an allocation of funds to provide the tools and spares outlined above. We are of the opinion that this expenditure is necessary to the business. Power Networks has confirmed that an allowance of money has been provided for each year of the regulatory period[254], derived by reducing the historical funds to a level that the business considers sustainable. No further evidence to support this derivation was provided. We would expect to see a robust spares and logistics framework to ensure the efficiency of the expenditure, rather than purchase of spares on a case by case basis. We are of the opinion that the level of forecast expenditure has not been justified; however, we note that the expenditure profile closely resembles the historical and forecast preventative maintenance expenditure profile (see section 8.12). Hence we are of the opinion that the forecast expenditure is reasonable.

Parsons Brinkerhoff is of the view that although the quantity of expenditure has not been justified, we are of the opinion that this expenditure is reasonable and likely to be efficient. Hence no adjustments are recommended to the forecast capex for the 2014/15-2018/19 period.

Initial Regulatory Proposal

Subsequent to the initial review conducted by Parsons Brinckerhoff, PWC submitted its IRP (see section 1.1.1). The IRP proposed capex for this program is shown in Table 7.57. This is a reduction of 0.8% compared to the staged submission.

Parsons Brinckerhoff notes that there is no material change to the forecast plant and equipment as set out in the IRP; the difference in the total forecast expenditure is due to an updated escalator[255] applied to the real 2012/13 forecast cost estimate.

Table 7.57 IRP submission forecast expenditure for Sub8255 - Capital Items & Essential Spares Program ($'000 real 2013/14)

Category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Non-network plant and equipment	1,234	1,234	1,234	1,234	1,234	6,171
Total	**1,234**	**1,234**	**1,234**	**1,234**	**1,234**	**6,171**

Source: Power and Water Corporation, 2013, '2014 NPD - IRP - Att 13A - Regulatory Information Notice - Regulatory Templates - Forecast Capital Expenditure Workbook', Forecast ($13-14)

Recommendations

No adjustments are recommended to the forecast capex for the 2014/15-2018/19 period

[253] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Capital Items and Essential Spares Program', Section 8.1, p. 4

[254] Power and Water Corporation, 28 June 2013, 'Business Need Identification - Power Networks Capital Items and Essential Spares Program', Section 3, p. 2

[255] Power and Water Corporation, 2013, '2014 Network Price Determination - Initial Regulatory Proposal - Confidential- 1 July 2014 to 30 June 2019 ', Table 1, p. 7, "Internal labour escalator –2013/14 and 2014/15; labour escalator has been changed to labour rate as approved by Power and Water's recent EBA negotiations."

7.10.5 Findings and recommendations

Parsons Brinckerhoff has undertaken a specific detailed review of the plant and equipment capex project and has recommended no adjustments of the capex associated with the Capital Items & Essential Spares Program (Sub8255 – see section 7.10.4.1). This recommendation reflects the findings of our specific review and in particular our view although the quantity of expenditure and the timing has not been justified, any adjustment would be an arbitrary adjustment.

Table 7.58 shows that the recommended plant and equipment capex for the 2014-19 regulatory period is $6.171m. This recommendation does not reduce the plant and equipment capex in real terms compared with the IRP proposed regulatory period expenditure.

Table 7.58 Recommended Plant and equipment capex ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	1,244	1,244	1,244	1,244	1,244
IRP submission proposed capex	1,234	1,234	1,234	1,234	1,234
Recommended adjustment to IRP proposed capex	-	-	-	-	-
Recommended capex	**1,234**	**1,234**	**1,234**	**1,234**	**1,234**
Regulatory Period	**6,171**				

Source: Parsons Brinckerhoff analysis

7.11 Summary of findings and recommendations

Parsons Brinckerhoff has undertaken a high level review of each expenditure category, including a number of specific detailed reviews of capex projects and has recommended adjustments to the expenditure categories. The recommendations provided in this report are in real 2013/14 dollars and may require the commission to apply real-cost escalators to be consistent with the RIN templates completed by PWC. These recommendations are summarised in Table 7.59.

Table 7.59 Recommended capex adjustments ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed capex	**75,378**	**56,354**	**68,634**	**42,646**	**62,540**
IRP submission proposed capex	**83,446**	**76,197**	**57,838**	**48,061**	**56,808**
Recommended user initiated capex adjustments (section 7.3.5)	(1,148)	(1,416)	(1,671)	(1,934)	(2,118)
Recommended augmentation capex adjustments (section 7.4.5)	(1,714)	(10,735)	(6,236)	9,724	(5,033)
Recommended replacement capex adjustments (section 7.5.5)	(18,568)	(6,523)	(4,441)	(9,003)	7,053
Recommended reliability and quality of supply capex adjustments (section 7.6.5)	10,888	(6,051)	(4,820)	301	(2,966)
Recommended compliance capex adjustments (section 7.7.4)	-	-	-	-	-
Recommended IT and communications adjustments (section 7.9.5)	-	-	-	-	-
Recommended non-network plant and equipment capex adjustments (section 7.10.5)	-	-	-	-	-
Recommended adjustment to IRP proposed capex	**(10,542)**	**(24,724)**	**(17,169)**	**(912)**	**(3,064)**
Recommended total capex	**72,903**	**51,473**	**40,669**	**47,149**	**53,744**
Regulatory Period	**265,937**				

Source: Parsons Brinckerhoff analysis

Table 7.60 shows the recommended capex for the 2014-19 regulatory period in terms of the standard control capex categories, consistent with RIN template 3.1. The values are in real 2013/14 dollars without labour and material escalation and may require the commission to apply real-cost escalators to be consistent with the RIN templates completed by PWC.

The recommended Network capex for the 2014-19 regulatory period is $252.451m. This recommendation reduces the Network capex by 18% in real terms compared with the IRP proposed regulatory period expenditure of $308.863m.

The recommended Non-network capex for the 2014-19 regulatory period is $13.487m. This recommendation does not reduce the Non-network capex in real terms compared with the IRP proposed regulatory period expenditure.

Table 7.60 Recommended Capex by standard control categories ($'000 real 2013/14)

Standard control capex categories	Recommendation					
	2014/15	2015/16	2016/17	2017/18	2018/19	Total
System Capex	**66,059**	**48,533**	**39,435**	**45,915**	**52,510**	**252,451**
Demand Related Capex	20,797	14,964	11,468	19,761	24,032	91,022
Network User Capex Initiated Capex	8,818	9,065	9,533	9,729	13,608	50,752
Zone Substations	-	-	-	-	-	-
Distribution Mains	6,365	6,342	6,313	6,398	10,993	36,411
Distribution substations	1,943	1,943	1,943	1,943	1,943	9,716
Metering	509	780	1,277	1,387	671	4,625
Augmentation Capex	11,980	5,899	1,935	10,032	10,424	40,270
Transmission terminal station	-	-	-	-	-	-
Zone substations	11,137	3,954	265	2,497	5,555	23,408
Transmission lines	817	923	1,670	7,535	4,869	15,813
Distribution mains	26	1,022	-	-	-	1,048
Distribution substations	-	-	-	-	-	-
Metering	-	-	-	-	-	-
Land and easements	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	-	-	-	-	-	-
Other	-	-	-	-	-	-
Non-Demand Related Capex	45,261	33,569	27,966	26,154	28,478	161,429
Replacement Capex	26,969	25,525	25,062	23,235	25,660	126,452
Transmission terminal station	-	-	-	-	-	-
Zone substations	15,608	13,823	13,249	11,133	11,880	65,691
Transmission lines	-	-	-	-	-	-
Distribution mains	5,680	6,052	5,051	5,161	5,124	27,068
Distribution substations	2,160	1,926	2,413	3,346	3,813	13,658
Metering	1,492	1,618	2,460	2,048	821	8,440
Land and easements	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	2,029	2,106	1,890	1,547	4,022	11,595
Other	-	-	-	-	-	-
Reliability & Quality Capex	16,448	7,232	2,196	2,110	2,041	30,027
Transmission terminal station	-	-	-	-	-	-
Zone substations	1,954	604	604	604	604	4,368
Transmission lines	11,119	4,929	-	-	-	16,048
Distribution mains	1,834	1,699	1,593	1,507	1,437	8,070
Distribution substations	-	-	-	-	-	-
Metering	-	-	-	-	-	-
Land and easements	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	1,542	-	-	-	-	1,542
Other	-	-	-	-	-	-
Compliance - Environment, safety and statutory	1,844	812	708	809	777	4,949
Transmission terminal station	-	-	-	-	-	-
Zone substations	-	-	-	-	-	-
Transmission lines	-	-	-	-	-	-
Distribution mains	-	-	-	-	-	-
Distribution substations	-	-	-	-	-	-
Metering	-	-	-	-	-	-
Land and easements	-	-	-	-	-	-
Secondary systems - Control, communications & Protection	1,532	500	500	497	465	3,494
Other	312	312	208	312	312	1,455

Standard control capex categories	Recommendation					
	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Non-System Capex	**6,845**	**2,939**	**1,234**	**1,234**	**1,234**	**13,487**
Non-network—IT and Communications Capex	5,611	1,705	-	-	-	7,316
Non-network—Motor Vehicles Capex	-	-	-	-	-	-
Non-network—Property Capex	-	-	-	-	-	-
Non-network—Plant & Equipment Capex	1,234	1,234	1,234	1,234	1,234	6,171
Non-network—Other capex	-	-	-	-	-	-
Capitalised Overheads	-	-	-	-	-	-
Total	**72,903**	**51,473**	**40,669**	**47,149**	**53,744**	**265,937**
Regulatory Period	**265,937**					

Source: Parsons Brinckerhoff analysis

8. Operating and maintenance expenditure review

Power Networks' opex consists of operational expenditure and maintenance expenditure. This section presents Parsons Brinckerhoff's review of PWC's proposed opex for the 2014-19 regulatory control period. High level overviews of total expenditure are provided, each followed by a review of the expenditure categories as set out in the RIN and in order of decreasing expenditure, and their trends. A summary of Parsons Brinckerhoff's findings and recommendations is provided in the conclusion of each section.

Each section of this opex review firstly considers Power Networks' staged review submission and then considers, at a high level, Power Networks' IRP submission (see section 1.1.1) and its impact on our assessments and recommendations.

In its staged submission Power Networks' submitted a proposed total operational and maintenance expenditure of $516.808m (real 2013/14) for the 2014-19 regulatory control period. A summary of the proposed total operational expenditure is set out in Table 8.1.

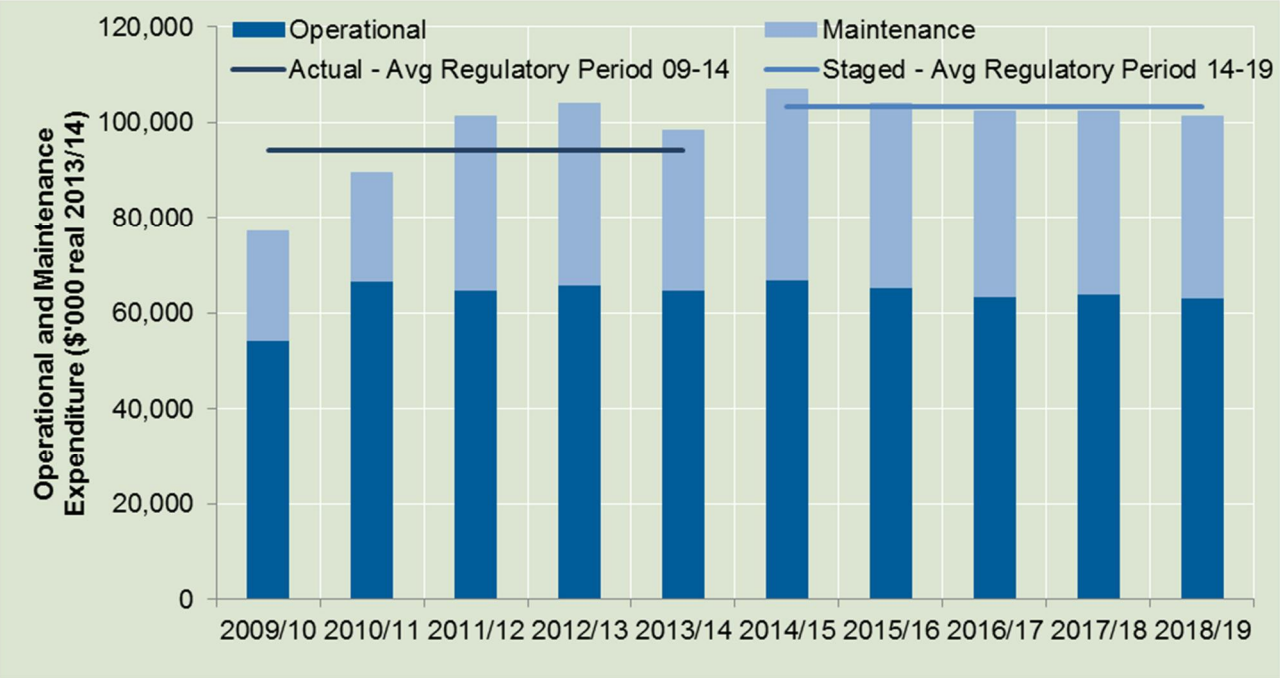
Table 8.1 Total opex overview – Staged submission ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Operational	54,290	66,675	64,608	65,898	64,687	66,764	65,168	63,287	63,878	63,082
Maintenance	22,911	22,730	36,555	38,029	33,687	40,218	38,776	39,049	38,475	38,111
Total	**77,201**	**89,405**	**101,163**	**103,927**	**98,374**	**106,982**	**103,944**	**102,336**	**102,352**	**101,194**
Regulatory Period	**470,070**					**516,808**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

Figure 8-1 shows the historical and forecast combined operational and maintenance expenditure from the staged submission. It illustrates that the operational and maintenance expenditure is forecast to increase by 10% in real terms compared with the current regulatory control period expenditure of $470.070m (real 2013/14). It indicates that Power Networks is requesting an average annual increase in expenditure, between the current regulatory period and the next, of $9.35m. There is an average increase of 4% from 2009/10 to 2013/14, which then changes to -1% during the next regulatory control period.



Source: Table 8.1

Figure 8-1 Operational and maintenance expenditure overview (2009/10 – 2018/19)

8.1 Total operational expenditure - high level review

In its staged submission Power Networks submitted a proposed total operational expenditure of $322.180m (real 2013/14) for the 2014-19 regulatory control period, which represents 62% of the total proposed opex. A summary of the proposed total operational expenditure is set out in Table 8.2.

Table 8.2 Total operational expenditure overview – Staged submission ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Corporate and shared services	14,844	20,996	21,025	26,927	25,276	23,788	22,534	20,756	20,220	20,230
Service delivery	24,113	29,409	20,869	17,434	16,723	16,650	16,635	16,750	16,735	16,750
Strategy and planning	9,860	11,067	13,878	11,406	12,808	12,833	12,833	12,833	12,833	12,833
System operations	1,501	1,391	4,356	4,852	4,851	4,790	4,790	4,790	4,790	4,790
Metering	3,014	3,037	3,257	3,770	2,973	4,678	4,513	4,442	4,234	4,517
Network management	957	775	1,223	1,481	2,056	2,030	2,030	2,030	2,030	2,030
GSL costs	0	0	0	29	0	1,684	1,522	1,376	1,245	1,127
Regulatory costs	0	0	0	0	0	311	311	311	1,790	804
Other	-	-	-	-	-	-	-	-	-	-
Full retail contestability related costs	-	-	-	-	-	-	-	-	-	-
Total	**54,290**	**66,675**	**64,608**	**65,898**	**64,687**	**66,764**	**65,168**	**63,287**	**63,878**	**63,082**
Regulatory Period	**316,156**					**322,180**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

8.1.1 Trends and comparative analysis

Figure 8-2 shows the historical and forecast operational expenditure from the staged submission and illustrates that the operational expenditure is forecast to increase by 2% in real terms compared with the current regulatory control period expenditure of $316.156m (real 2013/14).

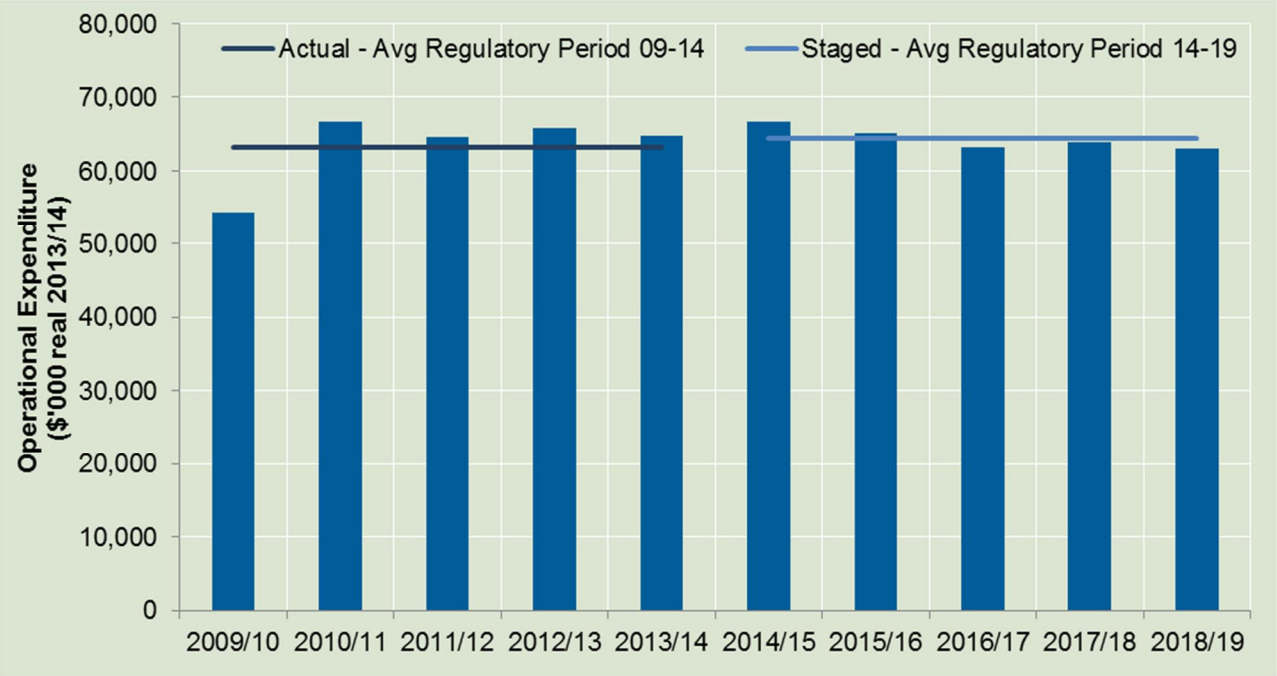


Figure 8-2 Operational expenditure overview– Staged submission ($'000 real 2013/14)

The expenditure was forecast using a methodology based on the reveal costs approach used by the AER. However some differences were noted in the approach:

- The 2012/13 actual expenditure was reviewed and non-recurrent costs were removed.
- The 2013/14 Statement of Corporate Intent (SCI) expenditure was then developed based on the adjusted 2012/13 costs.
- The forecast was then developed by rolling forward the 2013/14 SCI expenditure budget.

The notable difference with this approach is that the 2012/13 costs were not assess for efficiency of the expenditure. Therefore, it is possible inefficient expenditure has been included in the forecasts. To assess efficiency, Parsons Brinckerhoff used benchmarking against comparable DNSPs (section 4) and a detailed review of the non-recurrent or step changes. Figure 4-8 and Figure 4-9 show that the opex per customer is high compared to peer businesses.

As discussed in section 4.4, Parsons Brinckerhoff notes that Power Networks' geographical situation and business structure is likely to incur higher cost due to two key drivers:

- Limited economy of scale. Power Networks is a small business but still requires similar operational systems as other DNSPs in order to operate and manage their network. These base costs are largely fixed and would therefore contribute to the deviation from the trend line identified by the benchmarking.
- Locational cost. The remote location of the network results in higher labour costs, as described in Rawlinsons Australian Construction Handbook[256]. The uplifts vary across the state but have an average uplift of 30% in the Power Networks network areas.

[256] Rawlinsons Publishing, 2012, 'Rawlinsons Australia Construction Handbook'

Parsons Brinckerhoff considers that these two drivers contribute significantly to the deviation in efficiency identified in the benchmarking, and undertook sensitivity analysis to assess their impact.

The sensitivity analysis was undertaken by adjusting the expenditure of all businesses in the sample, by removing an amount between $10m and $20m[257] to represent the fixed cost, so we could assess the variable component of the expenditure that benefits from economies of scale. We then reduced Power Networks by a further 30% to adjust for the Northern Territory uplift. The reduction in the deviation from the trend line when the fixed component is estimated to be $10m is shown in Figure 8-3.

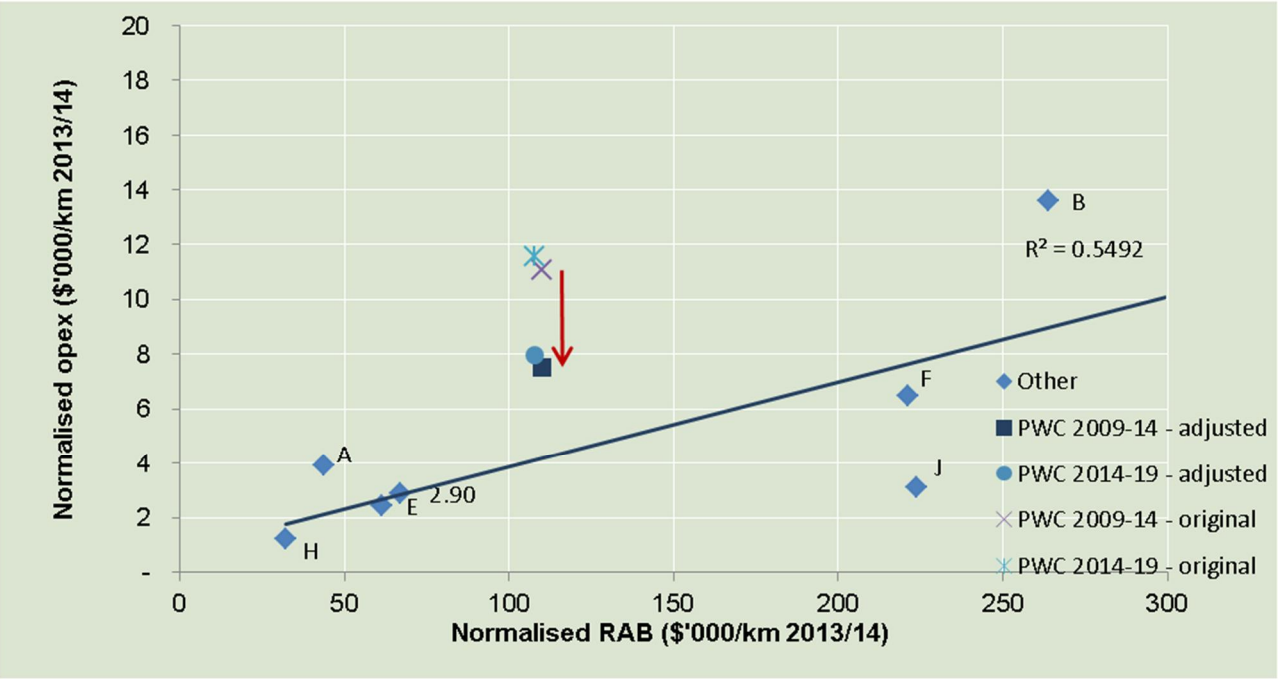


Figure 8-3 Sensitivity analysis of opex benchmarking

The sensitivity analysis showed that the uplift and economies of scale may account for a significant portion of the deviation from the trend line. While the adjusted value remains above the trend line, it lies within the range of peer businesses in the benchmarking sensitivity test, and therefore we do not recommend any global adjustments be made to the opex based on potential inefficiency identified through benchmarking.

The following sections provide detailed analysis of the proposed expenditure in each category.

8.2 Corporate and shared services

Power Networks provides multiple utility services, including electricity generation, electricity networks, water, sewerage and retail. Each of these divisions would require certain services and business units if they were operated as separate businesses. Since they are a single business the costs for the services are shared between the divisions. The Power Networks division captures the costs under the corporate and shared services category.

[257] The range used for the sensitivity analysis was based on Parsons Brinckerhoff's experience and knowledge of other DNSPs. We also note that the uplift factor applied had a greater impact on the movement towards the trend line than the fixed cost component.

8.2.1 Proposed expenditure

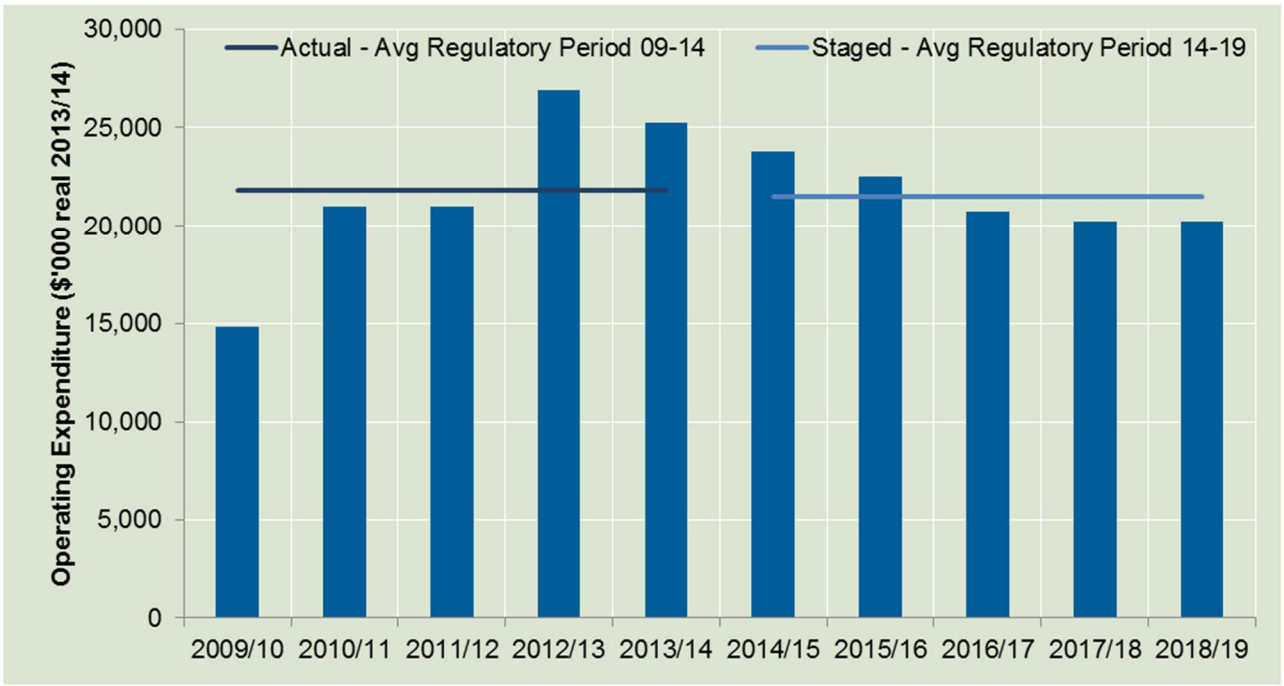
Table 8.3 shows the Corporate and Shared Services opex for the 2014-19 regulatory control period of $107.528m as proposed in the staged submission.

Table 8.3 Corporate and Shared Services staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Corporate services opex	-	-	-	-	-	23,629	22,375	20,597	20,061	20,072
Shared services opex	-	-	-	-	-	159	159	159	159	159
Total	**14,844**	**20,996**	**21,025**	**26,927**	**25,276**	**23,788**	**22,534**	**20,756**	**20,220**	**20,230**
Regulatory Period	**109,068**					**107,528**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Corporate and Shared Services opex from the staged submission is illustrated in Figure 8-4, which shows that the Corporate and Shared Services opex is forecast to decrease by 1% in real terms compared with the current regulatory control period expenditure of $109.068m.



Source: Table 8.3

Figure 8-4 Corporate and Shared Services opex – Staged submission ($'000 real 2013/14)

Analysis and findings

PWC forecast its future expenditure requirements for each corporate business unit and then allocated a portion of that cost to Power Networks based on the Cost Allocation Method (CAM)[258].

The high level review considered the profile of the forecast expenditure compared to the historical expenditure, which is shown in Figure 8-4. The chart identifies a step increase of $6.2m from 2009/10 to 2010/11 and a second step increase from 2011/12 to 2012/13, which then decrease back to the 2010/11 value by 2016/17.

Power Networks identified the first step change as a result of an increase in the total cost of the Employee and Organisational Services corporate business unit by $7.4m and the average allocation of all corporate overheads allocated to Power Networks increasing by 2% as a result of an increase of Power Networks personnel due to the Remedial Asset management Program (RAMP). Parsons Brinckerhoff is satisfied that this accounts for the increase in cost.

The second change was identified as a result of the share of the Asset Management System and its software depreciation expense allocated to Power Networks[259]. Parsons Brinckerhoff is satisfied that this accounts for the change in cost from 2012/13 to 2016/17.

Parsons Brinckerhoff undertook a detailed assessment of the methodology and approach taken by PWC to allocate the corporate and shared services between the divisions. Parsons Brinckerhoff reviewed the allocation method and rationale use for each division within the corporate business units and considers them to be based on a suitable driver for each allocation. We also sighted the data based system (Oracle) used and identified other sources of information used to develop the allocation ratios. Parsons Brinckerhoff considers that the information sources and procedures in place result in a reliable allocation ratio that is repeatable and appropriate.

Parsons Brinkerhoff notes that the CAM includes an allocation for insurance relating to personnel and substations, however, Power Networks stated that it excludes insurance relating to assets outside of substations, such as poles and wires, as such policies are not available. Power Networks has taken out a Self-Insurance policy to cover transmission and distribution conductors, refer to section 8.10 for details.

8.2.2 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.4.

The IRP forecast expenditure for the Corporate and Shared Services category increased by 2.8% ($600k) annually, $3m for the 2014-19 regulatory control period, compared to the staged submission. The change was identified to be a result of an increase to the Corporate Overhead Allocations applied to Power Networks for the use of Maximo in the call centre. Parsons Brinckerhoff does not consider this a material change.

Table 8.4 Corporate and Shared Services IRP submission opex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Corporate services opex	24,296	23,007	21,179	20,628	20,638	109,748
Shared services opex	159	159	159	159	159	794
Total	**24,455**	**23,166**	**21,337**	**20,787**	**20,797**	**110,542**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.1 – Working ($13-14)

[258] Power and Water Corporation, 2013, 'Power Networks Cost Allocation Method'

[259] Power and Water Corporation, 2013, 'Response to Issue 57 – Corporate and shared services cost', Section (B)

8.2.3 Findings and recommendations

Parsons Brinckerhoff is satisfied that PWC has followed the CAM when allocating corporate and shared services cost to the Power Networks division and that the causal allocation methodology is a prudent approach.

Table 8.5 shows that the recommended Corporate and Shared Services opex for the 2014-19 regulatory control period is $110.542m, being the amount proposed by Power Networks in the IRP.

Table 8.5 Recommended Corporate and Shared Services opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	24,455	23,166	21,337	20,787	20,797	110,542
Total adjustments	-	-	-	-	-	-
Recommended opex	**24,455**	**23,166**	**21,337**	**20,787**	**20,797**	**110,542**

Source: Parsons Brinckerhoff analysis

8.3 Service delivery

The Service Delivery group is responsible for the delivery of the Power Networks maintenance and capital works programs. It is comprised of the following sections:

- Field services
- Test and protection services
- Substation services
- SCADA and communications services,
- Metering services (considered as a separate category for the regulatory proposal)
- Work practices and training
- Project and finance administration.

8.3.1 Proposed expenditure

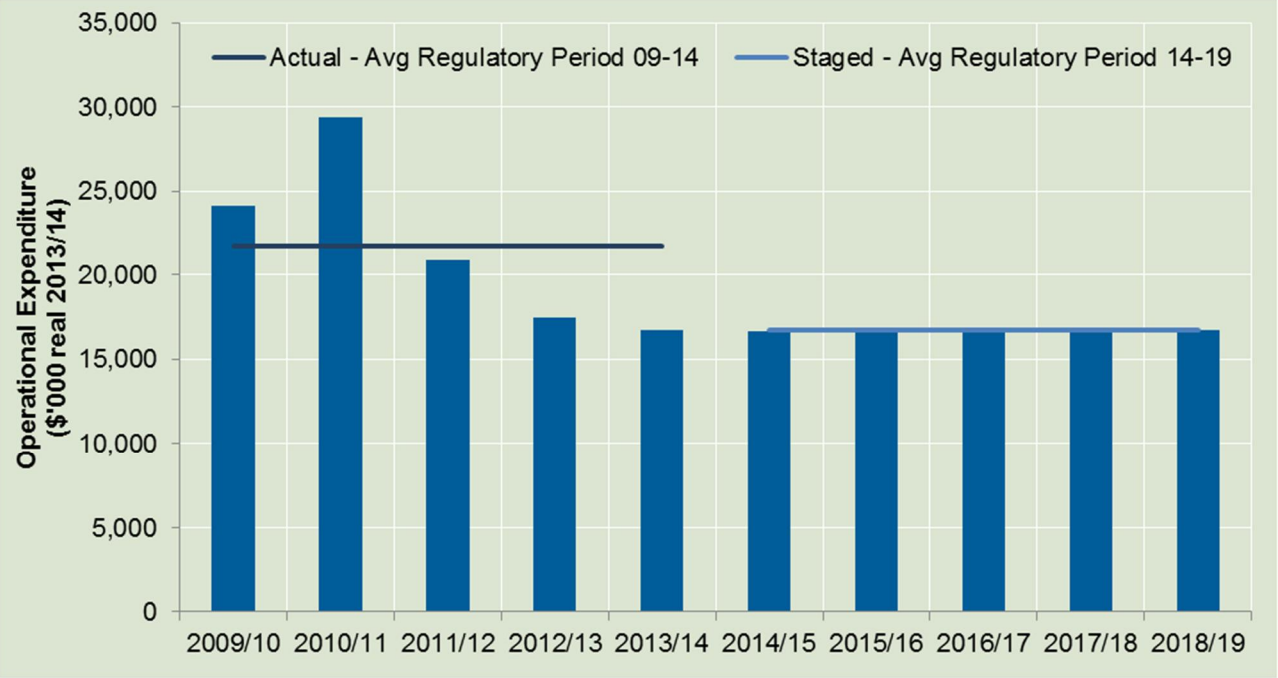
Table 8.6 shows the Service Delivery opex for the 2014-19 regulatory control period of $83.521m as proposed in the staged submission.

Table 8.6 Service delivery staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
In-house	-	-	-	-	-	16,120	16,120	16,220	16,220	16,220
Non-related party contractors	-	-	-	-	-	530	515	530	515	530
Total	**24,113**	**29,409**	**20,869**	**17,434**	**16,723**	**16,650**	**16,635**	**16,750**	**16,735**	**16,750**
Regulatory Period	**108,549**					**83,521**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Service Delivery opex from the staged submission is illustrated in Figure 8-5, which shows that the Service Delivery opex is forecast to decrease by 23% in real terms compared with the current regulatory control period expenditure of $108.549m.



Source: Table 8.6

Figure 8-5 Service delivery opex – Staged submission ($'000 real 2013/14)

8.3.2 Analysis and findings

Power Networks forecast their future expenditure requirements based on the 2013/14 Statement of Corporate Intent forecast expenditure which was adjusted for step changes and non-recurrent expenditure.

The high level review, as shown in Figure 8-5, identifies there is a step increase of $5.3m 2009/10 to 2010/11 then a decrease of $12.7m by 2013/14. These changes have been explained as a result of an increase to the workforce in 2010/11 as a result of the Remedial Asset Management Program[260] and then a focus being placed on accurate time sheeting which has resulted costs previously allocated to service delivery being allocated to the appropriate maintenance category. Parsons Brinckerhoff checked the magnitudes of the changes in the service delivery and maintenance categories and is satisfied that they support the explanation provided.

Parsons Brinckerhoff undertook a detailed review of the build-up of the costs. We found that the forecast annual expenditure comprised of the key items shown in Table 8.7. Note that these are an approximation based on the average contribution in the current period, as provided in the RIN Templates, as the forecast expenditure was not developed to this detail, but is expected to be composed of a similar mix of items and costs.

[260] Power and Water Corporation, 2013, 'Response to Issue 57 – Corporate and shared services cost', Section a.

Table 8.7 Breakdown of Service Delivery costs ($'000 real 2013/14)

Item	Approximate annual cost
Direct Costs	**8,440**
Labour and entitlements	8,440
Other Costs	**7,580**
IT and Communication	370
Travel	230
Property	690
Internal consumption	760
Vehicles (all light and heavy)	3,930
Remainder	1,600

Source: Parsons Brinckerhoff analysis based on Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.

The direct costs cover all labour allocated to the service delivery category including for functions such as operational planning, training, safety meeting and entitlements. Parsons Brinckerhoff understands that this amount allows for an expected vacancy rate of 6.2% of positions across Power Networks. A business case is expected to be submitted with the IRP to request additional resources based on a comprehensive review of the Service Delivery group. Parsons Brinkerhoff was not provided with a copy of that business case as part of the Stage 4 submission.

Approximately 52% of the 'Other' costs are allocated to vehicles, covering all light and heavy vehicles for operations, maintenance and capital projects. Parsons Brinckerhoff understands that it is prudent to allow expenditure for vehicle fleet operations, and although no information was provided to justify that the proposed expenditure is efficient, based on our benchmarking and sensitivity analysis (refer to section 8.1.1) we do not recommend any adjustments to this category.

In estimating the remaining categories, Power Networks allowed for step changes and non-recurrent costs covering SCADA and Communications upgrades and audit. These costs have been identified as predominantly addressing compliance and end of life issues, which were supported by the capex review (section 7.7.4). Parsons Brinckerhoff considers that expenditure to be prudent.

The expenditure allocated to the Remainder category of $1.6m does not have clear justification. Parsons Brinckerhoff notes that Power Networks did not have an opportunity to provide further clarification of the Remainder category expenditure within the timeframe of this review, however, with the information available we are unable to conclude that this expenditure is prudent or efficient and recommend it is excluded from the expenditure allowance.

8.3.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.8.

The IRP forecast expenditure for the Service Delivery category increased by an average of 3% ($0.420m) annually, $2.1m for the 2014-19 regulatory control period, compared to the staged submission. The change was identified to be a result of the following three items:

- Addition of Integrated Distribution Management System (IDMS) at a total cost of $0.330m for the 2014-19 regulatory control period. The IDMS opex is to run the IDMS proposed in the capex project number PRD30307. Refer to section 7.6.5.,

- Inclusion of expenditure related to the Service Delivery Workforce Business Case at an increase of $1.8m for the 2014-19 regulatory control period. The business case includes a cost of $0.655m for the 2014-19 regulatory control period for an engineering professional to operate the IDMS.
- Amendments to the Energy Management System upgrade step change with a reduction of $0.040m for the 2014-19 regulatory control period.

Power Networks also advised that the expected vacancy rate is 7.7%, stating that the value of 6.2% was reported incorrectly in the Stage 4 submission. The value of 7.7% had been used in calculations so it did not result in a change to the forecast.

Parsons Brinckerhoff notes that the capital replacement programs for distribution substations, HV cables and ORMU's have been recommended for inclusion in the forecast expenditure, refer to section 7.5. Parsons Brinckerhoff considers it prudent to increase the workforce with the appropriately skilled staff to meet the forecast capital works program.

In section 7.6.5, Parsons Brinkerhoff recommends that the IDMS project is not allowed due to insufficient justification to prove it is a prudent and efficient project. Therefore, Parsons Brinckerhoff also recommends that the opex related to the project, $0.985m for the engineer and annual operating costs, is not allowed.

Table 8.8 Service Delivery IRP submission opex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
In-house	16,250	16,543	16, 753	16,733	16,733	83,011
Non-related party contractors	530	515	530	515	530	2,619
Total	**16,780**	**17,058**	**17,283**	**17,248**	**17,263**	**85,630**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.1 – Working ($13-14)

8.3.4 Findings and recommendations

Parsons Brinckerhoff would expect a more granular breakdown for the forecast of each line item in order to prove prudency and efficiency of forecast expenditure. We are satisfied that most of the expenditure forecast for the Service Delivery category has been proven to represent prudent and efficient costs, however, Power Networks did not provide justification for the Remainder line item in the 'Other' cost build up

Table 8.9 shows that the recommended Service Delivery opex for the 2014-19 regulatory control period is $77,630m. This recommendation reduces the Service Delivery opex by 9% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.9 Recommended service delivery opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**16,780**	**17,058**	**17,283**	**17,248**	**17,263**	**85,630**
Adjustments – remove Remainder costs	(1,600)	(1,600)	(1,600)	(1,600)	(1,600)	(8,000)
Total adjustments	**(1,600)**	**(1,600)**	**(1,600)**	**(1,600)**	**(1,600)**	**(8,000)**
Recommended opex	**15,180**	**15,458**	**15,683**	**15,648**	**15,663**	**77,630**

Source: Parsons Brinckerhoff analysis

8.4 Strategy and planning

Strategy and Planning is responsible for the functions of asset management, network planning, customer connections, investment analysis functions and is *'substantially responsible for the delivery of the major capital program'*[261].

8.4.1 Proposed expenditure

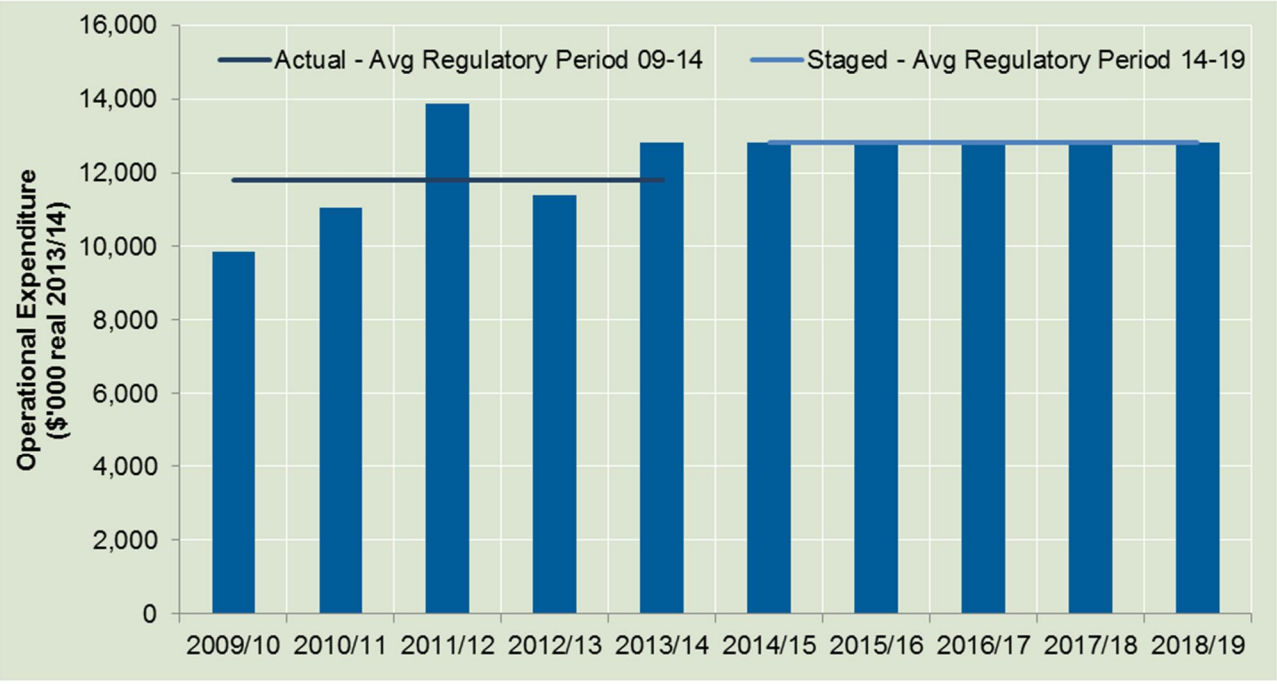
Table 8.10 shows the Strategy and Planning opex for the 2014-19 regulatory control period of $64.164m as proposed in the staged submission.

Table 8.10 Strategy and Planning staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
In-house	-	-	-	-	-	12,325	12,325	12,325	12,325	12,325
Non-related party contractors	-	-	-	-	-	508	508	508	508	508
Total	**9,860**	**11,067**	**13,878**	**11,406**	**12,808**	**12,833**	**12,833**	**12,833**	**12,833**	**12,833**
Regulatory Period	**59,018**					**64,164**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Strategy and Planning opex from the staged submission is illustrated in Figure 8-6, which shows that the Strategy and Planning opex is forecast to increase by 9% in real terms compared with the current regulatory control period expenditure of $59.018m.



Source: Table 8.10

Figure 8-6 Strategy and Planning opex – Staged submission ($'000 real 2013/14)

[261] Power and Water Corporation, 2013, 'Opex Category Justification – Power Networks – Opex Category: Strategy & Planning', Section 2, p. 2

8.4.2 Analysis and findings

Power Networks forecast their future expenditure requirements based on the 2013/14 Statement of Corporate Intent forecast expenditure which was adjusted for step changes and non-recurrent expenditure.

The high level review, as shown in Figure 8-6, identifies a gradual increase of $3m between 2009/10 and 2013/14 and a one off peak in 2011/12 of $14m. These changes have not been explained. At a high level the years of expenditure align with events in the wider business and, excluding the peak in 2011/12, are consistent with the increased focus on asset management within Power Networks. To assess any expenditure that cannot be considered efficient or prudent, Parsons Brinckerhoff undertook a detailed analysis.

Parsons Brinckerhoff found that the forecast annual expenditure comprised of the key items shown in Table 8.11. Note that these are an approximation based on the average contribution in the current period as the forecast expenditure was not developed to this detail, but is expected to be composed of a similar mix of items and costs.

Table 8.11 Breakdown of Strategy and Planning costs ($'000 real 2013/14)

Item	Approximate annual cost
Direct Costs	**7,978**
Labour and entitlements	7,978
Other Costs	**4,785**
IT and Communication	920
Travel	110
Property	515
Stores outsourcing	1,440
Vehicles (all light and heavy)	650
Remainder	1,150

Source: Parsons Brinckerhoff analysis based on Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1

The direct costs cover all labour and entitlements allocated to the Strategy and Planning group. Parsons Brinckerhoff understands that the forecast for labour allows for an expected vacancy rate of 6.2% of positions across Power Networks. The labour also includes a step change to allow for the equivalent of an additional 1.5 FTEs. Parsons Brinckerhoff is satisfied that there is no duplication with the additional people requested for other groups.

The expenditure allocated to the Remainder category of $1.15m does not have clear justification. Parsons Brinckerhoff notes that Power Networks did not have an opportunity to provide further clarification of the Remainder category expenditure, however, with the information available we are unable to conclude that this expenditure is prudent or efficient and recommend it is excluded from the expenditure allowance.

8.4.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The revised documentation provided as part of the IRP did not include any changes to the forecast expenditure set out in the staged submission.

Power Networks advised that the expected vacancy rate is 7.7%, stating that the value of 6.2% was reported incorrectly in the Stage 4 submission. The value of 7.7% had been used in calculations so it did not result in a change to the forecast.

8.4.4 Findings and recommendations

Parsons Brinckerhoff would expect a more granular breakdown for the forecast of each line item in order to prove prudency and efficiency of forecast expenditure. However, we are satisfied that most of the expenditure forecast for the Strategy and Planning category has been proven to represent prudent and efficient costs. Power Networks has provided no evidence that the 'Remainder' line item in the 'Other' costs build up is a prudent and efficient cost.

Table 8.12 shows that the recommended Strategy and Planning opex for the 2014-19 regulatory control period is $58.414m. This recommendation reduces the Strategy and Planning opex by 9% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.12 Recommended strategy and planning opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	12,833	12,833	12,833	12,833	12,833	64,164
Adjustments – remove Remainder costs	(1,150)	(1,150)	(1,150)	(1,150)	(1,150)	(5,750)
Total adjustments	**(1,150)**	**(1,150)**	**(1,150)**	**(1,150)**	**(1,150)**	**(5,750)**
Recommended opex	**11,683**	**11,683**	**11,683**	**11,683**	**11,683**	**58,414**

Source: Parsons Brinckerhoff analysis

8.5 System operations

The system operations expenditure category covers the cost of operating the interconnected power systems managed by Power Networks. This includes:

- network operations including controlling the HV system via SCADA where available or by directing authorised personnel and maintaining Wall Board drawings
- under frequency load shedding
- providing access to infrastructure
- fault call centre and crew dispatch, and
- recording fault information.

8.5.1 Proposed expenditure

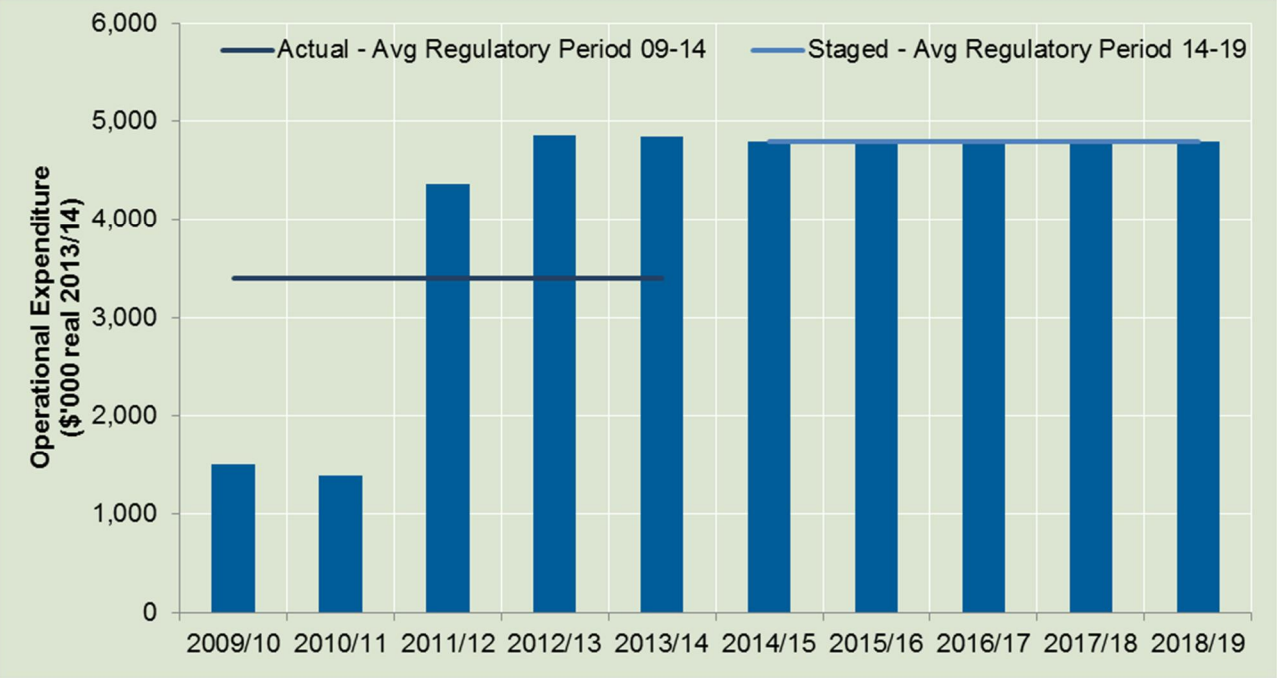
Table 8.13 shows the Systems Operations opex for the 2014-19 regulatory control period of $23.951m as proposed in the staged submission.

Table 8.13 System operations staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Systems operations costs	1,501	1,391	4,356	4,852	4,851	4,790	4,790	4,790	4,790	4,790
Total	**1,501**	**1,391**	**4,356**	**4,852**	**4,851**	**4,790**	**4,790**	**4,790**	**4,790**	**4,790**
Regulatory Period	**16,951**					**23,951**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Systems Operations opex from the staged submission is illustrated in Figure 8-7, which shows that the Systems Operations opex is forecast to increase by 41% in real terms compared with the current regulatory control period expenditure of $16.951m.



Source: Table 8.13

Figure 8-7 System operations staged submission opex overview (2009-19)

8.5.2 Analysis and findings

The System Control business unit is responsible for the operation of the transmission and distribution systems managed by Power Networks. Service Level Agreements (SLA) cover the cost of the operations of all networks operated by PWC (electricity, water, sewerage) and allocates costs to each business unit, including Power Networks. The SLAs have the following key attributes:

- an allocation of the number of staff, their tasks and utilisation required to operate the electricity network
- the hourly wage for the projected year (obtained from the Finance Business Unit)
- fixed facilities fee for the infrastructure
- annual adjustment for CPI
- allowance and schedule for extension of the SLA.

The step increase observed from 2010/11 to 2011/12 is a result of the commencement of the SLA between Power Networks and System Control. Parsons Brinckerhoff has reviewed the SLA and is satisfied that it reflects the costs needed to prudently and efficiently operate the network with appropriate allocation of costs to the other business groups (water, generation, sewerage).

However, Parsons Brinckerhoff notes that the cost includes work to be undertaken for both regulated and non-regulated assets[262]. Parsons Brinckerhoff understands that there are on 2 zone substations (Jabiru and Ranger Mine) out of 37 on the network which are non-regulated. These two zone substations are forecast to contribute 3.2% of the substation defects, based the analysis of work orders undertaken by Power Networks[263]. 27% of the total maintenance expenditure is forecast to be spent on substations. Parsons Brinckerhoff considers the level of work to be a reasonable proxy for the level of control and switching required by the control centre. Therefore we recommend a decrease of 1% (calculated as 27% x 3.2%) of the total SLA annual value.

8.5.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The revised documentation provided as part of the IRP did not include any changes to the forecast expenditure set out in the staged submission.

8.5.4 Findings and recommendations

Parsons Brinckerhoff is satisfied that the forecast for the System Operations category, once the allowance for non-regulated assets is removed, represents prudent and efficient expenditure.

Table 8.14 shows that the recommended System Operations opex for the 2014-19 regulatory control period is $23.710m. This recommendation reduces the System Operations opex by 1% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.14 Recommended system operation opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**4,790**	**4,790**	**4,790**	**4,790**	**4,790**	**23,951**
Adjustments – remove non-regulated assets	(48)	(48)	(48)	(48)	(48)	(240)
Total adjustments	**(48)**	**(48)**	**(48)**	**(48)**	**(48)**	**(240)**
Recommended opex	**4,742**	**4,742**	**4,742**	**4,742**	**4,742**	**23,711**

Source: Parsons Brinckerhoff analysis

8.6 Metering

8.6.1 Proposed expenditure

Table 8.15 shows the Metering opex for the 2014-19 regulatory control period of $22.385m as proposed in the staged submission. We note that these figures are slightly different to those set out in the supporting Opex Category Justification document, which is for $22.19m.

[262] Power and Water Corporation, 2013, '2011-12 System Control SLA analysis', 'Power Networks' tab

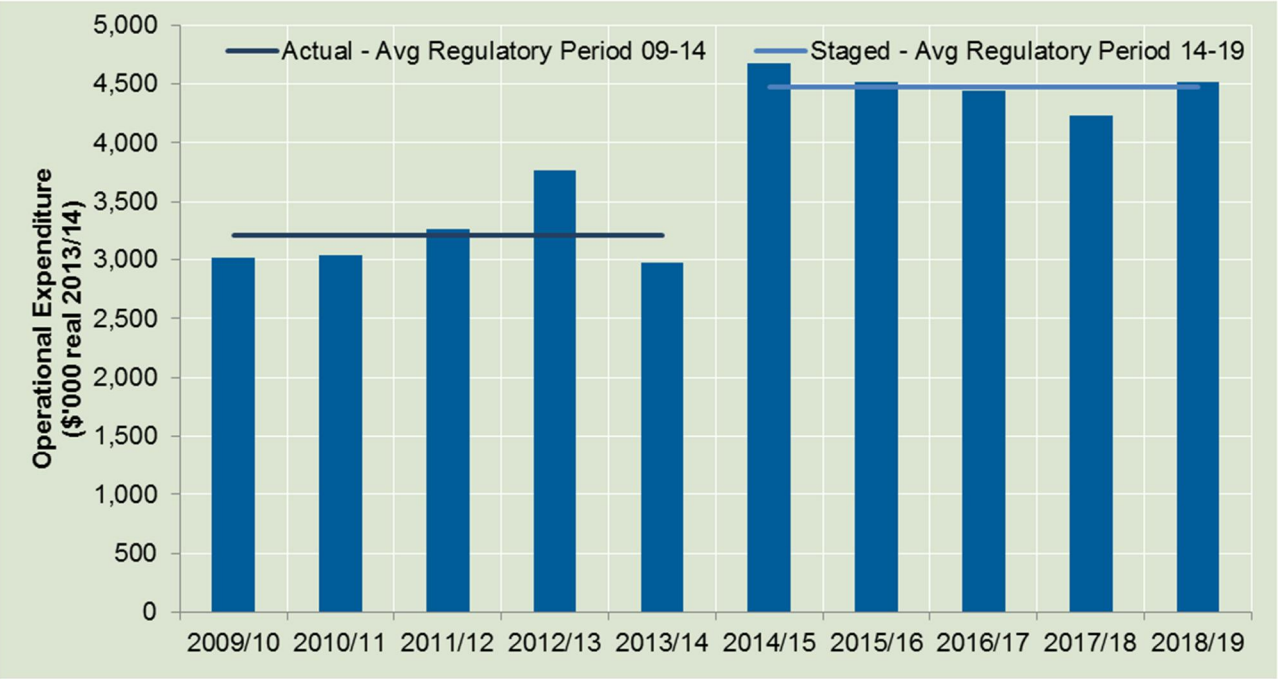
[263] Power and Water Corporation, 2013, '2013 NPD Planned and Unplanned Corrective Forecast Model', 'ZSS Defect Rate' tab

Table 8.15 Metering staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
In-house	2,012	1,994	2,247	2,774	1,842	3,561	3,396	3,325	3,117	3,400
Non-related party contractors	1,002	1,042	1,010	996	1,131	1,117	1,117	1,117	1,117	1,117
Total	**3,014**	**3,037**	**3,257**	**3,770**	**2,973**	**4,678**	**4,513**	**4,442**	**4,234**	**4,517**
Regulatory Period	**16,050**					**22,385**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Metering opex from the staged submission is illustrated in Figure 8-8, which shows that the Metering opex is forecast to increase by 39% in real terms compared with the current regulatory control period expenditure of $16.050m.



Source: Table 8.15

Figure 8-8 Metering opex – Staged submission ($'000 real 2013/14)

8.6.2 Analysis and findings

Meter reading is undertaken for both water and electricity meters in a common process. The cost to Power Networks is based on the number of electricity meters as a proportion of total meters (approximately 60% electricity and 40% water). Costs for meters related to non-regulated services and for new meter installations (capex) are excluded.

Power Networks Metering Opex is forecast to increase in the forthcoming regulatory control period relative to the current regulatory period due to the following two step changes in expenditure:

- upgrade to Power Networks Metering IT Systems, as explained in Power Networks' Metering IT Systems Upgrade Business Needs Identification (BNI)

- increase in Power Networks Metering Services' workforce, as explained in Power Networks' Metering Workforce Business Case (Appendix B).

Power Networks states that its current metering IT systems are inadequate to support efficient metering services operating processes. A range of process gaps associated with Power Networks' existing IT systems were identified by KPMG and Phacelift. The upgrade of IT systems and increase in workforce are focused on resolving the identified issues and appear to be prudent.

The increase in opex due to the upgraded IT systems appears reasonable as it is closely linked to increased licence costs and systems support costs.

The independent review by Phacelift conducted in 2012 recommends roles required for an efficient metering activity. Power Networks have assessed that implementing the new structure will result in an increase in staff by 11 FTEs. Parsons Brinckerhoff has assessed the Phacelift review and notes that Power Networks appears to have based its forecast on the creation of new roles to support the metering activity, rather than workloads. In particular:

- we question the need for two new support positions (Revenue Investigations Officer and Revenue Analyst) to support the Revenue Protection Manager to carry out revenue protection investigations, and perform revenue leakage analysis and develop Work Instructions and Procedures for all Metering. One additional staff would appear adequate to support this activity given that no increase in volume of work is likely and the development of Work Instructions and Procedures is a transient activity.
- Additionally, the implementation of Maximo is expected to reduce the manual handling of metering data, potentially freeing up a FTE.

Hence, in Parsons Brinckerhoff's view, 9 new FTE's should be sufficient to support the creation of the 11 full time roles identified.

8.6.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.16.The IRP forecast expenditure increased by 0.2% ($0.054m) for the 2014-19 regulatory control period compared to the staged submission.

Table 8.16 Metering – final forecast

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
In-house	3,481	3,387	3,194	3,236	3,447	16,745
Non-related party contractors	1,117	1,117	1,117	1,117	1,117	5,585
Total	**4,598**	**4,504**	**4,311**	**4,353**	**4,564**	**22,330**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.1 – Working ($13-14)

This is due to the an amendment to the capitalised labour step change; an amendment to metering IT opex step change; the inclusion of an interval meter rollout opex step change; the inclusion of a prepayment meter opex step change; removal of Water Services' allocation of meter reading support staff; and the amendment of an error to the capital expenditure profile.

This change is not considered material.

8.6.4 Findings and recommendations

Table 8.17 shows that the recommended metering opex for the 2014-19 regulatory control period is $21.250m. This recommendation reduces the Metering opex by 4.8% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.17 Recommended metering opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	4,598	4,504	4,311	4,353	4,564	22,330
Total adjustments	(216)	(216)	(216)	(216)	(216)	(1080)
Recommended opex	4,382	4,288	4,095	4,137	4,348	21,250

Source: Parsons Brinckerhoff analysis

8.7 Network management

Network Management provides centralised services to the network Power Networks business, covering general management of the group and management of legislative requirements, including:

- General management and coordination of PNs group activities and performance
- Management of Health and Safety legislation
- Management of environmental legislation
- Management of organisational change
- Management of financial and regulatory reporting.

8.7.1 Proposed expenditure

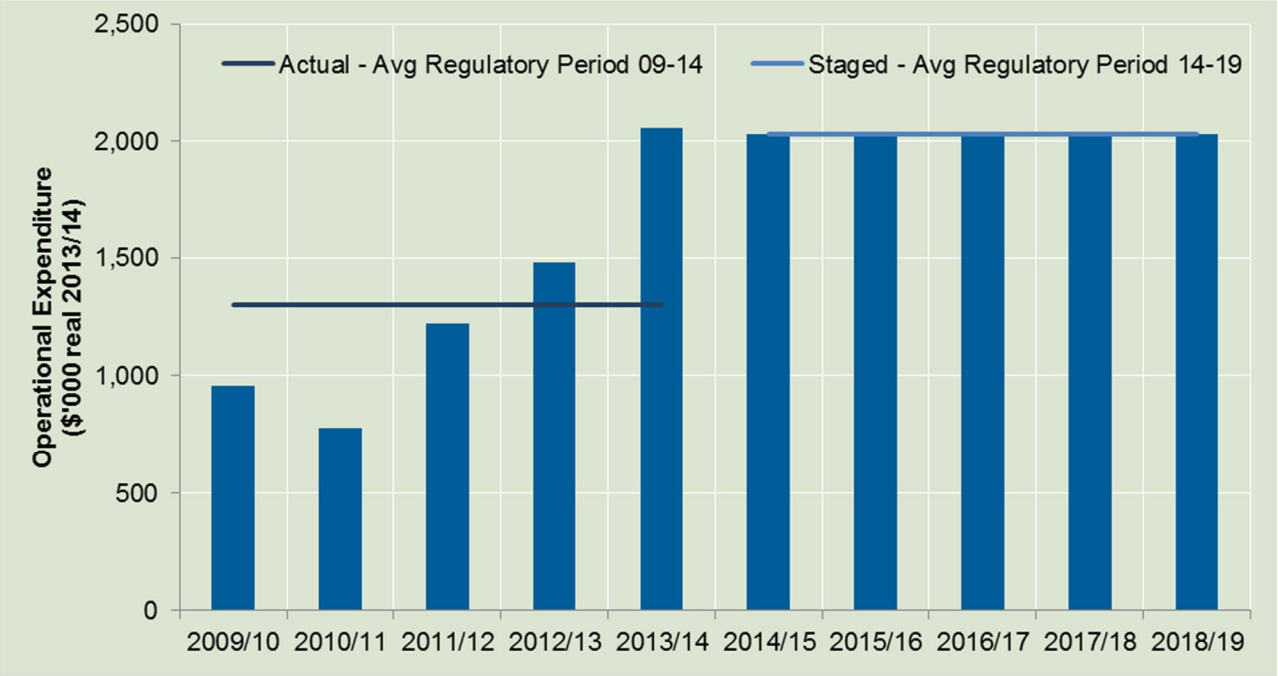
Table 8.18 shows the Network Management opex for the 2014-19 regulatory control period of $10.150m as proposed in the staged submission.

Table 8.18 Network management staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
In-house costs	-	-	-	-	-	1,796	1,796	1,796	1,796	1,796
Non-related party contractors	-	-	-	-	-	234	234	234	234	234
Total	957	775	1,223	1,481	2,056	2,030	2,030	2,030	2,030	2,030
Regulatory Period	6,491					10,150				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Network Management opex from the staged submission is illustrated in Figure 8-9, which shows that the Network Management opex is forecast to increase by 56% in real terms compared with the current regulatory control period expenditure of $6.491m.



Source: Table 8.18

Figure 8-9 Network Management opex – Staged submission ($'000 real 2013/14)

8.7.2 Analysis and findings

Power Networks forecast their future expenditure requirements based on the 2013/14 Statement of Corporate Intent forecast expenditure which was adjusted for step changes and non-recurrent expenditure.

The high level review, as shown in Figure 8-9, identifies a step increase of $0.7m between the average annual expenditure of the current period and the average annual expenditure forecast for the next period which is driven by internal labour costs. Parsons Brinkerhoff considers this an immaterial change.

No step changes or non-recurrent costs were identified by Power Networks for this category in the next regulatory period.

Parsons Brinckerhoff is satisfied that the expenditure is prudent and should be included in the expenditure allowance for this category.

8.7.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The revised documentation provided as part of the IRP[264] did not include any changes to the forecast expenditure set out in the staged submission.

8.7.4 Findings and recommendations

Parsons Brinckerhoff is satisfied that the forecast for the Network Management category represents prudent and efficient expenditure.

[264] Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.1 – Working ($13-14)

Table 8.19 shows that the recommended Network Management opex for the 2014-19 regulatory control period is $10.150m, being the amount proposed by Power Networks in the IRP.

Table 8.19 Recommended network management opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	2,030	2,030	2,030	2,030	2,030	10,150
Total adjustments	-	-	-	-	-	-
Recommended opex	2,030	2,030	2,030	2,030	2,030	10,150

Source: Parsons Brinckerhoff analysis

8.8 GSL costs

The Guaranteed Service Level (GSL) covers expenditure required to make payments to customers who receive service performance worse than defined thresholds.

The Northern Territory Guaranteed Service Level (GSL) Code took effect from 1 January 2012, with staged implementation of one performance measure (duration of a single interruption) commencing from 1 January 2012, and other measures taking effect from 1 July 2012.

8.8.1 Proposed expenditure

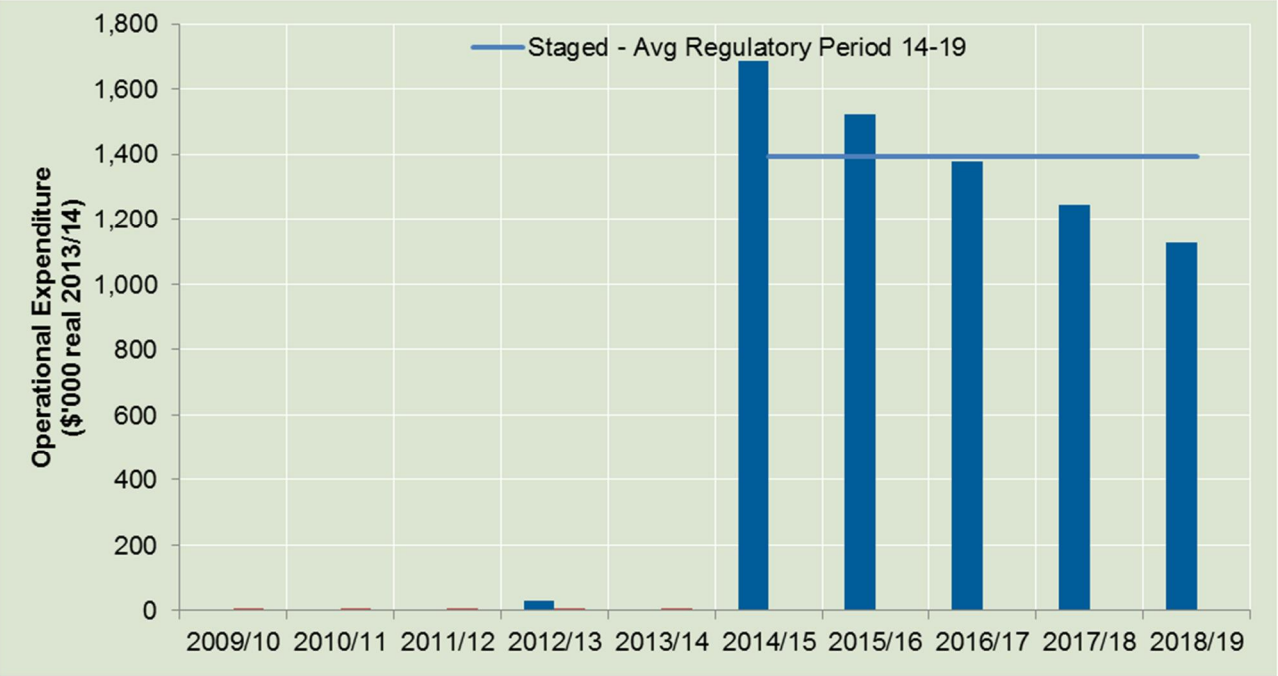
Table 8.20 shows the GSL opex for the 2014-19 regulatory control period of $6.956m as proposed in the staged submission. This includes GSL payments to customers and the cost to administer the GSL payment scheme.

Table 8.20 GSL staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
GSLs	-	-	-	29	-	1,684	1,522	1,376	1,245	1,127
Regulatory Period	29					6,956				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast GSL opex from the staged submission is illustrated in Figure 8-10, which shows that the GSL opex is forecast to increase by 23,886% in real terms compared with the current regulatory control period expenditure of $0.029m.



Source: Table 8.20

Figure 8-10 GSL costs opex – Staged submission ($'000 real 2013/14)

Actual and forecast expenditures in the current regulatory control period do not reflect the obligation to make payments due to scheme implementation issues. Full compliance is expected from the start of the 2014/15 year. GSL payments are forecast to decrease by 30% over the 2014/15 to 2018/19 regulatory control period due to the impact of the GSL program feeder upgrades and the SAIDI improvement program.

A step change in administration costs is forecast to occur in 2014-15. As recommended by PricewaterhouseCoopers in its Guaranteed Service Level Scheme Implementation Final Report, half of an additional resource within Power Networks is required to administer the GSL Scheme on an on-going basis[265].

8.8.2 Analysis and findings

All GSLs except 'Time to respond to a written enquiry' rely on the Maximo maintenance database, which has experienced implementation issues. Full implementation is not expected until the start of the 2014-15 year.

Table 8.21 shows the forecast GSL payments and the basis for the forecast.

[265] Refer to Power and Water Corporation, 2013, 'Opex Category Justification – Power Networks – REVISED Opex Category: Service Delivery', Appendix B – Service Delivery – Workforce Business Case, for the justification of the position of Customer Administration Officer.

Table 8.21 Basis of GSL forecasts ($ 2013/13)

Parameter	Forecast payments	Basis of forecast
Duration of a single interruption	508,320	FY 2010-11, two MED exclusions
Frequency of interruptions	230,515	FY 2010-11, two MED exclusions
Cumulative duration of interruptions	866,125	FY 2010-11, two MED exclusions
Time for establishing a connection	8,100	2% non-compliance (assumed)
Time for giving notice of planned interruptions	74,772	1% non-compliance (assumed)
Keeping appointments	50	1% non-compliance (assumed)
Time to respond to a written enquiry	120	1% non-compliance (assumed)

Source: Power and Water Corporation, 2013, Opex Category Justification - GSL Costs

Reliability GSLs

The forecast payment for the three reliability of supply parameters is based on actual reliability performance in the 2010/11 financial year. To test whether this year is representative, reliability performance for the period 2008/09 to 2012/12 was examined. Table 8.22 shows that reliability performance was worse in 2010/11 than for other years. Parsons Brinckerhoff considers that basing forecasts on the 2010/11 year will lead to an over-estimation. Given that Power Networks forecast most payments to be made to customers supplied from Short Rural feeders, Parsons Brinckerhoff has estimated the over-estimation by considering that the 2010/11 year is 1.6 times (315 minutes greater than) the 5-year average and applying a rate of 2403.64 dollars per SAIDI minute, the average rate indicated by the Power Networks information. The over-estimation in GSL payments is calculated as 37%.

Table 8.22 Analysis of reliability performance – SAIDI (minutes)

Feeder Category	2007/08	2008/09	2009/10	2010/11	2011/12	Ave	Percentage 2010/11 above ave
Rural long	1035.7	1737.3	1984.8	4386	2883.8	2405.5	182%
Rural short	392.5	474.6	357.6	837.2	549.9	522.4	160%
Urban	118.7	204.4	106.6	191.9	94.5	143.2	134%
CBD	2.1	10.7	13	59.6	13.1	19.7	303%

Source: Utilities Commission website and Parsons Brinkerhoff analysis

The forecast payment for the three reliability of supply parameters is also based on an assumption that all customers on a feeder experience an interruption whenever a fault occurs anywhere on that feeder. Parsons Brinckerhoff considered whether this approach was consistent with the physical electricity network:

- For faults occurring on the backbone of feeders, Power Networks' network does not generally utilise Automatic Circuit Reclosers (ACRs) or other devices that limit the areas impacted. Hence any fault on a feeder backbone would likely impact all customers on that feeder.
- For faults occurring on spur lines, these are generally fused except where the spur supplies a single or small group of customers. Hence, the impact of faults on spur lines is generally limited to those customers supplied by that spur line.

Parsons Brinckerhoff considers that assuming that all customers on a feeder experience an interruption leads to an over-estimation of costs. The magnitude of the over-estimation will be proportional to the number of faults on feeder backbone and on spur lines. Given that 97% of forecast payments are on the Short rural feeder category, a significant number of fused spur lines should exist. Parsons Brinckerhoff has not been

able to determine the actual proportion, but would expect that the forecast could be reduced by approximately 30%.

Notice of planned interruptions GSL

The forecast payment for 'Notice of planned interruptions' is approximately $75k per annum, based on an assumed non-compliance rate of 1%. This approach ignores that Power Networks hand delivers notices and has a standard practice of cancelling planned outages when notice has not been provided. The forecast amount, however, is not considered material.

Other GSLs

The forecast payment for the 'Time for establishing a connection', 'Keeping appointments', and 'Time to respond to a written enquiry' is not considered material.

8.8.3 Initial Regulatory Proposal submission

In its IRP, Power Networks states:

> "Power Networks note that the forecast expenditure is expected to change based on the recently approved electricity service standard targets under the 2012 NT Electricity Standards of Service (ESS) Code. These targets were approved on 12 July 2013, and Power Networks is currently reviewing the forecast to determine the impact on the Feeder Upgrade capital expenditure program and the Vegetation management maintenance expenditure program, and this in turn may have an impact on the forecast level of GSL Payments.
>
> In addition, Power Networks has recently received internal approval for a proposed Integrated Distribution Management System (IDMS). If the expenditure for this project is approved by the Commission, it will impact on the level of GSL Payments as Power Networks will be able to capture outages at a lower level."

No change to the forecast opex was proposed.

8.8.4 Findings and recommendations

Table 8.23 shows that the recommended GSL costs opex for the 2014-19 regulatory control period is $2.034m. This recommendation reduces the GSL costs opex by 71% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.23 Recommended GSL costs opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**1,684**	**1,522**	**1,376**	**1,245**	**1,127**	**6,956**
Adj for ave performance	(757)	(757)	(757)	(757)	(757)	(3,784)
Adj for number of customers impacted	(227)	(227)	(227)	(227)	(227)	(1,135)
Total adjustments	**(984)**	**(984)**	**(984)**	**(984)**	**(984)**	**(4,920)**
Recommended opex	**700**	**538**	**392**	**261**	**143**	**2,036**

Source: Parsons Brinckerhoff analysis

8.9 Regulatory costs

The Regulatory Cost category covers expenditure required for Power Networks to meet new obligations that will be established as the Utilities Commission progressively moves towards a regulatory framework similar to the National Electricity Rules applied by the AER.

8.9.1 Proposed expenditure

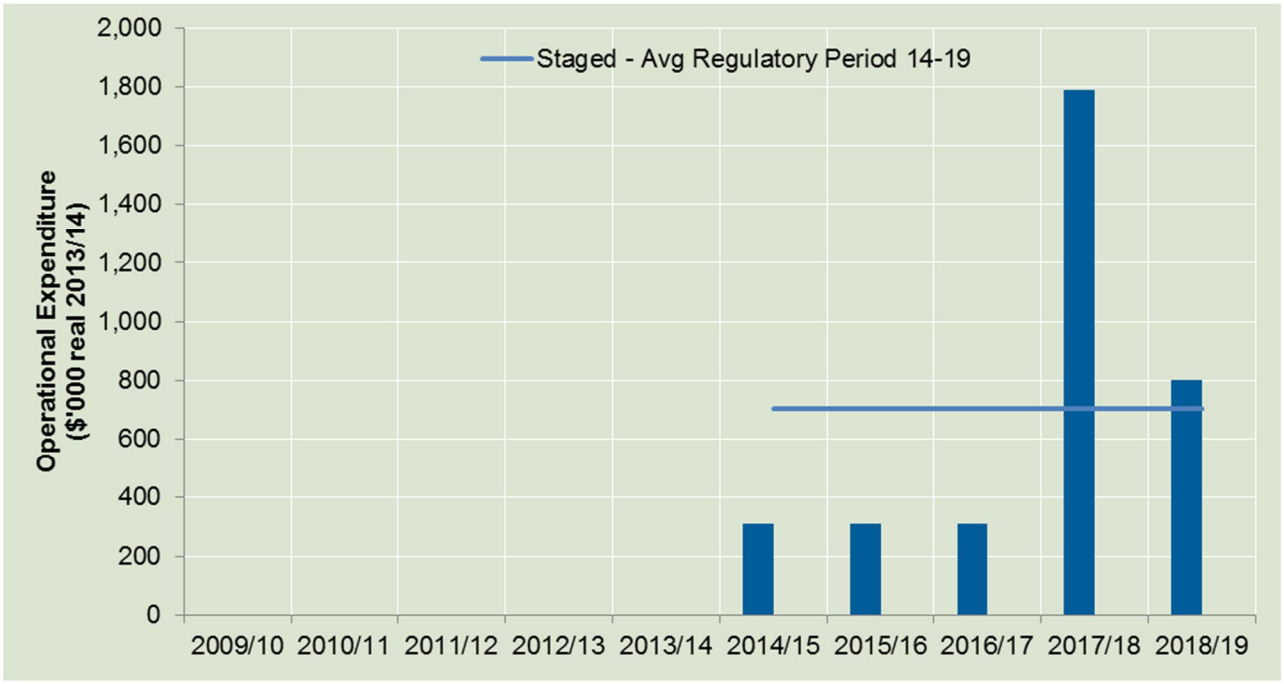
Table 8.24 shows the Regulatory Cost opex for the 2014-19 regulatory control period of $3.527m as proposed in the staged submission.

Table 8.24 Regulatory staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Regulatory costs	-	-	-	-	-	311	311	311	1,790	804
Total	-	-	-	-	-	**311**	**311**	**311**	**1,790**	**804**
Regulatory Period	**-**					**3,527**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2.1 – Working ($13-14)

The historical and forecast Regulatory Cost opex from the staged submission is illustrated in Figure 8-11, which shows that the Regulatory Cost opex is forecast to increase in real terms compared with the current regulatory control period expenditure.



Source: Table 8.24

Figure 8-11 Regulatory costs opex – Staged submission ($'000 real 2013/14)

8.9.2 Analysis and findings

Power Networks has stated that it requires an additional $3.53m during the regulatory control period in order to meet new reporting requirements. This cost comprises of two full time employees (FTEs) dedicated to regulatory reporting at a combined cost of $0.311m per year, and an additional $2m for preparation of the next submission.

During our review of the information provided and interviews with the Power Networks staff, we identified that a number of reports are currently required by the Utilities Commission and these are funded through Network Management group and a number of the additional report requirements cited will be completed by existing staff, for example, Network Management Plans and the RIT-D are normally prepared by the network planning engineers. Other reporting obligations of the regulatory reporting requirements have not been set or changes to existing processes will be undertaken by the work groups currently responsible for them. However, Parsons Brinckerhoff understands that the complete suite of regulatory reporting could be undertaken more effectively if coordinated by a central person and the role description of the Regulatory Compliance Manager addresses potentially new areas of the regulatory framework whereas the Regulatory Reporting Officer role appears to double up on functions that should already existing within Power Networks. Therefore, we recommend only the inclusion of the Regulatory Compliance Manager position and the removal of the $0.136m per annum associated with the Regulatory Reporting Officer role from the forecast expenditure.

The funding for the 2014-19 regulatory proposal has been capitalised under project PRD30483 at a cost of $2m. The cost for preparing the 2019-24 NPD, is split across 2017/18 and 2018/19 and has been forecast to be a total of $2m funded through operational expenditure.

8.9.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The revised documentation provided as part of the IRP[266] did not include any changes to the forecast expenditure set out in the staged submission.

8.9.4 Findings and recommendations

Parsons Brinckerhoff found that the two FTEs requested is not an efficient use of expenditure as many of the regulatory functions are already completed by the network management group in the current regulatory framework. We are of the view that this expenditure is efficient when limited to one FTE, and recommend an adjustment to the forecast expenditure to remove the expenditure associated with one FTE.

Parsons Brinckerhoff is satisfied that the expenditure forecast for the Regulatory Costs category, once the cost of one FTE has been excluded, represents prudent and efficient costs.

Table 8.25 shows that the recommended regulatory costs opex for the 2014-19 regulatory control period is $2.844m. This recommendation reduces the regulatory costs opex by 19% in real terms compared with the IRP proposed regulatory control period expenditure.

[266] Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.1 – Working ($13-14)

Table 8.25 Recommended regulatory costs opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**311**	**311**	**311**	**1,790**	**804**	**3,526**
Adjustments – remove one FTE	(136)	(136)	(136)	(136)	(136)	(682)
Total adjustments	**(136)**	**(136)**	**(136)**	**(136)**	**(136)**	**(682)**
Recommended opex	**174**	**174**	**174**	**1,654**	**667**	**2,844**

Source: Parsons Brinckerhoff analysis

8.10 Other costs

The IRP[267] included costs in an additional category that was not present in the staged submission. The costs have been included to allow for self-insurance of the Transmission and Distribution lines (above or below ground or underwater). Since the value of the expenditure is $0.934m for the 2014-19 regulatory control period, it does not meet the criteria as a material project or program and therefore has not been reviewed in detail or assessed for prudency and efficiency. However, Parsons Brinckerhoff notes that this is in line with good industry practice and recommends no adjustments to the forecast expenditure.

Table 8.26 Recommended other costs opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Self insurance – T&D	177	182	188	191	196	934
Adjustments	-	-	-	-	-	-
Total	**177**	**182**	**188**	**191**	**196**	**934**

8.11 Total maintenance expenditure- high level review

In its staged submission Power Networks submitted a proposed total maintenance expenditure of $194.628m (real 2013/14) for the 2014-19 regulatory control period, which represents 38% of the total proposed opex expenditure. A summary of the proposed total maintenance expenditure is set out in Table 8.27

Maintenance is broken into four categories; preventative, planned corrective, unplanned corrective and specific. Networks assets are grouped into seven asset classes and their maintenance needs are parented back to one or more of the maintenance categories.

[267] Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.1 – Working ($13-14)

Table 8.27 Total maintenance expenditure overview – Staged submission ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Preventative Maintenance	3,538	3,748	8,943	6,697	7,375	7,942	7,671	8,216	8,002	8,262
Planned Maintenance	2,631	3,239	5,319	12,517	9,971	13,179	13,277	12,945	12,780	12,438
Unplanned Maintenance	7,168	6,630	14,403	11,750	10,340	10,581	10,642	10,701	10,506	10,225
Vegetation Management	5,670	5,407	5,259	5,213	5,671	7,736	6,669	6,669	6,669	6,669
Specific Maintenance	3,904	3,705	2,631	1,852	330	780	518	518	518	518
Total	**22,911**	**22,729**	**36,555**	**38,029**	**33,687**	**40,218**	**38,777**	**39,049**	**38,475**	**38,112**
Regulatory Period	**153,912**					**194,628**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

To assess the drivers for maintenance expenditure, Parsons Brinckerhoff reviewed the Draft Power Networks Asset Strategies Procedure[268] and the Draft Power Networks Maintenance Policy[269]. The Asset Strategy Procedure outlines the maintenance cycle for each asset class with comparison to industry benchmarks, maintenance types and triggers, a list of assets within the asset class, and asset age and condition information where available. The Maintenance Policy outlines the philosophy and objectives for maintenance, and the roles and responsibilities. The policy also states that an annual maintenance plan will be developed for each year in a five year horizon. Parsons Brinckerhoff considers that the implementation of the policy and procedure should result in a robust maintenance regime and prudent expenditure on asset maintenance.

8.11.1 Trends and comparative analysis

Figure 8-12 shows the historical and forecast maintenance expenditure from the staged submission and illustrates that the maintenance expenditure is forecast to increase by 27% in real terms compared with the average annual expenditure in the current regulatory control period of $30.7m (real 2013/14).

The increase in expenditure occurred in two distinct steps, the first occurred from 2010/11 to 2011/12 where there was an increase of 61% and the second is forecast to be an increase of 19% and to occur from 2013/14 to 2014/15. These step changes are consistent throughout all asset class and when considering the maintenance categories. The result is an increase of 76% since the start of the current regulatory control period (2009/10 to 2014/15). The drivers for this increase are:

- an increased focus on preventative maintenance with a new maintenance regime[270],
- the Remedial Asset Management Program that was an outcome of the Casuarina incident[271], and

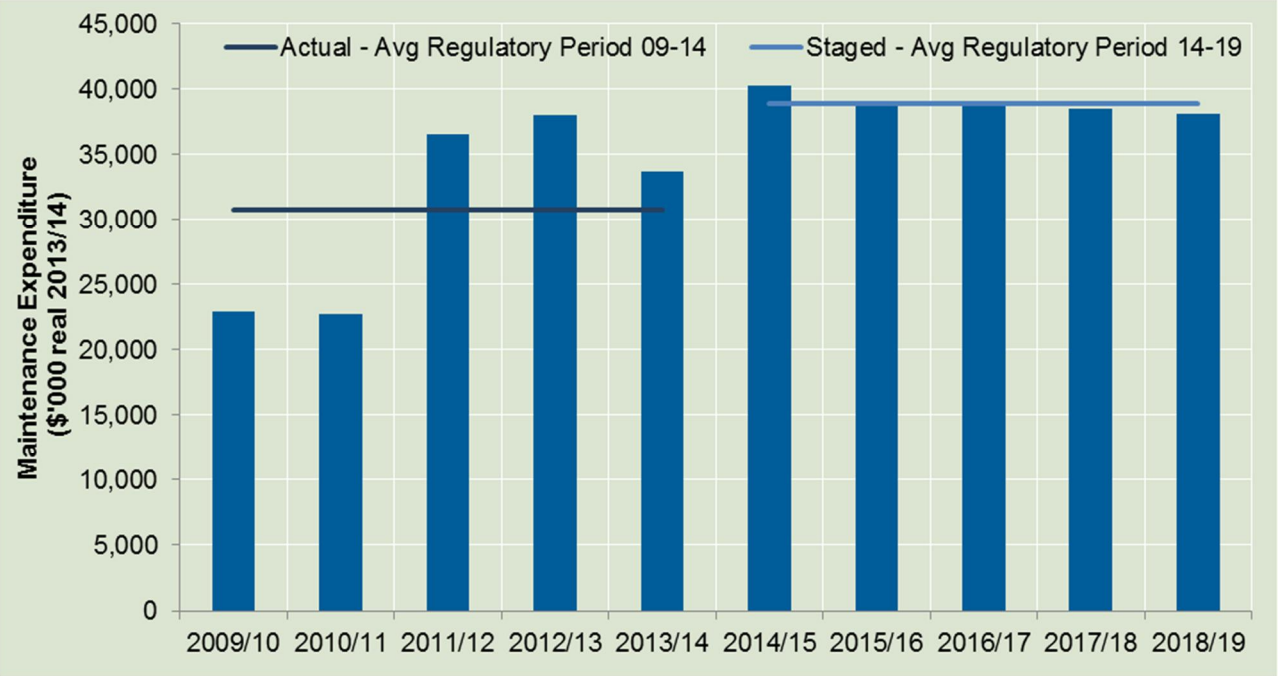
[268] Power and Water Corporation, 30 August 2013, 'Power Networks Asset Strategies Procedure', Version 2

[269] Power and Water Corporation, 30 August 2013, 'Power Networks Maintenance Policy', Version updated 2013 Draft

[270] Power and Water Corporation, 30 August 2013, 'Power Networks Asset Strategies Procedure', Version 2

[271] In 2008 there was a catastrophic failure of the Casuarina Zone Substation. This event increased Power Networks' awareness of the condition of their zone substation assets and the risks associated with poor condition assets.

- an increased focus on correct allocation of costs between the operational expenditure categories and the maintenance expenditure categories.



Source: Table 8.27

Figure 8-12 Maintenance expenditure overview – Staged submission ($'000 real 2013/14)

Power Networks forecasts its future maintenance expenditure requirements based on a bottom up build of volumes, unit costs from actual 2012/13 expenditure, and adjustments made for the projected growth rate of asset defects. The annual forecast expenditure was then adjusted for step changes due to the capital works program (capex/opex trade off), backlog reduction programs, administration and travel.

The following sections undertake high level and detailed reviews of each of the maintenance categories to determine the reasons for the increase in forecast expenditure and to assess if the forecast expenditure is prudent and efficient.

8.12 Preventative maintenance

Preventative maintenance covers maintenance on assets that is conducted periodically and is designed to prevent asset failures and capture asset data. This section excludes vegetation management, which is discussed separately in section 0, but includes:

- condition monitoring, which consists of continuous or periodic measurement and interpretation of data, or inspection of the physical condition of assets, to determine the need for maintenance
- time based maintenance, which consists of maintenance that is planned and carried out according to a predetermined plan.

The proposed expenditure and analysis of the need for the expenditure is described in the following sections.

8.12.1 Proposed expenditure

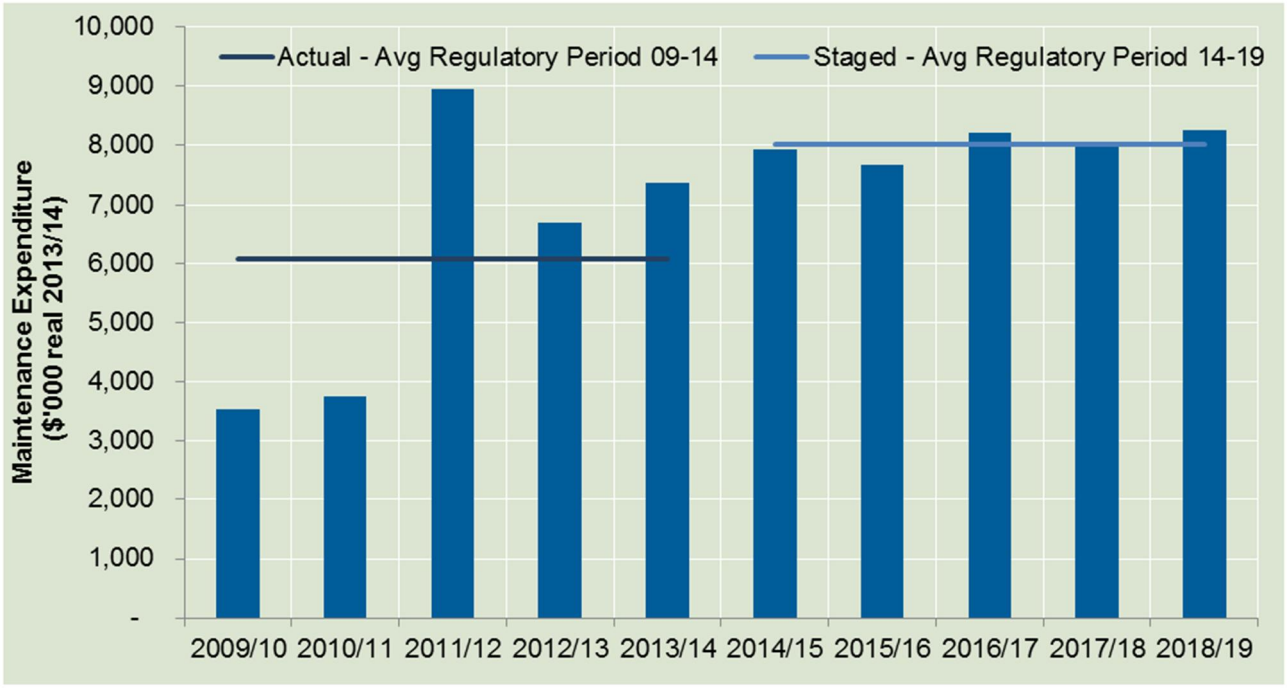
Table 8.28 shows the preventative maintenance opex for the 2014-19 regulatory control period of $40.092m as proposed in the staged submission. The expenditure was forecast using a bottom up build methodology which considered four major asset classes.

Table 8.28 Preventative maintenance staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Category	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission and distribution	1,542	1,376	1,701	1,946	3,648	2,811	2,734	3,007	2,977	2,857
Terminal station & zone substations	794	1,286	6,037	3,783	3,526	4,866	4,643	4,911	4,744	5,143
SCADA & controls	1,201	1,086	1,204	968	200	265	294	298	281	262
Decommissioned assets	-	-	-	-	-	-	-	-	-	-
Total	**3,538**	**3,748**	**8,943**	**6,697**	**7,375**	**7,942**	**7,671**	**8,216**	**8,002**	**8,262**
Regulatory Period	**30,300**					**40,092**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

The historical and forecast preventative maintenance opex from the staged submission is illustrated in Figure 8-13, which shows that the preventative maintenance opex is forecast to increase by 32% in real terms compared with the current regulatory control period expenditure of $30.300m.



Source: Table 8.28

Figure 8-13 Preventative maintenance opex – Staged submission ($'000 real 2013/14)

8.12.2 Analysis and findings

Power Networks forecasts its future expenditure requirements based on a bottom up build based on actual maintenance scheduled for 2014/15 to 2018/19 extracted from AMS and actual 2012/13 costs for each of those scheduled activities. Parsons Brinckerhoff undertook a high level and detailed review of the forecast to assess the prudency and efficiency of the expenditure.

The high level review considered the expenditure trend, the asset management strategy and the benchmarking undertaken in section 4. The profile of the forecast expenditure compared to the historical expenditure is shown in Figure 8-13. The chart identifies a step increase of $2m between the average annual expenditure of the current period and the average annual expenditure forecast for the next period. The increase is a result of a 238% step change ($3.7m to $8.9m) from 2010/11 to 2011/12.

Three key drivers were identified for this change:

- the implementation of the Remedial Asset Management Program (RAMP). RAMP was developed as a response to the Casuarina Zone Substation failure in 2008. The program commenced in 2008/09 but reached its peak in 2011/12[272]
- additional works were undertaken as part of the Preventative Maintenance program due to a decrease in the Specific Maintenance program[273]
- an increased focus on accurate time sheeting by administrative staff resulted in additional costs being allocated to the preventative maintenance program[273].

Parsons Brinckerhoff reviewed Power Networks' Asset Strategy Procedure (ASP) which sets out the asset types, locations, preventative maintenance and condition monitoring frequencies for the electricity networks. The ASP contains information relevant to managing the network assets and, if implemented and used as the basis for forecasting future work, should lead to reasonable expenditure forecasts.

The benchmarking undertaken by Parsons Brinckerhoff in Figure 4-10 shows that Power Networks maintenance expenditure is consistent with the trend line established by peer businesses. Parsons Brinckerhoff considers that this appears to be efficient expenditure. However, a detailed review of the bottom up build was undertaken to assess if any inefficiency exists and how the proposed expenditure should be adjusted.

The bottom up build for the next period, starting from 2014/15, has been based on the complete task breakdown extracted from AMS which covers the first full year of the preventative maintenance program. Parsons Brinckerhoff undertook a detailed assessment of the methodology and approach taken by Power Networks to use the AMS data to produce the forecast. We note the following:

- The forecast was based on 13,210 line items extracted from AMS that were part of the scheduled preventative maintenance program. An additional 349 line items were added manually to allow for assets that would be constructed during the regulatory control period. Assets decommissioned or replaced were found to be excluded from the forecast.
- Three asset groups had been excluded due to being classed as non-regulated assets. These were the Jabiru ZSS, Ranger Mine ZSS and the connecting transmission lines. The maintenance related to these assets was found to be excluded from the forecast.

Power Networks took two approaches to developing the costs relevant to each line item from the AMS data. Parsons Brinckerhoff notes:

- Where available, actual costs from the 2012/13 year were used to develop costs for line items extracted from AMS. Parsons Brinckerhoff considers this a sound approach. However, the implementation of this approach resulted in the data and calculations being spread over three separate worksheets which we consider likely to lead to data entry errors and difficulty updating any values as they are not all linked back to a single cell location.
- Where data was not available from AMS, Power Networks estimated costs without any clear justification or source being cited. However, since the work tasks have been considered at a granular level, the expenditure allocated to those line items seems reasonable, and the expenditure is forecast to remain

[272] Power and Water Corporation, 2013, 'Response to Issue 42 – General', Section (A)

[273] Power and Water Corporation, 2013, 'Response to Issue 43 – Preventative Maintenance', Section (D)

at a constant level throughout the period, we are satisfied that the estimate meets the requirements of the Utilities Commission in relation to this review and we recommend no adjustments to the forecast expenditure[274].

Parsons Brinckerhoff noted that Power Networks used a multiplier to increase the labour allocated to each task, based on its location, to allow for travel time. The multiplier chosen was arbitrary and had limited justification to support its selection. Flights and accommodation were determined separately based on actual data[275]. Parsons Brinckerhoff notes:

- Overall, the total cost of travel accounts for 11% of the total preventative maintenance program. This is made up of 8% for travel time and 3% for flights and accommodation.
- To assess the prudency of this level of expenditure on travel, we compared it to information available in the Rawlinsons Australian Construction Handbook 2012[276]. We adjusted the regional indices to remove the increased cost of materials in Darwin and therefore leave the cost adjustment for travel to regional areas. We found the cost to be approximately 9% which aligns with Power Networks' forecast 11%.

During the review of capital projects, Parsons Brinckerhoff had the following key findings:

- A number of planned zone substation replacement projects were deferred. The project and deferral are: Casuarina by 1 year, Berrimah by 2 years, East Arm and Lovegrove were deferred outside the next regulatory period, and Mitchell St Switching Station has become a contingent project (refer to section 7.5.4 for details). To allow for the deferrals, an increase in the preventative maintenance program has been recommended. Refer to Table 8.30. The increase is based on the difference between preventative maintenance costs for an existing and new zone substation[277].
- An inspection cost had been allocated to a capital project as part of the Distribution Pole Life Extension project (refer to section 7.5.4). It was removed from the capex category and has been reallocated to the opex preventative maintenance category as it relates to periodic inspection of poles. The inspection covers RLS Testing of poles at a cost of $0.630m per year from 2014/15 to 2016/17.

8.12.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.29.The IRP forecast expenditure for the Preventative Maintenance category increased by 0.03% ($0.010m) for the 2014-19 regulatory control period compared to the staged submission. The change was considered immaterial.

[274] Power and Water Corporation, 2013, 'Preventative Maintenance Forecast Model', 'Manual Entry' tab

[275] Power and Water Corporation, 2013, 'D2013/352642'. Noted in Power and Water, 2013, 'Preventative Maintenance Forecast Model','Calcs' tab, Cell A252.

[276] Rawlinsons Publishing, 2012, Rawlinsons Australia Construction Handbook, p.32. Rawlinsons Construction Handbook provides a Building Price Index for all capital cities which accounts for the relative cost of building materials and labour between the major cities but not travel costs. It also provides regional indices to account for increase construction costs in remote areas. PB adjusted the regional indices (averaged for the four PWC network regions) to remove the BPI and therefore only leave the uplift factor applicable to the Northern Territory for regional work. We consider this a suitable proxy for travel expenses and found it to be approximately 9%.

[277] Power and Water Corporation, 2013, 'Preventative Maintenance Forecast Model', 'cost estimates' tab

Table 8.29 Preventative maintenance by sub category – final forecast

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Transmission and distribution	2,811	2,734	3,007	2,977	2,857	14,386
Terminal station & zone substations	4,857	4,648	4,915	4,749	5,148	24,317
SCADA & controls	265	294	298	281	262	1,400
Decommissioned assets	-	-	-	-	-	-
Total	**7,933**	**7,676**	**8,221**	**8,006**	**8,267**	**40,103**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.2 – Working ($13-14)

8.12.4 Findings and recommendations

The bottom up build for the next period, starting from 2014/15, has been based on the complete task breakdown extracted from AMS which covers the first full year of the preventative maintenance program. The costs were developed through a combination of actual 2012/13 data and estimates. Parsons Brinckerhoff considers that the justification for the cost estimates could be significantly improved, but is nonetheless satisfied that the costs are prudent and efficient in accordance with the requirements of the Code.

As a result of the deferral of capital replacement projects recommended by the replacement capex review (see section 7.5), which were the basis for the Power Networks forecast, Parsons Brinckerhoff has recommended adjustments to the forecast to account for additional preventative maintenance that will be required during the period.

Table 8.30 shows that the recommended preventative maintenance opex for the 2014-19 regulatory control period is $43.098m. This recommendation increases the preventative maintenance opex by 8% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.30 Recommended preventative maintenance opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**7,933**	**7,676**	**8,221**	**8,006**	**8,267**	**40,103**
Adjustment – RLS Testing reallocation	630	630	630	-	-	1,890
Adjustment – zone substation deferral	170	255	255	170	255	1,105
Total adjustments	**800**	**885**	**885**	**170**	**255**	**2995**
Recommended opex	**8,733**	**8,561**	**9,106**	**8,176**	**8,522**	**43,098**

Source: Parsons Brinckerhoff analysis

8.13 Planned corrective maintenance

Planned corrective maintenance covers maintenance on assets that are identified to be defective during the Preventative Maintenance or other inspection programs. The forecast for this category has been developed based on the four categories Transmission and Distribution, Terminal Stations and Zone Substations, SCADA and Controls, and Decommissioned Assets.

The proposed expenditure and analysis of the need for the expenditure is described in the following sections.

8.13.1 Proposed expenditure

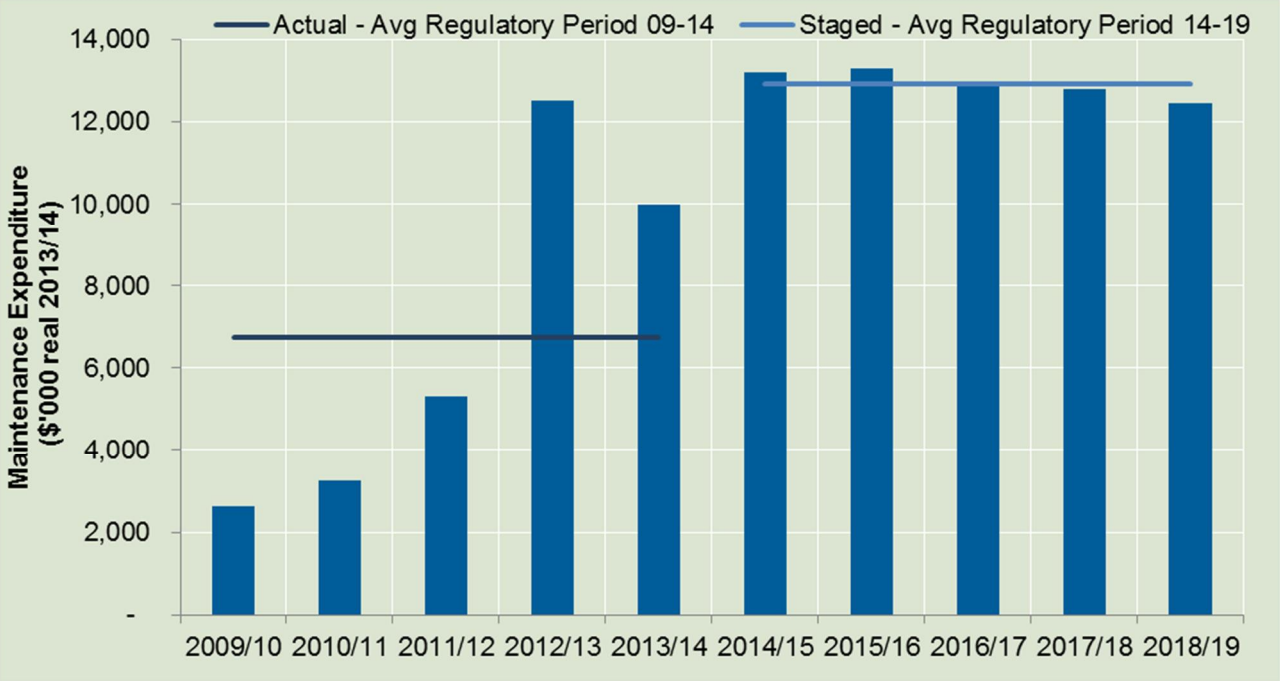
Table 8.31 shows the Planned Corrective Maintenance opex for the 2014-19 regulatory control period of $64.619m as proposed in the staged submission. The expenditure was forecast using a bottom up build methodology which considered four major asset classes.

Table 8.31 Planned corrective maintenance staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission and distribution	2,480	3,064	4,426	8,429	5,110	8,944	9,060	8,743	8,657	8,387
Terminal station & zone substations	151	175	833	2,424	3,819	2,601	2,582	2,567	2,488	2,416
SCADA & controls	-	-	46	1,506	1,043	1,559	1,559	1,559	1,559	1,559
Decommissioned assets	-	-	-	18	-	76	76	76	76	76
Metering assets	-	-	15	141	-	-	-	-	-	-
Total	**2,631**	**3,239**	**5,319**	**12,517**	**9,971**	**13,179**	**13,277**	**12,945**	**12,780**	**12,438**
Regulatory Period	**33,677**					**64,619**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

The historical and forecast Planned Corrective Maintenance opex from the staged submission is illustrated in Figure 8-14, which shows that the Planned Corrective Maintenance opex is forecast to increase by 92% in real terms compared with the current regulatory control period expenditure of $33.677m.



Source: Table 8.31

Figure 8-14 Planned Corrective Maintenance opex – Staged submission ($'000 real 2013/14)

8.13.2 Analysis and findings

Power Networks forecasts its future expenditure requirements based on the 2012/13 actual expenditure which was adjusted for the projected growth rate of asset defects. The annual forecast expenditure was then adjusted for step changes due to the capital works program, backlog reduction programs, administration and travel.

The high level review, as shown in Table 8.31, identifies there is a step increase of $6m between the average annual expenditure of the current period and the average annual expenditure forecast for the next period. The increase is a result of two step changes. The first occurred from 2011/12 to 2012/13 where there was an increase of 235% from $5.3m to $12.5m. The second step increase is forecast to occur from 2013/14 to 2014/15 (the first year of the next control period), and is forecast to be an increase of 32% from $10m to $13.2m.

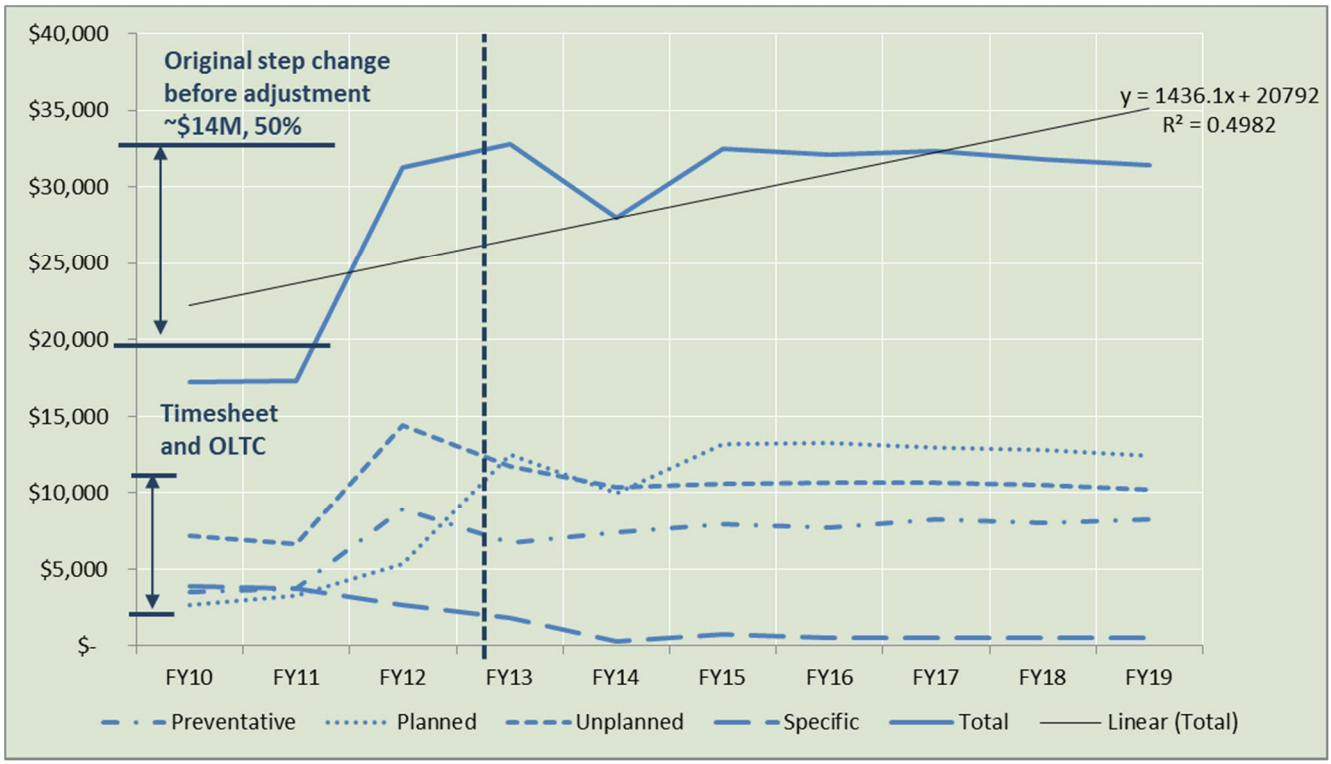
Power Networks identified that there were two key drivers for these changes. Firstly, a strong focus was place on accurately capturing the time spent on maintenance activities, including the implementation of timesheets for support staff. This resulted in costs that were previously captured under the Service Delivery category being allocated to maintenance activities. Also, the accuracy of time allocated between preventative, planned and unplanned maintenance activities was improved. Secondly, a maintenance program for the transformer On Load Tap Changers (OLTC) was undertaken in 2012/13, resulting in an additional one off cost of $2.5m.

Parsons Brinkerhoff assessed the transfer of time between the categories affected (Service Delivery, Planned and Unplanned Maintenance) by adjusting the costs for Planned Maintenance for 2009/10 to 2011/12 based on amounts estimated by Power Networks[278] that were charged to Service Delivery rather than Planned Maintenance in those years. We found that the step increase was removed but there was still an average annual increase of 8% from 2009/10 to 2012/13 (2013/14 was excluded as it is a forecast budget value and Power Networks has typically been overspending its budget[279]). During the next period, the total maintenance expenditure is forecast to peak in 2014/15 then decrease slightly for the rest of the period as a result of capital replacement projects.

The transfer of cost also revealed that the Operational Expenditure category had increased during the current regulatory control period, driven by increases to the Corporate and Shared Services category. Refer to section 8.2 for analysis.

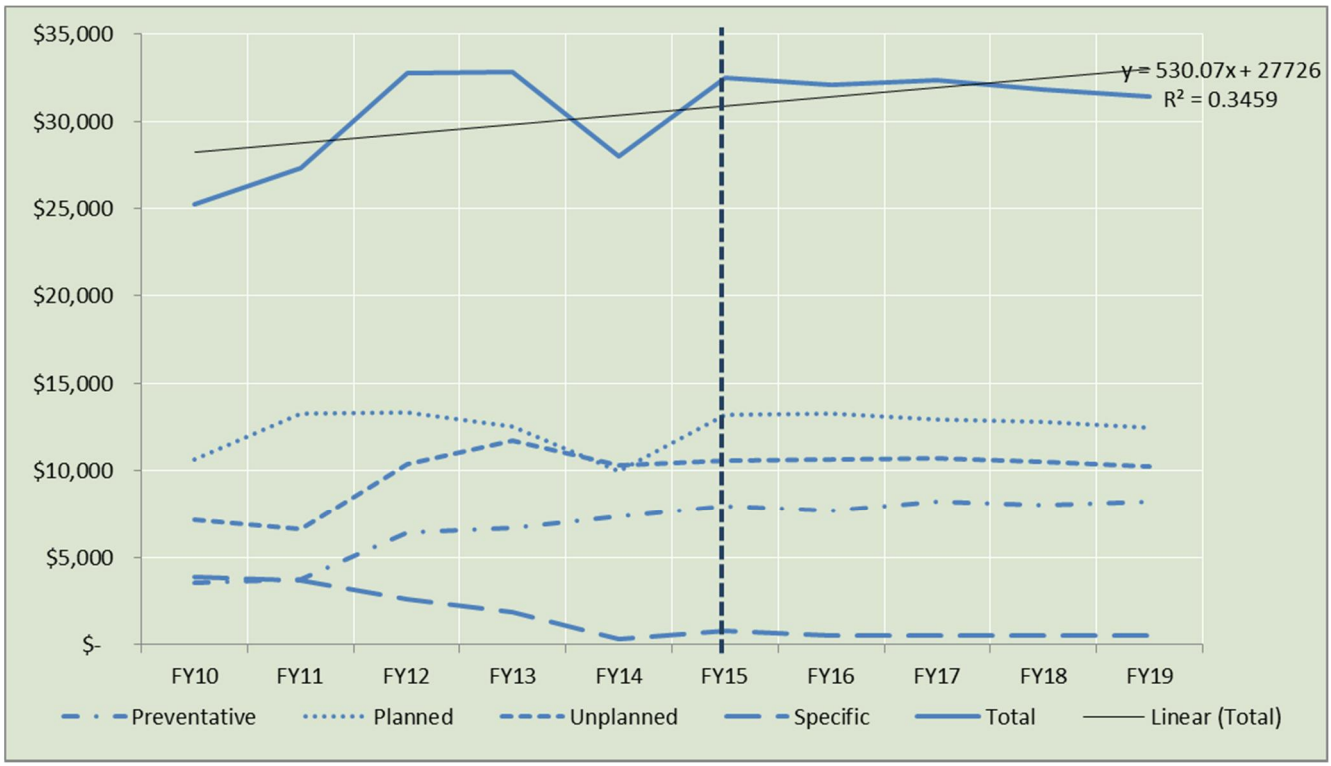
[278] Power and Water Corporation, 2013, 'Response to Issue 42 – General', Section (A)

[279] Power and Water Corporation, July 2013, 'Demonstrating the Efficiency of Proposed Operational Expenditure', p.7



Source: PB analysis

Figure 8-15 Maintenance expenditure pre reallocation of costs to test for step change.



Source: PB analysis

Figure 8-16 Maintenance expenditure post reallocation of costs to test for step change.

Parsons Brinckerhoff undertook a detailed assessment of the methodology and approach taken by Power Networks to produce the forecast. Parsons Brinckerhoff found that generally Power Networks had based their approach on the best data they had available and had made a genuine attempt to accurately forecast the expenditure requirements for the next control period. Parsons Brinckerhoff notes the following:

- Power Networks developed the forecast using 2012/13 costs as the base year but did not identify that any inefficient expenditure had been removed from the base year. Parsons Brinckerhoff is satisfied that the benchmarking shown in Figure 4-10 indicates that the base year expenditure was efficient relative to its peer businesses.
- Parsons Brinckerhoff reviewed additional information[280] provided by Power Networks regarding the calculation of the base year costs for planned corrective maintenance and is satisfied that non-regulated costs were identified and appropriately excluded.
- The defect growth rates were calculated and applied separately for the Zone Substations and the Transmission and Distribution network. The Zone Substations defect growth rate was calculated based on the number of work orders. The Transmission and Distribution network defect growth rate was calculated based on the number of interruptions, excluding LV interruptions, MEDs, planned outages and non-asset related interruption events (i.e., vegetation).
  - Analysis of Work Orders provided[281] showed that they covered both planned and unplanned events in zone substations. Parsons Brinckerhoff notes that there has been a similar number of planned and unplanned events in zone substations from 2009 and we are therefore satisfied that the use of work orders to forecast changes in defect growth rates to forecast planned corrective maintenance expenditure is appropriate.
  - The growth rate of unplanned outages on the transmission and distribution network has not been proven to relate to the growth of defects addressed by planned works. The program justification for planned corrective maintenance states that successful completion of the planned maintenance program should reduce unplanned faults, implying that that are inversely related. Parsons Brinckerhoff considers that the growth rate of unplanned outages should only be applied to the Unplanned Corrective Maintenance category and has removed the application of those growth factors from the Planned Corrective Maintenance category. This has resulted in a reduction of 6% of the total opex for this category.
  - The model does not clearly show how the defect growth rates were calculated from the analysis of the defect rates and number of work orders.
  - The profile of the defect rate (decreasing across the forecast period) aligns with the increased focus on preventative and planned maintenance, capital projects reducing the number of assets in poor condition and developing better asset knowledge.
- Parsons Brinckerhoff's review of the proposed capital program of works has identified a number of projects which have not been adequately justified, and as a result they are recommended to be deferred The project to be deferred and length of the deferral are: Casuarina by 1 year, Berrimah by 2 years, East Arm and Lovegrove were deferred outside the next regulatory period, and Mitchell St Switching Station has become a contingent project. Refer to section 7.5.4 for details. An increase in the planned corrective maintenance program has been recommended to compensate for the deferrals. The increase is based on the difference between maintenance costs for an existing and new zone substation[282]. Refer to Table 8.33.

[280] Power and Water Corporation, 2013, 'D2013 344191 NPD-Cost Analysis for R&M expenditure for Financial year 2009-10 to 2013-14'

[281] Power and Water Corporation, 2013, 'PB Item 1 (Maintenance Interviews) - Planned ~ analysis of DoForms, ISR and WOs.XLS', 'WOs' tab

[282] Power and Water Corporation, 2013,'Preventative Maintenance Forecast Model'

- In addition to the detailed review of the approach and methodology undertaken by Power Networks to determine its forecast, Parsons Brinckerhoff notes the following:
- The analysis does not take into account the current and expected network reliability:
  - The analysis is based on the number of defects identified on the network and number of work orders undertaken to rectify defects; however, it does not relate these figures back to network reliability.
  - Power Networks is required to manage the network to provide the level of reliability mandated by the Code, therefore, by managing the total network performance it can be appropriate to allow assets to fail in service or be defective provided they meet public safety and environmental requirements. Since the Casuarina incident in 2008, Power Networks has undertaken a number of programs aimed at improving knowledge of asset condition and improving asset maintenance practices, but Power Networks has not related this to the current network reliability and any expected improvements in reliability trends.
  - Power Networks has not discussed the current network reliability performance, shown that the network reliability needs to be improved, or considered how the ramp up of maintenance during the current period will impact the reliability performance measures during the next regulatory period. Without this analysis and discussion, it is not clear how Power Networks is performing. If Power Networks is not meeting reliability targets, then additional expenditure could be justified, and conversely, if Power Networks is exceeding its targets, it could reduce its expenditure to reduce the cost of electricity to customers.
  - As a result of the level of consideration given to total network reliability performance, it is not possible to identify where reliability performance benefits are derived from or what the expected performance will be, and therefore, it is not possible to allow expenditure specifically to address perceived reliability performance issues.
- The level of granularity of data is insufficient. Parsons Brinckerhoff normally expects more details in the forecast so individual asset classes, such as, poles, cross arms, conductors, cables etc, can be individually forecast and justified, rather than being wrapped up at the T&D or ZSS level. By using a more granular breakdown, cost forecasts can be more accurate and the justification of the prudency and efficiency of the expenditure can be made more specific to each asset class and therefore more robust.

8.13.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.4.The IRP forecast expenditure for the Planned Corrective Maintenance category decreased by 2% ($1.4m) across the 2014-19 regulatory control period compared to the staged submission.

Parsons Brinckerhoff notes that although the net change for the whole category is small, there is a significant change in the expenditure allocated to each asset class within the category. This has been identified as a result of changes to cost allocations of support staff[283] however the changes were only reflected in Table 14 of the justification document.[284].

The change was considered immaterial.

[283] Power and Water Corporation, 2013, 'Material Project/Program Justification – Revised Power Networks Repairs & Maintenance – Planned Corrective Maintenance', Section (1)

[284] Power and Water Corporation, 2013, 'Material Project/Program Justification – Revised Power Networks Repairs & Maintenance – Planned Corrective Maintenance', Table 14

Table 8.32 Planned corrective maintenance IRP submission opex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Transmission and distribution	9,323	9,440	9,123	9,037	8,767	45,690
Terminal station & zone substations	1,866	1,847	1,832	1,753	1,680	8,976
SCADA & controls	1,643	1,643	1,643	1,643	1,643	8,215
Decommissioned assets	76	76	76	76	76	379
Total	**12,908**	**13,005**	**12,673**	**12,508**	**12,166**	**63,260**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.2 – Working ($13-14)

8.13.4 Findings and recommendations

Parsons Brinckerhoff is satisfied that a reasonable approach was undertaken to forecast the planned corrective maintenance requirements for the next regulatory control period. Parsons Brinckerhoff considered that the following inputs and adjustments were not prudent or efficient, or required change based on changes to the capital program:

- Parsons Brinckerhoff considers that the information provided by Power Networks does not clearly show how the number of unplanned outages relates to the forecast for planned maintenance, and therefore we are not able to determine that this is a prudent approach. Parsons Brinkerhoff recommends the removal of the expenditure associated with the defect rate of change from the forecast, and to retain the expenditure at the historical average.
- The forecast maintenance requirements were based on a specific capital works program. Deferral of some capital works means additional maintenance expenditure will be required. Parsons Brinkerhoff suggests the addition of the associated expenditure to the forecast.

Table 8.33 shows that the recommended planned corrective maintenance opex for the 2014-19 regulatory control period is $59.102m. This recommendation reduces the specific maintenance opex by 7% in real terms compared with the IRP proposed regulatory control period expenditure.

The adjustments for changes to the Transmission and Distribution capital works and Zone Substations capital works include an increase in funding for both higher defect rates and high maintenance expenditure for existing assets compared to new assets.

Table 8.33 Recommended planned corrective maintenance opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**12,908**	**13,005**	**12,673**	**12,508**	**12,166**	**63,260**
Adjustment – T&D growth rate	(821)	(1,017)	(723)	(838)	(923)	(4,322)
Adjustment – ZSS capital works	-	8	52	52	52	164
Total Adjustments	**(821)**	**(1,009)**	**(671)**	**(786)**	**(871)**	**(4,158)**
Recommended opex	**12,087**	**11,996**	**12,002**	**11,722**	**11,295**	**59,102**

Source: Parsons Brinckerhoff analysis

8.14 Unplanned corrective maintenance

Unplanned corrective maintenance covers maintenance on assets that fail in service in order to restore them to an acceptable condition so they can be operated safely at the required level of reliability and capacity.

8.14.1 Proposed expenditure

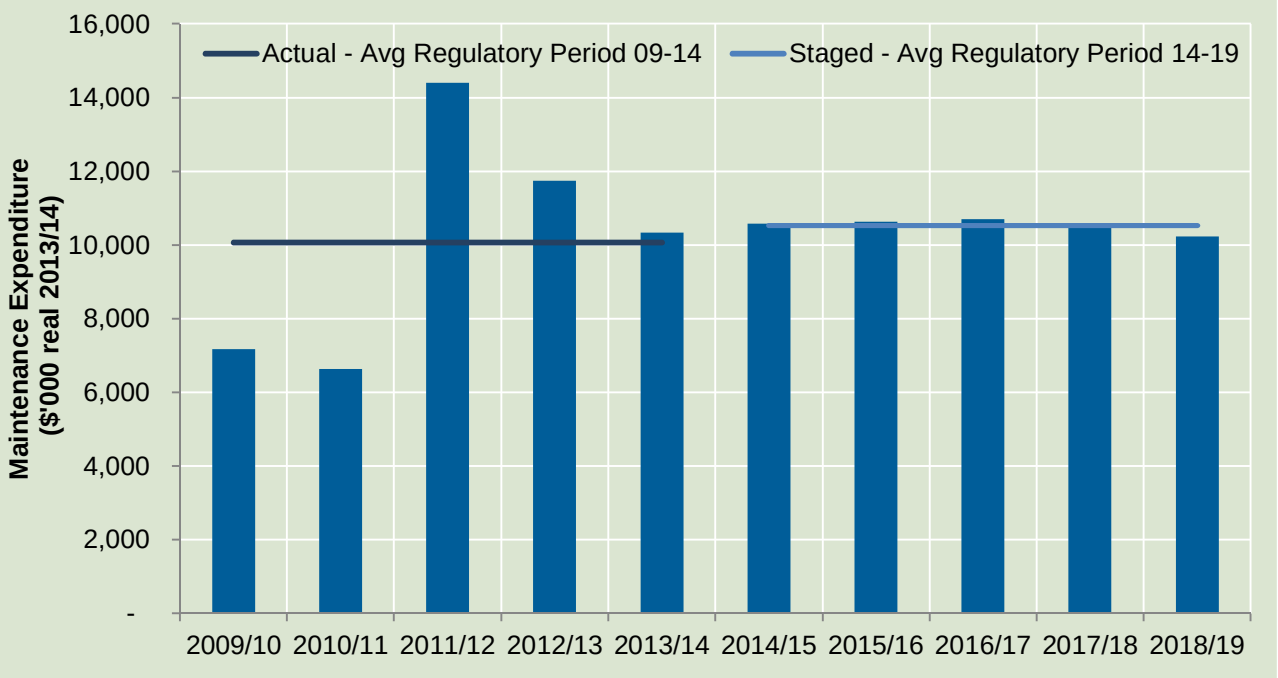
Table 8.34 shows the Unplanned Corrective Maintenance opex for the 2014-19 regulatory control period of $52.656m as proposed in the staged submission. The expenditure was forecast using a bottom up build methodology which considered four major asset classes.

Table 8.34 Unplanned corrective maintenance staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission and distribution	6,487	6,270	12,277	10,265	7,738	8,975	9,045	9,120	8,996	8,734
Terminal station & zone substations	530	76	1,325	990	1,064	1,149	1,139	1,123	1,052	1,034
SCADA & controls	151	285	799	435	1,538	458	458	458	458	458
Decommissioned assets	0	0	0	0	0	-	-	-	-	-
Metering assets	-	-	2	60	-	-	-	-	-	-
Total	**7,168**	**6,630**	**14,403**	**11,750**	**10,340**	**10,581**	**10,642**	**10,701**	**10,506**	**10,225**
Regulatory Period	**50,292**					**52,656**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

The historical and forecast Unplanned Corrective Maintenance opex from the staged submission is illustrated in Figure 8-15, which shows that the Unplanned Corrective Maintenance opex is forecast to increase by 5% in real terms compared with the current regulatory control period expenditure of $50.292m.



Source: Table 8.34

Figure 8-17 Unplanned maintenance opex – Staged submission ($'000 real 2013/14)

8.14.2 Analysis and findings

Power Networks forecast their future expenditure requirements based on the 2012/13 actual expenditure which was adjusted for the projected growth rate of asset defects. The annual forecast expenditure was then adjusted for step changes due to the capital works program, backlog reduction programs, administration and travel.

The high level review, as shown in Figure 8-17, identifies the average annual expenditure of the current period is approximately equal to the average annual expenditure forecast for the next period. However there is a significant step change from 2010/11 to 2011/12 of 217% ($6.6m to $14.4m).

The step change is largely driven by the transmission and distribution category. Power Networks identified the increased focus on accurate time sheet allocation by labour staff and the implementation of a time sheeting system for direct overhead staff (planners, schedulers, coordinators etc) as the key driver for the increase. The decrease from 2011/12 to 2013/14 is attributed to improved definition between Planned and Unplanned categories. Figure 8-15 and Figure 8-16 in section 8.13 show the trend of expenditures for each category with the cost allocation adjusted retrospectively based on information provided by Power Networks.

Parsons Brinckerhoff undertook a detailed assessment of the methodology and approach taken by Power Networks to produce the forecast. Parsons Brinckerhoff found that generally Power Networks had based their approach on the best data they had available and had made a genuine attempt to accurately forecast the expenditure requirements for the next control period. Parsons Brinckerhoff notes the following:

- Power Networks developed the forecast using 2012/13 costs as the base year but did not identify that any inefficient expenditure had been removed from the base year. Parsons Brinckerhoff is satisfied that the benchmarking shown in Figure 4-10 indicates that the base year expenditure was efficient relative to its peer businesses.

- Parsons Brinckerhoff reviewed additional information[285] provided by Power Networks regarding the calculation of the base year costs for planned corrective maintenance and is satisfied that non-regulated costs were identified and appropriately excluded.
- The defect growth rates were calculated and applied separately for the Zone Substations and the Transmission and Distribution network. The Zone Substations defect growth rate was calculated based on the number of work orders. The Transmission and Distribution network defect growth rate was calculated based on the number of interruptions, excluding LV interruptions, MEDs, planned outages and non-asset related interruption events (i.e., vegetation).
  - Analysis of Work Orders provided[286] showed that they covered both planned and unplanned events in zone substations. Parsons Brinckerhoff notes that the average number of work orders for planned events in zone substations from 2009 (post Casuarina) was of a similar magnitude to the number of unplanned events in zone substations (2012 and 2013 only). Therefore, Parsons Brinckerhoff is satisfied that the use of work orders to forecast changes in defect growth rates to forecast unplanned corrective maintenance expenditure is appropriate.
  - Parsons Brinckerhoff considers that the application of the growth rate of unplanned outages to adjust the Unplanned Corrective Maintenance category expenditure is appropriate.
  - The model does not clearly show how the defect growth rates were calculated from the analysis of the defect rates and number of work orders.
  - The profile of the defect rate (decreasing across the forecast period) aligns with the increased focus on preventative and planned maintenance, capital projects reducing the number of assets in poor condition and developing better asset knowledge.
- Parsons Brinckerhoff's review of the proposed capital program of works has identified a number of projects which have not been adequately justified, and as a result they are recommended to be deferred The project to be deferred and length of the deferral are: Casuarina by 1 year, Berrimah by 2 years, East Arm and Lovegrove were deferred outside the next regulatory period, and Mitchell St Switching Station has become a contingent project. Refer so section 7.5.4 for details. An increase in the planned corrective maintenance program has been recommended to compensate for the deferrals. The increase is based on the difference between maintenance costs for an existing and new zone substation[287]. Refer to Table 8.36.
- The unplanned corrective maintenance forecast takes into account forecast reduction in defects due to the Feeder Upgrade Program, however, there is not consideration regarding the contribution of the maintenance program to network reliability performance. Refer to section 0 for further discussion regarding the need to consider network reliability.

8.14.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.4.The IRP forecast expenditure for the Unplanned Corrective Maintenance category decreased by 6% ($3m) across the 2014-19 regulatory control period compared to the staged submission.

Parsons Brinckerhoff notes that although the net change for the whole category is small, there is a significant change in the expenditure allocated to each asset class within the category. This has been identified as a

[285] Power and Water Corporation, 2013, 'D2013 344191 NPD-Cost Analysis for R&M expenditure for Financial year 2009-10 to 2013-14'

[286] Power and Water Corporation, 2013, 'PB Item 1 (Maintenance Interviews) - Planned ~ analysis of DoForms, ISR and WOs.XLS', 'WOs' tab

[287] Power and Water Corporation, 2013, 'Preventative Maintenance Forecast Model

result of changes to cost allocations of support staff[288], however the changes were only reflected in Table 14 of the justification document[289].

The change was considered immaterial.

Table 8.35 Unplanned corrective maintenance IRP submission opex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Transmission and distribution	8,286	8,356	8,431	8,307	8,045	41,426
Terminal station & zone substations	1,302	1,292	1,276	1,205	1,187	6,261
SCADA & controls	394	394	394	394	394	1,968
Decommissioned assets	-	-	-	-	-	-
Total	**9,981**	**10,042**	**10,101**	**9,906**	**9,625**	**49,655**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.2 – Working ($13-14)

8.14.4 Findings and recommendations

Parsons Brinckerhoff is satisfied that a reasonable approach was undertaken to forecast the unplanned corrective maintenance requirements for the next regulatory control period. Parsons Brinckerhoff notes that the forecast maintenance requirements were based on a specific capital works program. Deferral of some capital works means additional maintenance expenditure will be required until the commissioning of those works. Based on this, Parsons Brinckerhoff recommends the adjustments shown in Table 8.36.

Table 8.36 shows that the recommended unplanned corrective maintenance opex for the 2014-19 regulatory control period is $49.793m. This recommendation increases the unplanned corrective maintenance opex by 0.3% in real terms compared with the IRP proposed regulatory control period expenditure.

The adjustments for changes to the Zone Substations capital works include an increase in funding for both higher defect rates and high maintenance expenditure for existing assets compared to new assets.

Table 8.36 Recommended unplanned corrective maintenance opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**9,981**	**10,042**	**10,101**	**9,906**	**9,625**	**49,655**
Adjustment – ZSS capital works	-	8	43	43	43	138
Total adjustments	**-**	**8**	**43**	**43**	**43**	**138**
Recommended opex	**9,981**	**10,050**	**10,144**	**9,950**	**9,669**	**49,793**

Source: Parsons Brinckerhoff analysis

[288] Power and Water Corporation, 2013, 'Material Project/program Justification - Revised Power Networks Repairs & Maintenance - Unplanned Corrective Maintenance', Section (1)

[289] Power and Water Corporation, 2013, 'Material Project/program Justification - Revised Power Networks Repairs & Maintenance - Unplanned Corrective Maintenance', Table 12

8.15 Vegetation management

The vegetation program covers all works related to vegetation management.

8.15.1 Proposed expenditure

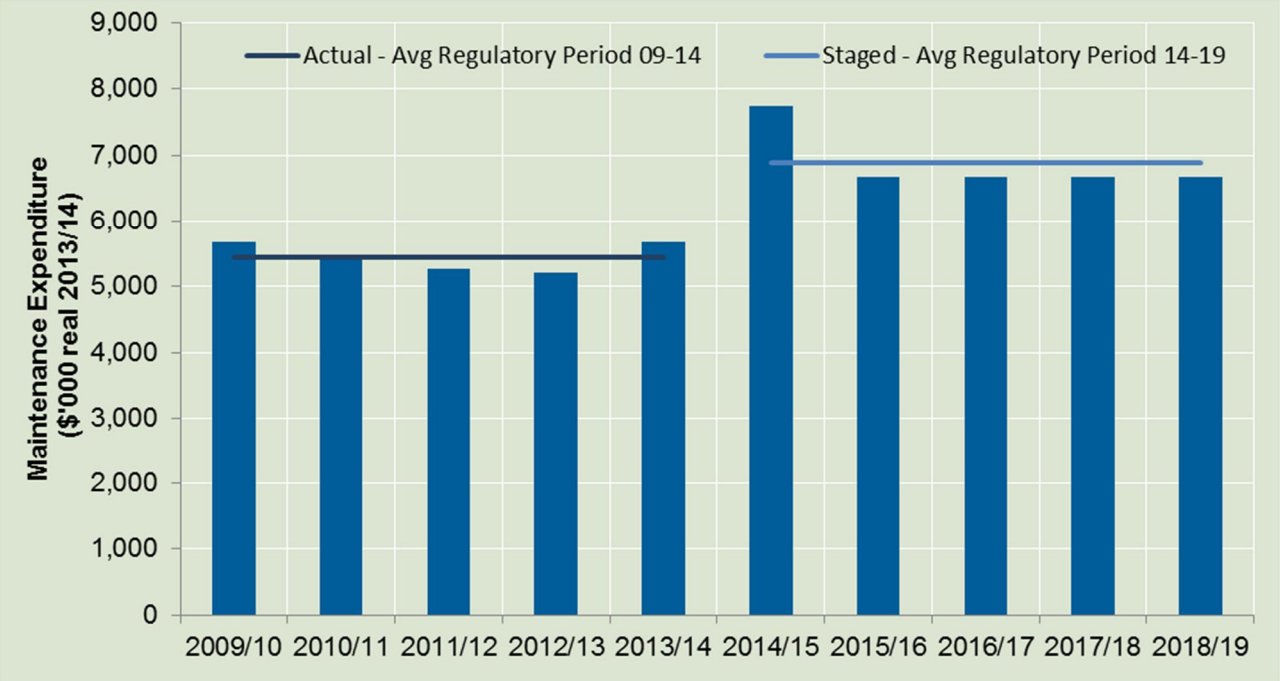
Table 8.37 shows the Vegetation Management opex for the 2014-19 regulatory control period of $34.441m as proposed in the staged submission. The expenditure was forecast based on the level of improvement of SAIDI required in each region of the network.

Table 8.37 Vegetation management staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
In-house	-	-	-	-	-	-	-	-	-	-
Non-related party contractors	5,670	5,407	5,259	5,213	5,671	7,736	6,669	6,669	6,669	6,669
Total	5,670	5,407	5,259	5,213	5,671	**7,736**	**6,669**	**6,669**	**6,669**	**6,669**
Regulatory Period	**27,220**					**34,411**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

The historical and forecast Vegetation Management opex from the staged submission is illustrated in Figure 8-18, which shows that the Vegetation Management opex is forecast to increase by 26% in real terms compared with the current regulatory control period expenditure of $27.220m.



Source: Table 8.37

Figure 8-18 Vegetation Management opex – Staged submission ($'000 real 2013/14)

8.15.2 Analysis and findings

The forecast shows an average annual step increase of $1.5m from the current control period to the next control period. The reasons provided are an ongoing annual cost increase of $1.25m to expand the program

to target specific areas in order to improve reliability, and a one off cost of $1m in 2014/15 to increase clearance to meet a new vegetation clearance standard.

Parsons Brinckerhoff notes the following:

- There is no clear need provided for the $1m one off cost to increase the vegetation clearance. Power Networks has not changed their standard and there is no certainty that it will be changed. Further, there is additional uncertainty as the scope of the proposed works has not been established and the need to negotiate with property owners and local councils, which has historically had a poor success rate, has not been undertaken.
- The driver for the annual $1.25m increase in expenditure is based on the need to improve network reliability. Parsons Brinckerhoff notes the following issues specific to the reliability performance analysis:
  - The analysis is based on the network regions as they relate to the budgeting process used by Power Networks and rather than the mandated standards set by the Utilities Commission. On 1 December 2012 a new standard[290] was published with targets set based on the SCONRR feeder categories. These targets are based on system wide, not regional, performance. The justification for additional works based on regional performance cannot be compared to the network wide performance targets. Without supporting evidence against the current mandated standards, there is not a clear need to improve reliability.
  - The reliability analysis only focuses on one aspect of reliability and does not give sufficient consideration to the overall network performance and all outage causes. A holistic view of network reliability would also consider any improvements achieved through any of the capital works, such as the Feeder Upgrade Program or zone substation replacements, or any benefits in reliability achieved through the increased focus on preventative and planned maintenance. In Parsons Brinckerhoff's view, the need for reliability improvement through vegetation management is not established.
  - There is no discussion regarding the efficiency of addressing reliability through vegetation management compared to other options.
  - The reliability analysis focused on SAIDI and did not consider SAIFI.
- The analysis presented is taken of a very short time frame so a real trend cannot be determined.

8.15.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.38.The IRP forecast expenditure for the Vegetation Management category increased by 1.9% ($0.6m) for the 2014-19 regulatory control period compared to the staged submission as a result of additional costs for in-house staff of $0.129m per year. Parsons Brinckerhoff does not consider that these forecast costs have been justified in the revised justification document[291].

Table 8.38 Vegetation management IRP submission opex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
In-house	129	129	129	129	129	644
Non-related party contractors	7,736	6,669	6,669	6,669	6,669	34,411
Total	**7,865**	**6,798**	**6,798**	**6,798**	**6,798**	**35,055**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.2 – Working ($13-14)

[290] Northern Territory of Australia, 1 December 2012, 'Electricity Standards of Service Code'

[291] Power and Water Corporation, 2013,'Material Project/Program Justification Revsied (sic) Power Networks Repairs & Maintenance - Vegetation Management Program'

8.15.4 Findings and recommendations

Power Networks has not changed their vegetation management standard and there is no certainty that it will be changed. Therefore, Parsons Brinckerhoff recommends the removal of the $1m one off expenditure increase associated with the vegetation management standard.

The need for additional vegetation management to improve network reliability has not been established. Parsons Brinckerhoff recommends the removal of the $1.25m annual increase in expenditure associated with the network reliability.

Parsons Brinckerhoff recommends an average annual expenditure of $5m[292], as this is the average actual annual amount Power Networks has expended on vegetation management this current period.

Table 8.39 shows that the recommended vegetation management opex for the 2014-19 regulatory control period is $25m. This recommendation reduces the vegetation management opex by 31% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.39 Recommended vegetation management opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**7,865**	**6,798**	**6,798**	**6,798**	**6,798**	**35,055**
Adjustment for change of standard	(1,000)	-	-	-	-	(1,000)
Adjustment for annual expenditure	(1,865)	(1,798)	(1,798)	(1,798)	(1,798)	(9,057)
Total adjustments	**(2,865)**	**(1,798)**	**(1,798)**	**(1,798)**	**(1,798)**	**(10,057)**
Recommended opex	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**25,000**

Source: Parsons Brinckerhoff analysis

8.16 Specific maintenance

Specific maintenance covers maintenance on identified type issues that affect specific models in specific asset classes. The forecast for this category has been developed based on the three categories Transmission and Distribution, Terminal Stations and Zone Substations, and Decommissioned Assets. The proposed expenditure and analysis of the need for the expenditure is described in the following sections.

8.16.1 Proposed expenditure

Table 8.40 shows the Specific maintenance opex for the 2014-19 regulatory control period of $2.851m as proposed in the staged submission.

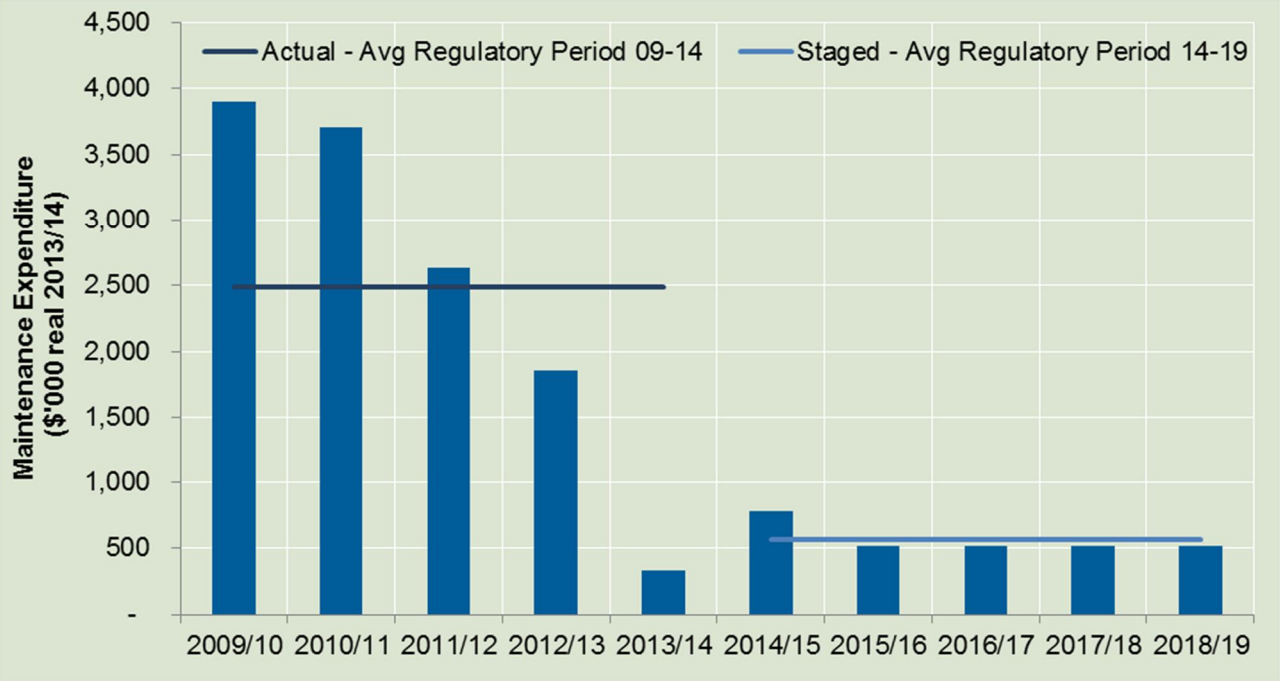
Table 8.40 Specific maintenance staged submission opex overview ($'000 real 2013/14)

	Actual			Estimate		Forecast				
Item	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Transmission & Distribution	938	1,671	1,576	1,715	-	425	223	223	223	223
Terminal Station & Zone Substation	2,966	2,034	1,056	137	330	356	295	295	295	295
Total	**3,904**	**3,705**	**2,631**	**1,852**	**330**	**780**	**518**	**518**	**518**	**518**
Regulatory Period	**12,423**					**2,851**				

Source: Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4, 2..2 – Working ($13-14)

[292] Power and Water Corporation, 2013, 'Vegetation expenditure summary from 2009 to 2013.XLS'

The historical and forecast Specific maintenance opex from the staged submission is illustrated in Figure 8-19, which shows that the Specific maintenance opex is forecast to decrease by 77% in real terms compared with the current regulatory control period expenditure of $12.423m.



Source:Table 8.40

Figure 8-19 Specific Maintenance opex – Staged submission ($'000 real 2013/14)

8.16.2 Analysis and findings

Parsons Brinckerhoff has reviewed the scope of works and forecasting approach undertaken to determine the proposed expenditure for the specific maintenance category in the next regulatory control period. The expenditure in the current regulatory period was significantly higher than the level of works forecast, and the cause has been identified as a result of the RAMP program and the implementation of recommendations from the Davies Report[293] which have now been completed.

Parsons Brinckerhoff notes that Power Networks has proposed an allowance of $0.250m per year for 'Unforseen Specific Maintenance', which represents 1% of the total maintenance forecast, without any further justification. Parsons Brinckerhoff considers that this appears to be a reasonable contingency for the total maintenance program and is not a material amount.

8.16.3 Initial Regulatory Proposal submission

Subsequent to the initial review conducted by Parsons Brinckerhoff, Power Networks submitted its IRP (see section 1.1.1). The IRP proposed opex for this category is shown in Table 8.41. The IRP forecast expenditure for the Specific Maintenance category increased by 115% ($3.3m) for the 2014-19 regulatory control period compared to the staged submission. The change was identified by Power Networks as a result of:

- an additional cost of $3.2m for substation decommissioning

[293] Davies, 4 February 2009, 'The Independent Enquiry into Casuarina Substation Event and Substation Maintenance across Darwin (Final Report)'. The Davies Report details the finding of the investigation following the failure of the Casuarina zone substation and outlines a number of recommendations to be undertaken by PWC.

- an increase to the Terminal and Zone Substation sub category of $0.100m

The additional forecast cost for substation decommissioning has been described in the justification document[294], however, since Parsons Brinkerhoff's capex review has resulted in deferral of some projects, the cost is recommended to be redistributed to reflect the deferral of work at Casuarina Zone Substation by one year and Berrimah Zone Substation by two years.

Table 8.41 Specific maintenance IRP submission opex overview ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Transmission & Distribution	425	223	223	223	223	1,317
Terminal Station & Zone Substation	356	318	318	318	318	1,629
Decommissioned assets	-	-	2,467	357	357	3,181
Total	**780**	**541**	**3,008**	**899**	**899**	**6,127**

Source: Power and Water Corporation, 2013, '2014 NPD – IRP – Att13B – Regulatory Information Notice – Regulatory Templates – Forecasting Operating & Maintenance Expenditure Workbook', 2.2 – Working ($13-14)

8.16.4 Findings and recommendations

Parsons Brinckerhoff recommends the changes to the forecast expenditure shown in Table 8.42 to reflect the deferral of the Casuarina and Berrimah Zone Substation replacements. This recommendation reduces the specific maintenance opex by 6% in real terms compared with the IRP proposed regulatory control period expenditure.

Table 8.42 Recommended specific maintenance opex ($'000 real 2013/14)

Item	2014/15	2015/16	2016/17	2017/18	2018/19	Total
IRP submission proposed opex	**780**	**541**	**3,008**	**899**	**899**	**6,127**
Adjustment – deferral of decommission costs	-	-	-	(335)	-	(335)
Total adjustments	**-**	**-**	**-**	**(335)**	**-**	**(335)**
Recommended opex	**780**	**541**	**3,008**	**564**	**899**	**5,793**

Source: Parsons Brinckerhoff analysis

[294] Power and Water Corporation, 2013,'Material Project/Program Justification Revsied (sic) Power Networks Repairs & Maintenance - Vegetation Management Program'

8.17 Summary of findings and recommendations

Parsons Brinckerhoff has undertaken a high level review of each expenditure category, including a number of specific detailed reviews of opex programs and has recommended adjustments to the expenditure categories. The recommendations provided in this report are in real 2013/14 dollars and may require the commission to apply real-cost escalators to be consistent with the RIN templates completed by PWC. These recommendations are summarised in Table 8.43.

Table 8.43 Recommended opex adjustments ($'000 real 2013/14)

	Recommendation				
Item	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Staged submission proposed opex and maintenance	**106,982**	**103,944**	**102,336**	**102,352**	**101,194**
IRP submission proposed opex and maintenance	**107,124**	**104,457**	**105,261**	**103,385**	**102,158**
Recommended Corporate and shared overhead adjustments (section 8.2.4)	-	-	-	-	-
Recommended Service Delivery adjustments (section 8.3.4)	(1,600)	(1,600)	(1,600)	(1,600)	(1,600)
Recommended Strategy and Planning adjustments (section 8.4.4)	(1,150)	(1,150)	(1,150)	(1,150)	(1,150)
Recommended System Operations adjustments (section 8.5.4)	(48)	(48)	(48)	(48)	(48)
Recommended Metering adjustments (section8.6.4)	(216)	(216)	(216)	(216)	(216)
Recommended Network management adjustments (section 8.7.4)	-	-	-	-	-
Recommended GSL Costs adjustments (section 8.8.4)	(984)	(984)	(984)	(984)	(984)
Recommended Regulatory Costs adjustments (section8.9.4)	(136)	(136)	(136)	(136)	(136)
Recommended Full Retail Contestability related costs adjustments	-	-	-	-	-
Recommended Other adjustments (section 8.10)	-	-	-	-	-
Recommended Preventative Maintenance adjustments (section 8.12.4)	800	885	885	170	255
Recommended Planned Maintenance adjustments (section 8.13.4)	(821)	(1,009)	(671)	(786)	(871)
Recommended Unplanned Maintenance adjustments (section 8.14.4)		8	43	43	43
Recommended Vegetation Management adjustments (section 8.15.4)	(2,865)	(1,798)	(1,798)	(1,798)	(1,798)
Recommended Specific Maintenance adjustments (section8.16.4)	-	-	-	(335)	-
Recommended adjustment to IRP proposed opex	**(7,020)**	**(6,048)**	**(5,675)**	**(6,840)**	**(6,505)**
Recommended total opex	**100,103**	**98,408**	**99,586**	**96,545**	**95,653**
Regulatory Period	**490,295**				

Source: Parsons Brinckerhoff analysis

Table 8.44 shows the recommended opex for the 2014-19 regulatory control period in terms of the standard control opex categories, consistent with RIN templates 2.1 and 2.2. The values are in real 2013/14 dollars without labour and material escalation and may require the commission to apply real-cost escalators to be consistent with the RIN templates completed by PWC.

The recommended operational opex for the 2014-19 regulatory control period is $307.512m. This recommendation reduces the operational opex by 6% in real terms compared with the IRP proposed regulatory control period expenditure of $328.184m.

The recommended maintenance opex for the 2014-19 regulatory control period is $182.784m. This recommendation reduces the maintenance opex by 6% in real terms compared with the IRP proposed regulatory control period expenditure of $194.2m.

Table 8.44 Recommended Opex by standard control categories ($'000 real 2013/14)

Standard control opex categories	Recommendation				
	2014/15	2015/16	2016/17	2017/18	2018/19
Operating Expenditure	**63,523**	**62,261**	**60,325**	**61,133**	**60,269**
Network management	2,030	2,030	2,030	2,030	2,030
Service Delivery	15,180	15,458	15,683	15,648	15,663
Strategy and Planning	11,683	11,683	11,683	11,683	11,683
Metering	4,382	4,288	4,095	4,137	4,348
Regulatory Costs	174	174	174	1,654	667
GSL Costs	700	538	392	261	143
System Operations	4,742	4,742	4,742	4,742	4,742
Corporate and shared overheads	24,455	23,166	21,337	20,787	20,797
Full Retail Contestability related costs	-	-	-	-	-
Other	177	182	188	191	196
Maintenance	**36,580**	**36,147**	**39,260**	**35,412**	**35,384**
Preventative Maintenance	8,733	8,561	9,106	8,176	8,522
Planned Maintenance	12,087	11,996	12,002	11,722	11,295
Unplanned Maintenance	9,981	10,050	10,144	9,950	9,669
Vegetation Management	5,000	5,000	5,000	5,000	5,000
Specific Maintenance	780	541	3,008	564	899
Total	**100,103**	**98,408**	**99,586**	**96,545**	**95,653**
Regulatory Period	**490,295**				

Source: Parsons Brinckerhoff analysis

Note: minor differences between Table 8.43 and Table 8.44 are due to rounding



9. Generic limitations of this report

This report has been developed with the following generic limitations:

9.1 Scope of services and reliance of data

This report has been prepared in accordance with the scope of work/services set out in the contract, or as otherwise agreed, between Parsons Brinckerhoff and the client. In preparing this report, Parsons Brinckerhoff has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

9.2 Study for benefit of client

This report has been prepared for the exclusive benefit of the client and no other party. Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with in this report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in this report (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in this report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

9.3 Other limitations

To the best of Parsons Brinckerhoff's knowledge, the facts and matters described in this report reasonably represent the conditions at the time of printing of the report. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may have resulted in a variation to the conditions.

Parsons Brinckerhoff will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Appendix A

Parsons Brinckerhoff's Terms of Reference

A1. Request for Proposal

A2. 2014-2019 Network Price Determination Framework and Approach Decision Paper

A3. Regulatory Information Notice - Under Section 25 of the Utilities Commission Act and Clause 22 of Network Licence

Appendix B

Justification Documentation

B1. Staged Submission Opex Category Justifications

- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Metering '
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: GSL Costs'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Regulatory Costs'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Service Delivery'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Strategy and Planning'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: System Operations'
- Power and Water Corporation, July 2014, 'Opex Category Justification - Power Networks - Opex Category: Corporate and Shared Services'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Network Management'
- Power and Water Corporation, 2 May 2013, 'Water and Electricity Metering Strategy', Final Report
- Power and Water Corporation, July 2013, 'Material Project/Program Justification - Power Networks Repairs & Maintenance - Unplanned Corrective Maintenance'
- Power and Water Corporation, July 2013, 'Material Project/Program Justification - Power Networks Repairs & Maintenance - Planned Corrective Maintenance'
- Power and Water Corporation, July 2013, 'Material Project/Program Justification - Power Networks Repairs & Maintenance - Preventative Maintenance'
- Power and Water Corporation, July 2013, 'Material Project/Program Justification - Power Networks Repairs & Maintenance - Specific Maintenance'
- Power and Water Corporation, July 2013, 'Material Project/Program Justification - Power Networks Repairs & Maintenance - Vegetation Management Program'

B2. IRP Submission Opex Category Justifications

- Power and Water Corporation, August 2013, 'Opex Category Justification - Power Networks - Revised Opex Category: Metering'
- Power and Water Corporation, August 2013, 'Material Project/Program Justification - Revised Power Networks Repairs & Maintenance - Planned Corrective Maintenance'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Regulatory Costs'
- Power and Water Corporation, August 2013, 'Opex Category Justification - Power Networks - Revised Opex Category: Service Delivery'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: System Operations'
- Power and Water Corporation, August 2013, 'Material Project/Program Justification - Revised Power Networks Repairs & Maintenance - Unplanned Corrective Maintenance'
- Power and Water Corporation, August 2013, 'Material Project/Program Justification - Revised Power Networks Repairs & Maintenance - Vegetation Management Program'
- Power and Water Corporation, August 2013, 'Opex Category Justification - Revised Power Networks - Opex Category: Corporate and Shared Services'
- Power and Water Corporation, August 2013, 'Opex Category Justification - Revised Power Networks - Opex Category: GSL Costs'
- Power and Water Corporation, July 2013, 'Opex Category Justification - Power Networks - Opex Category: Network Management'
- Power and Water Corporation, August 2013, 'Material Project/Program Justification - Revised Power Networks Repairs & Maintenance - Preventative Maintenance'
- Power and Water Corporation, August 2013, 'Material Project/Program Justification - Revised Power Networks Repairs & Maintenance - Specific Maintenance'
- Power and Water Corporation, August 2013, 'Opex Category Justification - Power Networks - Revised Opex Category: Strategy & Planning'

Appendix C

Supplementary Financial Details

C1. Cost Escalators

Table C–1: Consumer Price Index percentage change (weighted average of 8 capital cities) applied, as advised by Utilities Commission

Years	2009/10	2010/11	2011/12	2012/13	Source
Weighted average of 8 capital cities	2.4	3.1	2.4	2.3	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes[295]

[295] http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6401.0Main%20Features6Jun%202013?opendocument&tabname=Summary&prodno=6401.0&issue=Jun%202013&num=&view=

Table C–2: Consumer Price Index (%)

Capital city	Inflation (%)										Source
	2009/10	2010/11	2011/12	2012/13	2009/10	2014/15	2015/16	2016/17	2017/18	2018/19	
Sydney	2.4	3.0	2.5	2.6	2.5	2.5	2.5	2.5	2.5	-	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes(2009/10-2012/13) Australian Energy Regulator, 2009, 'Final Determination – New South Wales distribution determination 2009-10 to 2013-14', Table 11.8: AER conclusion on inflation forecast (2013/14 - 2017/18)
Melbourne	2.0	3.3	2.4	2.2	2.5	2.5	2.5	2.5	2.5	-	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes (2009/10-2012/13) Australian Energy Regulator, 2010, 'Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15', Table 11.3 AER conclusion on inflation forecasts (per cent) (2013/14 - 2017/18)
Adelaide	2.2	3.3	2.6	2.1	2.5	2.5	2.5	2.5	2.5	-	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes (2009/10-2012/13) Australian Energy Regulator, 2010, 'Final Decision – South Australia distribution determination 2010-11 to 2014-15', Table 11.5: AER conclusion on inflation forecast (per cent) (2013/14 - 2017/18)
Perth	2.6	2.8	2.1	2.2	2.5	2.5	2.5	2.5	2.5	-	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes(2009/10-2012/13) Australian Energy Regulator, 2009, 'Final Determination – New South Wales distribution determination 2009-10 to 2013-14', Table 11.8: AER conclusion on inflation forecast (2013/14 - 2017/18)
Hobart	2.6	2.9	2.2	1.2	2.5	2.5	2.5	2.5	2.5	-	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes (2009/10-2012/13) Australian Energy Regulator, 2009, 'Final Determination – New South Wales distribution determination 2009-10 to 2013-14', Table 11.8: AER conclusion on inflation (2013/14 - 2017/18)

Capital city	Inflation (%)										Source
	2009/10	2010/11	2011/12	2012/13	2009/10	2014/15	2015/16	2016/17	2017/18	2018/19	
Darwin	3.1	2.6	2.1	3.1	3.6	2.8	2.7	2.7	2.5	2.5	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes (2009/10-2012/13) Power and Water Corporation, 2013, 'RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)', 5.4 – Working (1) (2013/14 - 2017/18)
Canberra	2.2	2.7	2.5	2.5	2.5	2.5	2.5	2.5	2.5	-	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes (2009/10-2011/12) Australian Energy Regulator, 2009, 'Final Determination – New South Wales distribution determination 2009-10 to 2013-14', Table 11.8: AER conclusion on inflation forecast (2013/14 - 2017/18)
Brisbane	3.0	2.5	2.8	2.5	2.5	2.5	2.5	2.5	2.5	-	Australian Energy Regulator, 2010, 'Final Decision - Queensland distribution determination 2010-11 to 2014-15', Table 7.8: AER conclusion on the QLD DNSPs' real cost escalators (per cent) (2009/10 - 2014/15) Australian Energy Regulator, 2009, 'Final Determination – New South Wales distribution determination 2009-10 to 2013-14', Table 11.8: AER conclusion on inflation forecast (2015/16 - 2017/18)
Weighted Average	2.4	3.1	2.4	2.3	2.5	2.5	2.5	2.5	2.5	2.5	Australian Bureau of Statistics, 2013, 6401.0 (Consumer Price Index, Australia, Jun 2013), Table 2 All groups CPI, Percentage changes (2009/10 – 2012/13) Parsons Brinckerhoff analysis (2013/14 – 2018/19)

Table C–3: Annual Inflation (%)

Area	Inflation (%)										Source
	2009/10	2010/11	2011/12	2012/13	2009/10	2014/15	2015/16	2016/17	2017/18	2018/19	
Western Power	3.1	3.6	1.2	3.0	2.5	2.5	2.5	2.5	-	-	Western Power, 2012, Amended proposed access arrangement information for the Western Power Network', Appendix A Proforma forecast statements - Annual Inflation

Appendix D

Benchmarking

D1. Data Sources

Table D–1: Benchmarking data sources

Author	Document	Date	Source	Additional detail
Power and Water Corporation				
Power and Water Corporation	RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)	2013	5.4 – Working (1)	
Power and Water Corporation	RIN Template Worksheets Definitions, 3.1, 3.4 & 5.4 - Capex Spend, Capex Inputs, Input Cost Escalation ~ (Stage 3)	2013	3.1 – Working	Weighted Average cost escalators applied, see Appendix C, Table C–2
Power and Water Corporation	RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4	2013	2.1 – Working ($13-14)	
Power and Water Corporation	RIN Template Worksheets Definitions, 2.1, 2.2, 2.3, 2.4, 5.1 & 5.4 – Operating Exp, Maintenance Exp, Actual vs Forecasts, ~ Stage 4	2013	2.2 – Working ($13-14)	
Power and Water Corporation	Response to Issue 29 – Asset Data	2013	Section (c). Number of substations (historic and forecast 2009/10 -2018/19) for transmission business and distribution business	
Utilities Commission	Final determination – Networks Pricing: 2009 Regulatory Reset	2009	Table 3-1 'Commission's Assessment of Power and Water's Network Finances Third Regulatory Period'	
Power and Water Corporation	PowerWater Annual Report 2012	2012	Statistical Summaries - Staff	
Power and Water Corporation	Power and Water Corporation – 2011-12 Network Licence Annual Return	2012	Attachment A.1 Regulated Transmission/Distribution Line Lengths	
Power and Water Corporation	Power and Water Corporation – 2009-10 Network Licence Annual Return	2010	Attachment A.1 Regulated Transmission/Distribution Line Lengths	
Power and Water Corporation	Power and Water Corporation – 2010-11 Network Licence Annual Return	2011	Attachment A.1 Regulated Transmission/Distribution Line Lengths	
Power and Water Corporation	Power and Water Corporation – 2012-13 Network Licence Annual Return	2013	Attachment A.1 Regulated Transmission/Distribution Line Lengths	
Power and Water Corporation	2014 NPD - IRP - Att 13 - Regulatory Information Notice - Regulatory Templates 6.1 to 7.3	2013	Asset Utilisation (6.7) – Table 6.7.2 – Feeder utilisation	

Author	Document	Date	Source	Additional detail
Power and Water Corporation	2014 Network Price Determination - Initial Regulatory Proposal - Confidential	2013	Table 35 – RAB roll forward – Annual closing RAB	Weighted Average cost escalators applied, see Appendix C, Table C–2
Power and Water Corporation	PowerWater Annual Report 2012	2012	Statistical Summaries – Electricity	
Power and Water Corporation	Network Management Plan 2011/12 to 2016/17	2012	pg. 5	
Power and Water Corporation	RIN Template Worksheet 6.3 - System MD (2014 NPD - Stage 2)	2013	Maximum Demand at System Level - Table 6.3.1A	
Power and Water Corporation	RIN Template Worksheet 6.3 - System MD (2014 NPD - Stage 2)	2013	Maximum Demand at System Level - Table 6.3.1B	
Power and Water Corporation	RIN Template Worksheet 6.3 - System MD (2014 NPD - Stage 2)	2013	Maximum Demand at System Level - Table 6.3.1C	
Power and Water Corporation	Network Management Plan 2011/12 to 2016/17	2012	Appendix B5 – Transmission Cyclone Mitigation Strategy	
Western Power (Distributor)				
Economic Regulation Authority	Final Decision on Proposed Revisions to the Access Arrangement for Western Power Network	2012	Table 106 – Final Decision distribution network capital expenditure	Cost escalators applied, see Appendix C, Table C–3
Economic Regulation Authority	Final Decision on Proposed Revisions to the Access Arrangement for Western Power Network	2012	Table 7 – Final Decision target revenue for the distribution network, cost escalators applied	Cost escalators applied, see Appendix C, Table C–3
Economic Regulation Authority	Final Decision on Proposed Revisions to the Access Arrangement for Western Power Network	2012	Table 123 – Final Decision forecast distribution network capital base	Cost escalators applied, see Appendix C, Table C–3
Economic Regulation Authority	Final Decision on Proposed Revisions to the Access Arrangement for Western Power Network	2012	Table 65 – Final Decision capital base at 30 June 2012 for the distribution network	Cost escalators applied, see Appendix C, Table C–3
Economic Regulation Authority	Final Decision on Proposed Revisions to the Access Arrangement for the South West Interconnected Network	2009	Table 93 Authority's revised target revenue for the distribution network	Cost escalators applied, see Appendix C, Table C–3
Western Power	Amended proposed access arrangement information for the Western Power Network	2012	Appendix A Proforma forecast statements – Annual Inflation	Cost escalators applied, see Appendix C, Table C–3
Western Power	Amended proposed access arrangement information for the Western Power Network	2012	Appendix A Proforma forecast statements – Historical capital expenditure by reason	Cost escalators applied, see Appendix C,

Author	Document	Date	Source	Additional detail
				Table C–3
Western Power	Amended proposed access arrangement information for the Western Power Network	2012	Appendix A Proforma forecast statements – Forecast capital expenditure by reason	Cost escalators applied, see Appendix C, Table C–3
Western Power	Amended proposed access arrangement information for the Western Power Network	2012	Appendix A Proforma forecast statements – Historic non-capital costs by business category and activity	Cost escalators applied, see Appendix C, Table C–3
Western Power	Amended proposed access arrangement information for the Western Power Network	2012	Appendix A Proforma forecast statements – Forecast non-capital costs by business category and activity	Cost escalators applied, see Appendix C, Table C–3
Western Power	Annual Report 2010	2011	5.2 Connecting with customers pg. 15	
Western Power	Annual Report 2011	2012	Western Power Network peak demand pg. 14	
Western Power	Annual Report 2011	2012	Circuit Length (kilometres) pg. 14	
Western Power	Annual Report 2011	2012	Our customers and stakeholders pg. 13	
Western Power	Annual Report 2011	2012	Poles and towers pg. 14	
Western Power	Annual Report 2012	2012	Our Profile – Our customers and other stakeholders pg.14	
Western Power	Annual Report 2013	2012	People & Culture - Employee statistics pg38	
Western Power	Annual Report 2014	2012	Western Power Network peak demand 25 January 2012 pg. 12	
Western Power	Annual Report 2015	2012	Western Power Network's circuit length (kms) pg. 12	
Western Power	Annual Report 2016	2012	Poles and towers pg. 12	
Aurora Energy				
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 23 Total Capex	
Aurora Energy	Distribution System Planning Report 2012	2012	Executive Summary pg. 5	
Australia Energy Regulator	Final Distribution Determination – Aurora Energy Pty Ltd 2012-13 to 2016-17	2012	Table 1.2 - The AER'S final determination on Aurora's revenue cap for standard control services	Hobart cost escalators applied, see Appendix C, Table C–2

Author	Document	Date	Source	Additional detail
Australia Energy Regulator	Final Distribution Determination – Aurora Energy Pty Ltd 2012-13 to 2016-17	2012	Table 3.1 AER final determination on Aurora's RAB for current regulatory control period	Hobart cost escalators applied, see Appendix C, Table C–2
Australia Energy Regulator	Final Distribution Determination – Aurora Energy Pty Ltd 2012-13 to 2016-17	2012	Table 3.2 AER final determination on Aurora's RAB for forthcoming regulatory control period	Hobart cost escalators applied, see Appendix C, Table C–2
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 26 - Network division management opex	
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 28 - Non-network division management opex	
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 30- Other operating costs opex	
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 32 – Non- network management opex	
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 33 – Routine maintenance opex	
Aurora Energy	Aurora Energy Revised Regulatory Proposal 2012 – 2017	2012	Table 36 – Non-routine maintenance opex	
Aurora Energy	Annual and Sustainability Report 2010-11	2012	Figure 1 – Five Year Summary – Our people	
Aurora Energy	Annual and Sustainability Report 2010-11	2012	Figure 1 – Five Year Summary – Our customers	
Aurora Energy	Annual and Sustainability Report 2010-11	2012	Our organisation – our assets	
Aurora Energy	Annual and Sustainability Report 2010-11	2012	At a glance pg. 2	
Aurora Energy	Annual and Sustainability Report 2009/10	2011	Figure 33- Tamar Valley Power Station technical performance 2009/10	
Aurora Energy	Annual and Sustainability Report 2009/10	2011	Our organisation – our assets	
Aurora Energy	Annual Report 2011/12	2012	6. Our People pg. 37	
Aurora Energy	Annual Report 2011/12	2012	Figure 15- Tamar Valley Power Station financial year 2011-12 production statistics	
Aurora Energy	Distribution System Planning Report 2012	2012	5.2.1 Coincident System Peak pg.23	
Aurora Energy	Distribution System Planning Report 2012	2012	Table 1: Aurora Connected Customers	
Aurora Energy	Distribution System Planning Report 2012	2012	2. Distribution network overview	
Energex				
Energex	Revised Regulatory Proposal for the period July 2010 – June 2015	2010	Table 3.7 Revised Regulatory Proposal Capital	Brisbane cost escalators applied, see

Author	Document	Date	Source	Additional detail
			Expenditure Program for 2010 by category	Appendix C, Table C–2
Energex	Revised Regulatory Proposal for the period July 2010 – June 2015	2010	Table 5.1 Revised Regulatory Asset Base for 1 July 2010	Brisbane cost escalators applied, see Appendix C, Table C–2
Energex	Revised Regulatory Proposal for the period July 2010 – June 2015	2010	Table 5.2 Revised Regulatory Asset Base for the 2010-15 regulatory control period	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 8.3: Energex's revised regulatory proposal opex allowance	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 8.20: AER conclusion on Energex's total opex allowance	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 7.8: AER conclusion on the QLD DNSPs' real cost escalators (per cent)	
Energex	Energex Annual Performance Report 2011/12'	2012	Table 9: Changes to our key assets since 2007/8	
Energex	Energex Annual Performance Report 2011/12'	2012	Financial five year summary pg. 4	
Ergon Energy				
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 10: Ergon Energy's revised capex proposal by category	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 12: AER conclusion on Ergon Energy's capex allowance	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 8.4: Ergon Energy revised regulatory proposal opex allowance	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 8.21: AER conclusion on Ergon Energy's total opex allowance	Brisbane cost escalators applied, see Appendix C, Table C–2

Author	Document	Date	Source	Additional detail
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 16.8 AER's roll forward of Ergon Energy's regulatory asset base	Brisbane cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 16.12 AER decision on Ergon Energy's annula revenue requirements and X factors	Brisbane cost escalators applied, see Appendix C, Table C–2
Ergon Energy	Annual Stakeholder Report 2011/12	2012	Review of Operation - Energy Usage Snapshot pg. 23	
Ergon Energy	Annual Stakeholder Report 2011/12	2012	Network Statistics pg. 56	
Australian Energy Regulator	Final Decision - Queensland distribution determination 2010-11 to 2014-15	2010	Table 7.8: AER conclusion on the QLD DNSPs' real cost escalators (per cent)	
Powercor				
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 11.3 AER conclusion on inflation forecasts (per cent)	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 8.39: AER conclusion on Powercor capital expenditure 2011-15	Melbourne cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 3: Expected revenues	Melbourne cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 2: AER conclusion on growth forecasts - Powercor	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 18.14: AER forecast roll-forward of Powercor's regulated asset base	Melbourne cost escalators applied, see Appendix C, Table C–2
Citipower & Powercor Australia	Powercor Network Statistics'	2012	http://citipower.com.au/Powercor_Network_Statistics/	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 8.39: AER conclusion on Powercor capital expenditure 2011-15	Melbourne cost escalators applied, see Appendix C, Table C-2
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 3: Expected revenues	Melbourne cost escalators applied, see Appendix C,

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CitiPower				
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 11.3 AER conclusion on inflation forecasts (per cent)	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 8.38 AER conclusion on CitiPower capital expenditure 2011-15	Melbourne cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 7.31 AER final decision opex allowance for CitiPower	Melbourne cost escalators applied, see Appendix C, Table C–2
CitiPower	Revised Regulatory Proposal 2011-15	2010	Table 6.18 CitiPower's proposed step changes (including escalation, margins and overheads)	Melbourne cost escalators applied, see Appendix C, Table C–2
CitiPower + Powercor	Annual Report 2010		employee + results pg.20	
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CitiPower + Powercor	CitiPower Network Statistics'	2012	http://citipower.com.au/CitiPower_Network_Statistics/	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 1: AER conclusion on growth forecasts – CitiPower	
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Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 8.38 AER conclusion on CitiPower capital expenditure 2011-15	Melbourne cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 7.31 AER final decision opex allowance for CitiPower	Melbourne cost escalators applied, see Appendix C, Table C–2
CitiPower	Revised Regulatory Proposal 2011-15	2010	Table 6.18 CitiPower's proposed step changes (including escalation, margins and overheads)	Melbourne cost escalators applied, see Appendix C,

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CitiPower + Powercor	Annual Report 2010		employee + results pg.20	
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CitiPower + Powercor	CitiPower Network Statistics'	2012	http://citipower.com.au/CitiPower_Network_Statistics/	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 1: AER conclusion on growth forecasts – CitiPower	
Australian Energy Regulator	Final Decision – Victorian electricity distribution network service providers – Distribution determination 2011-15	2010	Table 18.12: AER forecast roll-forward of Citipower's regulated asset base	
ETSA Utilities				
ETSA Utilities	ETSA Utilities Revised Regulatory Proposal 2010-2015	2010	Table 2 : ETSA Utilities' revised total forecast net capital expenditure for 2010- 2015 regulatory control period (excluding metering services)	Adelaide cost escalators applied, see Appendix C, Table C–2
ETSA Utilities	ETSA Utilities Revised Regulatory Proposal 2010-2015	2010	Table 7.2: Bottom up forecast provided in response to question PB.ETS.VP.55	
ETSA Utilities	2011 Annual Report	2011	C – Historical Operating Statistics for year ending 31 December 2011 – Kilometers of line	
ETSA Utilities	2011 Annual Report	2011	C – Historical Operating Statistics for year ending 31 December 2011 – Distribution System Peak Demand	
ETSA Utilities	2011 Annual Report	2011	C – Historical Operating Statistics for year ending 31 December 2011 – Energy delivered	
ETSA Utilities	2011 Annual Report	2011	C – Historical Operating Statistics for year ending 31 December 2011 – Customer numbers	
ETSA Utilities	2011 Annual Report	2011	A – Business Overview	
Australian Energy Regulator	Final Decision – South Australia distribution determination 2010-11 to 2014-15	2010	Table 16.4: AER's forecast roll-forward of ETSA Utilities' regulatory asset bas	Adelaide cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision – South Australia distribution determination 2010-11 to 2014-15	2010	Table 1.1: AER draft decision on ETSA Utilities' annual revenue requirements and X factors,	Adelaide cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Decision – South Australia distribution determination 2010-11 to	2010	Table 11.5: AER conclusion on inflation forecast	

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	2014-15		(per cent)	
Essential Energy				
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 8.4: Country Energy's revised forecast opex allowance	Sydney cost escalators applied, see Appendix C, Table C-2
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 7.5: Country Energy's revised capex proposal	Sydney cost escalators applied, see Appendix C, Table C–2
Country Energy	Country Energy's Electricity Network Revised Regulatory Proposal 2009-2014'	2009	Table 8 – Forecast operating and Maintenance Expenditure for Standard Control Services	Sydney cost escalators applied, see Appendix C, Table C–2
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Ausgrid				
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 7.9: EnergyAustralia's revised distribution capex by category	Sydney cost escalators applied, see Appendix C, Table C-2
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 16.23: AER conclusion on EnergyAustralia's annual revenue requirements and X factors – distribution	Sydney cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 16.15: AER forecast roll-forward of EnergyAustralia's distribution regulatory asset base	Sydney cost escalators applied, see Appendix C,

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Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 6.4 EnergyAustralia's maximum demand forecasts	Sydney cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 8.5: EnergyAustralia's revised forecast opex allowance	Sydney cost escalators applied, see Appendix C, Table C–2
Ausgrid	Annual Report 2011/12	2012	About Ausgrid: Scale pg.5	
Ausgrid	Annual Report 2011/12	2012	Operational excellence pg. 10	
EnergyAustralia	Regulatory proposal	2008	10. Operating expenditure program pg. 130	
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 8.24: AER conclusion on EnergyAustralia's total forecast opex allowance	Sydney cost escalators applied, see Appendix C, Table C–2
EnergyAustralia	Regulatory proposal	2008	11.5.3 Outsourcing to non-related parties	Sydney cost escalators applied, see Appendix C, Table C–2
Ausgrid	Sustainability Indicators Supplement 2011/12	2012	Standard disclosures pg. 11	
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Endeavour Energy				
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 8.6: Integral Energy's revised forecast total opex allowance	Sydney cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 8.27: AER conclusion on Integral Energy's total forecast opex allowance	Sydney cost escalators applied, see Appendix C, Table C–2
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 7.12: Integral Energy's revised capex proposal by category	Sydney cost escalators applied, see Appendix C, Table C–2

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Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 16.18: AER forecast roll-forward of Integral Energy's regulatory asset base	Sydney cost escalators applied, see Appendix C, Table C–2
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Australian Energy Regulator	Draft Determination – New South Wales draft distribution determination 2009-10 to 2013-14	2009	Table 7: Integral Energy's energy and maximum demand forecasts 2009-10 to 2013-14	
Endeavour Energy	Annual Performance Report 2011-12'	2012	1. Our Organisation - Year at a glance – our operations	
Endeavour Energy	Annual Performance Report 2011-12'	2012	1. 4. Our People - Performance Indicator – Employee numbers 2007-2012 (based on full time equivalents)	
Australian Energy Regulator	Final Determination – New South Wales distribution determination 2009-10 to 2013-14	2009	Table 11.8: AER conclusion on inflation forecast	