Draft decision

Essential Energy distribution determination

2015–16 to 2018–19

Attachment 7: Operating expenditure

November 2014

AUSTRALIAN ENERGY REGULATOR

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Note

This attachment forms part of the AER's draft decision on Essential Energy's 2015–19 distribution determination. It should be read with other parts of the draft decision.

The draft decision includes the following documents:

Overview

Attachment 1 – Annual revenue requirement

Attachment 2 – Regulatory asset base

Attachment 3 – Rate of return

Attachment 4 – Value of imputation credits

Attachment 5 – Regulatory depreciation

Attachment 6 – Capital expenditure

Attachment 7 – Operating expenditure

Attachment 8 – Corporate income tax

Attachment 9 – Efficiency benefit sharing scheme

Attachment 10 – Capital expenditure sharing scheme

Attachment 11 – Service target performance incentive scheme

Attachment 12 – Demand management incentive scheme

Attachment 13 – Classification of services

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Attachment 15 – Pass through events

Attachment 16 – Alternative control services

Attachment 17 – Negotiated services framework and criteria

Attachment 18 – Connection policy

Contents

Shortened forms

Shortened form	Extended form
AARR	aggregate annual revenue requirement
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ASRR	aggregate service revenue requirement
augex	augmentation expenditure
capex	capital expenditure
CCP	Consumer Challenge Panel
CESS	capital expenditure sharing scheme
CPI	consumer price index
CPI-X	consumer price index minus X
DRP	debt risk premium
DMIA	demand management innovation allowance
DMIS	demand management incentive scheme
distributor	distribution network service provider
DUoS	distribution use of system
EBSS	efficiency benefit sharing scheme
ERP	equity risk premium
expenditure assessment guideline	expenditure forecast assessment guideline for electricity distribution
F&A	framework and approach
MRP	market risk premium

Shortened form	Extended form
NEL	national electricity law
NEM	national electricity market
NEO	national electricity objective
NER	national electricity rules
NSP	network service provider
opex	operating expenditure
PPI	partial performance indicators
PTRM	post-tax revenue model
RAB	regulatory asset base
RBA	Reserve Bank of Australia
repex	replacement expenditure
RFM	roll forward model
RIN	regulatory information notice
RPP	revenue pricing principles
SAIDI	system average interruption duration index
SAIFI	system average interruption frequency index
SLCAPM	Sharpe-Lintner capital asset pricing model
STPIS	service target performance incentive scheme
WACC	weighted average cost of capital

7 Operating expenditure

Operating expenditure (opex) refers to the operating, maintenance and other non-capital expenses, incurred in the provision of network services. Forecast opex for standard control services is one of the building blocks we use to determine a service provider's total revenue requirement.

This attachment provides an overview of our assessment of opex. Detailed analysis of our assessment of opex are in the following appendices:

- Appendix A - Base opex
- Appendix B - Rate of change
- Appendix C - Step changes
- Appendix D - Forecasting methodology.

7.1 Draft decision

We are not satisfied Essential Energy's forecast opex reasonably reflects the opex criteria.[1] We therefore do not accept the forecast opex Essential Energy included in its building block proposal.[2] Our alternative estimate of Essential Energy's opex for the 2014–19 period, which we consider reasonably reflects the opex criteria, is outlined in Table 7-1.[3]

Table 7-1 AER draft decision on total opex ($ million, 2013–14)

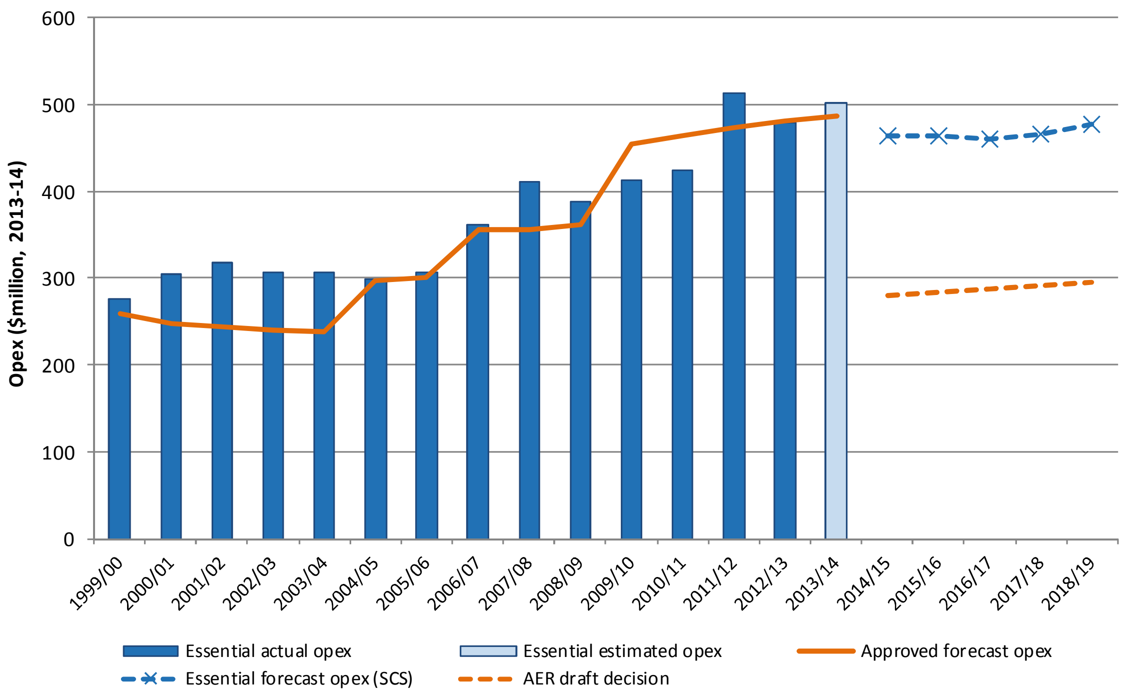
	2014–15	2015–16	2016–17	2017–18	2018–19	Total
Essential Energy's proposal	459.2	460.8	456.4	462.5	471.9	2310.7
AER draft decision	277.3	279.9	283.3	287.3	291.1	1418.8
Difference	-181.9	-180.9	-173.0	-175.2	-180.8	-891.8

Source: AER analysis.
Note: Excludes debt raising costs.

Figure 7-1 shows our draft decision compared to Essential Energy's proposal, its past allowances and past actual expenditure.

1 NER, cl. 6.5.6(c).
2 NER, cl. 6.5.6(d).
3 NER, cl. 6.12.1(4)(ii).

Figure 7-1 AER draft decision compared to Essential Energy's past and proposed opex ($ million, 2013–14)

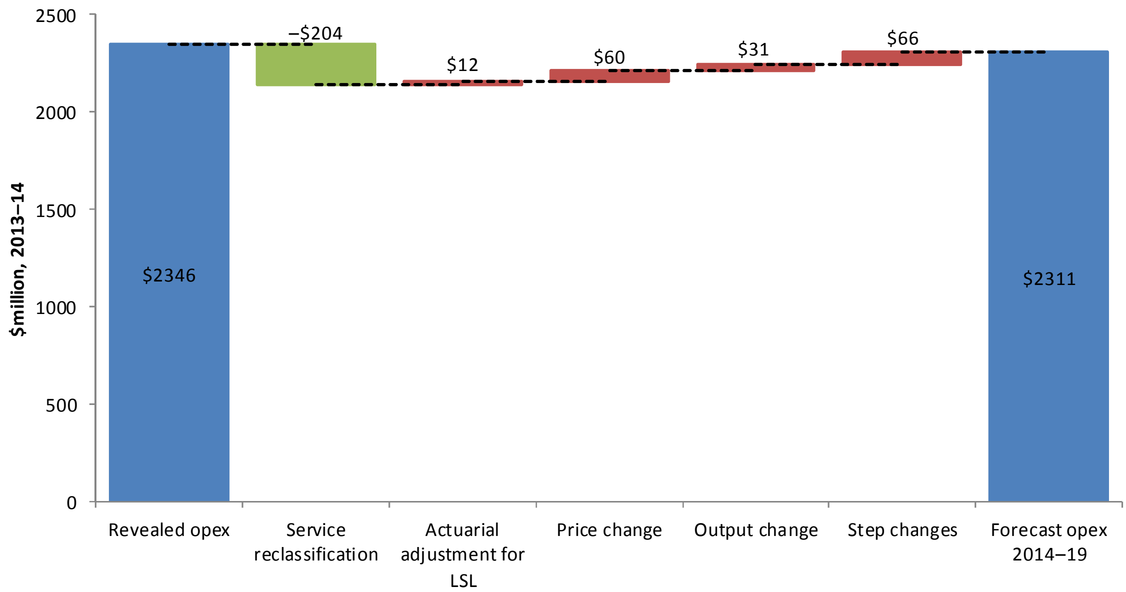


Source: Country Energy, Regulatory accounts 1999–2000 to 2004–05; Essential Energy, Economic benchmarking - Regulatory Information Notice response 2005–06 to 2012–13; Essential Energy, *Regulatory proposal for the 2014–19 period* - Regulatory Information Notice; AER analysis.

7.2 Essential Energy's proposal

Essential Energy proposed total forecast standard control service opex of $2311 million ($2013–14) for the 2014–19 period (excluding debt raising costs, totalling $21 million). In Figure 7-2 we have separated Essential Energy's opex forecast into its different elements.

Figure 7-2 Essential Energy's opex forecast ($ million, 2013–14)



Source: AER analysis.

Each of these elements are described below:

- Essential Energy used the actual opex it incurred in 2012–13 as the base for forecasting its opex for the 2014–19 period. It forecast this would lead to base opex of $2,346 million ($2013–14) over the 2014–19 regulatory control period.

- Essential Energy adjusted its base opex to remove opex on metering and ancillary network services that will be reclassified as alternative control services. This reduced its opex forecast by $204 million ($2013–14).

- Essential Energy proposed to remove the impact of an actuarial revaluation of its long service leave obligations from its reported actual opex for 2012–13. It considered that this was needed to ensure that base opex represents the actual ongoing opex needed to provide standard control services.[4] This increased Essential Energy's opex forecast by $12 million ($2013–14).

- Essential Energy accounted for forecast changes in prices related to labour price increases. These forecast price changes increased Essential Energy's opex forecast by $60 million ($2013–14).

- Essential Energy forecast output change by applying an asset growth multiplier calculated as a percentage of new assets on the replacement cost of its existing assets. This increased its opex forecast by $31 million ($2013–14).

- Essential Energy adjusted its opex for step changes.[5] This included increased forecast opex for the costs of implementing network reform, accounting treatment changes and increased allocation of overheads to opex. It included a decrease in forecast opex for vegetation management efficiencies. In total, step changes increased Essential Energy's opex forecast by $66 million ($2013–14).

7.3 Assessment approach

We decide whether or not to accept the service provider's total forecast opex. We accept the service provider's forecast if we are satisfied that it reasonably reflects the opex criteria.[6] If we are not satisfied, we replace it with a total forecast of opex that we are satisfied does reasonably reflect the opex criteria.[7]

It is important to note that we make our assessment about the total forecast opex and not about particular categories or projects in the opex forecast. The Australian Energy Market Commission (AEMC) has expressed our role in these terms:[8]

> It should be noted here that what the AER approves in this context is expenditure allowances, not projects.

The service provider's forecast is intended to cover the expenditure that will be needed to achieve the operating expenditure objectives. These objectives are:[9]

4 Essential Energy, *Regulatory proposal*, May 2014,p. 80.
5 This categorisation is from Regulatory Information Notice, Table 2.17. Elsewhere Essential Energy noted that it preferred the term 'change factor' to a 'step change'.
6 NER, cl. 6.5.6(c).
7 NER, cl. 6.5.6(d).
8 AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p. vii.
9 NER, cl. 6.5.6(a).

(1) meeting or managing the expected demand for standard control services over the regulatory control period

(2) complying with all applicable regulatory obligations or requirements associated with providing standard control services

(3) where there is no regulatory obligation or requirement, maintaining the quality, reliability and security of supply of standard control services and maintaining the reliability and security of the distribution system

(4) maintaining the safety of the distribution system through the supply of standard control services.

We assess the proposed total forecast opex against the opex criteria set out in the NER. The opex criteria provide that the total forecast must reasonably reflect:[10]

(1) the efficient costs of achieving the operating expenditure objectives

(2) the costs that a prudent operator would require to achieve the operating expenditure objectives

(3) a realistic expectation of the demand forecast and cost inputs required to achieve the operating expenditure objectives.

The AEMC noted that '[t]hese criteria broadly reflect the NEO [National Electricity Objective]'.[11]

In deciding whether or not we are satisfied the service provider's forecast reasonably reflects the opex criteria we have regard to the opex factors.[12] We attach different weight to different factors when making our decision to best achieve the National Electricity Objective. This approach has been summarised by the AEMC as follows:[13]

> As mandatory considerations, the AER has an obligation to take the capex and opex factors into account, but this does not mean that every factor will be relevant to every aspect of every regulatory determination the AER makes. The AER may decide that certain factors are not relevant in certain cases once it has considered them.

The opex factors we have regard to are:

- the most recent annual benchmarking report that has been published under clause 6.27 and the benchmark operating expenditure that would be incurred by an efficient Distribution Network Service Provider (DNSP) over the relevant regulatory control period
- the actual and expected operating expenditure of the DNSP during any preceding regulatory control periods
- the extent to which the operating expenditure forecast includes expenditure to address the concerns of electricity consumers as identified by the DNSP in the course of its engagement with electricity consumers
- the relative prices of operating and capital inputs

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10 NER, clause 6.5.6(c).

11 AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p. 113.

12 NER, clause 6.5.6(e).

13 AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p. 115.

- the substitution possibilities between operating and capital expenditure
- whether the operating expenditure forecast is consistent with any incentive scheme or schemes that apply to the DNSP under clauses 6.5.8 or 6.6.2 to 6.6.4
- the extent the operating expenditure forecast is referable to arrangements with a person other than the DNSP that, in our opinion, do not reflect arm's length terms
- whether the operating expenditure forecast includes an amount relating to a project that should more appropriately be included as a contingent project under clause 6.6A.1(b)
- the extent to which the DNSP has considered and made provision for efficient and prudent non-network alternatives
- any relevant final project assessment conclusions report published under 5.17.4(o),(p) or (s)
- any other factor we consider relevant and which we have notified the DNSP in writing, prior to the submission of its revised Revenue Proposal under clause 6.10.3, is an operating expenditure factor.

For this determination, there are two additional operating expenditure factors that we will take into account under the last opex factor above:

- our benchmarking data sets including, but not necessarily limited to:

  (a) data contained in any economic benchmarking RIN, category analysis RIN, reset RIN or annual reporting RIN

  (b) any relevant data from international sources

  (c) data sets that support econometric modelling and other assessment techniques consistent with the approach set out in our Guideline

  as updated from time to time.

- economic benchmarking techniques for assessing benchmark efficient expenditure including stochastic frontier analysis and regressions utilising functional forms such as Cobb Douglas and Translog.[14]

For transparency and ease of reference, we have included a summary of how we have had regard to each of the opex factors in our assessment at the end of this attachment.

More broadly, we also note in exercising our discretion, we take into account the revenue and pricing principles which are set out in the National Electricity Law (NEL).[15]

The Expenditure Forecast Assessment Guideline

After conducting an extensive consultation process with service providers, users, consumers and other interested stakeholders we issued an Expenditure forecast assessment guideline (our

[14] This is consistent with the approach we outlined in the explanatory statement to our Expenditure Forecast Assessment Guideline. See, for example, p. 131.

[15] NEL, s. 16(2); s. 7A.

Guideline) in November 2013 together with an explanatory statement.[16] Our Guideline sets out our intended approach to assessing operating expenditure in accordance with the National Electricity Rules (NER).[17]

We may depart from the approach set out in our Guideline but if we do so we give reasons for doing so. In this determination we have not departed from the approach set out in our Guideline. In our Framework and Approach paper for each service provider, we set out our intention to apply our guideline approach in making this determination.

Our approach is to compare the service provider's total forecast opex with an alternative estimate that we develop ourselves.[18] By doing this we form a view on whether we are satisfied that the service provider's proposed total forecast opex reasonably reflects the criteria. If we conclude the proposal does not reasonably reflect the opex criteria, we use our estimate as a substitute forecast. This approach was expressly endorsed by the AEMC in its decision on the major rule changes that were introduced in November 2012. The AEMC stated:[19]

> While the AER must form a view as to whether a NSP's proposal is reasonable, this is not a separate exercise from determining an appropriate substitute in the event the AER decides the proposal is not reasonable. For example, benchmarking the NSP against others will provide an indication of both whether the proposal is reasonable and what a substitute should be. Both the consideration of "reasonable" and the determination of the substitute must be in respect of the total for capex and opex.

Our estimate is unlikely to exactly match the service provider's forecast because the service provider may not adopt the same forecasting method. However, if the service provider's inputs and assumptions are reasonable, its method should produce a forecast consistent with our estimate.

If a service provider's total forecast opex is materially different to our estimate and there is no satisfactory explanation for this difference, we may form the view that the service provider's forecast does not reasonably reflect the opex criteria. Conversely, if our estimate demonstrates that the service provider's forecast reasonably reflects the expenditure criteria, we will accept the forecast.[20] Whether or not we accept a service provider's forecast, we will provide the reasons for our decision.[21]

Building an alternative estimate of total forecast opex

Our approach to forming an alternative estimate of opex involves five key steps:

1. We typically use the service provider's actual opex in a single year as the starting point for our assessment. While categories of opex can vary from year to year, total opex is relatively recurrent.

2. We assess whether opex in that base year reasonably reflects the opex criteria. We now have a number of different techniques including economic benchmarking, by which can test the efficiency of opex in the base year. If necessary, we make an adjustment to the base year expenditure to ensure that it reflects the opex criteria. We can utilise the same techniques available to assess the efficiency of base year opex to make an adjustment to base year opex.

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16 AER, *Expenditure forecasting assessment guideline - explanatory statement*, November 2013.
17 NER cl. 6.5.6.
18 AER, *Expenditure forecast assessment guideline*, November 2013, p. 7.
19 AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p. 112.
20 NER, cl. 6.5.6(c).
21 NER, cl. 6.12.1(3)(ii).

3. As the opex of an efficient service provider tends to change over time due to price changes, output and productivity, we trend the adjusted base year expenditure forward over the regulatory control period to take account of those changes. We refer to this as the rate of change.

4. We then adjust the base year expenditure to account for any other forecast cost changes over the regulatory control period that would meet the opex criteria. This may be due to new regulatory obligations and efficient capex/opex trade-offs. We call these step changes.

5. Finally we add any additional opex components which have not been forecast using this approach. For instance, we forecast debt raising costs based on the costs incurred by a benchmark efficient service provider. If we removed a category of opex from the selected base year, we will need to consider what additional opex is needed for this category of opex in forecasting total opex.

Underlying our approach are two general assumptions:

- the efficiency criterion and the prudence criterion in the NER are complementary
- actual expenditure was sufficient to achieve the expenditure objectives in the past.

We have used this general approach in our past decisions. It is a well-regarded top-down forecasting model that has been employed by a number of Australian regulators over the last fifteen years. We refer to it as a 'revealed cost method' in our Guideline (and we have sometimes referred to it as the base-step-trend method in our past regulatory decisions).

While these general steps are consistent with our past determinations, we have adopted a significant change in how we give effect to this approach, following the major changes to the NER made in November 2012. Those changes placed significant new emphasis on the use of benchmarking in our expenditure analysis. We will now issue benchmarking reports annually and have regard to those reports. These benchmarking reports provide us with one of a number of inputs for determining the benchmark efficient costs of providing opex.

We have set out more detail about each of the steps we follow in constructing our forecast below.

Step 1 – Starting point - base year expenditure

We prefer to use a recent year for which audited figures are available as the starting point for our analysis. We call this the base year. This is for a number of reasons:

- As total opex tends to be relatively recurrent, total opex in a recent year typically best reflects a service provider's current circumstances.
- During the past regulatory control period, we have incentives in place to reward the service provider for making efficiency improvements by allowing it to retain a portion of the efficiency savings it makes. Similarly, we penalise the service provider when it is relatively less efficient. This gives us confidence that the service provider did not spend more in the proposed base year to try to inflate its opex forecast for the next regulatory control period.
- Service providers also face many regulatory obligations in delivering services to consumers. These regulatory obligations ensure that the financial incentives a service provider faces to reduce its costs are balanced by obligations to deliver services safely and reliably. In general, this gives us confidence that recent historical opex will be at least enough to achieve the opex objectives.

In choosing a base year, we need to make a decision as to whether any categories of opex incurred in the base year should be removed. For instance:

- If a category of opex in the base year will not be included in standard control services opex in the 2014–19 period we will remove it. For instance, for this draft decision we removed metering and ancillary network services which will be reclassified as alternative control services in the 2014–19 period.
- Rather than use all opex in the base year, service providers also often forecast specific categories of opex using different methods. We must also assess these methods in deciding what the starting point should be. If we agree that these categories of opex should be assessed differently, we will also remove them from the base year.

As part of this step we also need to consider any interactions with the incentive scheme for opex, the Efficiency Benefit Sharing Scheme (EBSS). The EBSS is designed to achieve a fair sharing of efficiency gains and losses between a service provider and its consumers. Under the EBSS, service providers receive a financial reward for reducing their costs in the regulatory control period and a financial penalty for increasing their costs. The benefits of these reductions in opex flow through to consumers as long as base year opex is no higher than the opex incurred in that year. Similarly, the costs of an increase in opex flow through to consumers if base year opex is no lower than the opex incurred in that year. If the starting point is not consistent with the EBSS, service providers could be excessively rewarded for efficiency gains or excessively penalised for efficiency losses in the prior regulatory control period.

Step 2 – Assessing base year expenditure

Regardless of the base year we choose, the service provider's actual expenditure may not reflect the opex criteria. For example, it may not be efficient or management may not have acted prudently in its governance and decision-making processes. We must test whether actual expenditure in that year should be used to forecast efficient opex in the next regulatory control period.

As we set out in our Guideline, to assess the efficiency of a service provider's actual expenditure, we use a number of different techniques.[22]

For instance, we may undertake a detailed review of a service provider's actual opex. For this draft decision, we have reviewed Essential Energy's labour and workforce and vegetation management practices.

Benchmarking is particularly important in comparing the relative efficiency of different service providers. The AEMC highlighted the importance of benchmarking in its changes to the NER in November 2012:[23]

> The Commission views benchmarking as an important exercise in assessing the efficiency of a NSP and informing the determination of the appropriate capex or opex allowance.

By benchmarking a service provider's expenditure we can compare its productivity over time, and to other service providers. For this decision we have used Multilateral Total Factor Productivity, Partial Factor Productivity and several opex cost function models to assess Essential Energy's efficiency.[24]

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22 AER, *Expenditure forecast assessment guideline*, November 2013, p. 22.

23 AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p. 97.

We also have regard to trends in total opex and category specific data to construct category benchmarks. We have used this information to inform our assessment of the efficiency of base year expenditure. In particular, we can use this category analysis data to diagnose potential sources of inefficiency. It may also lend support to, or identify potential inconsistencies with, our broader benchmark modelling.

If we determine that a service provider's base year expenditure does not reasonably reflect the opex criteria, we will not use it as our starting point for our estimate of total forecast opex. Rather, we will adjust it so it reflects an efficient, recurrent level of opex that does reflect the opex criteria. To arrive at an adjustment, we use the same techniques we used to assess the service provider's efficiency.

Step 3 – Rate of change

Once we have chosen an efficient starting point, we apply an annual escalator to take account of the likely ongoing changes to efficient opex over the forecast regulatory control period. Efficient opex in the forecast regulatory control period could reasonably differ from the efficient starting point due to changes in:

- prices
- outputs
- productivity.

We estimate the change by adding expected changes in prices (such as the price of labour and materials) and outputs (such as changes in customer numbers and demand for electricity). We then incorporate reasonable estimates of changes in productivity.

Step 4 – Step changes

We then consider if there is other opex needed to achieve the opex objectives in the forecast period. We refer to these as 'step changes'. Step changes may be for cost drivers such as new, changed or removed regulatory obligations, or efficient capex/opex trade-offs. As our Guideline explains, we will typically compensate a service provider for step changes only if efficient base year opex and the rate of change in opex of an efficient service provider do not already compensate for the proposed costs.[25]

Step 5 – Other costs that are not included in the base year

In our final step, we make any further adjustments we need for our opex forecast to achieve the opex objectives. For instance, our approach is to forecast debt raising costs based on a benchmarking approach rather than a service provider's actual costs. This is to be consistent with the forecast of the cost of debt in the rate of return building block.

After applying these five steps, we arrive at our total opex forecast.

Comparing the service provider's proposal with our estimate

Having established our estimate of total forecast opex we can test the service provider's proposed total forecast opex. This includes comparing our alternative total with the service provider's total forecast opex. However, we also assess whether the service provider's forecasting method,

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24 The benchmarking models are discussed in detail in Appendix A, which details our assessment of base opex.

25 AER, *Expenditure forecast assessment guideline*, November 2013, p. 24.

assumptions, inputs and models are reasonable, and assess the service provider's explanation of how that method results in a prudent and efficient forecast.

The service provider may be able to adequately explain any apparent differences between its forecast and our estimate. We can only determine this on a case by case basis using our judgment.

This approach is supported by the AEMC's decision when implementing the changes to the NER in November 2012. The Commission stated:[26]

> the AER could be expected to approach the assessment of a NSP's expenditure (capex or opex) forecast by determining its own forecast of expenditure based on the material before it. Presumably this will never match exactly the amount proposed by the NSP. However there will be a certain margin of difference between the AER's forecast and that of the NSP within which the AER could say that the NSP's forecast is reasonable. What the margin is in a particular case, and therefore what the AER will accept as reasonable, is a matter for the AER exercising its regulatory judgment.

If we are not satisfied there is an adequate explanation for the difference between our opex forecast and the service provider's opex forecast, we will use our opex forecast in determining a service provider's total revenue requirement.

As outlined in our Guideline, if the prudent and efficient opex allowance to achieve the opex objectives is lower than a service provider's current opex, we would expect a prudent operator would take the necessary action to improve its efficiency. We would expect a service provider (including its shareholders) to wear the cost of any inefficiency. To do otherwise, would mean electricity network consumers would fund some costs of a service provider's inefficiency. Accordingly, if our opex forecast is lower than a service provider's current opex we would generally not consider it appropriate to provide a transition path to the efficient allowance. This approach appears to be reflected in the NER, which provides that we must be satisfied that the opex forecast reasonably reflects the efficient costs of a prudent operator given reasonable expectations of demand and cost inputs to achieve the expenditure objectives.[27]

7.4 Reasons for draft decision

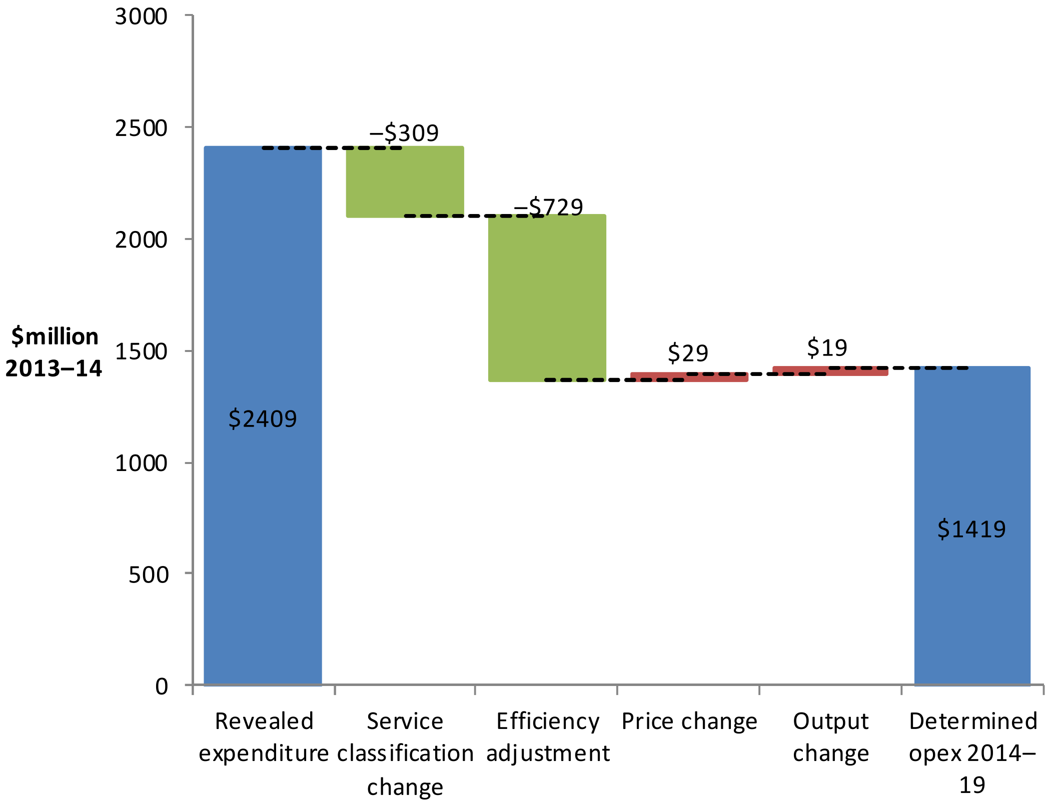
We are not satisfied that Essential Energy's total forecast opex reasonably reflects the opex criteria. We compared Essential Energy's opex forecast to an opex forecast we constructed using the method outlined above. Our estimate is of the efficient opex a prudent operator would require to achieve the opex objectives. Essential Energy's proposal is higher than ours and we are satisfied that it does not reasonably reflect the opex criteria. For this reason, we have substituted Essential Energy's total opex forecast with our total opex forecast.

Figure 7-3 illustrates how our forecast has been constructed. The starting point on the left is what Essential Energy's opex would have been for the 2014–19 period if it was set based on Essential Energy's reported opex in 2012–13.

[26] AEMC, *Final Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012, p.112.

[27] AER, *Expenditure forecast assessment guideline - Explanatory statement*, November 2013, p. 23.

Figure 7-3 AER draft decision opex forecast



Source: AER analysis.

Table 7-2 summarises the quantum of the difference between Essential Energy's proposed total opex and our draft decision estimate.

Table 7-2 Proposed vs. draft decision total forecast opex ($ million, 2013–14)

	2014–15	2015–16	2016–17	2017–18	2018–19	Total
Essential Energy's proposal	459.2	460.8	456.4	462.5	471.9	2310.7
AER draft decision	277.3	279.9	283.3	287.3	291.1	1418.8
Difference	-181.9	-180.9	-173.0	-175.2	-180.8	-891.8

Source: AER analysis.
Note: Excludes debt raising costs.

The key areas of difference between our estimate of opex and Essential Energy's estimate are outlined below.[28]

Base opex

We tested the efficiency of Essential Energy's base opex in 2012–13 using a number of different techniques. We are not satisfied it represents opex incurred by an efficient and prudent service

[28] For each of these parts of opex, our analysis is supported by an appendix. In addition Appendix D assesses Essential Energy's forecasting methodology. We do not consider Essential Energy's forecasting methodology to be a significant driver of the difference.

provider. Our alternative estimate of base opex is based on what we consider would be an efficient starting point to forecast total opex that reasonably reflects the opex criteria.

The techniques we used to test the efficiency of Essential Energy's opex are outlined in Table 7-3. All evidence suggests Essential Energy's actual opex is materially inefficient.

Table 7-3 Assessment of the efficiency of Essential Energy's opex

Technique	Description of technique	Findings
Regulatory proposal review	We examined Essential Energy's regulatory proposal and accompanying supporting information, including the NSW DNSPs' submission on the AER's issues paper.	Evidence that Essential Energy has historically had some inefficient practices is evident from its regulatory proposal and subsequent submissions. For example, Essential Energy cites concerns with stranded labour due to the reduction in capex activity since the formation of Networks NSW.[29] Networks NSW CEO Vince Graham has also publicly confirmed the existence of labour inefficiency and uncompetitive enterprise agreements.[30]
Economic benchmarking	Economic benchmarking measures the efficiency of a service provider in the use of its inputs to produce outputs. The economic benchmarking techniques we used to test Essential Energy's efficiency included Multilateral Total Factor Productivity, Multilateral Partial Factor Productivity and opex cost function modelling. We compared Essential Energy's efficiency to other service providers in the NEM.	Despite differences in the techniques we used, all benchmarking techniques show Essential Energy performs about half as efficiently as the most efficient service providers in the NEM (CitiPower and Powercor).
Partial Performance Indicator (PPI) benchmarking	PPIs are used to compare the performance of businesses in delivering one type of output.	PPIs corroborate our economic benchmarking evidence. Essential Energy appears to have higher costs than most other service providers on total network cost per customer and total opex per customer.
Category analysis benchmarking	Category analysis compares the costs of different service providers on discrete categories of opex. We have examined labour, overheads, maintenance, emergency response and vegetation management expenditure.	In general, Essential Energy appeared to have high or very high costs relative to most of its peers on the majority of the categories we examined.
Review of labour and workforce practices	Labour costs represent a large proportion of all NSW service providers' opex. We engaged Deloitte Access to review the NSW service providers' labour and workforce practices.	Deloitte Access Economics found that Essential Energy's labour and workforce management issues meant the base year would not likely represent efficient costs. Deloitte Access Economics considered that Networks NSW had identified significant efficiency improvements with the NSW service providers but noted the reforms are only in their early stages. Deloitte Access Economics concluded it is therefore likely that the full benefits of the current NNSW

29 Essential Energy is not necessarily seeking to recover all of these costs from customers but stranded costs are clear evidence of Essential Energy's inefficiency. Essential Energy, *Regulatory Proposal*, p. 78; NSW DSNPs, *Submission on AER issues paper*, 8 August 2014, pp. 12–16.

30 See, for example, Vince Graham, *Selling off electricity networks will give NSW cheaper power bills*, The Australian, 20 August 2014, p. 12; Angela Macdonald-Smith, *Networks CEO attacks unions, makes threat on outsourcing*, Sydney Morning Herald, 20 October 2014, p. 25.

Technique	Description of technique	Findings
		efficiency programs will not be realised until the 2014-19 regulatory control period.[31]
Review of vegetation management	Acknowledging its past inefficiency, Essential Energy has proposed a step decrease in vegetation management in the forecast period. Accordingly, we decided to examine vegetation management as a source of inefficiency.	Through our review of Essential Energy's vegetation management practices, we discovered inefficiencies arising from its contractor management and largely reactive approach to vegetation clearance.
Review of operating environment factors	While our economic benchmarking techniques take into account certain key differences in operating environments of service providers, they cannot account for all differences. We reviewed over 35 different operating environment factors to determine whether it is necessary to provide an allowance when deciding on the ultimate adjustment to base year opex.	We found some operating environment differences that affect Essential Energy's opex performance in economic benchmarking. Overall, we consider a 10 per cent allowance for operating environment differences is necessary.
Direct comparison benchmarking	Direct comparison is a simple form of benchmarking which compares the outputs and costs of service providers directly.	Direct comparison shows that Essential Energy incurred similar total opex to the sum of Powercor and SA Power Networks over the past eight years despite Essential Energy serving only 54 per cent of the customers and operating a network that experiences only 47 per cent of the peak demand of Powercor and SA Power Networks' combined networks.

Source: AER analysis.

Following detailed examination of the quantitative and qualitative evidence, we consider it is appropriate to adjust Essential Energy's base year opex. On the advice of Economic Insights, we have used the results from its preferred benchmarking model (Cobb Douglas stochastic frontier analysis (SFA)) as the starting point.[32] However, we consider the following adjustments are necessary:

1. We have provided a further 10 per cent allowance for those operating environment differences not completely captured by our preferred benchmarking model.
2. We have compared Essential Energy's efficiency to a weighted average of all networks with efficiency scores above 0.75 (CitiPower, Powercor, United Energy, SA Power Networks and AusNet) rather than the most efficient service provider (CitiPower) in our preferred model.

In combination, these allowances reduce the benchmark level of efficiency to a point that is approximately 18 per cent lower than the most efficient service provider predicted by the Cobb Douglas SFA model alone.

We estimate an efficient service provider would need less base opex than a forecast based on Essential Energy's actual opex in 2012–13. Table 7-4 illustrates how our efficient base level of opex compares with Essential Energy's actual opex in 2012–13. We are satisfied our substitute base opex forms the appropriate starting point for total forecast opex that reasonably reflects the opex criteria.

31 Deloitte Access Economics, *NSW Distribution Network Service Providers Labour Analysis*, October 2014, pp. i-iii.
32 Economic Insights, 2014, p. iv.

Table 7-4 Comparison of our estimate of base opex with Essential Energy's actual opex in 2012–13 ($ million, 2013–14)

	Essential Energy
Actual opex in 2012-13 (adjusted)[a]	414.9
Substitute base opex	**270.8**
Difference	144.1
Percentage opex reduction	**34.7%**

Note: (a) we have adjusted Essential Energy's opex in 2012–13 for: debt raising costs and the reclassification of services from standard control services to alternative control services.
Source: AER analysis.

Our detailed assessment of all NSW service providers' base opex is outlined in appendix A.

Rate of change

Our forecast rate of change in opex captures the forecast year on year change in efficient base opex. Specifically, it accounts for forecast changes in output levels, prices and productivity (such as economies of scale). These three opex drivers should account for the main reasons why the efficient base level of opex changes over time. The output and productivity change variables capture the forecast change in the inputs required. The price change variable captures the forecast change in the real prices of those inputs.

In percentage terms the difference between Essential Energy's and our annual rate of change is mainly driven by the difference in forecast labour price changes. We have used a different methodology to Essential Energy. Our forecast labour price change is based on an average of Independent Economics' and Deloitte Access Economics' forecasts. Essential Energy proposed labour price forecasts based on its Enterprise Bargaining Agreement (EBA) for 2014–15 and Independent Economics' forecast for the remaining years of the 2014–19 period.[33]

Although our rate of change differs to Essential Energy's on an annual basis, in cumulative terms, there is no significant difference over the forecast period. In dollar terms, forecast opex attributed to the rate of change in our opex forecast is lower than Essential Energy's proposed opex forecast because our estimate of the rate of change is applied to a lower base level of opex.

33 Since Essential Energy's EBA is lower than its consultant's labour forecasts, this results in Essential Energy's forecast price change being lower than ours in the years where Essential Energy has an EBA and higher than ours where Essential Energy applied Independent Economics' forecasts.

Table 7-5 Rate of change in opex - Difference between Essential Energy and our approach

	2014–15	2015–16	2016–17	2017–18	2018–19
Essential Energy					
Annual rate of change in opex (per cent)	0.28	1.24	1.85	1.88	1.95
Cumulative index[34]	1.003	1.015	1.034	1.053	1.074
AER					
Annual rate of change in opex (per cent)	1.14	0.95	1.23	1.39	1.32
Cumulative index	1.011	1.021	1.034	1.048	1.062

Source: AER analysis.

Our detailed assessment of the rate of change in opex is outlined in appendix B.

Step changes

We have not included any step changes in our alternative opex forecast.

Essential Energy has forecast several increases in opex in the 2014–19 period related to the costs of implementing network reform, accounting treatment changes, and increased allocation of overheads to opex. We are not satisfied that including these costs in our alternative opex forecast would lead to a forecast of opex that reasonably reflects the opex criteria.

Other cost drivers identified by Essential Energy as step changes relate to matters we explicitly considered in forming our forecast of an efficient base level of opex (e.g. vegetation management, service reclassification). We have not considered these cost changes as step changes.

A summary of the revenue impact of our position and the reasons for our position outlined in Table 7-6.

Table 7-6 Summary of our assessment of step changes

	Essential Energy proposal	AER draft decision	Reason for position
Accounting treatment changes	52.7	–	Our forecast of base opex already accounts for efficient opex a prudent and efficient service provider would need to provide standard control distribution services. A prudent and efficient service provider would not require a step change in opex for this cost driver.
Costs to implement network	94.2	–	Our forecast of base opex already accounts for efficient opex a prudent and efficient service provider

[34] The cumulative index shows the overall trend in the rate of change. This takes into account the greater impact earlier years will have compared to the later years on the overall opex forecast. For example price change in year one will affect all five years of the forecast period whereas a price change in year five will only affect the last year of the opex forecast.

	Essential Energy proposal	AER draft decision	Reason for position
reform program			would need to provide standard control distribution services. A prudent and efficient service provider would not require a step change in opex for this cost driver.
Other (including savings)	69.9	–	Our forecast of base opex already accounts for efficient opex a prudent and efficient service provider would need to provide standard control distribution services. A prudent and efficient service provider would not require a step change in opex for this cost driver.
Vegetation management	–150.4	–	Not considered as a step change. We considered the efficiency of Essential Energy's vegetation management practices in forming our view of an efficient base level of opex.
Reclassified ancillary network and metering services	–203.8	–	Not considered as a step change. We removed reclassified ancillary network and metering services from Essential Energy's actual opex in forming our view of an efficient base level of opex.
Actuarial adjustment for long service leave	11.5	–	Not considered as a step change. Actuarial adjustments for long service leave are reflected in movements in provisions. We adjusted Essential Energy's actual opex for movement in provisions in forming our view of an efficient base level of opex.

Source: AER analysis; Essential Energy, *Regulatory proposal*, p. 73.

Our detailed assessment of step changes is outlined in Appendix C.

7.4.1 Debt raising costs

Debt raising costs are transaction costs incurred each time debt is raised or refinanced. We forecast them using our standard forecasting approach for this category which sets the forecast equal to the costs incurred by a benchmark firm. Our assessment approach and the reasons for those forecasts are set out in appendix H to the rate of return attachment.

7.4.2 Interrelationships

In assessing Essential Energy's total forecast opex we took into account other components of its regulatory proposal, including:

- the impact of cost drivers that affect both forecast opex and forecast capex. For instance forecast maximum demand affects forecast augmentation capex and forecast output growth used in estimating the rate of change in opex.
- the approach to assessing rate of return, to provide consistency between our determination of debt raising costs and the rate of return building block.
- changes to the classification of services from standard control services to alternative control services.

- consistency with the application of incentive schemes - in particular our draft decision not to subject any expenditure to the EBSS during the 2015–19 regulatory control period.
- concerns of electricity consumers identified in the course of its engagement with consumers.

7.4.3 Assessment of opex factors

In deciding whether or not we are satisfied the service provider's forecast reasonably reflects the opex criteria we have regard to the opex factors.[35] Table 7-7 summarises how we have taken the opex factors into account in making our draft decision.

Table 7-7 AER consideration of opex factors

Opex factor	Consideration
The most recent annual benchmarking report that has been published under rule 6.27 and the benchmark operating expenditure that would be incurred by an efficient Distribution Network Service Provider over the relevant regulatory control period.	There are two elements to this factor. First, we must have regard to the most recent annual benchmarking report. Second, we must have regard to the benchmark operating expenditure that would be incurred by an efficient distribution network service provider over the period. The annual benchmarking report is intended to provide an annual snapshot of the relative efficiency of each service provider. The second element, that is, the benchmark operating expenditure that would be incurred an efficient provider during the forecast period, necessarily provides a different focus. This is because this second element requires us to construct the benchmark opex that would be incurred by a hypothetically efficient provider for that particular network over the relevant period. We have used several assessment techniques that enable us to estimate the benchmark opex that an efficient service provider would require over the forecast period. These techniques include economic benchmarking, opex cost function modelling, category analysis and a detailed review of Essential Energy's labour and workforce practices and vegetation management. We have used our judgment based on the results from all of these techniques to holistically form a view on the efficiency of Essential Energy's proposed total forecast opex compared to the benchmark efficient opex that would be incurred over the relevant regulatory control period.
The actual and expected operating expenditure of the Distribution Network Service Provider during any proceeding regulatory control periods.	Our forecasting approach uses the service provider's actual opex as the starting point. We have compared several years of Essential Energy's actual past opex with that of other service providers to form a view about whether or not its revealed expenditure is sufficiently efficient to rely on it as the basis for forecasting required opex in the forthcoming period.
The extent to which the operating expenditure forecast includes expenditure to address the concerns of electricity consumers as identified by the Distribution Network Service Provider in the course of its engagement with electricity consumers.	We understand the intention of this particular factor is to require us to have regard to the extent to which service providers have engaged with consumers in preparing their regulatory proposals, such that they factor in the needs of consumers.[36] We have considered the concerns of electricity consumers as identified by Essential Energy – particularly those expressed

[35] NER, cl. 6.5.6(e).
[36] AEMC, *Rule Determination*, 29 November 2012, pp. 101, 115.

Opex factor	Consideration
	in the consumer-focussed overview provided as an attachment to its regulatory proposal.[37]
The relative prices of capital and operating inputs	We have had regard to multilateral total factor productivity benchmarking when deciding whether or not forecast opex reflects the opex criteria. Our multilateral total factor productivity analysis considers the overall efficiency of networks with in the use of both capital and operating inputs with respect to the prices of capital and operating inputs.
The substitution possibilities between operating and capital expenditure.	Some of our assessment techniques examine opex in isolation – either at the total level or by category. Other techniques consider service providers' overall efficiency, including their capital efficiency. We have relied on several metrics when assessing efficiency to ensure we appropriately capture capex and opex substitutability. In developing our benchmarking models we have had regard to the relationship between capital, opex and outputs. We also had regard to multilateral total factor productivity benchmarking when deciding whether or not forecast opex reflects the opex criteria. Our multilateral total factor productivity analysis considers the overall efficiency of networks with in the use of both capital and operating inputs. Further, we considered the different capitalisation policies of the service providers' and how this may affect opex performance under benchmarking.
Whether the operating expenditure forecast is consistent with any incentive scheme or schemes that apply to the Distribution Network Service Provider under clauses 6.5.8 or 6.6.2 to 6.6.4.	The incentive scheme that applied to Essential Energy's opex in the 2009–14 regulatory control period, the EBSS, was intended to work in conjunction with a revealed cost forecasting approach. In this instance, we have forecast efficient opex based on benchmark efficient service provider. We have considered this in deciding how the EBSS should apply to Essential Energy in the 2009–14 regulatory control period and the 2014–19 period.
The extent the operating expenditure forecast is referable to arrangements with a person other than the Distribution Network Service Provider that, in the opinion of the AER, do not reflect arm's length terms.	Some of our techniques assess the total expenditure efficiency of service providers and some assess the total opex efficiency. Given this, we are not necessarily concerned whether arrangements do or do not reflect arm's length terms. A service provider which uses related party providers could be efficient or it could be inefficient. Likewise, for a service provider who does not use related party providers. If a service provider is inefficient, we adjust their total forecast opex proposal, regardless of their arrangements with related providers.
Whether the operating expenditure forecast includes an amount relating to a project that should more appropriately be included as a contingent project under clause 6.6A.1(b).	This factor is only relevant in the context of assessing proposed step changes (which may be explicit projects or programs). We did not identify any contingent projects in reaching our draft decision.
The extent the Distribution Network Service Provider has considered, and made provision for, efficient and prudent non-	We have not found this factor to be significant in reaching our draft decision.

[37] Essential Energy, *Affordable, safe and reliable electricity: An overview of our plans 2014-19*, Attachment to Regulatory Proposal.

Opex factor	Consideration
network alternatives.	

The NER require that we notify the service provider in writing of any other factor we identify as relevant to our assessment, prior to the service provider submitting its revised regulatory proposal.[38] Table 7-8 identifies these factors.

Table 7-8 Other factors we have had regard to

Opex factor	Consideration
Our benchmarking data sets, including, but not necessarily limited to: 1. data contained in any economic benchmarking RIN, category analysis RIN, reset RIN or annual reporting RIN 2. any relevant data from international sources 3. data sets that support econometric modelling and other assessment techniques consistent with the approach set out in our Guideline as updated from time to time.	This information may potentially fall within opex factor (4). However, for absolute clarity, we are using data we gather from NEM service providers, and data from service providers in other countries to provide insight into the benchmark operating expenditure that would be incurred by an efficient and prudent distribution network service provider over the relevant regulatory period.
Economic benchmarking techniques for assessing benchmark efficient expenditure including stochastic frontier analysis and regressions utilising functional forms such as Cobb Douglas and Translog.	This information may potentially fall within opex factor (4). For clarity, and consistent with our approach to assessment set out in our Guideline, we are have regard to a range of assessment techniques to provide insight into the benchmark operating expenditure that an efficient and prudent service provider would incur over the relevant regulatory control period..

[38] NER, cl. 6.5.6(e)(12).

A Base year opex

In this appendix, we present our detailed analysis of the NSW service providers' base year opex. Base year opex is the starting point for our approach to developing an estimate of the total forecast opex we consider meets the requirements of the NER.[39] We use this approach to assess each of the NSW service providers' total forecast opex proposals. If we are not satisfied the service providers' opex proposals reasonably reflect the opex criteria, our estimates form the basis of any adjustments we will make.[40]

To ensure our estimates of total forecast opex reasonably reflect the opex criteria, we must be satisfied the starting point is efficient. If we use revealed expenditure that includes inherent inefficiencies as the basis for a forecast, the forecast will also contain these inefficiencies. Therefore, if we find that the base year expenditure is inefficient or in some other way unrepresentative of the expenditure needed to achieve the opex objectives in the forecast period, we adjust it. The NSW service providers do not appear to disagree with this because their regulatory proposals recognise a need to move towards a more efficient cost base.[41] However, we do not agree on how to identify inefficiencies. Nor do we agree on the quantum or timing of the required adjustment. The structure of this Appendix is:

- Section A.1 sets out a summary of our findings and base year adjustments
- Section A.2 explains our approach to assessing the efficiency of base year opex in more detail
- Section A.3 presents our benchmarking analysis, a key component of our approach to assessing efficiency
- Section A.4 outlines potential sources of inefficiency that we have identified in base year opex
- Section A.5 shows our consideration of the effects of operating environment factors that might affect particular service providers relative to the benchmark
- Section A.6 explains our conclusions on base year opex, including the adjustment.

A.1 AER findings and estimates of efficient base year opex

In this section we provide a summary of our findings and our view of the efficient base year opex for each NSW service provider. The NSW service providers' regulatory proposals, other submissions and our own analysis provide evidence that efficiency problems exist within the NSW service providers' historic opex. For example, each service provider cites concerns with stranded labour due to the reduction in capex activity since the formation of Networks NSW.[42] Networks NSW CEO Vince

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39 As we explain in the opex attachment, this is the total forecast opex we consider the prudent and efficient expenditure a service provider would require to achieve the opex objectives in the forthcoming period.

40 NER, clauses 6.5.6(c) and (d) and 6.12.1(4).

41 Ausgrid, *Regulatory Proposal*, 2014, May 2014, p. 59; Endeavour Energy, *Regulatory Proposal*, May 2014, pp. 76, 86–88; Essential Energy, *Regulatory Proposal*, May 2014, 2014 pp. 77–78.

42 The NSW service providers are not necessarily seeking to recover all of these costs from customers but these costs are clear evidence of inefficiency. Ausgrid, *Regulatory Proposal*, May 2014, p. 59; Essential Energy, *Regulatory Proposal*, May 2014, p. 78; Endeavour Energy, *Regulatory Proposal*, May 2014, pp. 76, 79–80; NSW DSNPs, *Submission on AER issues paper*, 8 August 2014, pp. 12–16.

Graham has also highlighted the existence of labour inefficiency and uncompetitive enterprise agreements in the media.[43]

The NSW service providers submit they are restructuring their businesses to "ensure a sustainable and efficient cost base going forward." However, they are expecting consumers to bear some of the associated costs. In particular, the NSW service providers highlight their obligations under the *Fair Work Act 2009* as a reason for incurring additional expenditure to improve their efficiency.[44] On the information before us, we are not satisfied that the NSW service providers have made a sufficiently robust argument for why consumers should share in funding their transition to an efficient level of opex.

We expect all service providers to comply with their legal obligations, whether those obligations arise in legislation, contract or some other legal duty. They must comply with, for example, the *Fair Work Act 2009* and other relevant laws in providing their services. However, we find that the presence of a legal obligation, by itself, is insufficient to justify us providing opex for a particular item. Service providers undertake many significant activities by agreeing to enter into legally binding arrangements. Enterprise agreements are one example of this.

If a contractual or legal obligation was sufficient to justify the provision of opex, it would curtail the scope for us to undertake efficiency assessments. Put differently, the costs of contract that incorporated inefficient expenditures would be passed through to consumers if we were unable to assess efficiency. Such an approach is more in keeping with a cost of service model rather than the efficiency based regulatory regime under which we operate.

Also, we determine a service provider's opex allowance at the total level. We do not seek to interfere in the decisions a service provider will make about how and when to spend this total opex allowance to run its network, including the particular legal obligations it enters into to do so. The service provider is free to choose how to manage its allowance.

Therefore, if a service provider ultimately spends inefficiently or imprudently, it will bear those additional costs and, conversely, if it achieves efficiencies it may make additional profits. This is a core feature of incentive based regulation and is intended to reflect the conditions that would be faced by businesses operating in a competitive environment.

Our findings are consistent with the view that material inefficiency exists in each of the NSW service provider's historic opex. Accordingly, we do not accept their proposed base year opex amounts as the starting point for estimating required total forecast opex in the forthcoming period. Table A-1 contains our draft determination estimates of base year opex.

[43] See, for example, Vince Graham, *Selling off electricity networks will give NSW cheaper power bills*, The Australian, 20 August 2014, p. 12; Angela Macdonald-Smith, *Networks CEO attacks unions, makes threat on outsourcing*, Sydney Morning Herald, 20 October 2014, p. 25.

[44] NSW DSNPs, *Submission on AER issues paper*, 8 August 2014, pp. 12–16.

Table A-1 Draft determination estimates of efficient base year opex ($million 2013–14)

	Ausgrid	Endeavour	Essential
Proposed base opex (adjusted)[a]	488.6	224.0	414.9
Substitute base opex	**325.9**	**201.0**	**270.8**
Difference	162.7	23.0	144.1
Percentage opex reduction[b]	**33.3%**	**10.3%**	**34.7%**

Note: (a) we have adjusted the service providers' proposed opex for debt raising costs, new CAM (if applicable) and new service classifications.
(b) implied opex reduction is relative to proposed opex.[45]

Source: AER analysis.

The percentage reductions to proposed base year opex for Ausgrid and Essential Energy may seem large. However, they are much less than the implied reduction based on raw benchmarked efficiency scores developed by our consultant Economic Insights. Table A-2 sets out the quantitative raw efficiency scores of each service provider compared to the efficiency frontier. The percentages expressed in Table A-2 represent how efficient each of the NSW service providers are on average as a proportion of the frontier business.[46] A score of 45, for example, means the service provider is 45 per cent as efficient as the frontier service provider (or, put differently, 55 per cent less efficient than the frontier business).

Table A-2 Quantitative raw efficiency scores compared to the frontier (average for 2005–06 to 2012–13) (per cent)

Assessment technique	Ausgrid	Endeavour	Essential
Cobb Douglas stochastic frontier analysis (SFA CD)	45	59	55
Translog estimated least squares regression (LSE TLG)	50	63	64
Cobb Douglas estimated least squares regression (LSE CD)	44	59	61
Opex multilateral partial factor productivity (opex MPFP)	45	61	48
Multilateral total factor productivity (MTFP)	57	70	57

Source: Economic Insights 2014.

If we did not make further adjustments to these raw efficiency scores, the reductions in base year opex (based on the Cobb Douglas SFA model) for Ausgrid, Endeavour Energy and Essential Energy respectively would be 49 per cent, 32 per cent and 49 per cent.[47]

Instead, in arriving at our substitute base opex we analysed various benchmarking techniques, examined possible sources of high expenditure that might be driving the perceived gap between the NSW service providers and their more efficient peers, and investigated the operating environment factors that differentiate the service providers. We holistically developed an estimate of base opex,

45 This differs to the percentage reduction to base year opex recommended in Economic Insights' report. This is because Economic Insights' report is relative to the amount of Network services opex in the base year rather than the base opex proposed by the service provider. See Economic Insights, *Economic Benchmarking Assessment of Operating Expenditure for NSW and ACT Electricity DNSPs*, November 2014, Denis Lawrence, Tim Coelli and John Kain (Economic Insights, 2014). p. 55.

46 For our preferred benchmarking technique, the frontier business is CitiPower, which has a score of 0.95.

47 The implied opex reduction here is relative to proposed base opex whereas the CD SFA efficiency score is relative to average opex performance over 2006 to 2013.

starting with Economic Insights' Cobb Douglas Stochastic Frontier Analysis (SFA) model. However, rather than mechanistically applying the efficiency adjustment the model predicts, we have, on the basis of the quantitative and qualitative evidence before us, made three adjustments to the 'raw' benchmarking results in favour of the service providers.

Rather than using the National Energy Market (NEM) frontier service provider, CitiPower, as the benchmark for efficiency comparisons, the first adjustment is to set a lower benchmark based on an average of the efficiency scores of the most efficient service providers in the NEM. This reduces the benchmark efficiency target by 9 percentage points to 0.86 from 0.95.

The second adjustment is to modify the benchmark efficiency target to account for operating environment factors specific to NSW. We are satisfied that a 10 per cent operating environment adjustment is appropriate for the NSW service providers. This effectively reduces the benchmark efficiency target by 8 percentage points to 0.78.

Additionally we have made a third adjustment because the Cobb Douglas SFA model efficiency scores represent service providers' average efficiency for the benchmarking period. We have applied a trend to move the substitute base opex from a forecast of the average amount for the 2006 to 2013 period to a forecast for 2012–13, the base year. In trending the average amount forward, we have used essentially the same rate of change method we use to determine the trend component of our base step trend methodology. For this reason, the percentage reductions differ to the average efficiency scores. We explain this further in section A.3.4.

Table A-3 shows the effect of these adjustments.

Table A-3 Derivation of estimate of efficient base year opex ($ million, 2013–14)

Stage of estimate	Ausgrid	Endeavour	Essential
Starting point: 'Raw' CD SFA forecast with frontier service provider as benchmark	247.6	151.4	210.5
Adjustment 1: Change benchmark to weighted average of top efficiency scores	25.5	15.6	21.7
Adjustment 2: Adjust benchmark to account for operating environment factors	27.3	16.7	23.2
Adjustment 3: Adjust benchmark to move from average results to 2013 results	25.5	17.3	15.4
Substitute base opex	**325.9**	**201.0**	**270.8**

Source: AER analysis.

The reduction in base opex for Endeavour Energy is lower than for Ausgrid and Essential Energy for two reasons. Endeavour Energy has a higher efficiency score and its costs have increased at a slower rate than Ausgrid's and Essential Energy's. Although Essential Energy's efficiency score is higher than Ausgrid's the reduction to its base year opex is larger because its opex has been increasing at a greater rate during the benchmarking period (and particularly in the base year). However, Essential Energy has proposed that an efficiency carryover penalty be applied to its revenue under the currently operating Efficiency Benefit Sharing Scheme (EBSS). We have chosen not to impose that penalty for the reasons outlined in the EBSS attachment.

The following sections summarise our reasoning for selecting the starting point for, and making adjustments to, our substitute base opex.

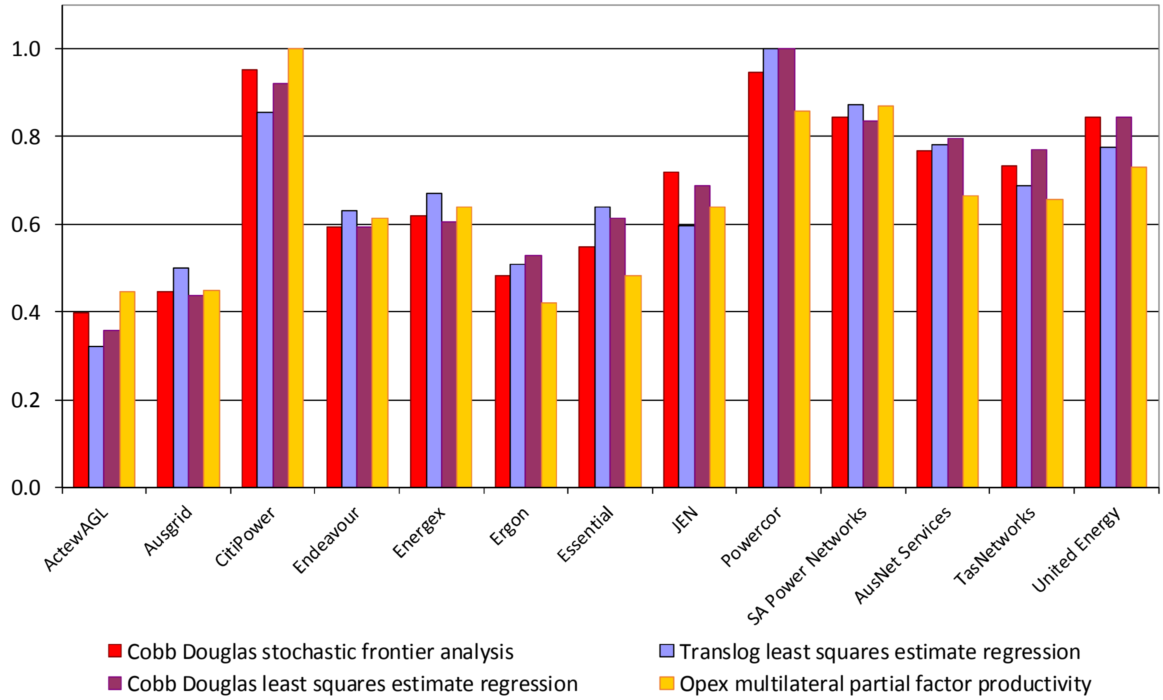
Benchmarking results

In assessing a service provider's forecast opex, the NER requires us to have regard to the benchmark opex that would be incurred by an efficient service provider over the relevant regulatory control period.[48] To that end, we engaged Economic Insights, experts in economic benchmarking, to develop several techniques for assessing the relative efficiency of service providers compared to their peers. Economic Insights developed five techniques to assess the relative efficiency of service providers. Three techniques use econometric modelling and two are index-based. Four of the five techniques measure opex performance. Economic Insights found:[49]

> The efficiency scores across the three econometric models are relatively close to each other for each DNSP and they are, in turn, relatively close to the corresponding MPFP score. This similarity in results despite the differing methods used and datasets used reinforces our confidence in the results.

Figure A-1 presents the results of each opex model for each distribution network service provider in the NEM. A score of 1 is the best score.

Figure A-1 Econometric modelling and opex MPFP results



Source: Economic Insights 2014.

Each model may differ in terms of estimation method or model specification and accounts for operating environment factors (factors that may differentiate service providers) to differing degrees so the results will never be identical. Regardless of which technique is used, Figure A-1 demonstrates that the base year expenditure of Ausgrid, Endeavour Energy and Essential Energy is materially inefficient. We consider our economic benchmarking techniques in detail in section A.3.1 and section A.3.2.

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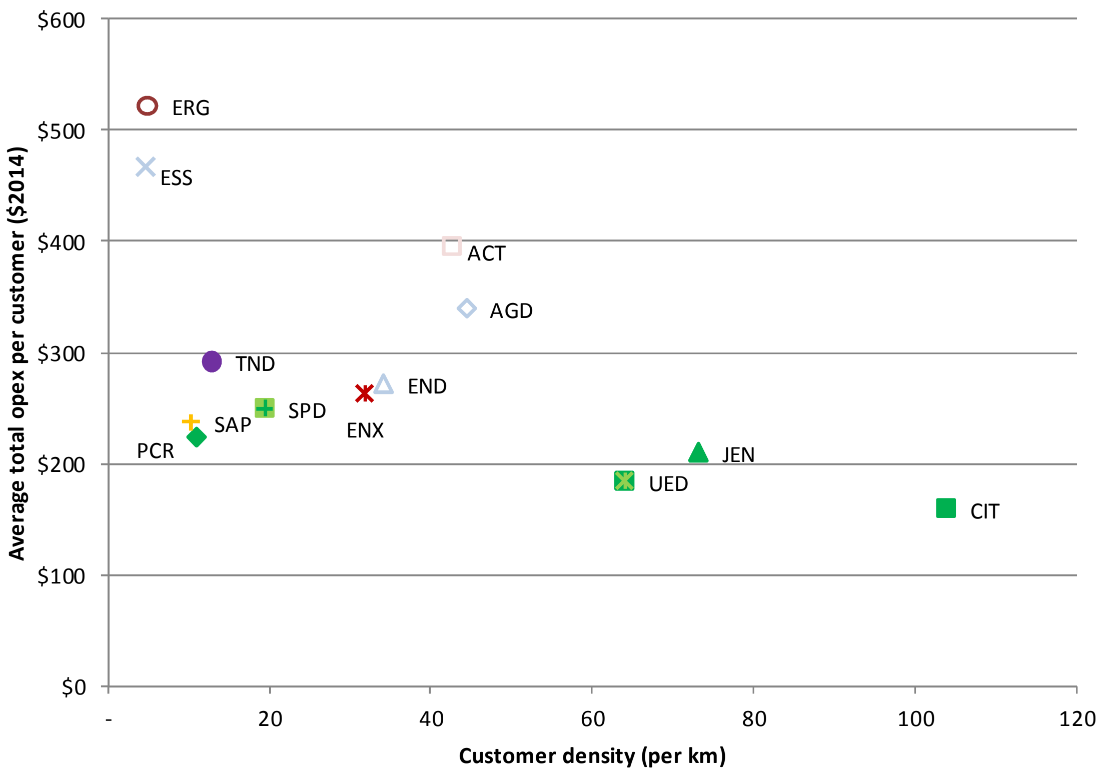
48 NER, cl. 6.5.6(e)(4).
49 Economic Insights, 2014, pp. 46–47.

We also examine partial performance indicators (PPIs) – a different method of benchmarking. Although they are more simplistic measures, the PPI results provide further evidence to support the results of our other benchmarking techniques. Figure A-2 compares, for example, average annual opex per customer for each service provider.

Figure A-2 Average annual opex per customer for 2009 to 2013 against customer density ($2013-14)



Source: Economic benchmarking RIN data.

Figure A-2 demonstrates a clear demarcation between the NSW service providers and the majority of their peers (predominantly the Victorian and South Australian service providers but also TasNetworks, Energex and ActewAGL depending on the service provider). Based on this measure, Endeavour Energy performs somewhat more favourably than Ausgrid and Essential Energy because it appears comparatively lower (and is almost comparable to AusNet Services). This is consistent with the economic benchmarking results which (in most cases) indicate that Endeavour Energy performs better than the two other NSW service providers.

Per customer PPI metrics tend to (on balance) favour urban service providers over rural providers as, typically, rural service providers will have more assets per customer because their customers are more spread out. We must bear this in mind when we consider the results in Figure A-2. In particular, Essential Energy has a very low density network so it will appear to perform worse on PPIs than it does on the economic benchmarking models – particularly compared to frontier performers CitiPower and Powercor. Ausgrid and Endeavour Energy will compare more favourably to Powercor due to their higher customer densities, but less favourably to CitiPower because CitiPower is very dense.

This is simply a limitation of PPIs because they do not explicitly account for operating environment differences. If we consider the results of a number of PPIs, with these limitations in mind, we can nevertheless see that the results strongly support the economic benchmarking results set out above. We consider PPIs in detail in the benchmarking section (A.3.3) of this appendix.

Sources of inefficiency or high expenditure

The Cobb Douglas SFA model (our preferred benchmarking technique) takes into account key operating environment factors such as economies of scale, network density and the relationship between opex and the multiple outputs service providers deliver. However, it does not account for all differences. We have used other assessment techniques, including category analysis and detailed reviews of expenditure categories, to investigate potential sources of inefficiency or other explanations for high expenditure demonstrated by the benchmarking results.

Category analysis

Category analysis is a form of simple benchmarking. Category analysis metrics are PPIs that focus on particular categories of opex in isolation. They are, therefore, the next level of detail below the total cost and total opex PPIs we presented earlier. We would not necessarily expect every metric to produce the same results because service providers may allocate opex across the categories differently. Therefore, some service providers may perform relatively well on some category metrics despite having high expenditure overall.

Broadly, however, our analysis suggests that on the majority of the category analysis measures the NSW service providers appear to have high costs relative to most other service providers. Table A-4 summarises the results of each metric.

A service provider's expenditure is recorded as 'high' when it appears above its peers and 'comparable' where the gap is less distinct. 'Very high' indicates a substantial gap between other service providers. We consider these results are consistent with and support the findings of our economic benchmarking techniques.

Table A-4 Summary of category analysis metrics – NSW service providers' relative costs (average for 2008–09 to 2012–13)

	Ausgrid	Endeavour	Essential
Labour	Very High	High	Very High
Total overheads	Very High	High	Very High
Total corporate overheads	Comparable	Comparable	High
Total network overheads	Very High	Comparable	Comparable
Maintenance	High	High	Comparable
Emergency response	High	High	High
Vegetation management	High	High	Very High

Source: AER analysis.

Given the NSW service providers generally have high expenditure on category analysis for most categories of expenditure, we consider this supports the view that it is likely systemic issues exist across the service providers (particularly for Ausgrid and Essential Energy). The results of the labour and total overhead metrics (which are broader measures) tend to support this view as well.

Detailed review

Category analysis suggested labour and (for Essential Energy) vegetation management appeared to be significant drivers of costs. Accordingly, we have conducted more detailed analysis of these categories of expenditure.

Labour

Labour costs are the largest component of the NSW service providers' opex, accounting for more than 70 per cent of total opex.[50] Given this magnitude, we engaged Deloitte to provide a review of the labour and workforce management practices of the NSW service providers.

Deloitte found in respect of the labour costs incurred in delivering the capex program (labour-related capex), there is evidence to suggest that the expenditure and approach to resourcing the program was not consistent with that of a prudent or efficient service provider. In particular:[51]

- All service providers seem to have relied too heavily on hiring permanent internal labour resources rather than using temporary external contractors to undertake the capex program
- In 2007, Ausgrid entered into an arrangement which appears to have driven its costs up, or at a minimum entrenched them at a relatively high level
- All service providers' labour-related capex was impacted by a unionised workforce that was relatively inflexible, high-cost and unproductive compared to their peers.

Deloitte considered the base year would not likely represent efficient costs because for much of the 2009-14 regulatory period it appears likely that the service providers' labour costs were impacted by:[52]

- A relatively inflexible workforce with limited ability to innovate or respond to changing circumstances
- Labour costs entrenched in Enterprise Bargaining Agreements (EBAs) which are well above peer costs
- In some cases, poor management of labour costs – for example in relation to overtime
- Union opposition to management attempts to reduce costs and/or improve productivity.

Deloitte found that Networks NSW had identified significant efficiency improvements with the NSW service providers but noted:[53]

> [W]hile some savings have already been identified and realised, the reforms are only in their early stages and therefore it is likely that the full benefits of the current NNSW efficiency programs will not be realised until the 2014-19 regulatory control period. In particular, due to these anticipated future efficiencies, it is in our view unlikely that the opex base year (2012-13) reflects efficient labour costs.

We consider this is supporting evidence driving some of the scope for our proposed base opex adjustments. The evidence also suggests Endeavour Energy has been improving its efficiency for longer than Ausgrid and Essential Energy so its remaining inefficiency seems to be less than for its two peers.

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[50] See, for example, NSW service provider responses to annual RINs for 2012–13.
[51] Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, pp. i–v.
[52] Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, pp. i–v.
[53] Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, p. iv.

However, as Deloitte noted in its report, the Networks NSW reform program has not looked beyond the three NSW businesses for potential opportunities to improve efficiency. This supports our view that Endeavour Energy has efficiencies it is yet to realise. Deloitte's analysis supports the benchmarking evidence.

We are satisfied, on the basis of our detailed review, that labour and workforce management contributes to a material source of inefficiency in opex in the 2012-13 base year for each of the NSW service providers is likely due to labour and workforce management. We discuss our labour review findings in detail in section A.4.3.

Vegetation management (Essential Energy)

Essential Energy's vegetation management opex has increased markedly over the 2009–14 period; it more than doubled from $79 million per annum to $193 million ($2013–14).[54] In its regulatory proposal, Essential Energy submitted a step down in vegetation management in the forthcoming regulatory control period because it identified efficiencies through a number of strategic reform initiatives.[55]

Essential Energy engaged Select Solutions in December 2012 to review its vegetation management strategy.[56] Select Solutions' review found that Essential Energy must move to a "significantly more efficient" vegetation management model to reduce the impact of its expenditure on customer prices.[57] Select Solutions found several causes of inefficiency, including:

1. attributing too much vegetation management effort to reactive spot clearing rather than proactive cyclic maintenance
2. primarily engaging contractors for cutting on a demonstrably less efficient hourly rate basis
3. less than optimal outsourcing.

We are satisfied, on the basis of our detailed review, that vegetation management practices contributed to Essential Energy's high opex in the 2012–13 base year. This level of expenditure is unlikely to be representative of the efficient and prudent base opex in future years. We discuss our vegetation management review findings in detail in section A.4.3.

Operating environment factors

While Economic Insights' benchmarking models account for key differences – customer density, network line length and degree of network undergrounding, for example – they do not account for all differences. Accordingly, we have estimated the impact of three significant operating environment factors for which we are satisfied an adjustment should be made (namely for subtransmission configuration, jurisdictional regulations and bushfire regulations). The combined impact of these adjustments on Ausgrid, Endeavour Energy and Essential Energy respectively is 3.6 per cent, 3.1 per cent and 0.6 per cent.

In addition, there are several other factors that we consider have little impact individually but, collectively, could potentially be more material. For the less significant operating environment factors,

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54 Essential Energy, *Regulatory Proposal*, May 2014, p. 66.
55 Essential Energy, *Regulatory Proposal*, May 2014, p. 73.
56 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, pp. 10–11.
57 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, p. 13.

we are satisfied that it is appropriate to consider their impact on opex holistically. Some may be difficult to quantify, particularly given certain factors may comparatively advantage the NSW service providers and some may disadvantage them. Examples of these factors include topography and natural disasters.

Therefore, we are satisfied it is reasonable to incorporate a 10 per cent margin on input use into our adjustment for each service provider. We discuss operating environment factors in detail in section A.5.

Our conclusions on base opex

We have demonstrated in the preceding sections that all the evidence (quantitative and qualitative) points towards the need for an adjustment to each service provider's base year opex. Our consultant has provided advice that the economic benchmarking results are robust and reinforce each other.[58] In turn, the category analysis results and detailed review findings corroborate the benchmarking results. We explain above that if we were to make an adjustment based on the benchmarking results alone, we would use the Cobb Douglas SFA model as our preferred method. However, we consider it is necessary to determine an adjustment holistically, balancing the evidence from our qualitative analysis and the quantitative results.

To this end we have incorporated allowances so that the amount we approve, when considered in the context of our overall decision, will best contribute to the achievement of the NEO, be sufficient to maintain the safety of the system and allow service providers an opportunity to recover at least their efficient costs.

The detailed labour review provides evidence of inefficiencies within Ausgrid and Essential Energy and, to a lesser extent, Endeavour Energy. While the formation of Networks NSW has generated some improvements, the evidence suggests more efficiencies have yet to be realised. Customers should not be asked to fund more than the efficient costs of a prudent service provider. That would not be consistent with the opex criteria or further the NEO to the greatest degree.

Following the advice of Economic Insights,[59] detailed examination of operating environment factors and sources of inefficiency, we consider it is appropriate to adjust each service provider's base year opex, but:

1. provide a further 10 per cent allowance for those operating environment differences not completely captured by our preferred benchmarking model
2. compare the efficiency of the NSW service providers to a weighted average of all networks with efficiency scores above 0.75 rather than the minimum cost frontier service provider (that is, an average of the efficiency scores of CitiPower, Powercor, United Energy, SA Power Networks and AusNet).

In combination, these allowances reduce the benchmark level of efficiency to approximately 18 per cent less than predicted by the Cobb Douglas SFA model alone.

While economic theory suggests that the appropriate benchmark reference point for efficient opex is an efficient service provider we have taken a cautious approach to making adjustments. This allows a margin for the potential effect of any modelling uncertainty and data error. Table A-5 presents our

58 Economic Insights, 2014, p. 37.
59 Economic Insights, 2014, p. iv.

comparison of the proposed base year of the NSW service providers against our estimated efficient base year opex, taking into account the above considerations.

Table A-5 Comparison of estimated efficient base opex against proposed base opex ($ million, 2013–14)

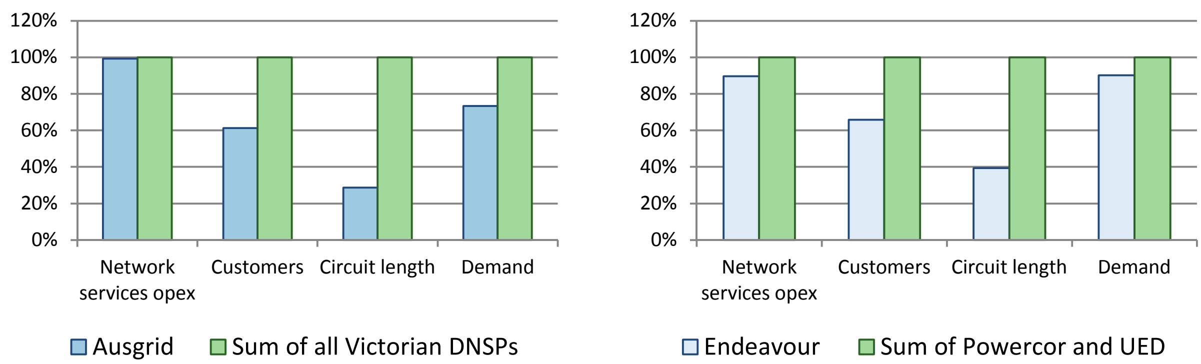
	Ausgrid	Endeavour	Essential
Proposed base opex (adjusted)[a]	488.6	224.0	414.9
Substitute base opex	**325.9**	**201.0**	**270.8**
Difference	162.7	23.0	144.1
Percentage opex reduction[b]	33.3%	10.3%	34.7%

Note: (a) we have adjusted the service providers' proposed opex for debt raising costs, new CAM (if applicable) and new service classifications.
(b) implied opex reduction is relative to proposed opex and rolled forward to 2012–13.
Source: AER analysis.

Putting the adjustments into perspective

Figure A-3 shows some very simplistic direct comparisons to put the NSW service providers' historical opex spending into perspective. We compared the NSW service providers to combinations of other service providers to show that for similar levels of opex it is possible to produce greater amounts of outputs. Where possible we have compared the NSW service providers to a combination of service providers with similar characteristics. Given the size of its past opex, this was difficult for Ausgrid, so we considered the most appropriate comparator to be the sum of all Victorian service providers covering the state of Victoria.

Figure A-3 Direct comparisons between NSW service providers and multiple peers (averages for 2006 to 2013 period)



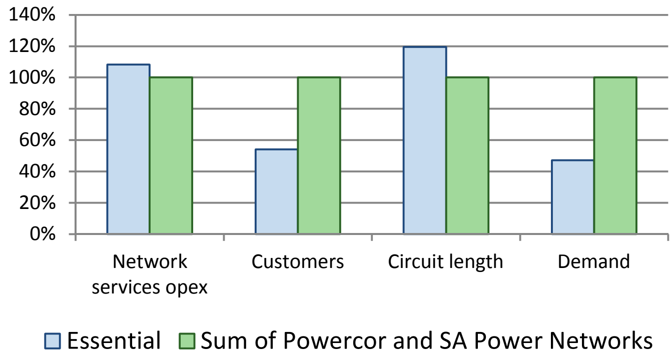


Figure A-3 shows that over the 2006–13 period, Ausgrid spent (on average) almost the same amount of opex on core network services[60] as the five Victorian service providers together spent on networks covering the entire state of Victoria. However, Ausgrid has fewer customers to service, lower maximum demand to meet and a substantially shorter circuit length to operate.

Similarly, Endeavour Energy and Essential Energy spent largely comparable amounts of opex to a combination of two Victorian or South Australian service providers despite (in all but one measure) providing less outputs. While these simplistic comparisons do not account for differences between the service providers, they support evidence of material inefficiency shown by our more sophisticated benchmarking techniques and our detailed analysis.

60 Standard control services opex less opex associated with connections, street lighting, metering and ancillary services.

A.2 Assessment approach

In our Expenditure Forecast Assessment Guideline (our Guideline), we explain that although we examine revealed expenditure in the first instance, we will use our various assessment techniques to test its suitability for the purpose of developing a forecast.[61] If a service provider performs well compared to its peers we can be satisfied that it is appropriate to rely on its revealed expenditure. Conversely, if our techniques show the service provider has high expenditure relative to its peers, it may be inappropriate to rely on revealed expenditure as the efficient starting point for total forecast opex.

While we use several assessment techniques to assess efficiency, benchmarking in particular is an essential part of our approach. The NER provide us with discretion as to how and when we use benchmarking in decision-making and support us in using it as the basis for adjusting a service provider's total forecast opex.[62] For this determination, our approach is to use various benchmarking techniques. This includes economic benchmarking, partial performance indicators and category-based techniques. If benchmarking shows a service provider's base year opex is materially inefficient, our approach is to complement our benchmarking findings with other analysis such as PPIs, category-based techniques and detailed review to investigate the drivers of, or potential explanations for, the apparently high expenditure.

The NSW service providers support some parts or our approach but disagree with others. Therefore, while we are to some extent reiterating the approach we outlined in our Guideline, we consider it appropriate to discuss the economic theory behind our approach. Building on this, we then explain our approach to identifying and adjusting for inefficiencies and why we find this approach to be more appropriate than the approach proposed by the NSW service providers. First, however, we explain how we choose the base year.

A.2.1 The starting point

Our Guideline explains that when we examine revealed expenditure, we assume that if the service provider has been meeting its objectives during the previous period then the past expenditure it incurred was sufficient for it to achieve those opex objectives. That is, the service provider has demonstrated it was capable of operating its network in a manner that achieved the opex objectives with the expenditure it actually incurred at the time.[63]

We have used 2012–13 as the base year for our forecasts of opex, subject to our consideration of efficiency adjustments. We used this to test the NSW service providers' opex forecasts against the opex criteria. Our choice of base year is consistent with the NSW service providers' choice of base year. They proposed the use of 2012–13 as the base year because:[64]

- it was the latest available actual opex at the time they prepared their total opex forecasts
- opex for that year had been audited and provided to the AER
- (for Endeavour and Ausgrid) opex for that year was below the AER’s allowance for that year.

61 AER, *Expenditure Forecast Assessment Guideline*, November 2013, pp. 7–8.
62 AEMC, *Final Rule Determination*, 29 November 2012, pp. 112-–13.
63 AER, *Expenditure forecast assessment guideline*, November 2013, p. 9.
64 Ausgrid, *Regulatory proposal*, May 2014, p. 53; Endeavour Energy, *Regulatory proposal to the Australian Energy Regulator*, May 2014, p. 83; Essential Energy, *Regulatory proposal*, May 2014, p. 71.

The first step in our forecasting approach is to estimate actual opex in the final year of the regulatory control period. Our Guideline outlines that we will estimate this as:

$$A_f^* = F_f - (F_b - A_b) + \ non - recurrent\ efficiency\ gain_b$$

Where:

- F_f is the determined opex allowance for the final year of the preceding regulatory control period
- F_b is the determined opex allowance for the base year
- A_b is the amount of actual opex in the base year
- $non - recurrent\ efficiency\ gain_b$ is the non − recurrent efficiency gain in the base year

For this decision we have not added back (subtracted) any non-recurrent efficiency gains (losses) from the base year. This is because the transition EBSS that applied to the NSW and ACT services providers in the 2009–14 regulatory control period does not allow for this adjustment. Making this adjustment only to base opex would result in the service provider being excessively rewarded (or penalised) for non-recurrent efficiency gains (losses) made in the base year.

Given this, we have considered the impact of non-recurrent efficiency gains (losses) in our selection of the base year. In fact, this is one of the key considerations in choosing the base year, where we try to choose a year reflective of recurrent expenditure. If we find revealed expenditure to be efficient, and we do not need to make an efficiency adjustment, the choice of base year has little impact on revenue. This is because any increase (decrease) in opex is counteracted by a decrease (increase) in the EBSS carryover. These two effects cancel each other out. However, if we make an efficiency adjustment to revealed expenditure then the choice of base year could influence revenues. We consider this when we choose the base year to use.

Typically, we use the revealed expenditure of the second or third last year of the preceding regulatory control period. The second last year is usually the most recent available audited expenditure at the time of our final determination. [65] To the extent expenditure drivers change over time the second last year is likely to best reflect expenditure in the forecast period. We then use expenditure in the base year to estimate expenditure in the final year by adding the difference in the regulatory opex allowances for the base year and the final year.

However, the selection of a base year that appears representative of recurrent expenditure does not necessarily mean that the service provider's expenditure was actually efficient and prudent. If we consider the service provider's revealed costs in the base year are materially inefficient, we make an adjustment to account for this. The next section explains material inefficiency and why we must adjust for it.

A.2.2 What is material inefficiency?

Material inefficiency is a concept we introduce in our Guideline.[66] We consider a service provider is materially inefficient when it is not at (or close to) its peers on the efficient frontier. This stems from the

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65 Sometimes we use the third last year, being the most recent year available when the service provider submits its regulatory proposal.

66 AER, *Expenditure Forecast Assessment Guideline*, November 2013, p. 22.

NEO, which, as we explain in the explanatory statement to our Guideline, is fundamentally an efficiency objective.[67] The second reading speech introducing the NEL states, for example:[68]

> The market objective is an economic concept and should be interpreted as such. For example, investment in and use of electricity services will be efficient when services are supplied in the long run at least cost, resources including infrastructure are used to deliver the greatest possible benefit and there is innovation and investment in response to changes in consumer needs and productive opportunities.
>
> The long term interest of consumers of electricity requires the economic welfare of consumers, over the long term, to be maximised. If the National Electricity Market is efficient in an economic sense the long term economic interests of consumers in respect of price, quality, reliability, safety and security of electricity services will be maximised.

In essence, this explains that service providers are economically efficient when they deliver electricity services to a level in the long run interests of consumers at the lowest sustainable cost having regard to all the factors in the NEO.

A service provider in a competitive market has a continuous incentive to improve its economic efficiency. It will enjoy greater market share if it can continue to provide the best service at the lowest cost to the consumer. Conversely, an economically inefficient service provider will not survive because its long run marginal cost of production will be above that of the other firms and it will lose its market share to those who are more efficient.

A natural monopoly service provider, on the other hand, does not operate in a competitive market. Absent regulation, a natural monopoly can use its monopoly position to charge higher prices (and decrease service quality) and derive monopoly profits at the expense of consumers and economic efficiency.

Service providers may be historically inefficient or may not respond to efficiency incentives. Therefore, as noted in our Guideline, it is necessary for us to review the relative efficiency of service providers' historical expenditure when we assess their forecast expenditure.[69]

In the explanatory statement to our Guideline*,* we explain Hilmer's three components of efficiency (productive efficiency, allocative efficiency and dynamic efficiency).[70] We consider productive efficiency is most relevant for assessing cost forecasts.[71] Accordingly, when we assess total forecast opex in accordance with the first opex criterion – the efficient costs of achieving the opex objectives – we are principally focused on the service provider's productive efficiency.

Measuring productive efficiency

A service provider is productively efficient when it provides its services at minimum cost. To test whether service providers are inefficient we estimate the minimum cost at which they could provide their services with reference to the actual performance of other distributors. In doing this we estimate a benchmark minimum cost frontier (the frontier). If a service provider's costs are materially higher than as predicted by the frontier and there are not mitigating circumstances we conclude that the

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67 AER, *Expenditure Forecast Assessment Guideline – Explanatory Statement*, November 2013, pp. 17–-0.

68 Second reading speech, National Electricity (South Australia) (New National Electricity Law) Amendment Bill 2005, Parliament of South Australia, Hansard of the House of Assembly, 9 February 2005, p. 1452.

69 AER, *Expenditure forecast assessment guideline*, November 2013, p. 8.

70 AER, *Explanatory statement, expenditure forecast assessment guideline*, November 2013, pp. 125–129.

71 Productive efficiency is most relevant to assessing cost forecasts because using benchmarking to measure and report relative productive efficiency will also promote dynamic efficiency and allocative efficiency due to it incentivising service providers to innovate and adopt best practice. Measuring productive efficiency will also assist us in determining the efficient prices/revenues for services promoting allocative efficiency. See Independent Inquiry into National Competition Policy (F Hilmer, Chair), *National Competition Policy*, Australian Government Publishing Service, Canberra, 1993.

service provider is materially inefficient. The degree to which a service provider is inefficient is the degree to which their costs are higher than the frontier.

The various benchmarking techniques we use in our analysis enable us to assess efficiency and productivity performance in terms of historical expenditure. This is critical for determining the suitability of revealed expenditure for base year efficient expenditure, or whether we must adjust it.

When comparing the efficiency of service providers on a like-for-like basis,[72] economic theory indicates we should do so relative to the frontier rather than an overall industry average. If using benchmarking as the only means of assessing efficiency, the frontier represents the minimum cost to achieve the opex objectives for a comparable network service provider(s). In contrast, an industry average business may still be materially inefficient as it will be further from the frontier than the industry frontier performer(s). An industry average performer has the ability to further reduce its costs, and it should bear the responsibility for this rather than visiting inefficient costs on its consumers.

However, as we explain throughout this appendix, we have – on the advice of our consultant, Economic Insights – taken a cautious approach in this draft determination in assessing base opex. We are estimating the appropriate benchmark comparison point as the average of the most efficient Australian networks (those service providers who have an efficiency score greater than 0.75 on our preferred technique).

While the minimum cost frontier is the appropriate comparison point for determining relative efficiency, there is merit in making the adjustment less dependent on the performance of a single service provider. We consider this mitigates the risk of data imperfection or potential error in estimating the frontier performer.

Such an approach appropriately considers the revenue and pricing principles.[73] We need to balance, for example, incentives to promote economic efficiency with the economic costs and risks of the potential for under and over investment by the service provider in its distribution system.[74] We are satisfied that the benchmark comparison point will result in a total forecast opex estimate that reasonably reflects the opex criteria, subject to accounting for any exogenous factors not captured by benchmarking.

As a result, we may not apply a downward adjustment to base year expenditure for our alternative opex forecast if the service provider is operating close to, but below, the frontier. However, if our benchmarking shows the service provider's base year opex is materially inefficient, we will make an adjustment. That adjustment is necessary for us to be satisfied that our total forecast opex reasonably reflects the opex criteria. An estimate of total forecast opex based on an inefficient starting point cannot be efficient, so it would not satisfy the first opex criterion. To perform our economic functions in a manner that will or is likely to contribute to the achievement of the NEO, we therefore adjust the base opex to account for material inefficiency.

A.2.3 Identifying material inefficiency

We have several assessment techniques we can use to identify material inefficiency. Benchmarking is central to our approach. For this review, the key techniques we used to identify inefficiencies are:

- multilateral total factor productivity (MTFP) and multilateral partial factor productivity (MPFP)

72 This includes properly controlling for factors that may affect the cost but are exogenous to the network service providers.
73 NEL, s. 16(2)(i).
74 NEL, ss. 7A(3) and 7A(6).

- econometric modelling of the opex cost function
- partial performance indicators (PPIs)
- direct comparison.

Additionally, to identify potential sources of inefficiency within opex we have used category analysis and detailed review of certain expenditure categories. This approach is consistent with the approach we set out in our Guideline.

The use of diverse techniques involving both quantitative and qualitative approaches allows us to cross-check our findings, identifying potential irregularities in our approach. This approach also provides us with confidence in our results when the analyses in the various techniques yield consistent results.

A.2.4 The use of benchmarking

The NSW service providers do not disagree with making efficiency adjustments. Each of their regulatory proposals recognises a need to move towards a more efficient cost base.[75] However, the service providers have proposed incremental adjustments to remove inefficiency and have sought to recover some of the costs of these efficiency adjustments. This approach is inconsistent with the requirement for forecasts of expenditure to reasonably reflect the prudent and efficient costs of achieving the opex objectives. Further, under this approach consumers would bear not only the costs of removing inefficiencies but fund the inefficiencies themselves.

Also, the NSW service providers have, in our view, taken a flawed approach to identifying inefficiency because their approach does not incorporate top down benchmarking. It is necessary to consider the efficiency of providing services overall rather than the efficiency of specific activities. The NSW service providers have proposed incremental efficiency adjustments that apply to specific activities. This approach focuses on certain aspects of performance in isolation, which ignores the trade-offs of delivering different output combinations. Under this approach, a service provider could offset the savings it identifies for one output by increasing costs for another.

We consider top down benchmarking approaches are more appropriate because they demonstrate how efficient a service provider is overall, in comparison to its peers. Because top-down benchmarking measures can be applied more objectively and approached holistically, they do not focus on single aspects of service providers' costs at the detriment of others. Also because top-down benchmarking compares service providers, they reveal which service providers have relatively high base expenditure.

In contrast, the service providers' approach does not compare their performance with their peers on a like-for-like basis. Therefore, their approach does not provide any guidance on the efficiency of their proposal relative to their peers. An efficiency adjustment from a comparatively high base, for example, may not be sufficient to address the inefficiency in totality.

Many other stakeholders support the use of benchmarking. These include:

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75 Ausgrid, *Regulatory Proposal*, May 2014, p. 59; Endeavour, *Regulatory Proposal,* May 2014, p. 76; Essential, *Regulatory Proposal*, May 2014, p. 78.

- The ACT Civil and Administrative Tribunal[76]
- AGL[77]
- The Consumer Challenge Panel[78]
- EnergyAustralia[79]
- The National Generators Forum[80]
- The Public Interest Advocacy Centre.[81]

The NSW service providers consider benchmarking is of limited value due to what they describe as inherent limitations and, as a consequence, submit we should not use it to reject a proposal or as a basis for substitution.[82] Broadly, we can classify the service providers' submissions on benchmarking into three categories:

- benchmarking is unreliable
- the data are not robust
- it is not possible to compare service providers because they are different.

While we address these issues below, the service providers' views are inconsistent with the NER changes introduced in November 2012. These changes reinforce the importance of benchmarking in assessing expenditure;[83] a topic we discussed at length in the explanatory statement to our Guideline. The service providers also use certain forms of benchmarking to support their own proposals. We address these issues in more detail below.

The NER require us to undertake benchmarking

Benchmarking is central to our task of assessing expenditure forecasts. We must form a view about whether a service provider's opex forecast reasonably reflects the opex criteria. In doing so, we must have regard to the opex factors. The first factor requires us to produce annual benchmarking reports that compare service providers' expenditure. When reviewing a service provider's total forecast opex, we must have regard to those reports as well as the benchmark opex that would be incurred by an efficient service provider.[84]

Benchmarking techniques enable us to objectively examine the prudency and efficiency of total forecast opex as required by clause 6.5.6 of the NER. In doing this, these benchmarking techniques measure how efficient service providers were at providing (and are forecasting to provide) their

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76 ACAT, *ACAT Submission – Issues paper: ActewAGL electricity distribution regulatory proposal 2014–15 to 2018–19*, 22 August 2014, p. 2.

77 AGL, *NSW Electricity Distribution Networks Regulatory Proposals: 2014–19 – AGL submission to the Australian Energy Regulator*, 8 August 2014, p. 14.

78 Consumer Challenge Panel, *Submission 1 to AER regarding NSW DNSP regulatory proposals 2014–19*, p. 41.

79 Energy Australia, *Submission to Australian Energy Regulator - NSW electricity distribution revenue determinations, 8 August 2014,* p. 3.

80 NGF, *NGF Submission to the Revenue Determinations 2014–2019) of the NSW Distribution Network Service Providers*, 8 August 2014, p. 3.

81 PIAC, *Moving to a New Paradigm: Submission to the Australian Energy Regulator's NSW electricity distribution network price determination*, 8 August 2014, p. 17.

82 Ausgrid, Regulatory Proposal, p. 67; Endeavour, Regulatory Proposal, p.77; Essential, Regulatory Proposal, p. 86.

83 See, for example, AEMC, Rule Determination, 29 November 2012, pp. vii–viii.

84 NER, cl. 6.5.6(e)(4).

network services in accordance with the opex objectives, taking into account demand and the requisite regulatory and safety obligations.

Benchmarking is reliable

The NSW service providers have provided submissions on when benchmarking should be used and the reliability of benchmarking. A number of submissions referenced the Productivity Commission's Inquiry Report citing the conditions in which benchmarking should be used in regulatory determinations.[85] [86] Other comments stated that benchmarking should be used as an informative tool rather than a determinative tool.[87] At heart, these submissions comment on the reliability of benchmarking for determining the efficient expenditure requirements of distributors.

We are in a position to comment upon its reliability for assessing base opex now that we have several benchmarking techniques available to us. We consider that they are reliable. We have multiple techniques and their results support each other.

If we found that we could not draw conclusions on the relative efficiency of network service providers using benchmarking we would not rely upon it. For example, we note that whole-of-business benchmarking of the performance of the transmission networks (as set out in our annual transmission benchmarking report) remains in its infancy. We consider there remain a number of analytical challenges that need to be overcome before firm conclusions can be drawn on the relative efficiency of transmission networks from benchmarking.[88] This is not the case in relation to distribution networks.

We consider that benchmarking is preferable to the forecasting techniques of the NSW service providers because benchmarking is transparent and impartial. Service providers have an incentive to overstate their expenditure requirements in order to increase their future revenues and as such their forecasts may be upwardly biased. Benchmarking is less susceptible to bias. Our benchmarking uses actual data setting out the revealed historic performance of the service providers. Our economic benchmarking data and Economic Insights' modelling and analysis are all in the public domain so it is also transparent.

In contrast to our benchmarking, the base opex forecasting methods in the NSW service providers' regulatory proposals are not always transparent, verifiable or repeatable.[89]

Further, as noted in our assessment of the service providers' forecasting method in their regulatory proposals, the service providers each apply different forecasting techniques for similar components of their opex proposals. For instance for vegetation management costs:

- Ausgrid states it uses a base year forecasting approach[90]

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85 Productivity Commission, *Inquiry report, Electricity Network Regulatory Frameworks*, 9 April 2013

86 Ausgrid, *Regulatory Proposal*, 2014, p. 47; Endeavour Energy, *Regulatory Proposal* p. 71; Essential, *Regulatory Proposal*, 2014 pp. 86–7.

87 Endeavour Energy, *Regulatory Proposal*, May 2014, p. 71, Essential Energy, *Regulatory Proposal*, May 2014, pp. 86–7; CitiPower, Powercor and SA Power Networks, *draft benchmarking report submission*, p. 2.

88 AER, *Transmission Annual Benchmarking Report*, November 2014, p. 5.

89 Essential's vegetation management costs and costs to implement reforms and 'other' costs Essential regulatory proposal, 2014, p. 73.
Endeavour Energy's vegetation management costs, capital prioritisation costs and the costs of savings programs, Endeavour Energy, *Regulatory proposal*, May 2014, p. 86.
Ausgrid's opex for meeting compliance obligations, leasing costs, and productivity savings. Ausgrid, *Regulatory proposal*, May 2014, pp. 57–60.

- Essential Energy uses a detailed cost build up[91]
- Endeavour Energy proposes a step change in costs based upon forecast contract costs.[92]

This selection of forecasting techniques leads to different results. These differing results may bias forecasts in accordance with the preference of the relevant service provider. The results of our analysis are consistent and robust. We have used many different benchmarking (and other) assessment techniques. These include benchmarking at the whole of business level, at the total opex level and at the opex category level. These techniques take into account the different outputs of distributors. These also consider the main drivers of network costs. The important point for our consideration of the analysis is that the benchmarking results are corroborated both by each of the different techniques we have applied and by the other findings of our other analysis.

Our top down benchmarking analysis of base year opex is less complex than alternative techniques available to us. The top down benchmarking has allowed us to avoid a detailed, line-by-line efficiency assessment of base year opex. Given the volume of different expenditures in base opex a line-by-line assessment is not practical. Also, such assessments rely heavily on the information of the service provider which is not commonly available to other stakeholders, may not be audited or otherwise verified and may be inaccurate.

We have tested and validated our benchmarking techniques to ensure they are robust. However, all forecasting techniques are, by nature, subject to some degree of error. Economic Insights accounts for potential error in its economic benchmarking techniques. Where we have relied upon benchmarking, we have interpreted the findings as appropriate for the particular technique. For example, in determining efficient base year opex, we have not directly benchmarked the NSW service providers against the most efficient service provider (as economic theory suggests we should). Rather, on the advice of our expert consultant, to allow for potential modelling and data error, we have benchmarked the NSW service providers against the weighted average efficiency of service providers with a score of 0.75 or higher. We have also considered the effect of operating environment factors in detail.

Modelling issues

We have taken into account a number of modelling issues that we consider important to address when implementing benchmarking. We address these modelling issues in the following sections.

Model specification issues

Model specification is an issue our benchmarking consultant Economic Insights has been very mindful of in developing its top down benchmarking models. The NSW service providers noted that model specification will affect benchmarking results in their proposals.[93] We agree with this point, and Economic Insights has undertaken a careful approach to ensure that its model specifications are appropriate. We consider that Economic Insights' model specifications are the best currently available. Economic Insights' approach to selecting the model specification is objective. It tested its models rigorously to provide results that:

- capture all material inputs and outputs

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90 Ausgrid, *Regulatory Proposal*, May 2014, p. 54. We note Ausgrid also forecast a price increase for vegetation management contract costs.

91 Essential Energy, *Regulatory Proposal*, May 2014, p. 70.

92 Endeavour Energy, *Regulatory Proposal*, May 2014, pp. 87–88.

93 Ausgrid, *Regulatory proposal*: Attachment 5.33, p. 6, Endeavour Energy, *Regulatory Proposal*: Attachment 0.12, p. 7-8, Essential Energy, *Regulatory Proposal* Attachment 5.4, p. 6.

- do not unduly preference one type of distributor over another
- provide a realistic spread of results
- are not sensitive to estimation method, small changes in model specification or data points.

Economic Insights' model specifications do not appear to advantage or disadvantage any particular type of service provider. For example, they do not show a bias towards urban or rural service providers. The results capture all the material outputs.

Submissions by the service providers noted that benchmarking does not account for all the variables that might affect network costs.[94] As such, the residual in the models might capture the effect of these variables and not necessarily inefficiency. Like all modelling techniques, benchmarking is limited in the number of variables that it can accommodate. However, we consider that we have captured all of the material variables to the extent that the economic benchmarking data and modelling permit. However, given they cannot account for every difference, we have also considered other operating environment factors that could potentially affect benchmarking comparisons in section A.5. Our analysis indicates that only a few of these factors appear to have a material effect on total opex and we have accounted for them appropriately in our draft decision.

Huegin, which has conducted benchmarking analysis for several service providers, has submitted that due to the small number of Australian service providers, finding a model specification that fits all service providers will require a relatively simple, high level model. This will mean that more costs will be pushed to the residual.[95]

We acknowledge that the size of the available data set will influence the confidence in a benchmarking modelling. The specific issue is that the accuracy of parameter coefficients will depend on the number of data points available. We have multiple top-down and category analysis benchmarks to provide cross checks of our benchmarking analysis. Further, to calibrate parameter estimates for econometric and SFA techniques, Economic Insights used an international data set capturing distributors in New Zealand and Ontario. The New Zealand and Ontario dataset has allowed Economic Insights to develop more precise parameter coefficients. Together, these two approaches have enabled us to develop more complex models and cross check our benchmarking results. Despite the differing approaches, Economic Insights' benchmarking techniques have produced consistent results. This indicates that the benchmarking findings are robust.

Potential bias[96]

We consider that Economic Insights' benchmarking models are comparatively free from bias (as they are objective) relative to the forecasts of stakeholders with their own interests. The results of different benchmarking techniques show no bias towards certain types of service providers. For example, the two most efficient service providers cover both urban and rural networks. The two least efficient service providers are the smallest and largest (in terms of customer numbers).

Economic Insights has taken an objective approach to developing its benchmarking models. It developed input and output specifications with regard to economic theory, expert engineering knowledge and cost driver analysis. Our preferred model specification reflects all material inputs and

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94 Ausgrid, *Regulatory Proposal*: Attachment 5.33, May 2014, p. 3, Endeavour Energy, *Regulatory Proposal*: Attachment 0.12, May 2014, p. 3, Essential Energy, *Regulatory proposal*: Attachment 5.4, May 2014, p. 5.

95 Huegin*, Distribution Benchmarking Study*: 2014, Ausgrid p. 10.

96 Huegin, *Distribution Benchmarking Study 2014: Ausgrid*, p. 10.

outputs. Further, as outlined below, Economic Insights went through an extensive testing process to ensure the benchmarking data is robust.

Residuals and potential inefficiency[97]

As noted by the Productivity Commission, the key question for a regulator engaged in benchmarking is not whether there is inefficiency, but whether there is enough to matter for regulatory purposes.[98] We consider that the benchmarking analysis presented here indicates that the current expenditure of the NSW service providers is substantially inefficient. Our preferred model, as recommended by Economic Insights is the Cobb Douglas SFA model. The Cobb Douglas SFA model has a separate error term that allows us to differentiate between statistical noise and systematic inefficiency.

Benchmarking performance may be affected by cost allocation and capitalisation approach

Submissions have noted that cost allocation or capitalisation approaches may affect performance.[99] We consider that cost allocation may affect benchmarking but not significantly. We have considered the potential effect of differences in cost allocation approaches in determining the margin for operating environment factors.

An examination of the distributors across the NEM indicates that different corporate structures and ownership arrangements are in place. Flexibility in corporate structures and ownership arrangements allow distributors to organise themselves in order to provide services efficiently.[100] These differences necessitate the application of differing cost allocation and cost capitalisation approaches. This is why we have allowed differences in cost allocation methods under our cost allocation guidelines.[101]

As such, cost allocation approaches and capitalisation policies will reflect the service provider's selected corporate structure. Differences in the capitalisation of costs will reflect the investment decisions of service providers undertaken under the same regulatory framework.

There is leeway in whether distributors capitalise or expense some costs. This may manifest itself in different capitalisation approaches across networks. However, statutory accounts are the basis of regulatory accounts so these policies accord with consistent statutory reporting requirements. Also, these approaches must also align with our nationally consistent cost allocation guidelines.

Further, benchmarking is common in industries without regulations governing cost allocation approaches. For example, many product retailers[102] and firms in technology development[103] benchmark their costs against their competitors. Also, differences in cost allocation approaches have not stopped network businesses in undertaking their own benchmarking to support their regulatory proposals. As we note below, other distribution service providers, transmission service providers and gas distributors have provided us with benchmarking analysis to support their proposals.

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97 Huegin, *Distribution Benchmarking Study 2014: Ausgrid*, p. 10.

98 Productivity Commission, *Electricity Network Regulatory Frameworks – Inquiry Report*, Volume 1, 9 April 2013, p. 155

99 ActewAGL, *Operating and capital expenditure 'site visit' clarifications*, 3 October 2014, pp. 7–11, Ausgrid, *Regulatory proposal*: Attachment 5.33, May 2014, p. 19, Huegin, *Distribution Benchmarking Study 2014: Ausgrid*, p. 32, Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 5.

100 Restrictions of ownership arrangements or corporate structures may limit the ability of distributors to innovate or seek efficiencies in the way that they provide their services.

101 With the restriction that costs be directly allocated to services where possible and that shared costs be allocated using an appropriate causal allocator.

102 Deloitte, *SGA book of metrics for retail: Executive Summary*, February 2010.

103 Deloitte, *Measuring product development performance in high tech companies*, April 2010.

We have found that the networks that are close to the frontier appear to have varying capitalisation policies. This is important because, all other things being equal, a higher opex to capex ratio should make a service provider appear worse on opex benchmarking. However, SA Power Networks, United Energy and Powercor all have high ratios of opex to capex, but they are three of the top five performers under our benchmarking analysis. This would indicate that the capitalisation of costs does not significantly influence benchmarking performance. In particular, capitalisation does not appear to be a factor that adversely influences the NSW distributors. The opex to capex ratios for the NSW distributors are considerably lower than four of the five service providers that perform best on the SFA Cobb Douglas model. We discuss capitalisation policies in further detail in section A.5.3.

TFP, high level assessments and identifying potential areas of inefficiency

The NSW service providers have submitted that TFP benchmarking is too high level to identify potential areas of inefficiency.[104] We take the view that top down forecasting approaches are the most appropriate tools for a regulator to assess base opex. The NER requires us to consider the efficiency and prudency of total forecast opex. Top down benchmarking of opex enables us to do this.

It is difficult to discern inefficiency of total opex through detailed cost assessments. A service provider may be inefficient for a number of reasons. As noted by the Productivity Commission inefficiency can manifest itself in many ways:

- Businesses may invest prematurely in what would ultimately be productive investment (the likely outcome of insufficient demand management or excessive reliability standards).
- Businesses may use existing capital inefficiently (lower capital productivity). For example, poor maintenance arrangements may require more redundancy than necessary.
- Businesses may make investments that are not required at all to produce output (the conventional definition of ‘goldplating’).
- Investment costs may be excessive due to poor project management.
- Labour may be in excess of what is required or poorly used (resulting in lower labour productivity).
- Physical investments and labour inputs may be at efficient levels, but may be priced excessively. This could arise if the weighted average cost of capital is too high or if unions are able to negotiate higher wages (which appears to be true — figure 2.14 — especially for the state-owned corporations).

Inefficiency can be specific to certain activities of a service provider or may be systemic across a range of activities. Networks might be relatively efficient in providing some services but might be inefficient overall by using different inputs. It is difficult to account for all these factors when assessing the contribution of individual costs that comprise total opex. Indeed in detailed cost assessments it can be difficult to see the 'forest for the trees' as the focus in such assessments tends to the reasons for differences in individual expenditures. This does not mean detailed cost assessments do not have a role. We use them to assess step changes, for example. However, we consider detailed cost assessments alone are inappropriate for determining an efficient overall opex forecast.

Further, our task under the NER does not require us to determine the source of inefficiency. We must determine whether we are satisfied the total forecast opex reasonably reflects the opex criteria. That is, efficient costs a prudent operator would require to achieve the opex objectives.

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[104] Ausgrid, *Regulatory Proposal*: Attachment 5.33, May 2014, p. 5, Endeavour Energy, *Regulatory Proposal*: Attachment 0.12, May 2014, p. 7, Essential Energy, *Regulatory Proposal*, Attachment 5.4, May 2014, p. 9.

Data are robust

In their regulatory proposals the NSW service providers commented that the data for benchmarking may not be accurate.[105] We have dedicated significant effort to ensuring that our economic benchmarking data are accurate.

We developed our benchmarking information requirements through a year-long consultation process. We initiated our consultation in November 2012 with the publication of the issues paper to our Guideline. As part of this consultation we held numerous workshops open to interested stakeholders from regulated businesses and consumer representatives. These included nine workshops on our economic benchmarking information requirements (upon which we have based the bulk of our benchmarking analysis) from March to June in 2013. We also published numerous papers covering the data requirements for economic benchmarking. We met with each of the network businesses and circulated a number of drafts of the benchmarking data requirements.

We released our draft economic benchmarking information instruments in August 2013 and the final information instruments (incorporating stakeholder submissions) in November 2013. Subsequent to the release of the benchmarking data requirements we required the network businesses to submit unaudited information responses for review in March 2014. In reviewing these templates we identified and resolved data issues.

We required the service providers to seek independent audit of their final benchmarking data, which was due on 30 April 2014. We also required the CEO of the service providers to certify the accuracy of the information provided. Once we received the benchmarking data we published the data on our website. We called for cross submissions (where service providers could comment on each other’s data) on the economic benchmarking data. No significant data issues were identified in the cross submissions.

On 5 August 2014 we circulated our draft annual benchmarking report and associated modelling and data to service providers. In responding to this report service providers were afforded another opportunity to identify data issues. In this process service providers provided guidance on how the modelling could be improved.[106] We have incorporated this feedback into our benchmarking analysis.

Because of this process, we consider that the data that we have received for benchmarking is robust. This perspective has been supported by Economic Insights. We are particularly encouraged by our consultant's statement that:[107]

> While no dataset will likely ever be perfect, the AER's economic benchmarking RIN data provider the most consistent and thoroughly examined DNSP dataset yet assembled in Australia.

Service providers are comparable

Several submissions have stated that service providers are not comparable, citing differences in the operating environments of service providers that models are unable to account for.[108] The Consumer Challenge Panel (CCP) noted that:

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105 Ausgrid, *Regulatory proposal:* Attachment 5.33, May 2014, p. 5, Endeavour Energy, *Regulatory proposal:* attachment 0.12 p. 7, Essential Energy, *Regulatory proposal*: attachment 5.4, May 2014, p. 6.

106 Energex noted that we had not excluded the effect of its feed in tariffs from its opex in our PPI modelling. Citipower, Powercor and SA Power Networks noted that our reliability PPI metrics included major event days.

107 Economic Insights, 2014, p. 3.

108 Ausgrid, *Regulatory proposal:* attachment 5.33, May 2014, p. 3, Endeavour Energy, *Regulatory proposal:* attachment 0.12, May 2014, p. 3, Essential Energy, *Regulatory Proposal*: Attachment 5.4, May 2014, p. 3

> It is to be expected that every business will seek to distinguish themselves and thereby diminish the importance of benchmarking by the AER. Our view is that every business will be advantaged on some measures by virtue of their operating environment, and disadvantaged on others. On balance, benchmarking is appropriate and will work.[109]

There are some differences in the scope of services and operating environments of distributors. However, we have accounted for these in our analysis. We are only examining the standard control services for the NSW service providers in the 2014–19 period. To do this we exclude the costs of other services from our opex data for benchmarking. The benchmark models account for major operating factors. We have also considered the effects of additional operating environment factors in detail in section A.5.

Benchmarking has been used to support regulatory proposals

We note that each of the NSW service providers use benchmarking in different circumstances to support their regulatory proposals. For instance the NSW service providers submitted benchmarking reports by Heugin and KPMG. The Heugin reports, though critiquing benchmarking, also provided benchmarking analysis showing that under some metrics the NSW service providers appear efficient.[110] The service providers also engaged KPMG to provide benchmarking analysis of their information and communications technology expenditures.[111] In reaching our decision, we have had appropriate regard to this benchmarking information.

Benchmarking has been a consistent feature of electricity and gas regulatory proposals that the AER has received for distribution networks, transmission networks and gas distribution networks in recent years.

Ausgrid notes that "we consider that well designed tools can play a role for a business or regulator to test the efficiency of a forecast."[112] We agree with this statement. We also support and encourage stakeholders investigating the efficiency of service providers. However we disagree with the approach that Ausgrid's consultant, Huegin, has adopted to conduct its benchmarking and we consider that its benchmarking analysis is deficient.

Huegin's benchmarking uses only a subset of the available data. Huegin only benchmarks eight distributors within Australia and New Zealand and does not reveal the identities of those in the sample (apart from the network to which their report relates). Using a small sample of all the NEM distributors creates potential selection bias – particularly if Huegin selects inefficient service providers. This appears the case, as three of the service providers are the NSW networks which are inefficient under our analysis.

Huegin uses partial performance indicators (PPIs) to benchmark the performance of the NSW service providers. We also use PPIs and consider that they provide an insight into the efficiency of the networks. However we consider that PPIs do not, on their own, adequately measure relative efficiency.[113] In order to measure relative efficiency it is necessary to consider the multiple inputs and

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109 Consumer Challenge Panel, *Submission 1 to AER regarding NSW DNSP regulatory proposals 2014-19*, p. 41.

110 Ausgrid, *Regulatory proposal*, May 2014, p. 47, Essential Energy, *Regulatory proposal*, May 2014, p. 63, Endeavour Energy, *Regulatory proposal*, May 2014, p.100.

111 KPMG, 2013 Utilities ICT Benchmarking Final Report Ausgrid, 7 March 2014, KPMG, 2013 Utilities ICT Benchmarking Final Report Endeavour Energy, 7 March 2014, Essential Energy, *Regulatory proposal*, May 2014 p. 58.

112 Ausgrid, *Regulatory Proposal*: Attachment 5.33, May 2014, p. 3.

113 In some instances, particularly capex assessment, PPIs are appropriate because we do not have more sophisticated techniques. However, for this decision, we have several techniques that can measure relative efficiency, particularly for opex.

outputs of networks, their scale and the environment within which they operate. As stated in the ACCC/AER working paper series on benchmarking opex and capex in electricity networks: [114]

> While PPIs provide some insights, they can give misleading information regarding the overall economic performance of energy utilities producing multiple outputs and multiple inputs. For example, when considered in isolation, a labour productivity measure would tend to overstate the growth of overall productivity in a utility experiencing a substantial degree of capital deepening (i.e., capital substituting for labour in the production). Similarly, inadequately accounting for the multiple outputs produced by a utility would also make performance comparison over time or across utilities less useful for the regulator.
>
> PPIs assume a linear relationship between the input and output measures and also assume that any change in the input measure can be described by a change in the output measure. However, in most circumstances the change in an input usage will be dependent on a number of inputs, outputs and other factors that may not be described in the model. In particular, PPIs used in isolation cannot easily take into account differences in the market or operating environment that impact upon a business but are beyond the control of management. For example, a utility may have a relatively high or low unit cost simply because it faces input prices or serves customers that are different from those for utilities operating in other regions. Because of this, they may present problems in providing a meaningful comparison of businesses in different operating environments.

Huegin's analysis also does not identify all the businesses in its benchmarking sample. Rather, Huegin only identifies the business to which the particular report relates. As such, it is challenging for stakeholders to compare results because they cannot consider them in the context of economies of scale and partial productivity, which may affect the comparisons.

Each of the NSW service providers considers that trends in a service provider's results over time are of more value than relative efficiencies between service providers at a point in time.[115] Ausgrid, for example, submits that its growth rates in expenditure are among the lowest out of the peer group studies.[116] This conclusion is drawn from Huegin's analysis.

While we agree that cost reductions are generally a good thing, we consider that it is important to consider the starting point of efficiency. If a firm is grossly inefficient, improving efficiency is not a reason to accept their base year. Forecasts developed using that base year would contain inefficiencies. This would be inconsistent with the expenditure criteria that require us to ensure forecasts reasonably reflect the prudent and efficient costs of achieving the expenditure objectives.[117]

A.2.5 Implementing efficiency improvements

Our approach to determining the quantum of any adjustment to the base opex that might be necessary to account for inefficiencies in the base year, differs significantly from the service providers' bottom up approach to implementing efficiency improvements. In particular, the NSW service providers consider we should set an opex allowance that funds a transition to the efficient level of expenditure. In other words, it starts above the efficient level of opex to achieve the opex objectives and reduces gradually, reaching the efficient level of expenditure over the course of the regulatory control period. Consumers would therefore fund the transition to efficiency.

Each of the NSW service providers has identified inefficiencies in its base year and proposed savings measures to reduce these inefficiencies going forward:

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[114] ACCC/AER working paper series, *Benchmarking Opex and Capex in Energy Networks, Working Paper no.6*, May 2012, p.17.

[115] Endeavour Energy, *Regulatory proposal*, May 2014, p. 100. Essential Energy, *Regulatory proposal*, May 2014, p. 63. Ausgrid, *Regulatory proposal*, May 2014, p. 67.

[116] Ausgrid, *Regulatory proposal*, May 2014, p. 67.

[117] NER cl. 6.5.6(c).

- Ausgrid proposes to achieve efficiencies arising from the NSW government network reform program by removing functional duplication, streamlining corporate and support services and creating better and faster procurement and logistic processes[118]
- Endeavour Energy proposes reductions to corporate, administration and network operations in addition to reductions arising from the NSW Government Network Reform Program[119]
- Essential Energy proposes efficiencies to:
  - ensure minimal impact on customers as a result of losing the synergies of being an integrated Network/Retail/Gas business
  - to eliminate fully the cost impact of excess resources from reduced capital investment
  - to remove inefficiencies in their vegetation management program.[120]

However, Essential Energy and Ausgrid also include the costs of achieving efficiencies in their regulatory proposals and all service providers are expecting consumers to fund redundancy costs.[121]

When efficiencies should take effect

We have determined that the efficient base year opex is below what the NSW service providers spent in that base year. Some stakeholders have submitted that if we significantly reduce a service provider's allowance, it may not be realistic for the service provider to make the necessary efficiency savings immediately; rather, a period to transition to the efficient level would be appropriate.[122] On the information before us, we are not satisfied that the NSW service providers have made a sufficiently robust argument for why consumers should share in funding their transition to an efficient level of opex.

In particular, during our consultations with NSW service providers, they raised a point for our consideration concerning enterprise bargaining agreements (EBAs).

Under the NER, the total forecast opex should be sufficient to achieve certain objectives. One of these objectives is the applicable 'regulatory obligations or requirements' that the service provider must meet that are associated with the provision of standard control services.

The service providers submitted that they must meet their obligations under the *Fair Work Act 2009* and should be funded by consumers to do so.[123] This implies they consider their EBAs constitute regulatory obligations or requirements and, in determining total forecast opex, we should take account of the specific circumstances they may face under the EBAs they have negotiated in relation to their ongoing labour costs.

The term ‘regulatory obligation or requirement’ has a specific definition in the NEL.[124] The definition limits what constitutes a regulatory obligation or requirement to:

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118 Ausgrid, *Regulatory proposal*, May 2014, p.59.
119 Endeavour Energy, *Regulatory proposal*, May 2014, pp. 75–78.
120 Essential Energy, *Regulatory proposal*, May 2014, pp. 73–74
121 Ausgrid, *Regulatory proposal*, May 2014, p. 51.Essential Energy, *Regulatory proposal*, May 2014, pp. 73–74; NSW DSNPs, *Submission on AER issues paper*, 8 August 2014, pp. 12–16.
122 Grid Australia, *Grid Australia submission on AER draft expenditure forecast assessment guidelines,* 20 September 2013, pp. 16–17.
123 NSW DSNPs*, Submission on AER issues paper*, 8 August 2014, pp. 12–16.
124 NER, Ch. 10 definition of 'regulatory obligation or requirement' and NEL, s2D.

- distribution system safety duties
- distribution reliability standards
- distribution service standards
- obligations under the NEL, NER, NERL and NERR
- tax obligations on service providers
- use of land
- protection of the environment
- an act of a participating jurisdiction that materially affects the provision of electricity network services.

An EBA is an agreement made under the *Fair Work Act 2009*. That Act is a piece of Commonwealth legislation. The definition of 'participating jurisdiction' only includes the Commonwealth in limited circumstances and those circumstances do not apply here.[125] Accordingly, in our view, the terms of an EBA do not constitute a 'regulatory obligation or requirement'.

However, we think it is important to also highlight a more general point about the opex allowance that we determine.

Employers and employees have significant discretion to agree on terms and conditions that are incorporated into an EBA. This includes the period during which that agreement will run.

When we determine total forecast opex, we are setting a total forecast for an objectively efficient and prudent service provider to achieve certain objectives in the provision of standard control services for a particular network area.

We do not seek to interfere in the decisions a service provider will make about how and when to spend this total opex allowance to run its network, including the particular legal obligations it enters into to do so. The service provider is free to choose how to manage its allowance.

We do not approve a particular EBA or any other plan of expenditure when we set a total opex allowance. When a service provider enters into an agreement of any kind, it does so in a context where it knows that a particular allowance will apply for five years, but there is no guarantee that the same or a similar allowance will be approved for the following five year period.

If a service provider ultimately spends inefficiently or imprudently, it will bear those additional costs and, conversely, if it achieves efficiencies it may make additional profits. This is a core feature of incentive based regulation and is intended to reflect the conditions that would be faced by businesses operating in a competitive environment.

We must be satisfied that the total opex forecast reasonably reflects the efficient costs of a prudent operator (not the service provider in question), given reasonable expectations of demand and cost inputs, to achieve the opex objectives.

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125 NEL, s.5.

It is important to note the effect of a change to the NER in November 2012 on this point. Previously, the NER provided that the total forecast opex should reasonably reflect the costs that a prudent operator *in the circumstances of the service provider* would require to achieve the objectives. The reference to "in the circumstances of the service provider" was deleted from this rule to ensure that the opex forecast would reasonably reflect the costs of an objectively prudent provider, rather than a provider in the particular circumstances of the service provider concerned. One of the stated objectives of this change was to ensure that benchmarking could be applied to assess the efficient and prudent expenditure requirements of an objective operator.[126]

The broader circumstances of a service provider are still relevant to our assessment, as we are assessing a forecast to achieve certain opex objectives. Thus, the forecast must reasonably reflect the costs necessary to meet or manage the expected demand for services, to comply with regulatory requirements for the network in question, and to maintain the safety of the system, as these are opex objectives.

However, our assessment is necessarily focussed on forecasting what an objective efficient and prudent service provider would require to achieve those opex objectives, rather than what a service provider in all the same circumstances as the relevant service provider would require. If the forecast was made by reference to a provider in all the same circumstances as the service provider, the AER would potentially need to make a decision that incorporated matters as specific as the service provider's staffing levels or car leasing arrangements, and other matters that are completely within the discretionary control of management. That would run counter to the notion of having a national market in which an independent regulator sets an efficient level of opex (and other building blocks) for a prudent provider to deliver services.

It follows from this that, in our view, a forecast which allowed a service provider to transition over time to an efficient opex would provide for the recovery of inefficient costs during the transition period. It would place the burden of funding inefficiencies on consumers, rather than on the service providers.

If our determined prudent and efficient allowance to achieve the opex objectives is lower than actual past expenditure, our view is that a prudent operator would take the necessary action to improve its efficiency. This view seems to be supported by AGL, who submitted that in competitive markets, prudent and efficient firms incur short term costs to increase efficiency because the benefits of those costs will accrue to the owners in the long-term.[127] On the information before us, our view is, mirroring what would be expected under competitive market conditions, it would be appropriate for service providers (including their shareholders) to bear the cost of any inefficiency rather than consumers. This view differs to the NSW service providers' proposals, which include redundancy costs and in some instances other costs to achieve efficiency improvements.

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126 AEMC, *Rule Determination, National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 and National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, November 2012, p.107

127 AGL, *NSW Electricity Distribution Networks Regulatory Proposals: 2014-19 - AGL submission to the Australian Energy Regulator*, 8 August 2014, p. 15.

A.3 Benchmarking results in detail

In this section we set out our analysis of the benchmarking techniques we have used to test to see whether base year opex of the service providers is efficient in greater detail. The techniques, developed for us by our consultant Economic Insights, measure either the overall efficiency of service providers or how efficiently they use opex in particular. They are:[128]

- multilateral total factor productivity (MTFP) – is an index that measures the ratio of inputs used for output delivered
- econometric modelling techniques:
  - Cobb Douglas stochastic frontier analysis (SFA) – this estimates the efficient level of opex required for a service provider by constructing an efficient frontier and compares this to the actual opex used by the service provider
  - Cobb Douglas least squares estimate – is similar to the above in modelling opex cost function but uses least squares estimation method to estimate an industry-average technology, which is then shifted to envelope the most efficient service provider sampled
  - Translog least squares estimate – this is similar to the Cobb Douglas least squares estimate technique but uses different functional form assumption regarding the relationship between opex and outputs.

Additionally, we used opex multilateral partial factor productivity (MPFP), which is an index-based technique that measures 'the ratio of output quantity index to opex input quantity index.[129] Each benchmarking technique compares the relative efficiency of service providers to its peers. They each may differ in terms of estimation method or model specification and account for operating environment factors (factors that may differentiate service providers) to differing degrees. Despite this, Economic Insights found:[130]

> The efficiency scores across the three econometric models are relatively close to each other for each DNSP and they are, in turn, relatively close to the corresponding MPFP score. This similarity in results despite the differing methods used and datasets used reinforces our confidence in the results.

We also examine some PPIs, which are a simpler form of benchmarking. Finally, we present the implied adjustments to base opex based on benchmarking alone (that is, prior to considering operating environment differences other than those included in the models).

A.3.1 Findings from multilateral total factor productivity and multilateral partial factor productivity

Economic Insights' MTFP and MPFP modelling indicates that, prior to considerations of operating environment factors, the NSW service providers are inefficient overall and are also inefficient in the use of their opex. Inefficiency at the whole of business level and at the opex level indicates that the opex inefficiency of the service providers is not offset by efficiency in the use of capital.

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128 AER, *Expenditure forecast assessment guideline*, November 2013, p. 13.

129 At the time of developing the Expenditure forecast assessment guideline, we had not received data from service providers so we considered data envelopment analysis (DEA) may be another technique we could apply. However, given the data quality and the availability of international data, we have been able to apply stochastic frontier analysis. This is a superior technique to DEA. Economic Insights, 2014, p. 7.

130 Economic Insights, 2014, pp. 46–47.

Table A.6 presents the raw results of the MTFP and MPFP analysis. An efficiency score of 57 per cent means the service provider is 57 per cent as efficient as the frontier business (or, put another way, 43 per cent less efficient).

Table A-6 Relative performance of NSW distributors using MTFP and MPFP

Distributor	MTFP Efficiency Score	MTFP Implied inefficiency	Opex MPFP	Opex MPFP implied inefficiency
Ausgrid	57%	43%	45%	55%
Endeavour	70%	30%	61%	39%
Essential	57%	43%	48%	52%

Source: Economic Insights.[131]

Methodology

Multilateral total factor productivity allows for the comparison of productivity levels between service providers and productivity across time. Productivity is a measure of the quantity of output produced from the use of a given quantity of inputs. When there is scope to improve productivity, this implies there is productive inefficiency.

In this section we consider partial factor productivity (PFP) and total factor productivity (TFP). TFP measures total output relative to an index of all inputs used. PFP measures total output relative to one particular input (e.g. opex partial productivity is the ratio of total output quantity index to an index of opex quantity input).

For further detail on MTFP and index number benchmarking approaches we direct readers to our previous publications.[132]

Inputs and outputs

Economic Insights' preferred output specification for the MTFP and MPFP includes:

- Customer numbers
- Ratcheted maximum demand
- Circuit line length
- Energy throughput
- Reliability (measured as total customer minutes off supply)

Economic Insights sets out its reasons for the selection of these outputs in its report.[133] In developing this output specification Economic Insights considered a number of different specifications.[134] Other specifications tested, unlike this specification, appeared to disadvantage either urban or rural service

131 Economic Insights, 214, pp. 17–20.
132 These include:
AER, *Better Regulation, Explanatory Statement Expenditure Forecast Assessment Guideline*, November 2013.
ACCC/AER, *Benchmarking Opex and Capex in Energy Networks, Working Paper no.6*, May 2012.
133 Economic Insights, 2014, pp. 9–14.
134 Economic Insights, 2014, pp. 9–14.

providers. Also, this specification takes into account the operating environment variable of customer density by including both customers and line length as outputs. It similarly includes some allowance for differences in energy density and demand density by including energy delivered and a measure of maximum demand as outputs. Further this specification includes reliability as an output.[135]

The MTFP analysis uses opex and capital as inputs. In this analysis capital is split into five distinct components – subtransmission overhead lines, distribution overhead lines, subtransmission underground cables, distribution underground cables and transformers and other. Each input is measured in terms of its physical quantity.[136] This measure of inputs aligns with Economic Insights' preferred input specification which is justified in our explanatory statement to our Guideline.[137]

Several submissions on our draft benchmarking report said that we did not allocate an appropriate weight to line length.[138] Economic Insights consider that the weighting for overhead lines is appropriate because it has been developed through a Leontief estimation of the cost function.[139]

Some submissions also noted that Economic Insights' lines and cables input index for MTFP analysis might be multiplicative in nature placing a greater weighting on high voltage lines than is warranted.[140] Economic Insights addressed this concern by creating separate input indexes for subtransmission and distribution lines. The weighting given to high voltage lines will not influence our alternative assessment techniques that examine the productivity of opex. These techniques, unlike MTFP, are not sensitive to the weighting given to individual capital inputs.

Results

Figure A-4 presents the relative efficiency of the service providers. A score of 100 per cent indicates that the service provider is 100 per cent efficient (they are producing the highest ratio of outputs to inputs). A score of 50 per cent indicates that a service provider is half as efficient as the frontier networks and can reach the frontier halving its inputs.

The MTFP results indicate that, on average, CitiPower, SA Power Networks, United Energy and JEN are the most productive. Ausgrid, ActewAGL, Ergon Energy, Essential Energy and TasNetworks appear to be amongst the least efficient.

135 Economic Insights, 2014, p. 11.

136 Economic Insights, 2014, pp. 12–14.

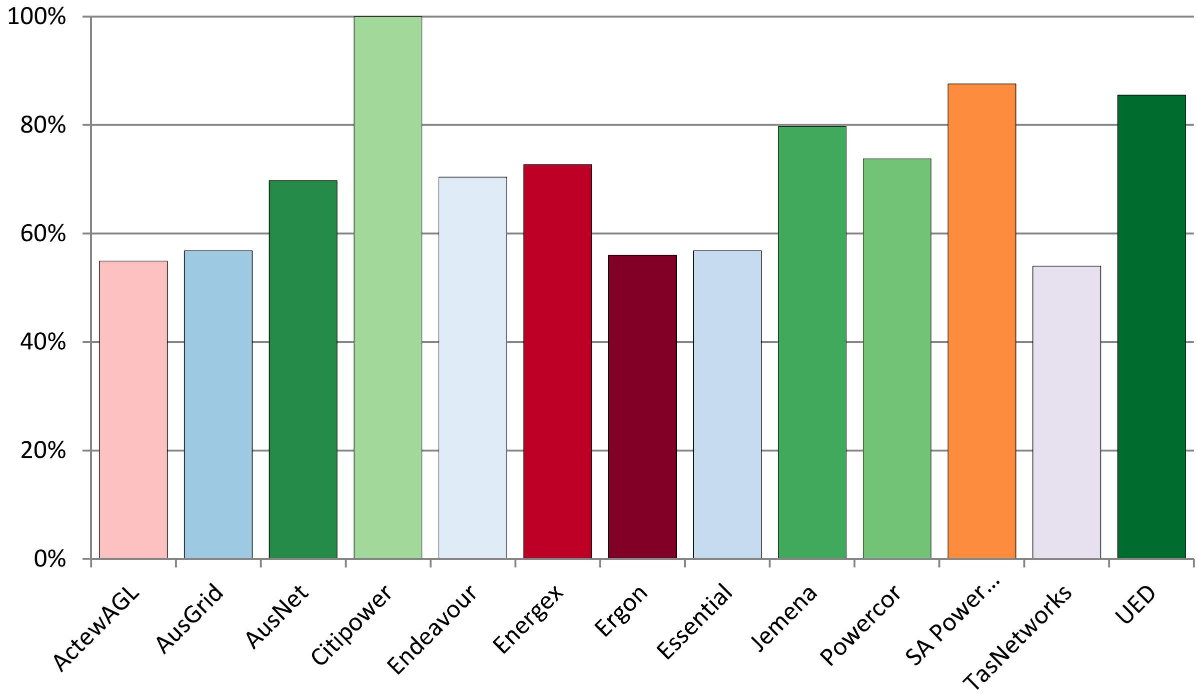
137 AER, *Better Regulation, Explanatory statement, Expenditure Forecast Assessment Guidelines for electricity transmission and distribution*, November 2013, pp. 154–156.

138 CitiPower, Powercor Australia and SA Power Networks, Joint submission to AER on draft annual benchmarking report for electricity distribution network service providers, 22 August 2014, pp. 2–3.

139 Economic Insights, 2014, p. 57.

140 AusNet services draft TNSP benchmarking report submission, pp. 6–7. Huegin, *ActewAGL Productivity Performance Analysis*, September 2014, p. 9.

Figure A-4 MTFP Performance (average 2006–2013)



Source: Economic Insights, 2014.

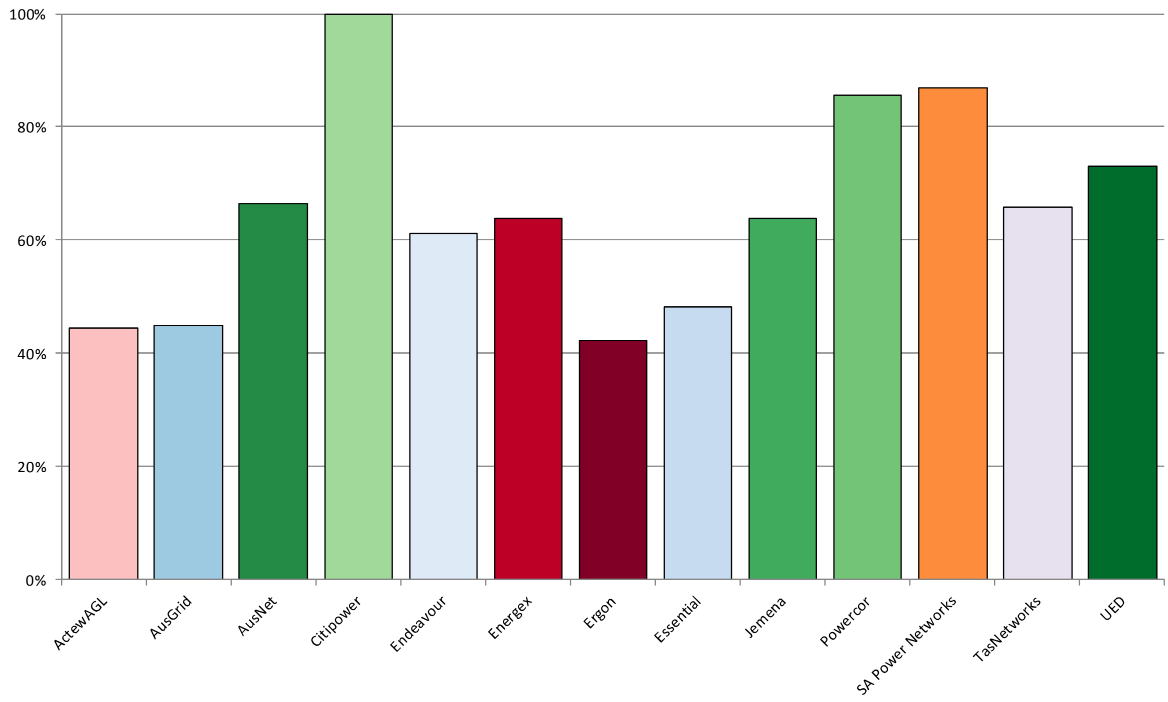
The results also indicate that the NSW service providers can achieve efficiency improvements going forward because there are significant efficiency gaps between their performance and the frontier service providers. This finding aligns with the findings of benchmarking undertaken by the EUAA.[141]

Figure A-5 presents the opex multilateral partial factor productivity (MPFP) results. As would be expected, the performance of the service providers changes somewhat under these results, reflecting the different combination of opex and capital used by the service providers to deliver network services. However the results are broadly consistent with the MTFP results, excepting TasNetworks, who performs much better on MPFP.[142] Under both measures the NSW service providers appear less productive than several of their peers.

141 Mountain, B.R., May 2011. *Australia's rising electricity prices and declining productivity: the contribution of its electricity distributors*. Energy Users Association of Australia, Melbourne. p. 31.

142 TasNetworks has recently reduced its opex significantly and is currently spending close to its 2009 levels of opex (in real terms).

Figure A-5 Opex MPFP performance (average 2006–13)



Source: Economic Insights, 2014.

The MTFP and MPFP modelling takes into account a number of important operating environment factors. Customer density is implicitly included in the model because both customer numbers and line length are included as outputs. Further, the modelling has separate input indexes for overhead and underground lines, which factor in the differences in costs between overhead and underground lines when weighting the inputs. Economic Insights also excluded the first-stage of transformation at the zone station level where there are two stages and split the line inputs into subtransmission and distribution voltages. Thus the model specification makes some allowances for differences in system structure and complexity across distributors, such as the delineation between transmission and distribution networks in different states.[143]

In addition to accounting for these factors in the model specification, Economic Insights tested the effect of the following operating environment factors on the MPFP scores in a second-stage regression analysis:

- customer numbers (to check whether additional scale effects are significant)
- customer, energy and demand network densities
- the share of underground cable length in total circuit kilometres
- the share of single stage transformation capacity in single stage plus the second stage of two stage transformation capacity at the zone substation level, and

[143] Economic Insights, 2014, pp. 18–19.

- system average interruption duration index (SAIDI).[144]

Economic Insights found, using these tests, that none of these variables are statistically significant in their effect on the MPFP scores.[145] This indicates that the MPFP results have appropriately captured the effects of these variables.

Given that the model incorporates the significant outputs of the distributors and accommodates a number of operating environment factors, we consider that the results are robust. Despite this, index number analysis has some limitations. Specifically, index numbers do not replicate the underlying production function of the firms in question and instead assume constant returns to scale.[146] As such, it is prudent to compare index number analysis with econometric modelling.

A.3.2 Findings from econometric modelling of the opex cost function

Economic Insights has chosen to model the opex cost function of the service providers using three models.[147] These models are Cobb Douglas SFA, Cobb Douglas least squared estimate (CD LSE) and Translog least squared estimate (TLG LSE). The findings from these models support each other. Like the opex MPFP analysis, prior to the consideration of the effects of operating environment conditions, these models indicate that the NSW service providers are inefficient. Table A-7 presents the results of this analysis. Though the models differ in their estimation method or specification, they are broadly consistent with the opex MPFP results and support each other. The efficiency scores are the efficiency of the service provider relative to the frontier service provider.

Table A-7 Efficiency scores (average for 2006–13)[148]

Service provider	Cobb Douglas SFA	CD LSE	TLG LSE
Ausgrid	45	44	50
Endeavour	59	59	63
Essential	55	61	64

Source: Economic Insights.[149]

Methodology

The TLG LSE and CD LSE models are regressions of Translog and Cobb Douglas opex cost functions, respectively.[150] In order to estimate efficiency, these models include dummy variables for each of the service providers. The dummy variables pick up differences in opex levels after the effects of all the included variables are accounted for. The service provider with the lowest valued dummy variable coefficient is the most efficient in this case (as it has the lowest underlying cost). It is necessary then to transform the dummy variable coefficients to form efficiency scores such that the

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144 Customer minutes off supply are not included as a negative output in the opex MPFP indexes used in the second stage regression.

145 Economic Insights, 2014, p. 24.

146 This is because the MTFP analysis measures productivity as a ratio of inputs and outputs. Econometric analysis allows for more flexible relationships between inputs and outputs and can accommodate increasing and decreasing returns to scales. This is because econometric models estimate the effect of each individual output variable on inputs and allow for different relationships between inputs and outputs (such as a Cobb Douglas production function).

147 Economic Insights, 2014, p. iii.

148 An efficiency score of 60 per cent indicates that a service provider is 60 per cent as efficient in the use of its opex as the frontier service provider.

149 Economic Insights, 2014, p. 36.

150 The Translog model differs from the Cobb Douglas model in that it has a more flexible functional form. This means that the Translog model allows for the elasticity of opex to outputs to change depending on the relative quantities of outputs.

most efficient service provider has an efficiency score of one, to which the relative opex efficiency of other service providers are measured.

These models are more sophisticated than the MTFP and MPFP approaches. They are parametric techniques which mean that they model the underlying production function of the service providers as specified. Further, these models allow for the direct incorporation of operating environment factors into the analysis.

The Cobb Douglas SFA method is the most sophisticated model because it directly estimates the efficient frontier and efficiency scores for the networks. It also retains the benefits of the LSE models. In the Cobb Douglas SFA method, the stochastic disturbance term is decomposed into a white noise term and a cross-sectional (firm-specific) strictly positive random term, which is interpreted as a measure of inefficiency. For these reasons the Cobb Douglas SFA method is Economic Insights' preferred model. We agree and have adopted Economic Insights' recommendations. Economic Insights' report provides a detailed explanation of these modelling approaches.[151]

International data

In developing the econometric models Economic Insights initially used only Australian data. However, the Australian data proved not to have enough cross sectional variance to allow for the development of a robust model for the opex cost function.[152] Consequently, Economic Insights augmented the data set with international data to allow for the development of more accurate models. Economic Insights drew on the established benchmarking data sets for New Zealand and Ontario distributors for this purpose.

Economic Insights used the international data to calibrate parameter estimates within the econometric models. Through the incorporation of international data Economic Insights was able to develop robust econometric models of the opex cost function. The significant t-ratio for each of the parameters demonstrates the accuracy of the parameter estimates.[153]

The models themselves do not benchmark the Australian service providers against their international peers. Economic Insights used the international data to estimate the opex cost function of service providers to a high degree of accuracy. The models derive efficiency scores for the service providers by comparing their actual opex to opex predicted by the models. We only compare efficiency scores for the Australian networks. That is, we ascertain the relative efficiency of the Australian networks among themselves.

We consider that there is potential to benchmark Australian service providers against their international peers. However, time has not permitted us to undertake this benchmarking in this instance.

We also engaged Pacific Economics Group Research (PEGR) to examine the scope to supplement its benchmarking data with data from the US Federal Energy Regulatory Commission (FERC). PEGR noted significant data inconsistencies between Australian and FERC dataset. Standardized reliability data are available for some US utilities from state regulators. However, the overlap between this group of utilities and the group that reports total distribution route miles is not large.[154] They found that

151 Economic Insights, 2014, pp. 25–28.
152 Economic Insights, 2014, pp. 28–29.
153 Economic Insights, 2014, p. 33.
154 PEGR, *Database for Distribution Network Services in the US and Australia*, 21 August 2014, p. 5.

consistent data were unavailable, for several variables in the AER data set. These included variables pertaining to reliability, line length, system age, and distribution transformer capacity.[155]

PEGR was only able to assemble data for fifteen US service providers that had the basic data required for two or more years. A further complication with the US data is that many network businesses are vertically integrated. This creates challenges in making like-for-like comparisons of network services opex. All the service providers in the data set also provided transmission services. Further, these service providers often also operated electricity generators.[156]

PEGR developed an illustrative benchmarking model that benchmarked the Australian service providers against their US counterparts. PEGR found that while US companies generally fared better in the benchmarking than their Australian counterparts, statistical tests would be unable to reject the hypothesis that most Australian utilities are average cost performers. Given, additionally, the small sample size, they could not confidently conclude from the research that service providers in the United States tend to be more efficient in their management of network services opex than those in Australia.[157]

PEGR also developed an example benchmarking model using only Australian data. However, due to the limited number of observations, we consider that this benchmarking is not robust enough to rely on. PEGR noted that the current size of the Australian dataset did not permit particularly accurate estimation of the parameters for their Translog model.[158]

We agree with PEGR's concerns regarding international benchmarking. Having reviewed PEGR's illustrative modelling we found that the US data are not generally comparable in terms of variable coverage and definitions to our dataset for the Australian service providers. As a result, the example model specification presented in PEG (2014) does not incorporate or appropriately measure key output dimensions of network services such as peak demand or capacity in explaining opex differences across networks. Furthermore, with an unbalanced panel of 170 observations for the fifteen US utilities over the period 1995 to 2013, the US data cannot provide sufficient additional cross-sectional variations in order to model reliably the opex of Australian service providers. We also identified a number of observations violating monotonicity properties of the opex cost function in the model.[159] Further, we note that even with a better dataset, Economic Insights chose not to directly benchmark Australian service providers against their international peers.

Model specification

The opex cost functions incorporate the significant output variables of customer numbers, circuit length, and ratcheted maximum demand.[160] Unlike the MTFP model the opex cost function models do not include energy delivered and reliability. Economic Insights excluded energy delivered because it was highly correlated with ratcheted maximum demand. The estimated coefficients of either energy delivered or ratcheted maximum demand were generally insignificant in these models. Economic Insights found that the correlation coefficient between these two variables was larger than 0.99 and the behaviour of their coefficients was almost certainly a consequence of multicollinearity problems.

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155 PEGR, *Database for Distribution Network Services in the US and Australia*, 21 August 2014, p. 5.
156 PEGR, *Database for Distribution Network Services in the US and Australia*, 21 August 2014, p. 5.
157 PEGR, *Database for Distribution Network Services in the US and Australia*, 21 August 2014, p. 3.
158 PEGR, *Database for Distribution Network Services in the US and Australia*, 21 August 2014, p. 25.
159 A monotonicity violation occurs when the cost elasticity with respect to an output is negative.
160 The ratcheted maximum demand is the highest maximum demand of the businesses in the observation year or prior years.

Hence Economic Insights excluded energy delivered.[161] As energy delivered is highly correlated with ratcheted maximum demand the model will pick up the effect of energy delivered.

Reliability was not included because consistent reliability data is not available for the international distributors.[162] We are comfortable with Economic Insights not including reliability in the econometric models. A primary driver of reliability performance is capital expenditure. Expenditure on maintenance may prevent outages. However, individual network outages lead to opex associated with rectifying the outages.

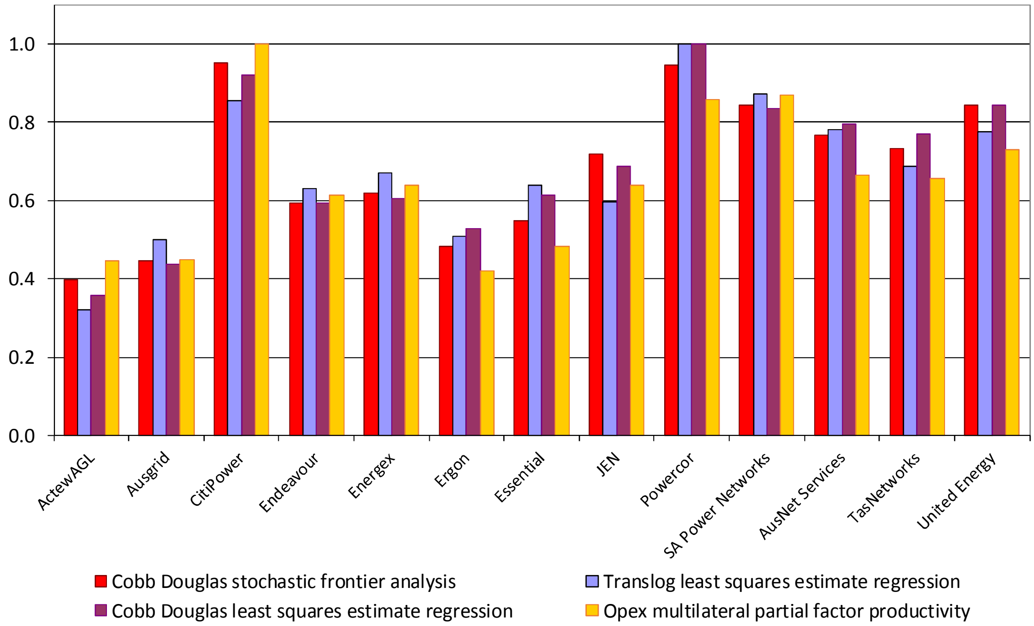
The opex cost function models also include the proportion of underground circuits as an operating environment factor. This is consistent with the MTFP analysis which has separate input indexes for overhead and underground lines. As expected the coefficient of this variable is negative. Underground cables will require less ongoing maintenance than overhead cables. Further, underground cables do not incur vegetation management costs.

Economic Insights did not include a capital input variable as equivalent data was not available in Ontario. However Economic Insights found that the aggregate capital quantity variable formed by aggregating physical measures of lines, cables and transformers and using annual user costs as weights has a very high correlation of 0.95 with the energy delivered output and of 0.94 with the ratcheted maximum demand output. Similarly the constant price capital stock variable had a correlation of 0.88 with both the customer number and ratcheted maximum demand output variables. This suggests that the omission of a capital input variable is unlikely to have a significant bearing on the results as it is likely to be highly correlated with the included output variables.[163]

Figure A-6 presents the benchmarking results for each of the econometric cost functions. This figure also presents the opex MPFP results. Figure A-6 shows that the models, despite employing different efficiency measurement techniques, the econometric models produce consistent results. Further these models are consistent with the opex MPFP results. This gives us confidence that the models provide an accurate indication of the efficiency of base year opex.

161 Economic Insights, 2014, p. 32.
162 Economic Insights, 2014, p. 32.
163 Economic Insights, 2014, p. 32.

Figure A-6 Econometric modelling and opex MPFP results



Source: Economic Insights, 2014.

All the models indicate that, prior to accounting for the effect of operating environment conditions not already factored into the modelling, there are significant efficiency differences between the frontier businesses (CitiPower and Powercor) and the NSW service providers.

Economic Insights has not accounted for all operating environment factors that may affect the benchmarking performance explicitly in the opex cost functions. However, the econometric modelling captures the important operating environment factors such as scale and density. The Cobb Douglas and Translog cost functions explicitly measure the scale effect. The inclusion of international distributors in the analysis ensures that the modelling will appropriately capture economies of scale. For example, the dataset used in the opex cost function analysis contains 88 small service providers (less than 100,000 customers). As both line length and customer numbers are included as outputs the model specification captures the customer density effect.

We consider that it is important to consider a broad range of benchmarking techniques. As such, we have also conducted partial performance indicator benchmarking. We outline the results of our partial performance indicator benchmarking in the following section.

A.3.3 Partial performance indicators

PPIs are complementary to economic benchmarking. We can compare the results from each method to crosscheck their validity. High costs on a single PPI do not necessarily indicate an inefficient level of base opex because each PPI examines only one driver of costs. However, if a service provider has high costs on several PPIs, it is likely that service provider's base level of opex is inefficient. In this respect, it is useful to compare PPI results with the economic benchmarking results.

For the purpose of PPI comparisons, we have chosen two 'per customer' metrics and used them to compare the NSW service providers to Powercor. This provides an indication of the magnitude of the NSW service providers' costs – using an alternative benchmarking technique – relative to one of the top performers for economic benchmarking.

We have presented the metrics against customer density, which is the number of customers per km of route line length. We have done this because less dense (that is, rural) service providers have more assets per customer so they appear to have high higher costs on 'per customer' metrics than urban service providers. Presenting metrics against customer density provides a visualisation of the service providers' relative densities and makes it easier to distinguish between urban providers, rural providers and those in between. This then enables more meaningful comparisons.

Powercor's customer density makes it a better point of comparison to the NSW service providers than CitiPower (the other top performer) because CitiPower is significantly denser than all other service providers. Powercor, on the other hand, is closer in customer density to Essential Energy and has a lower customer density than Ausgrid and Endeavour Energy. This means, in theory that Powercor should be at a cost disadvantage relative Ausgrid and Endeavour Energy (due to their higher customer densities).

Importantly, this is a limitation of PPIs only; it does not apply to our economic benchmarking techniques because they explicitly take customer density into account.

Operating environment considerations

PPIs do not explicitly account for operating environment factors, so we must bear this in mind when interpreting the results. However, we have taken measures to minimise the effects of operating environment factors on PPIs. To account for scale, we have normalised our PPIs by customer numbers. Customer numbers is an easily understandable output measure that reflects the relative scale of service providers. Economic benchmarking also suggests customer numbers is the most significant driver of costs.

Total customer cost

Total customer cost for network services is a partial performance measure of the costs incurred by service providers that they pass on to customers. It includes opex, return on capital,[164] and depreciation costs.[165] This indicator only includes costs incurred in providing the core 'poles and wires' component of distribution services. We have excluded costs associated with other services such as connections, metering and public lighting. This is to prevent classification of services from influencing results on this indicator. As a total cost measure, it also takes into account differences in allocation between capex and opex.

Total customer cost for network services is a good measure of asset costs and operating costs. We chose to use return on capital and depreciation costs to represent asset costs instead of capex because together, they are a better indication of asset costs than capex. Capex, which only reflects new assets in a given year, has the potential to overstate or understate asset costs.

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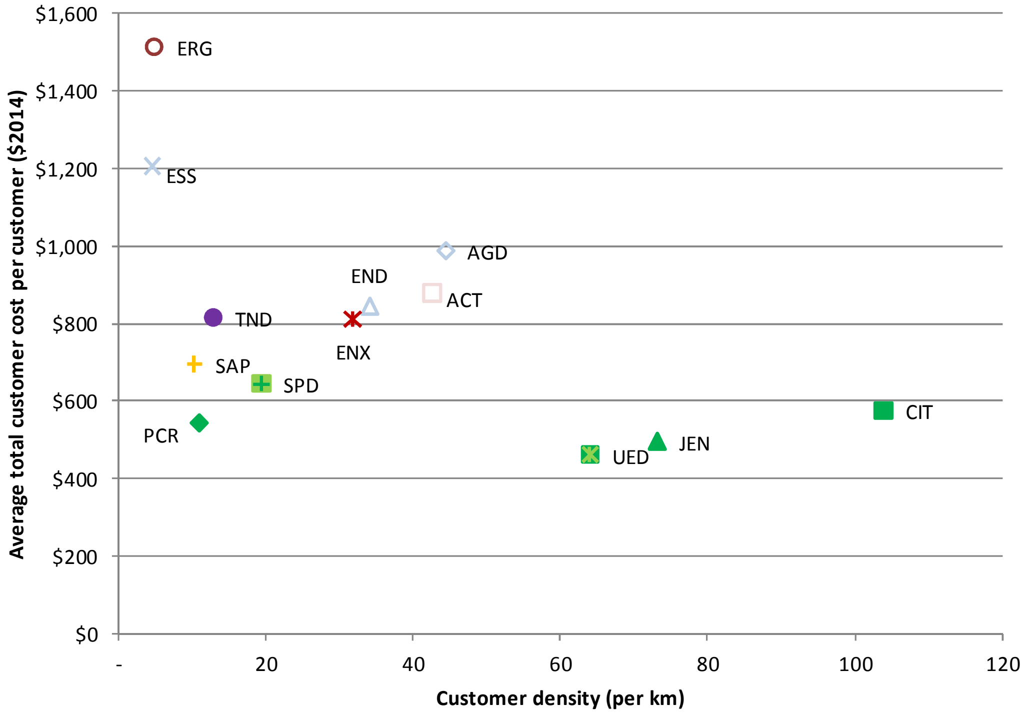
164 We have applied a real vanilla weighted average cost of capital of 6.09. In calculating this average return on capital, we applied the parameters in the AER's rate of return guideline where possible, used a market risk premium of 6.5 per cent based our most recent transmission determination, a risk free rate based on the yield 10 year CGS 365 day averaging period, and a debt risk premium based on an extrapolation of the Bloomberg BBB fair yield curve.

165 We have measured depreciation costs using straight line depreciation. Straight line depreciation entails a constant rate of depreciation over the expected life of an asset. Under this measure asset age should not affect the rate of depreciation unless fully depreciated assets are still utilised. However, asset age will influence the return on investment. The return on investment is calculated as a percentage of the total value of the RAB. This means that as an asset base gets older the return that distributors earn on it will decrease with time.

Figure A-7 Average annual total customer cost for 2009 to 2013 against customer density ($2013–14)



Source: Economic Benchmarking RIN data and AER analysis.

Figure A-7 shows that Ausgrid, Endeavour Energy and Essential Energy all have higher costs than Powercor. Endeavour Energy appears to perform better than Ausgrid and Essential Energy, due to it appearing lower. Endeavour Energy shows a similar cost per customer to TasNetworks and Energex.

Because Essential Energy has a lower customer density than Powercor, in theory, Essential Energy should be at a cost disadvantage on this 'per customer' PPI. This is because it has more assets per customer and, therefore, more costs. The economic benchmarking results appear to support this notion because Essential Energy appears to perform worse in Figure A-7 relative to Powercor than it does on the economic benchmarking results in Figure A-6.

However, the economic benchmarking results nevertheless indicate that Essential Energy's costs are higher than Powercor's. The economic benchmarking techniques explicitly account for customer density. Therefore, differences in customer density can only account for part of the cost difference between Essential Energy and Powercor. This is consistent with AGL's view in its submission on the NSW service providers' regulatory proposals. AGL noted that although there are operating environment factors that may explain some of the differences between service providers' operating expenditures, it is unable to understand why Essential Energy has a cost per customer twice that of AusNet Services which is similarly required to cover a large region.[166]

On total customer cost per customer, Ausgrid, Endeavour, and Essential appear to have high costs relative to Powercor. These results are consistent with our economic benchmarking, which does account for factors such as scale and customer density. As a result, these operating environment

166 AGL, *NSW Electricity Distribution Networks Regulatory Proposals: 2014-19 - AGL submission to the Australian Energy Regulator*, 8 August 2014, p. 16.

factors only explain a part of the cost differential between the NSW service providers and Powercor. Table A-8 below compares the NSW service providers' total customer cost per customer to Powercor's.

Table A-8 Comparison NSW service providers' average total customer costs per customer to Powercor's for 2009 to 2013 ($2013)

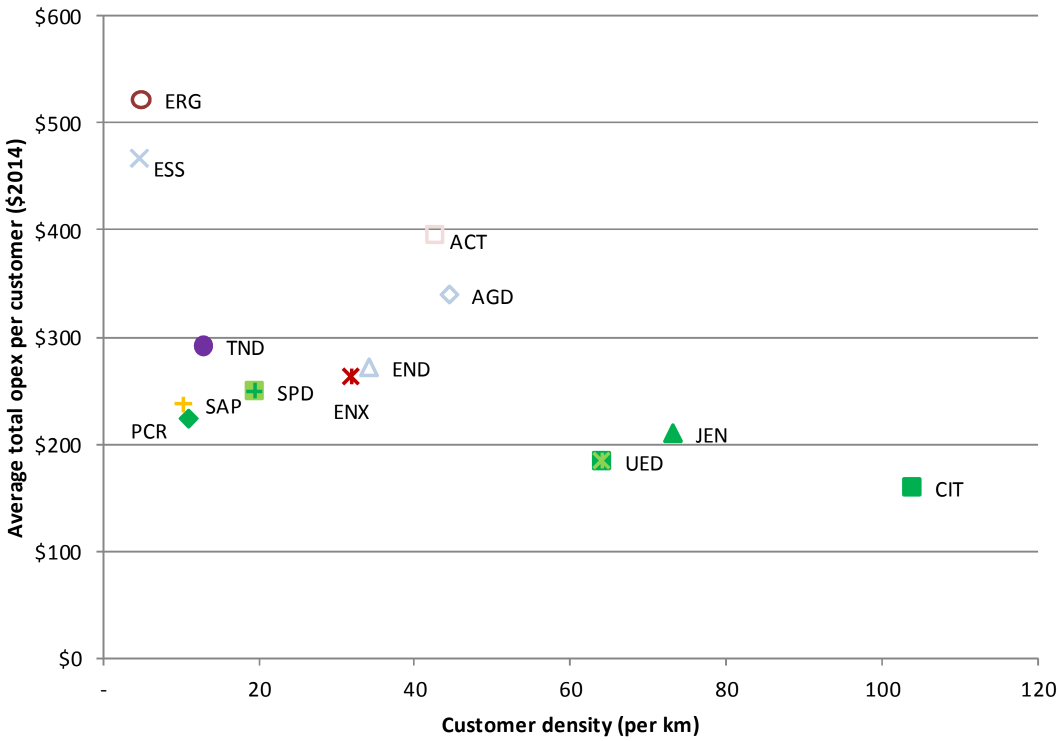
Service Provider	Cost	Difference in total customer cost per customer to Powercor	Implied efficiency score[167]
Ausgrid	$978	$440	55%
Endeavour	$836	$298	64%
Essential	$1,194	$656	45%

Source: Economic Benchmarking RIN and AER Analysis.

Total opex

This metric measures the opex cost per customer of providing core 'network services'. As with the total customer cost metric, have excluded the costs associated with other services such as connections, metering and public lighting to prevent classification of services from influencing results. This measure does not include a capital component because it measures opex only. However, we can compare the results to Figure A-7 to ensure capitalisation approaches are not materially influencing the results.

Figure A-8 Average annual opex for 2009 to 2013 against customer density ($2013-14)



Source: Economic benchmarking RIN data.

167 We calculated the efficiency scores as Powercor's cost per customer divided by that of the relevant NSW service provider.

Consistent with total user cost per customer, Ausgrid, Endeavour Energy, and Essential Energy appear to have high costs relative to Powercor. Figure A-8 also demonstrates that Endeavour Energy's opex cost per customer is not as high as Ausgrid's costs, or Essential Energy's. This is consistent with the economic benchmarking results.

Consistent with Figure A-7, Essential Energy appears to perform comparatively worse on Figure A-8 than it does on the economic benchmarking. However, as we mention above, economic benchmarking shows differences in customer density can only account for part of the cost difference between Essential Energy and Powercor.

When we consider the impact of capitalisation, comparison between Figure A-8 and Figure A-7 shows the positions of Ausgrid, Endeavour Energy and Essential Energy are largely unchanged. This indicates that their relatively high opex is not offset by lower capital costs. Table A-9 compares the NSW service providers' opex per customer to Powercor.

Table A-9 Comparison NSW service providers' average opex per customer to Powercor's for 2009 to 2013 ($2013)

Service Provider	Opex	Difference in opex per customer to Powercor	Implied efficiency score[168]
Ausgrid	$336	$115	66%
Endeavour	$269	$48	82%
Essential	$462	$241	48%

Source: Economic Benchmarking RIN.

A.3.4 Using benchmarking to estimate efficient base year opex

In the following sections we outline our reasoning on the appropriate benchmarking technique to estimate efficient base year opex. We also demonstrate the adjustments to the NSW service providers' base year opex suggested by benchmarking.

Weighing the different benchmarking techniques

We have applied a number of different benchmarking techniques. We have taken the results of each of these techniques into account when measuring relative efficiency because they complement each other and provide useful cross checks. However, on the recommendation of Economic Insights, we consider that the Cobb Douglas SFA econometric model is the most appropriate for estimating efficient base opex. We consider the characteristics and outline how we have used each of the techniques in turn below.

MPFP and our three econometric models all provide an indicator of opex efficiency between service providers. The raw efficiency score shows the relative position of the service provider under consideration to the frontier in terms of the use of opex. Conceptually, the raw efficiency score using any of these four techniques measures the extent of inefficiency prior to adjustments for modelling error and certain operating environment factors (factors that may differentiate service providers).

Each of these measures is slightly different in terms of functional form, inputs, outputs or operating environment factor coverage. The efficiency scores are, therefore, also measures of the scope of the

[168] We calculated the efficiency scores as Powercor's cost per customer divided by that of the relevant NSW service provider.

raw adjustment required to base year opex in order to develop an estimate of the total forecast opex that we would be satisfied reasonably reflects the opex criteria. Therefore, comparatively, they are slightly different measures relative to each other but provide useful cross-checks.

MTFP plays an important role as the overarching indicator of total productive efficiency and, consequently, operates as a check on the techniques that examine opex efficiency (such as opex partial MPFP and category analysis). This is necessary because a service provider could, for example, appear to be inefficient in the use of opex alone, but be efficient overall. In such a circumstance the apparent opex inefficiency may be a result of an efficient combination of opex and other inputs. As such, MTFP provides an important cross check for opex specific benchmarking approaches.

MTFP and MPFP analysis also has the advantage of being able to incorporate a broader range of inputs and outputs than the econometric techniques. For instance, our preferred MPFP model contains five outputs (energy delivered, ratcheted maximum demand, customer numbers, circuit length and minutes off supply) and four inputs (opex, overhead lines, underground cables and transformer capacity). The transformer capacity input excludes the first stage of two stage transformation at the zone substation level. Further, MTFP and MPFP are not as data intensive as other benchmarking approaches.

However, while MTFP and MPFP analysis has the advantage of producing robust results with small datasets, they are deterministic methods that do not facilitate the calculation of confidence intervals and can only directly accommodate a small number of operating environment factors.

The econometric models, on the other hand, allow the estimation of confidence intervals and explicitly account for operating environment factors. The opex cost functions specify a smaller number of outputs (customer numbers, circuit length, and ratcheted peak demand) than MPFP but account for operating environment factors such as share of underground cables and economies of scale.

The Cobb Douglas SFA model is comparatively superior to Economic Insights' other econometric techniques because it directly estimates the efficient opex cost function. In doing so it takes into account economies of scale, network density and the relationship between opex and the multiple outputs service providers face. Therefore, Economic Insights recommends Cobb Douglas SFA as the preferred model for estimating efficient base year opex.[169]

However, the Cobb Douglas LSE and Translog LSE models provide useful cross checks of the Cobb Douglas SFA model. The Translog LSE model allows for a more flexible opex cost functional form incorporating second order coefficients. Should the Translog LSE model produce inconsistent results it might indicate that the opex cost function being inappropriately captured by one of the models. The LSE and SFA Cobb Douglas models both estimate efficiency using slightly different techniques. By running both methods we can observe whether the efficiency measurement technique makes a material difference to relative efficiency performance.

The PPIs are simple, intuitive metrics that provide another perspective on the relative efficiency of networks. As the PPIs only focus on one aspect of a service provider's performance they do not provide an overall indication of efficient costs. They are, however, useful for cross checking the results from the opex models and MTFP.

169 Economic Insights, 2014, p. iv.

Table A-10 presents the raw results of our benchmarking analysis. This table indicates that the results of our benchmarking analysis are consistent. There are some differences between the efficiency techniques – particularly the PPIs (which only examine one output). However, this is expected as the benchmarking approaches differ in their characteristics. The consistency between the modelling gives us comfort the Cobb Douglas model is not producing anomalous results and is an appropriate basis for our estimate of efficient opex.

Table A-10 Quantitative raw efficiency scores compared to the frontier (per cent)

Assessment technique	Frontier business	Ausgrid	Endeavour	Essential
Cobb Douglas stochastic frontier analysis	CitiPower	45	59	55
Translog estimated least squares regression	Powercor	50	63	64
Cobb Douglas estimated least squares regression	Powercor	44	59	61
Opex multilateral partial factor productivity	CitiPower	45	61	48
Multilateral total factor productivity	CitiPower	57	70	57
Total customer cost per customer PPI	Powercor	55	64	45
Opex per customer PPI	Powercor	66	82	48

Source: AER analysis.

What the adjustment would be if we used the raw benchmarking results

Table A-11 presents our comparison of the proposed base year of the NSW service providers against estimated efficient base year opex based solely on the benchmarking results. As we explain above, if we made an adjustment based on benchmarking alone, we would use the Cobb Douglas SFA model. Table A-11 presents the implied reduction in opex the Cobb Douglas SFA model predicts would be required to catch up to the frontier service provider.

Table A-11 Implied reduction to proposed base year opex predicted by benchmarking before adjustments

	Ausgrid	Endeavour	Essential
Proposed base opex (adjusted)[a]	488.6	224.0	414.9
Benchmarking estimate of efficient base opex	268.6	165.7	223.2
Implied reduction	241.0	72.6	204.4
Implied percentage reduction to reach full efficiency[b]	49%	32%	49%

Note: (a) we have adjusted the service providers' proposed opex for debt raising costs, new CAM (if applicable) and new service classifications.
(b) implied opex reduction is relative to proposed base opex whereas the CD SFA efficiency score is relative to average opex performance over 2006 to 2013.
Source: AER analysis.

The results of the models presented here reflect the average distance from the frontier for the service providers over the benchmarking period.[170] Consequently this does not directly compare to the service providers' base year opex (which is 2012–13) because the average opex will reflect their average network characteristics over the eight year period.

[170] Economic Insights, 2014, p. 46.

Hence, to calculate our estimate of efficient base year opex we have, on the recommendation of Economic Insights, trended forward the average efficient opex by the change in outputs, input prices[171] and technical efficiency to properly reflect conditions in the base year. This is consistent with our approach to trending forward expenditure for the 2014–19 period using our rate of change approach but relies on fewer assumptions because we can use actual observed output growth (rather than a forecast). For this reason, the percentage reductions in Table A-11 are different to those implied by the raw Cobb Douglas SFA results in Table A-10.

As we mention above, the Cobb Douglas SFA model takes into account several operating environment factors, including economies of scale, network density and the relationship between opex and the multiple outputs service providers face. It does not, however, account for all operating environment differences. In addition, an adjustment based on the Cobb Douglas SFA model alone does not take into account:

- consideration of findings from detailed review or other qualitative analysis of the service providers' regulatory proposals and supporting information
- the potential for modelling or data issues.

Given this, we consider it would be inappropriate to make adjustments to base year opex on the basis of raw results alone. Rather, we prefer to holistically consider the results of our quantitative and qualitative analysis in forming a view on the appropriate adjustment. We present the ultimate adjustments in section A.6.

171 Also referred to as real prices in the expenditure forecast assessment guideline.

A.4 Sources of inefficiency or high expenditure in the base year

We have used detailed review to investigate supporting evidence for the benchmarking results in the detail of the service providers' historic expenditure. We have:

- examined the service providers' explanations of opex drivers in their regulatory proposals and supporting material
- conducted category analysis benchmarking for major categories of opex
- undertaken detailed reviews of two key expenditure categories:
  - labour costs
  - vegetation management (Essential Energy only).

The aim of this detailed review is not to identify all inefficiencies in the practices of the NSW service providers or in their base year opex, or to explain all reasons for the gap in performance compared to their peers. As we state in section A.2, inefficiencies can manifest themselves in many ways and may not be easy to identify. This evidence, therefore, does not necessarily explain the entire performance gap quantified in the benchmarking.

Our findings reveal a diverse – but consistent – body of evidence that supports the view that the service providers' proposed base year opex is not reflective of the base costs that would be appropriate for the purposes of forecasting expenditure over the 2014–19 period in accordance with the opex criteria. Therefore, we are satisfied the results of these investigations support the overall benchmarking results.

A.4.1 Findings from the service providers' proposals

As we explain in section A.2, we develop our own estimate of total forecast opex to assess a service provider's proposal. However, to support that estimate, this section presents some evidence from the service providers' regulatory proposals (and subsequent submissions) support the findings that there are inefficiencies in their historical opex.[172] They are in the process of transitioning to more efficient opex levels over time. Endeavour Energy began implementing reforms ahead of its NSW peers, but it acknowledges there is further scope for efficiencies that it has yet to realise. This material is consistent with the results of our benchmarking. In particular:

- each of the NSW service providers state in their proposals and submission on the AER's issues paper that they have surplus labour due to reduced capex requirements and the cessation of transitional service agreements (resulting from the sale of retail businesses). All three service providers are facing stranded labour problems due to reductions in capex.[173] The NSW service providers suggest they will not reduce their workforces to efficient levels immediately and consumers should fund the costs of voluntary redundancies or other measures to transition to a more efficient level of expenditure.[174]

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172 Ausgrid, *Regulatory Proposal*, May 2014, p. 59; Essential Energy, *Regulatory Proposal*, May 2014, p. 78; Endeavour Energy, *Regulatory Proposal*, May 2014, p. 76; NSW DSNPs, *Submission on AER issues paper*, pp. 12-16.

173 Ausgrid, *Regulatory Proposal*, May 2014, p. 59; Essential Energy, *Regulatory Proposal*, May 2014, p. 78; Endeavour Energy, *Regulatory Proposal*, May 2014, p. 76; NSW DSNPs, *Submission on AER issues paper*, pp. 12-16.

174 Networks NSW, *Submission on AER issues paper*, pp. 12-16.

- each NSW service provider submitted, with its regulatory proposal, a Networks NSW document entitled *Delivering efficiencies for our customers*.[175] This document indicates that NSW service providers have not been operating or investing in their networks efficiently in the past. Despite this, their forecasts are relatively similar to past expenditure levels.

Labour practices

Each of the NSW service providers state in their proposals that they have surplus labour. For example, Ausgrid and Essential Energy state they are facing a “pool of excess resources” due to reduced capex requirements and the cessation of transitional service agreements (resulting from the sale of retail businesses). They are proposing voluntary redundancies to transition their labour workforces to "sustainable" levels.[176] Endeavour Energy faced similar problems, albeit somewhat earlier than Ausgrid and Essential Energy.[177]

While the NSW service providers have each proposed efficiencies to largely offset the costs (some of which came into effect towards the end of the 2009–14 period) they consider are associated with becoming more efficient, their acknowledgement of inefficiency supports our view that their base year opex (that is, their historical expenditure) is materially inefficient for the purposes of developing a forecast for the 2014–19 period. Excess labour in capex also provides us with an indication of inefficient labour management and engagement practices.

In addition, the NSW service providers' regulatory proposals and submission on the AER's issues paper suggest they expect consumers to fund the costs of voluntary redundancies or other measures to transition to an efficient expenditure base. Essential Energy and Ausgrid, for example, state in their regulatory proposals that:[178]

> While [cost restructuring] is a prudent option that ensures customers will not bear the financial burden of maintaining a workforce and other support costs (e.g. property / IT) in excess of requirements, [we] nevertheless [are] employer[s] with certain legislative obligations to [our] employees, some of whom have been with us for a long period of time. We must meet these obligations.

In their submission on the AER's issues paper, the NSW service providers state:[179]

> Nevertheless, because of the impact on the cost base, the NSW DNSPs must take prudent action, within the confines of the Fair Work Act, to restructure the business to ensure a sustainable and efficient cost base going forward. In this respect, the NSW DNSPs’ proposed opex forecasts for 2014- 19 include restructuring costs to reduce the size of the workforce, which primarily relate to voluntary employee redundancy. We note that we are legally obliged to pay voluntary redundancy costs when staff exit the businesses.

We expect all service providers to comply with their legal obligations, whether those obligations arise in legislation, contract or some other legal duty. They must comply with, for example, the *Fair Work Act 2009* and other relevant laws in providing their services. However, the presence of a legal obligation, by itself, is insufficient to justify us providing opex for a particular item. Service providers undertake many significant activities by agreeing to enter into legally binding arrangements. Enterprise agreements are one example of this. If a contractual or legal obligation was sufficient to justify the provision of opex, it would curtail the scope for us to undertake efficiency assessments.

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175 Ausgrid, *Attachment 1.01 to Regulatory Proposal*; Endeavour Energy, *Attachment 0.02 to Regulatory Proposal*; Essential Energy, *Attachment E.1 to Regulatory Proposal*.
176 Ausgrid, *Regulatory Proposal*, May 2014, p. 59; Essential Energy, *Regulatory Proposal*, May 2014, p. 78.
177 Endeavour Energy, *Regulatory Proposal*, May 2014, pp. 79–80.
178 Ausgrid, *Regulatory Proposal*, May 2014, p. 59; Essential Energy, *Regulatory Proposal*, May 2014, p. 78.
179 NSW DSNPs, *Submission on AER issues paper*, pp. 13-15.

The NER require us to establish the total opex that we are satisfied reasonably reflects the opex criteria. In particular, this includes the efficient costs of an objectively prudent service provider to achieve the opex objectives for the service provider's service area. We do not seek to interfere in the decisions a service provider will make about how and when to spend this total opex allowance to run its network, including the particular legal obligations it enters into to do so. The service provider is free to choose how to manage its allowance.

Therefore, if a service provider ultimately spends inefficiently or imprudently, it will bear those additional costs and, conversely, if it achieves efficiencies it may make additional profits. This is a core feature of incentive based regulation and is intended to reflect the conditions that would be faced by businesses operating in a competitive environment.

On the information before us, we are not satisfied that the NSW service providers have made a sufficiently robust argument for why consumers should share in funding their transition to an efficient level of opex.

Given the prominence of labour issues in the regulatory proposals, submissions and our category analysis benchmarks, we engaged Deloitte to conduct a detailed labour review. Section A.4.2 contains our analysis.

Opex forecasts

While each NSW service provider has proposed efficiencies in its forecast, they have all forecast stable or increasing opex. Given the efficiencies the NSW service providers have identified we would expect to see decreases in opex.

The NSW service providers have identified efficiencies that they have incorporated into their forecasts. These include opex savings from the network reform program and business led efficiencies. Networks NSW has said that it forecasts that the network reform program will lead to $147 million[180] in opex savings across the NSW service providers by financial year 2017.[181] In total the NSW service providers forecast that the network reform program and their cost saving initiatives will deliver total efficiencies of $839 million ($2014), before implementation costs, over the actual 2014–2019 period.

Table A-12 NSW service providers forecast opex efficiencies and implementation costs 2014–15 to 2018–19

Service Provider	Opex efficiencies identified ($million, 2013–14)	Implementation costs ($million, 2013–14)	Opex efficiencies as a percentage of opex without efficiency savings
Ausgrid	$230	$106	7.8%
Endeavour[182]	$304	n/a	n/a
Essential	$291	$95	11.5%

Source: Ausgrid, *Regulatory proposal*, May 2014, p. 51; Endeavour Energy, *Regulatory proposal*, May 2014, p. 87; Essential Energy, *Regulatory proposal*, May 2014, pp. 73, 79.

180 Networks NSW does not explain if these are real or nominal dollars.
181 Networks NSW, *Delivering Efficiencies for our customers*. May 2014, p. 3.
182 Endeavour Energy did not provide information on the total value of the implementation costs for its efficiency programs in its regulatory proposal.

However, these efficiencies seem to come at a cost. All of the NSW service providers have identified costs associated with improving their efficiency. Endeavour Energy has estimated the costs of loss of synergies and reduced capital investment over the 2009–14 period as a step change but states it is fully eliminating the cost impacts.[183] As we explain above, however, Endeavour Energy is nevertheless seeking redundancy costs in its regulatory proposal.

Essential Energy suggests the substantial decrease in its forecast capex programs will result in an increase in opex in the 2014–19 period, stating the decrease in forecast capex:[184]

> …creates a step-up in our operating expenditure compared to our base year. This step-up reflects the costs of aligning our labour force, reallocating overheads and undertaking additional maintenance expenditure.

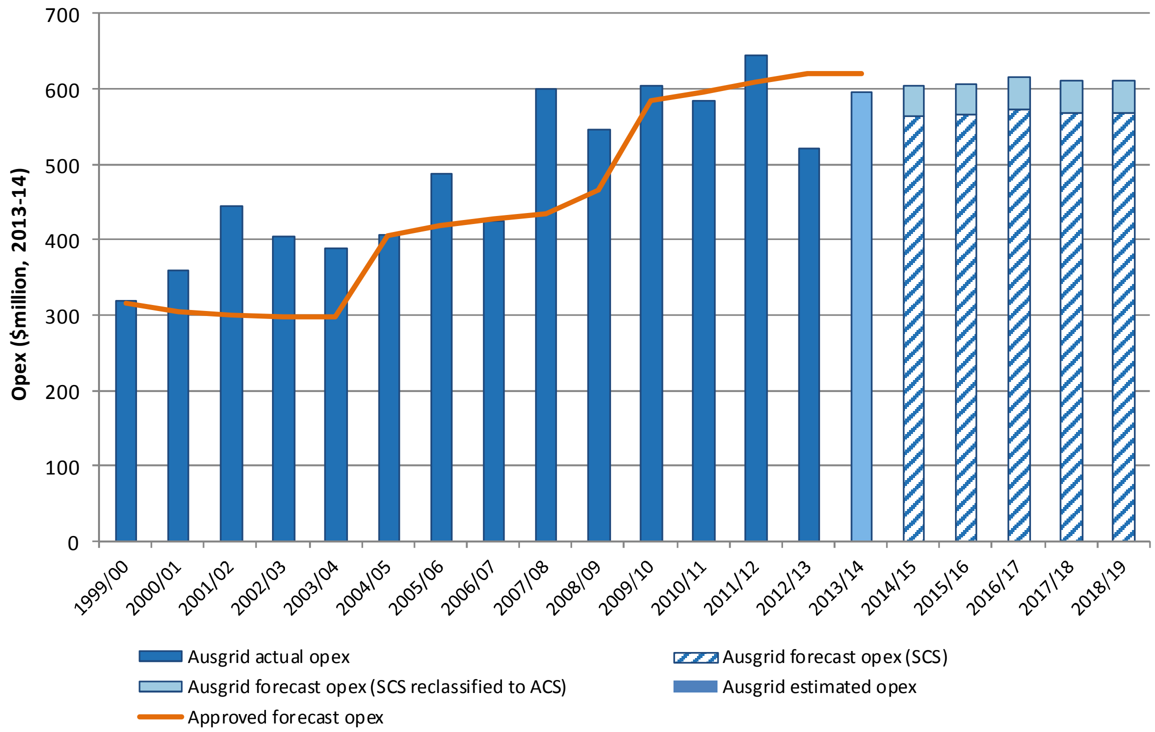
Ausgrid is proposing $105.5 million of 'implementation expenditure' to achieve its proposed $230.4 million of productivity improvements.[185]

In addition, the NSW service providers have all reclassified certain expenditures from standard control services to alternative control services to account for the reclassification of metering and ancillary network services. When we consider the impact of the reclassification, it becomes apparent that proposed total forecast opex levels are close to or higher than actual expenditure at the end of the 2009–14 period, which was a period of significant opex spending (see Figure A-9 to Figure A-11). This raises a question about the extent to which the service providers are actually proposing to improve their opex efficiency over the forecast period.

In accordance with the NER we have made our draft determination on the *total* forecast opex required by each of the NSW service providers.[186] We discuss the service providers' forecasting approach in appendix D.

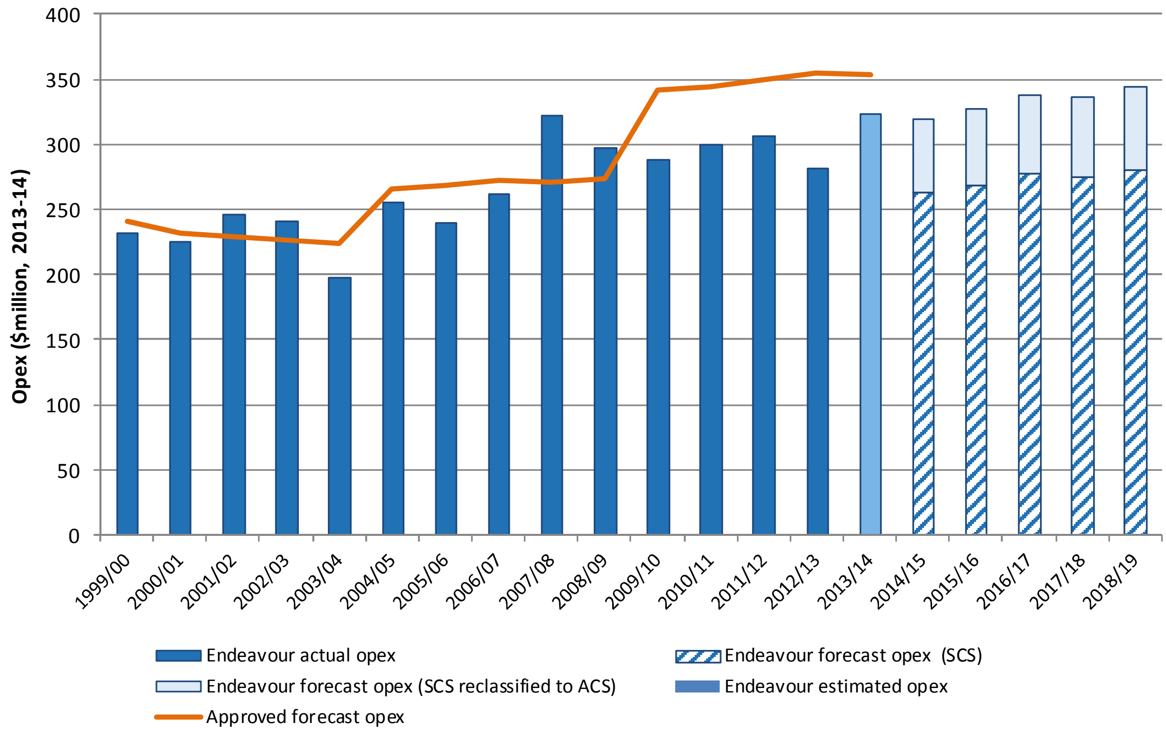
183 Endeavour Energy, *Regulatory Proposal*, May 2014, pp. 80, 86.
184 Essential Energy, *Regulatory Proposal*, May 2014, p. 74.
185 Ausgrid, *Regulatory Proposal*, May 2014, p. 58.
186 NER, cl. 6.12.1(4).

Figure A-9 **Ausgrid's past and forecast total opex, including reclassified services ($million, 2013-14)**



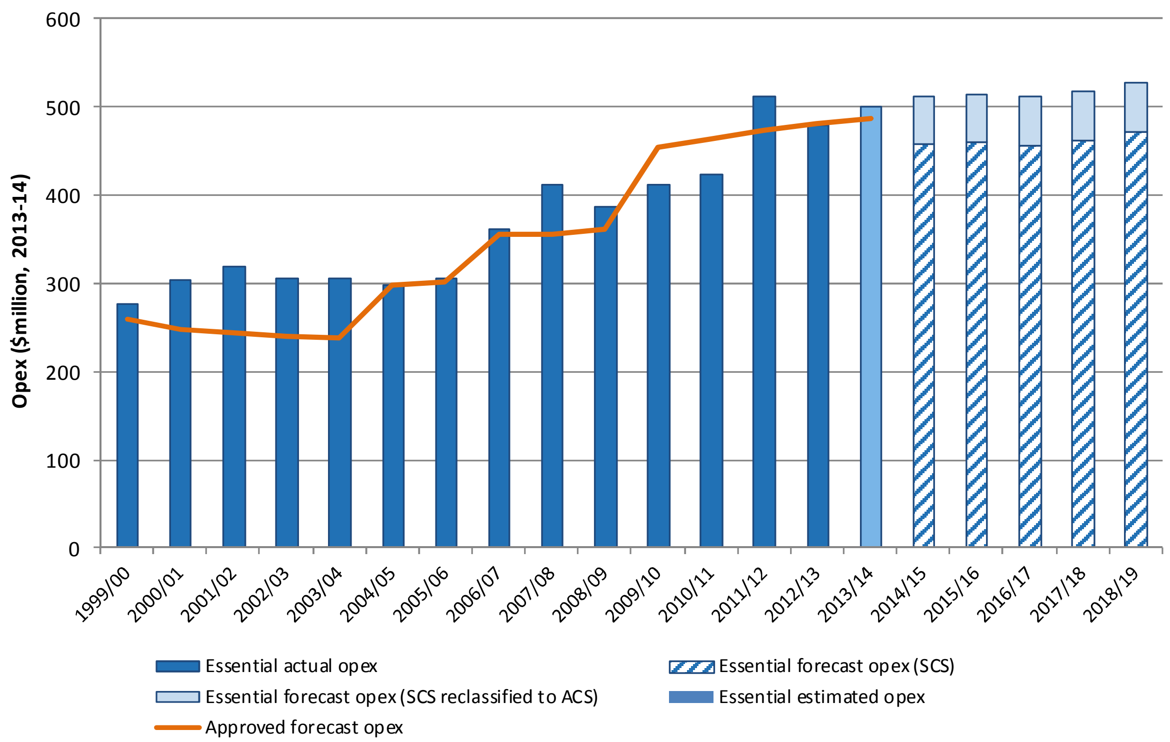
Source: AER analysis.

Figure A-10 **Endeavour Energy's past and forecast total opex, including reclassified services ($million, 2013-14)**



Source: AER analysis.

Figure A-11 Essential Energy's past and forecast total opex, including reclassified services ($ million, 2013–14)



Source: AER analysis.

A.4.2 Category analysis

Category analysis metrics are PPIs that focus on particular categories of opex in isolation. They are, therefore, the next level of detail below the total cost and total opex PPIs we presented in section A.3.3. We would not necessarily expect every metric to produce the same results because service providers may allocate opex across the categories differently. This is relevant to our analysis. For instance, a source of apparent inefficiency in the base year could be due to costs associated with a particular category of opex, for which there is a reasonable explanation for the high costs. Similarly, a service provider could appear to perform well on some category metrics but be inefficient overall. Category analysis is, however, useful for identifying areas of high cost and potential inefficiency.

Broadly, our analysis suggests that on the majority of the category analysis measures the NSW service providers appear to have high costs relative to most other service providers. Table A-13 shows a summary of the results. A service provider is 'high' when it appears above most of its peers and 'comparable' where the gap is less distinct. 'Very high' indicates a substantial gap between most service providers. We consider the results are consistent with and support the findings of our economic benchmarking techniques.

Table A-13 Summary of category analysis metrics – NSW service providers' relative costs (average over 2008–09 to 2012–13)

	Ausgrid	Endeavour	Essential
Labour	Very High	High	Very High
Total overheads	Very High	High	Very High
Total corporate overheads	Comparable	Comparable	High
Total network overheads	Very High	Comparable	Comparable
Maintenance	High	High	Comparable
Emergency response	High	High	High
Vegetation management	High	High	Very High

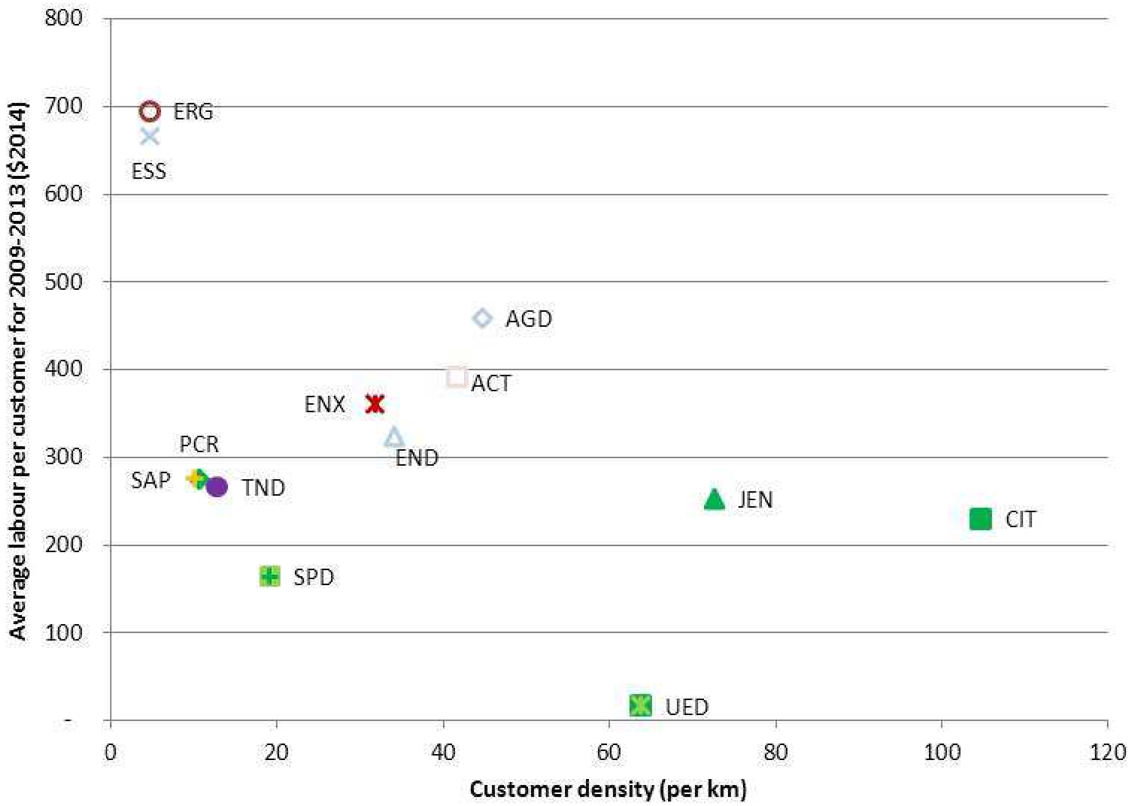
Source: AER analysis.

Given the NSW service providers generally perform poorly on category analysis for most categories of expenditure, we consider this supports the view that it is likely systemic issues exist across the service providers. The results of the labour and total overhead metrics (which are broader measures) tend to support this view as well. We discuss each metric below.

Labour

Figure A-12 measures labour costs per customer, normalised by customer density. Labour expenditure, in this context, only applies to costs incurred for internal labour. It excludes the labour costs of external contractors. We have used labour expenditure rather than the number of staff because labour expenditure is a better indicator of the costs faced by service providers than staff numbers. Staff numbers may provide an indirect indicator, but due to differences in wages, firms with similar staff numbers may have different labour expenditures

Figure A-12 Average annual labour expenditure per customer for 2009 to 2013 ($2013–14)



Source: Category analysis RIN data and economic benchmarking RIN data.

Figure A-12 shows that Endeavour Energy appears to have high labour costs per customer relative to AusNet, SA Power Networks, Powercor and TasNetworks. While Endeavour Energy also appears higher than JEN, UED and CitiPower, it is significantly less dense. Given 'per customer' metrics tend to favour higher density service providers, we must bear this in mind when comparing Endeavour Energy to these businesses.

Ausgrid and Essential Energy appear to have very high costs relative to most service providers. These results are consistent with our economic benchmarking. Although Essential Energy has very low customer density, and some of the observed cost differential will be due to that, we consider that it is still appropriate to compare it to other service providers with predominantly rural service areas or which cover very large territories, such as SA Power Networks and Powercor. Further, given the results of the economic benchmarking, it is unlikely that the large gap between Essential Energy and these other rural service providers can solely be due to customer density.

Because this metric excludes contractor costs, contracting policies are likely to affect service providers' relative positions on this metric. This is likely why UED – who over the benchmarking period outsourced almost all of its opex – has such low labour costs per customer compared to everyone else.

The results in Figure A-12 are consistent with the total customer cost PPI and (bearing Essential Energy's customer density in mind) the economic benchmarking results. This indicates that lower costs in other areas do not offset relatively high labour costs for these businesses at the total level.

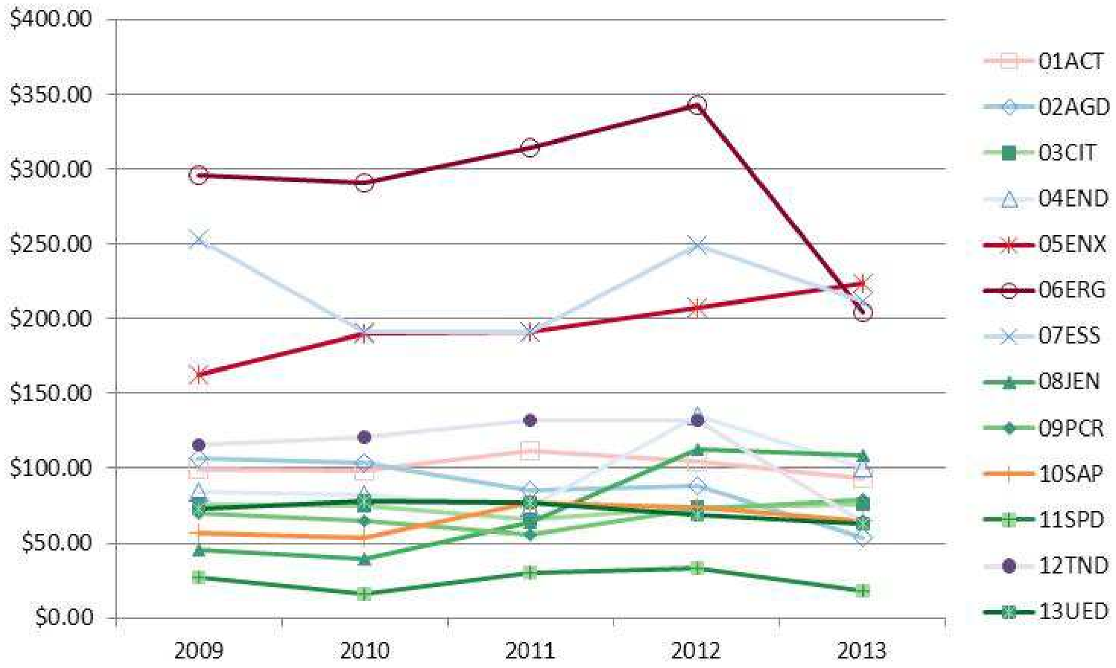
Corporate overheads

Corporate overheads, in this context, are all expensed and capitalised overhead costs allocated to standard control services that are not directly attributable to operating an electricity distribution system (that is, not network overheads). Among other things, these include costs incurred by legal, finance, and human resources functions. We have measured total corporate overheads rather than corporate opex overheads because opex overheads are affected by service providers' capitalisation policies.

We have not presented this metric against customer density. Customer density should not greatly affect the level of corporate overheads a service provider incurs because corporate overheads should be largely fixed costs.

Figure A-13 shows the average spends for Essential Energy are well above that for most service providers. These results are consistent with our economic benchmarking. However, Ausgrid and Endeavour's spends are comparable to that of most service providers.

Figure A-13 Corporate overheads per customer 2009 to 2013 ($2013–14)



Source: Category analysis RIN data and economic benchmarking RIN data.

Network overheads

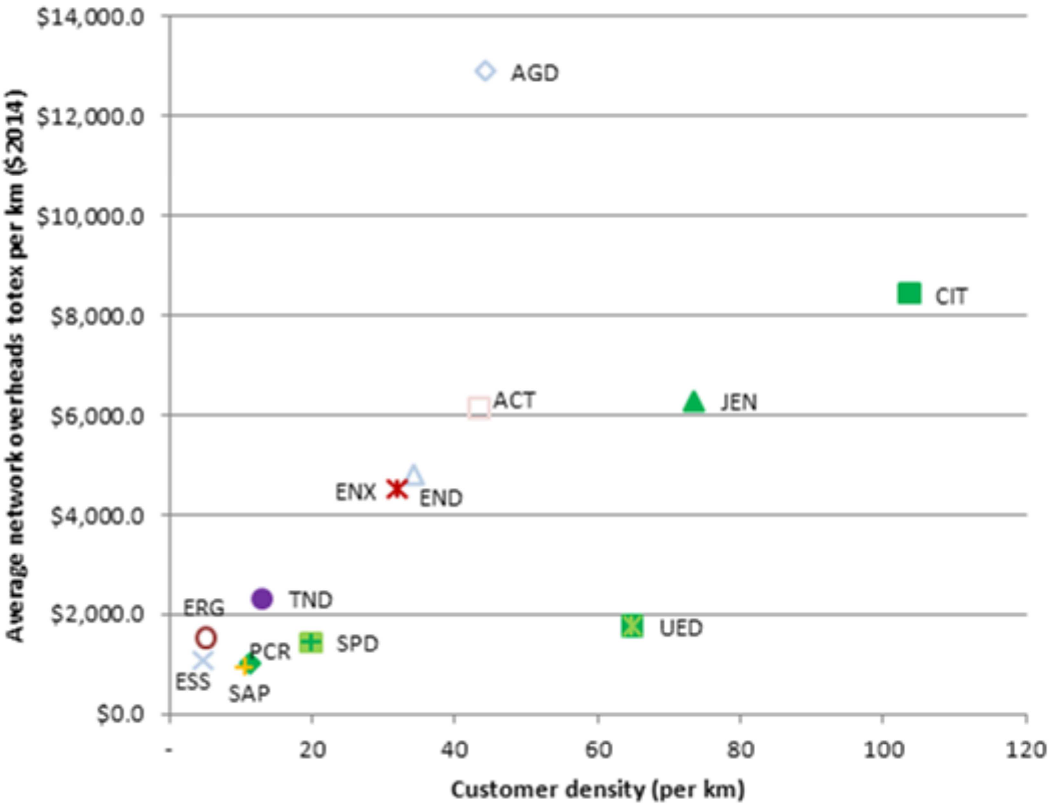
Network overheads are all expensed and capitalised overhead costs allocated to standard control services that are directly attributable to operating an electricity distribution system. Among other things, these include costs incurred by network planning and asset management functions.

We chose total network overheads per customer because network overheads are likely to vary with changes in the amount of work done on the network. Customer numbers are a good proxy for this. We chose to normalise network overheads costs by circuit kilometre because asset volumes are more likely to drive network overhead costs than customer numbers. We have used circuit length as a proxy for assets. Circuit length is a more easily understandable and intuitive measure than capacity measures such as transformer capacity or circuit capacity.

When making comparisons on 'per kilometre' metrics against customer density, we need to bear in mind that service providers with low customer densities should appear more favourably than those with high customer densities. Lower density service providers are typically larger networks with many kilometres of line to serve sparsely located customers. While this generally means they tend to have high 'per customer' costs, they also have low 'per kilometre' costs.

'Per kilometre' metrics, therefore, typically favour rural service providers over urban service providers. For example, because Ausgrid and Endeavour Energy have lower customer densities than JEN they should, in theory, also have lower costs per kilometre on this PPI.

Figure A-14 Average network overheads per circuit km for 2009 to 2013 against customer density ($2013–14)



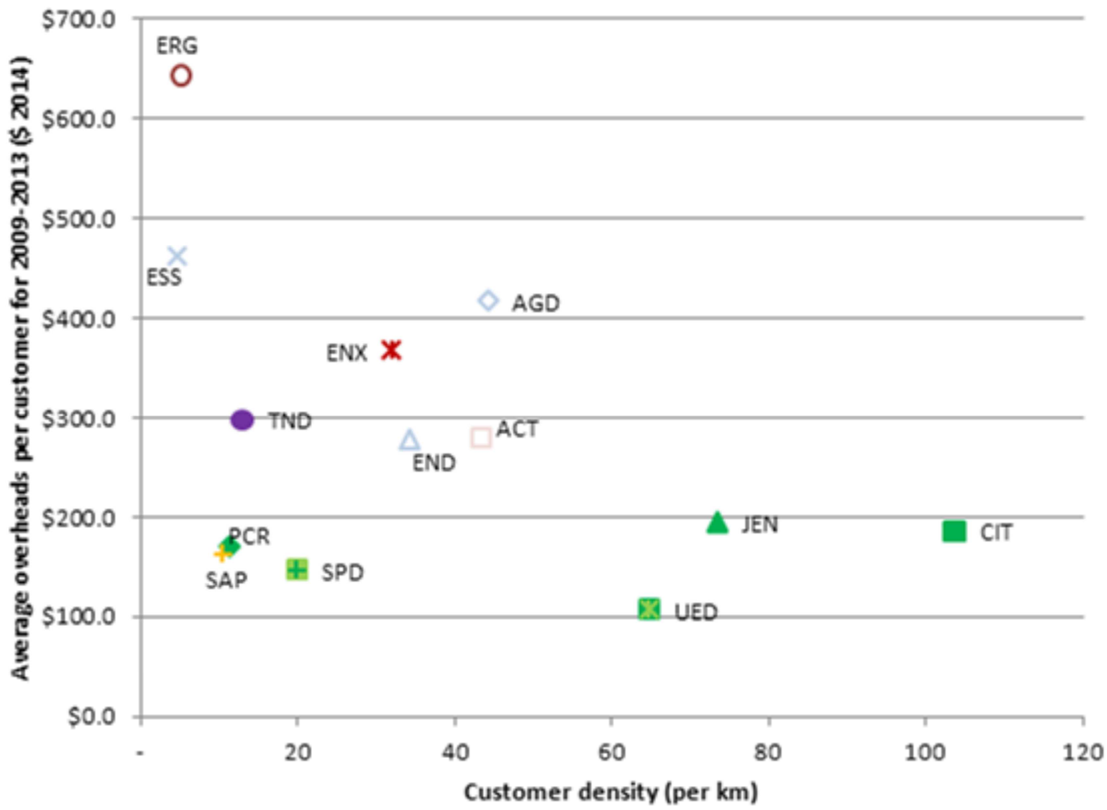
Source: Category analysis RIN data and economic benchmarking RIN data.

Ausgrid appears to have very high costs relative to ActewAGL, Energex, Endeavour Energy, CitiPower, JEN, and UED. Essential Energy and Endeavour Energy however, appear to have network overhead costs that are comparable to service providers with similar densities. However, given Essential Energy's much lower density, we would expect to see it on a lower position than all other service providers.

Total overheads

Total overheads are the sum of corporate and network overheads for both capex and opex allocated to standard control services. We have used total overheads allocated to both capex and opex to ensure that differences in capitalisation policies do not affect the analysis. It also mitigates the impact of service provider choices in allocating their overheads to corporate or network services.

Figure A-15 Average overheads per customer for 2009 to 2013 against customer density ($2013–14)



Source: Category analysis RIN data and economic benchmarking RIN data.

Figure A-15 shows that Endeavour Energy appears to have high costs relative to all Victorian service providers and SA Power Networks, but lower costs than Energex, Ausgrid and TasNetworks. Ausgrid and Essential Energy appear to have very high costs relative to most of their peers.

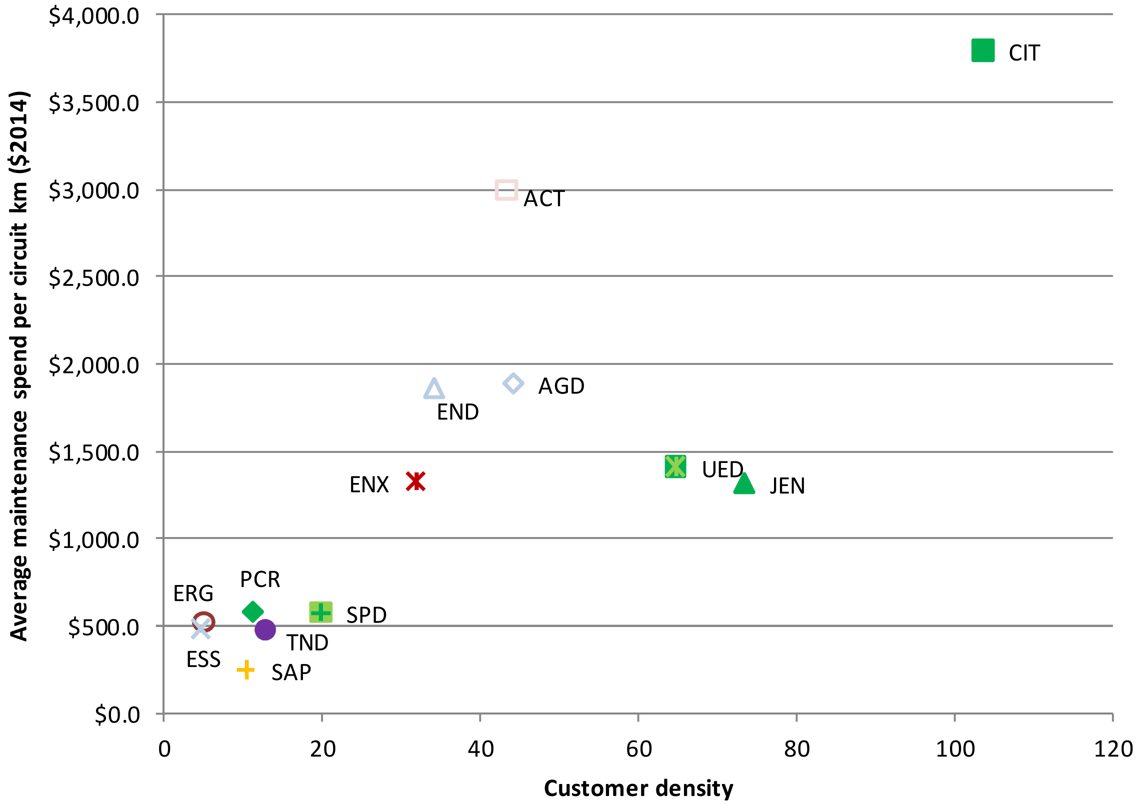
On this 'per customer' metric, Essential Energy will appear higher than all service providers other than Ergon Energy (due to its similarly low customer density). However, differences in customer density can only account for part of the cost difference between Essential Energy and SA Power Networks and Powercor, who are also rural (albeit slightly more dense). This is consistent with the economic benchmarking results, which do account for customer density and show Essential Energy has high costs relative to its peers.

Maintenance

Maintenance expenditure relates to the direct operating costs incurred in maintaining poles, cables, substations, and SCADA, but excludes vegetation management costs and costs incurred in responding to emergencies.

We chose maintenance per circuit kilometre because assets are more likely to drive maintenance costs than customer numbers. We used circuit length because it is a more easily understandable and intuitive measure of assets than transformer capacity or circuit capacity.

Figure A-16 Average maintenance per circuit km for 2009 to 2013 against customer density ($2013–14)



Source: Category analysis RIN data and economic benchmarking RIN data.

Figure A-16 shows that Ausgrid and Endeavour Energy appear to have high costs relative to Energex, JEN and UED.

Essential Energy appears to have costs that are comparable to the other rural service providers. However, Essential Energy, as the least dense service provider, should, in theory, have lower costs per kilometre than more dense service providers such as TasNetworks and SA Power Networks.

Emergency response

Emergency response expenditure is the direct operating cost incurred in responding to network emergencies, excluding costs associated with major event days. We excluded major event day emergency response costs and interruptions because major events are outside of the control of service providers.

We chose emergency response per interruption because the number of supply interruptions is more likely to drive emergency response costs than customer numbers. We used supply interruptions rather than interruption duration because the number of interruptions is more likely to drive emergency response costs than the duration of interruptions. Where there is an interruption, there must be expenditure to correct it. The duration of an interruption should not impose emergency response costs on the service provider. There may be other costs imposed on the service provider such as lost revenue or Guaranteed Service Level payments, but these are not emergency response costs.

It is possible to make comparisons between service providers of different densities on this metric because customer density should not affect the average emergency response spend per interruption. Although customer density does not appear to affect costs, we have measured emergency response costs against customer density because the average spends against customer density are easier to read than the time trend of expenditures.

Figure A-17 shows the range of service providers' emergency response expenditure per interruption is relatively narrow.

Figure A-17 Average emergency response expenditure per interruption for 2009 to 2013 against customer density ($2013–14)

Source: Category analysis RIN data and economic benchmarking RIN data.

Ausgrid, Endeavour Energy and Essential Energy appear to have high costs relative to most other service providers. These results are consistent with our economic benchmarking.

Vegetation management

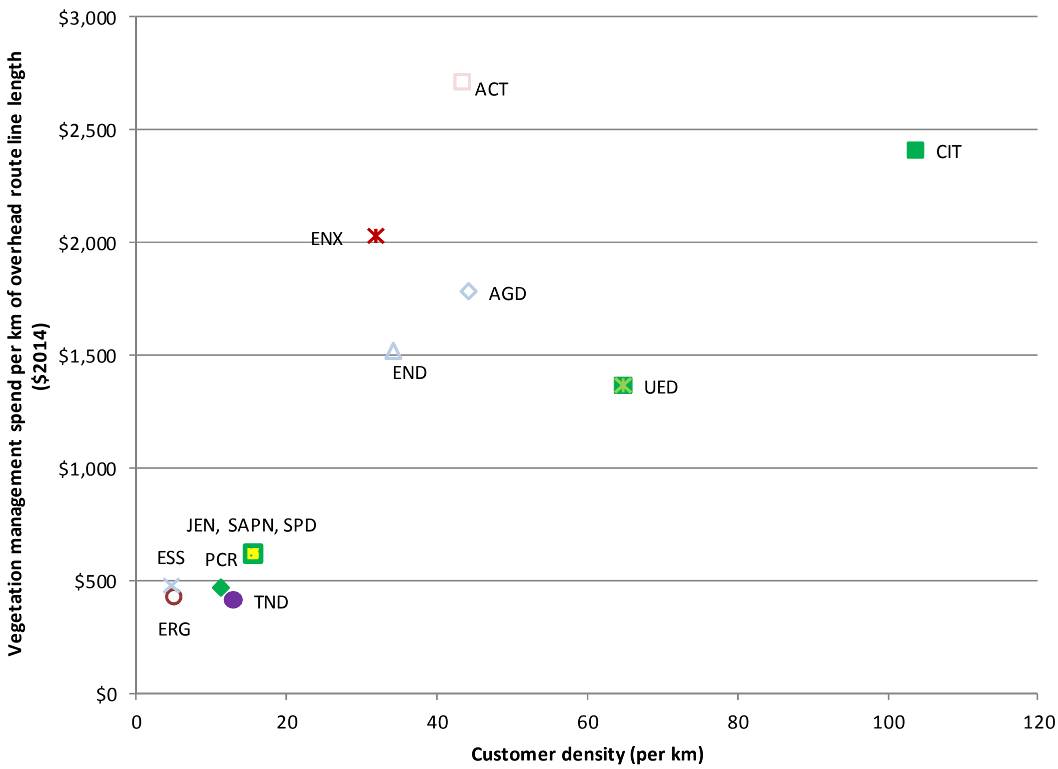
Vegetation management expenditure includes tree trimming, hazard tree clearance, ground clearance, vegetation corridor clearance, inspection, audit, vegetation contractor liaison, and tree replacement costs.

We chose vegetation management per kilometre of overhead route line length because the length of overhead lines is more likely to drive vegetation management costs than customer numbers. We used overhead route line length rather than maintenance span length or circuit length.

Ideally, we would use maintenance span length. Maintenance span length measures the length of service providers' lines that have undergone vegetation management in the preceding twelve months. However, service providers' estimation assumptions seem to influence the data on maintenance spans. For some service providers maintenance spans are only a small part of overhead route line length, while for others they makes up the vast majority of overhead route line length. Therefore, we consider overhead route line length is a better measure of the area of network that requires vegetation management.

We have not used circuit length because it could understate costs per kilometre when multiple circuits run through the same vegetation (if, for example, poles support more than one circuit). This is because vegetation management for one circuit should equally affect the other. Our definition of route line length requires service providers to count the length of only one circuit where two circuits run in parallel.

Figure A-18 Average vegetation management costs per kilometre of overhead line length for 2009 to 2013 against customer density ($2014)

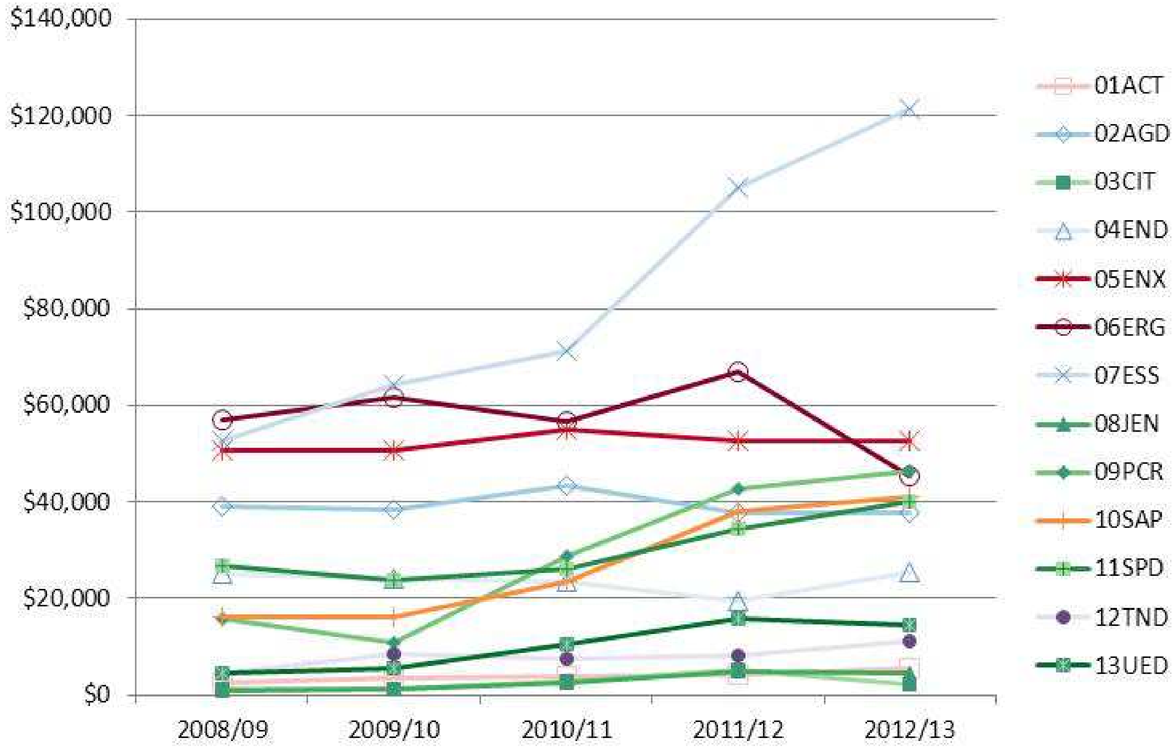


Source: Category analysis RIN and Economic benchmarking RIN.

Figure A-18 shows Ausgrid and Endeavour Energy appear to have high costs relative to UED but lower costs compared to Energex, ActewAGL and CitiPower. Essential Energy appears to have slightly higher vegetation management costs relative to Ergon Energy, Powercor, and TasNetworks. As a 'per kilometre' metric, Figure A-18 will favour rural businesses. Given this, Essential Energy, as the least dense service provider, should have lower costs per kilometre than more dense service providers such as TasNetworks and SA Power Networks.

We have also chosen to present the trend in total vegetation management costs. It demonstrates a significant increase in vegetation management costs over the period 2009 to 2013 for Essential. Over the period 2009 to 2013, Essential's direct vegetation management costs increased from $53 million ($2013–14) to $121 million. Over the same period, there have also been significant increases for the some other service providers. Figure A-19 is not normalised by an output so service providers are not directly comparable. However, Ergon Energy, which has a similarly sized rural network, has had relatively stable vegetation management costs over the period.

Figure A-19 Total vegetation management costs 2009 to 2013 ($'000, 2014)



Source: Category analysis RIN data

We have undertaken a detailed review of Essential Energy's vegetation management program in section A.4.3 due to the increase in its expenditure over the period 2009 to 2013. Essential Energy also identified that its vegetation management costs were inefficient in its regulatory proposal.[187]

A.4.3 Detailed review

Our analysis in the above sections provides clear evidence of material inefficiency in the NSW network service providers' revealed opex. In particular, the NSW service providers' regulatory proposals identify problems with surplus labour. Category analysis metrics also show that their labour costs are a likely source of material inefficiency. In addition, Essential Energy's regulatory proposal and category analysis both suggest Essential Energy's vegetation management expenditure is worth investigating further. As a result, we conducted a detailed review of these topics.

Labour

Labour costs are the largest component of the NSW service providers' opex, accounting for more than 70 per cent of total opex.[188] As we explain in section A.4.1, the NSW service providers' regulatory proposals and supporting information suggest historical inefficiencies in labour. Our economic benchmarking and category analysis results and submissions on the AER's issues paper[189]

[187] Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, p. 9.

[188] See, for example, NSW service provider responses to annual RINs for 2012–13.

[189] See, for example, AGL, *NSW Electricity Distribution Networks Regulatory Proposals: 2014–19 - AGL submission to the Australian Energy Regulator*, 8 August 2014, p. 9; Origin, *Submission to NSW Electricity Distributors' Regulatory Proposals*, p. 21; EUAA, *Submission to NSW Electricity Distribution Revenue Proposals (2014/15 to 2018/19)*, 8 August 2014, p. 3; TEC, *Submission to the Australian Energy Regulator Issues Paper on the NSW Electricity Distribution Businesses Regulatory Proposals*, 8 August 2014, p. 13.

support this view. In order to better understand labour cost drivers, we engaged Deloitte Access Economics (Deloitte) to conduct a targeted detailed review of labour and workforce practices.

Subsequent to commencing our engagement with Deloitte, CEO of Networks NSW Vince Graham released an opinion piece in *The Australian*. Among other things, it noted:[190]

> Public ownership, politically powerful unions and amenable management have all combined to deliver union agreements that drive higher labour costs and higher electricity bills. We employ 12,000 NSW workers at a labour cost of more than $1.5bn a year. Labour costs are about 70 per cent of our operating costs. Labour costs and labour productivity are important drivers of electricity network charges.
>
> For many years under government ownership, NSW unions have exercised a "shadow management" role, entrenching unproductive and uncompetitive work practices.

This article reinforced the importance of our decision to review labour and workforce practices in detail. In particular, it indicates that systemic labour problems are likely a key cause of material inefficiency in the NSW service providers' base year opex.

Our scope of work for Deloitte asked three questions:

1. Did the NSW service providers (a) interpret and (b) resource the change in Ministerial licence requirements in a manner consistent with a prudent and efficient service provider?

2. In addition to changes in licence requirements, do the NSW service providers have practices that suggest their labour management is inefficient?

3. How would the above issues impact on the recurrent expenditure towards the end of the 2009–14 regulatory period?

Following initial responses from the NSW service providers to requests for information, it became apparent that the service providers did not resource their workforces in the 2009–14 solely based on changes in their licence requirements. Accordingly, we asked Deloitte to broaden its review of the first question to resourcing of the overall capex programs in 2009–14.

The answers to these questions are important to help us decide whether expenditure in the base year is an appropriate starting point for forecasting a total opex that will reasonably reflect the opex criteria for the 2014–19 period. Deloitte conducted a comprehensive and independent review of each of the three service provider's labour and workforce practices. This involved:

- reviewing over 300 documents provided by the service providers and Networks NSW in response to requests for further information
- holding in-depth discussions with each of the service providers and Networks NSW via video conference
- reviewing past and current regulatory proposals, supporting information and legislative requirements.

Ministerial licence requirements and the capital program

Deloitte considered the Ministerial licence conditions regarding prescriptive design planning criteria placed considerable pressure on the NSW service providers to deliver a significant volume of capital works in the years prior to, and during, the 2009–14 regulatory period. The service providers were all

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190 Vince Graham, *Selling off electricity networks will give NSW cheaper power bills*, The Australian, 20 August 2014, p. 12.

substantively compliant with the licence requirements by 1 July 2014. The licence requirements (as amended in 2007) required the service providers to be:[191]

> …as compliant as reasonably practicable with the applicable design planning criteria in Schedule 1 in relation to all network elements by 1 July 2014; and fully compliant with the applicable design planning criteria in Schedule 1 in relation to all network elements by 1 July 2019.

Deloitte also observed that the deadlines for compliance in the 2007 licence requirements were not as strict as those in the first version, which the Minister promulgated in August 2005. While not readily apparent from the service providers' regulatory proposals for the 2009–14 period, the 2005 version required that each service provider:[192]

> …must comply with the applicable design planning criteria in relation to all network elements from 1 July 2009.

The 2007 version of the licence conditions was, therefore, to some extent less strict than its predecessor. Notwithstanding this, Deloitte considered the service providers acted prudently by aiming to be largely compliant by 2014. Deloitte's view is had they not strived to do so, the service providers would be criticised if a major network incident occurred that could have been avoided had they complied.

However, Deloitte also found evidence that the service providers' expenditure and approaches to resourcing their capex programs was not consistent with that of a prudent or efficient service provider. In particular Deloitte stated that there is strong evidence to indicate:[193]

- each service provider relied too heavily on hiring internal labour resources rather than using temporary external contractors to undertake their capex programs
- Ausgrid entered into an arrangement which appears to have driven its costs up, or at a minimum entrenched them at a relatively high level
- All service providers' labour related capex was impacted by unionised workforces that were relatively inflexible, high cost and unproductive compared to their peers.

Deloitte also noted that each of the service providers was focused on delivering capex programs quickly to meet compliance with licence conditions by 2014 rather than 2019. Deloitte states:[194]

> [I]t is indisputable that being compliant by 2014 rather than 2019 will have increased net costs and to some extent compliance speed was being prioritised over cost.
>
> …
>
> Given the higher costs of becoming compliant in a compressed timeframe, it might be expected that deferral of some capex to the 2014-19 regulatory period would be prudent, especially given the 2019 deadline in the licence conditions.

Deloitte observed that Endeavour Energy's capex is likely to have been relatively more efficient than Ausgrid's given Ausgrid's unique but costly approach to increasing its workforce. Further, with the advent of Networks NSW, Deloitte considered some capex efficiencies seem to have been identified and implemented towards the end of the 2009–14 period. However, the ease with which the service

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191 Ian Macdonald, MLC MINISTER FOR ENERGY *Design, Reliability and Performance Licence Conditions For Distribution Network Service Providers*, 1 December 2007, cl. 14.2.

192 Design, reliability and performance Licence conditions Imposed on Distribution Network Service Providers by the Minister for Energy and Utilities, 1 August 2005, cl. 14.1.

193 Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, p. iii.

194 Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, p. 15–16.

providers were able to achieve efficiencies – in terms of projects deleted or deferred and in terms of reductions in costs for projects that have proceeded – highlight the likely inefficiency in business practices occurring prior to this time.

Labour inefficiencies

In addition to inefficiencies in delivering their capital programs, Deloitte found evidence of inefficiency in each of the service providers' labour costs and practices. For much of the 2009–14 regulatory period it appears likely that the service providers' labour costs were heavily impacted by:

- a relatively inflexible workforce with limited ability to innovate or respond to changing circumstances
- Labour costs entrenched in Enterprise Bargaining Agreements (EBAs) which are well above peer costs
- In some cases, poor management of labour costs – for example in relation to overtime
- Union opposition to management attempts to reduce costs and/or improve productivity.

These factors are apparent to a different extent across all three service providers but, in general, it appears that Endeavour Energy commenced a program improving its efficiency at an earlier stage than Ausgrid and Essential Energy. This appears to be in part due to its earlier and more successful use of outsourcing and the earlier introduction of efficiency programs such as Project Challenge and Project Compete. Consequently, Ausgrid and Essential Energy appear more inefficient than Endeavour Energy.

Deloitte noted a "significant driver of the labour costs … is the total workforce for each DNSP".[195] Ausgrid and Essential Energy had the highest average staffing levels over the 2009–14 period of any service providers in the NEM. Endeavour Energy had lower levels but was still relatively high compared to other providers. This is an important point to note, as costs are driven not only by the relative terms and conditions of employees but by the total number of employees and contractors that each service provider chooses to engage. Deloitte concluded that there was evidence that the approach to resourcing was not efficient or prudent.

All three service providers have achieved and are forecasting to achieve significant labour savings going forward. This demonstrates that for the majority of the 2009–14 regulatory period, the labour costs incurred by the NSW service providers were higher than efficient levels. In particular, savings achieved from overtime reductions were approximately $57 million across the three service providers between 2012 and 2013. However, the majority of the $2.7 billion in savings produced to date have been made part way through 2012–13 and in 2013–14 and Networks NSW has forecast further possible savings.

Further, while the service providers and Networks NSW have begun a reform process to harmonise processes and implement efficiency measures, it appears they have made very limited use of benchmarking outside of NSW. Accordingly, even when the service providers achieve the opex savings forecast by Networks NSW, they are likely to still be a significant distance from the cost levels achieved by the Victorian service providers.

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[195] Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, p. 6.

Relevantly, Deloitte's analysis is consistent with IPART's 2010 review of the productivity performance of State Owned Corporations. This review found, for example, that the NSW service providers' labour productivity declined by between 27 and 29 per cent over 2001–02 to 2008–09. IPART observed that the service providers submitted the Ministerial licence conditions were a factor driving increased labour inputs.[196]

Despite IPART's findings in 2010, Deloitte's review confirms the service providers' labour inefficiencies have continued until the commencement of Networks NSW's reform program.

Impact on recurrent expenditure towards the end of the 2009–14 regulatory period

Deloitte’s review confirmed that Networks NSW and the service providers have made significant improvements to leadership, workforce alignment and workforce flexibility, which is improving cost efficiency and productivity.

However, while the service providers have identified and realised significant savings, the reforms are only in their early stages and therefore it is likely that the full benefits of the current NNSW efficiency programs will not be realised until at least the end of the 2014-19 regulatory period. We are of the view, however, that under the NER, additional costs in transitioning to a more efficient level of expenditure are not passed on to consumers through the building block model but are funded by service providers.

In particular, due to these anticipated future efficiencies, Deloitte considered it unlikely that the opex base year (2012–13) reflects efficient labour costs:[197]

> [W]hile some savings have already been identified and realised, the reforms are only in their early stages and therefore it is likely that the full benefits of the current NNSW efficiency programs will not be realised until the 2014-19 regulatory period. In particular, due to these anticipated future efficiencies, it is in our view unlikely that the opex base year (2012-13) reflects efficient labour costs.

We consider this is supporting evidence driving some of the scope for our proposed base opex adjustments.

Vegetation management (Essential Energy)

Vegetation management is Essential Energy’s largest single opex item in the base year, comprising almost 40 per cent of network opex in 2012–13.[198] Essential Energy's performance measures connected with vegetation management have deteriorated in the 2009–14 period but its expenditure has increased markedly. In its regulatory proposal, Essential Energy submitted a step down in vegetation management in the forthcoming regulatory control period because it identified efficiencies through a number of strategic reform initiatives.[199]

Our review of the documentation Essential Energy submitted with its regulatory proposal supports our findings that one of the sources of Essential Energy's high expenditure in its base year opex (identified with our benchmarking techniques) is likely due to vegetation management practices.

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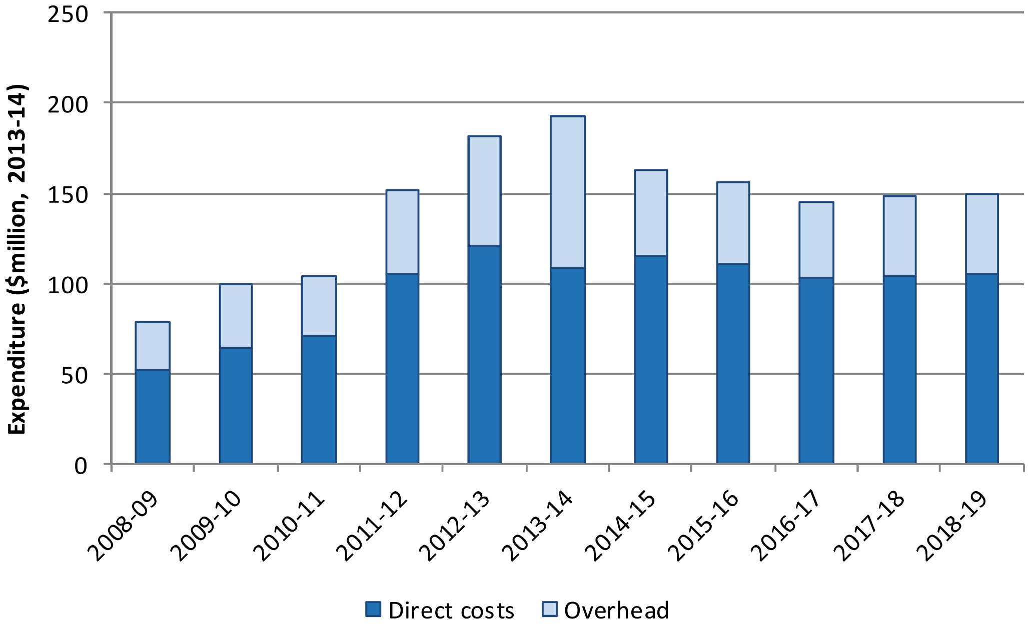
196 IPART, *Review of the Productivity Performance of State Owned Corporations Other Industries — Final Report*, July 2010, pp. 52–56.
197 Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, p. 57.
198 Essential Energy, *Regulatory Proposal*, May 2014, p. 66.
199 Essential Energy, *Regulatory Proposal*, May 2014, p. 73.

Analysis of expenditure and performance

Over the past six years, Essential Energy's actual vegetation management expenditure has more than doubled from $79 million to $193 million ($2013–14).[200] Essential Energy has forecast this to decline slightly to $150 million in 2018–19. Figure A-20 and Table A-14 show that a large portion of vegetation management costs are overhead costs, which account for approximately 30 per cent of total expenditure on average and 44 per cent in 2013–14.

Figure A-20 Essential Energy's historic and forecast vegetation management expenditure split by direct costs and overhead ($ million, 2013–14)



Source: Category analysis RIN, Table 2.1.2 and Table 2.16.2; Essential Energy, *Regulatory Proposal*, May 2014, p. 66; AER analysis.

For the purposes of assessing base year opex, we are interested in historic actual expenditure rather than forecast expenditure. However, it is interesting to observe that while Essential Energy is proposing to slightly reduce its vegetation management expenditure in the forecast period from the peak in 2012–13 and 2013–14, it has not forecast any significant reduction in overhead as a proportion of total costs.

Table A-14 Essential Energy's vegetation management expenditure split by direct costs and overhead for 2008-09 to 2018-19 ($ million, 2013–14)

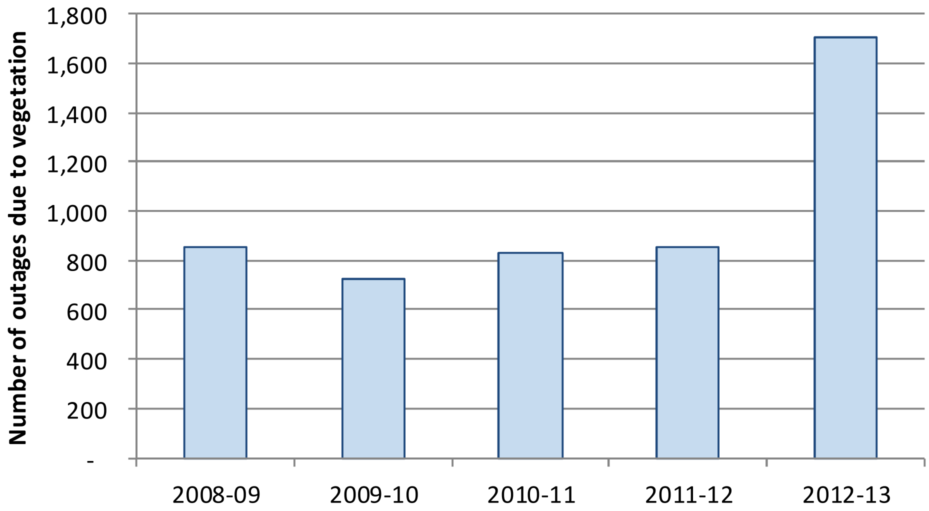
	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
Direct costs	53	64	71	105	121	109	115	110	103	104	106
Overhead	26	36	33	47	61	84	48	46	42	44	44
Total	79	100	104	152	182	193	163	156	145	148	150
Overhead proportion	33%	36%	32%	31%	33%	44%	29%	29%	29%	30%	30%

Source: Category analysis RIN, Table 2.1.2 and Table 2.16.2; Essential, Regulatory Proposal, p. 66; AER analysis.

200 Essential Energy, *Regulatory Proposal*, May 2014, p. 66.

In addition, if we examine Essential Energy's performance data on sustained interruptions to supply due to vegetation, it shows that despite the increased expenditure, performance deteriorated markedly in 2012-13. Figure A-21 shows that the number of vegetation-related interruptions to supply more than doubled in this year from the previous four year average of approximately 820 interruptions.

Figure A-21 Essential Energy's historic network outages due to vegetation

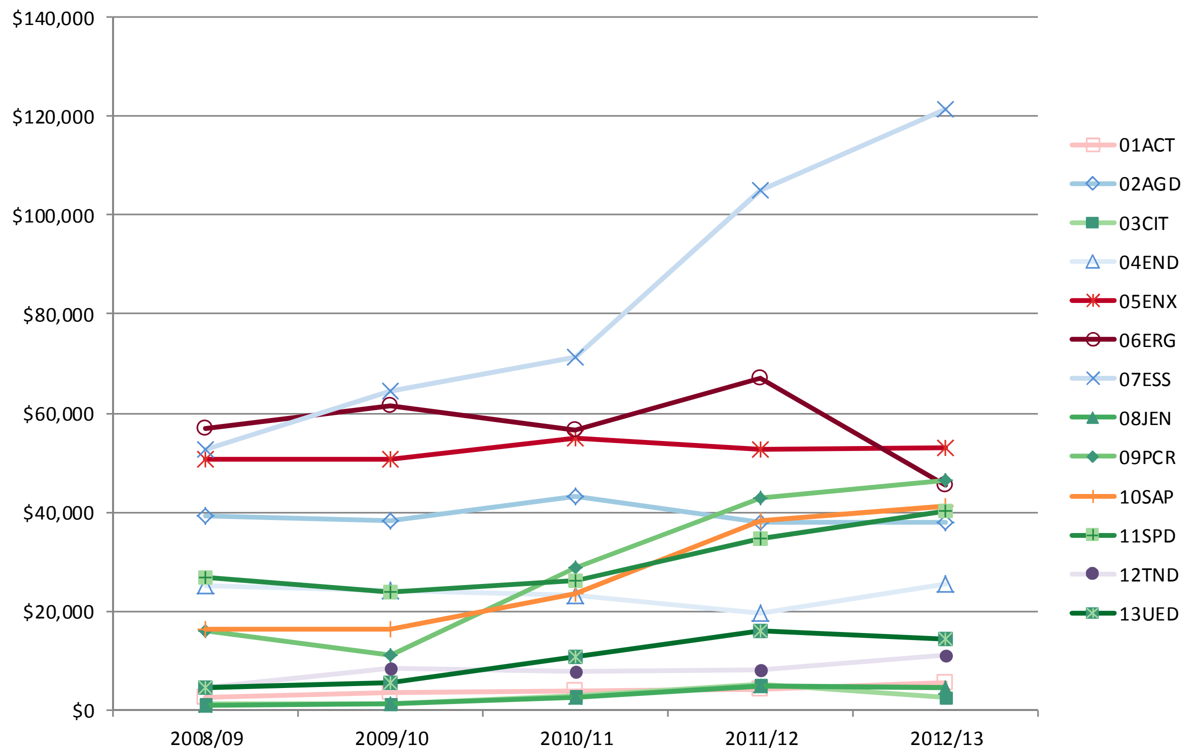


Source: Category Analysis RIN, Table 6.3.1; AER analysis.

We might expect a significant increase in expenditure in a particular year to be the result of a targeted effort to improve performance. Figure A-21, however, shows that this was not the case in 2012–13.

When we compare Essential Energy's direct vegetation management costs to the other NEM service providers, it is clear that Essential Energy's expenditure is well above its peers in the latter part of the 2008–09 to 2012–13 period.

Figure A-22 Total vegetation management costs, excluding overheads for 2008–09 to 2012–13 ($000, 2013–14)



Source: Category analysis RIN, Table 2.1.2.

As we observe in section A.4.2 we must exercise some caution in directly comparing service providers on this metric because we do not normalise it by an output. However, Ergon Energy, which has a similarly large and sparse rural network (see Table A-15), shows substantially lower vegetation management expenditure over the period. In itself, this is quite significant because Ergon Energy has high expenditure compared to most of its peers, particularly up to 2011–12.

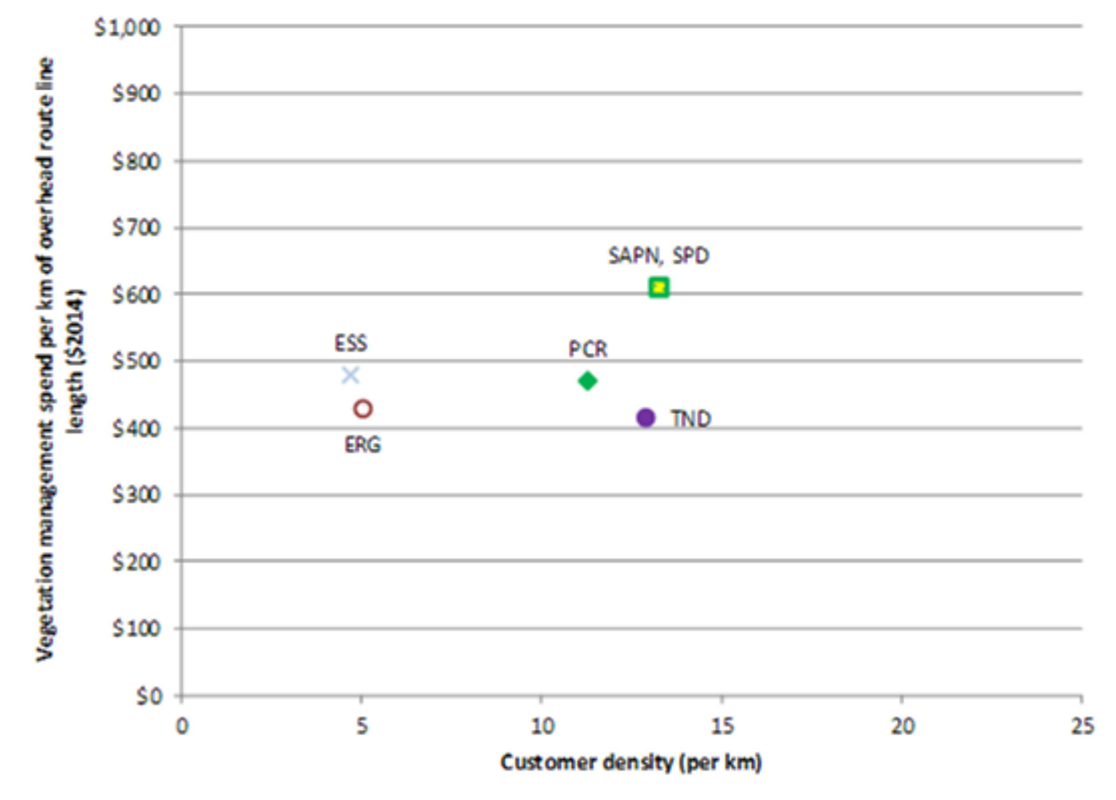
Table A-15 Comparison of network characteristics for Essential Energy and Ergon Energy (averages for 2008–09 to 2012–13)

	Overhead route line length	Customer numbers	Customer density
Essential Energy	166,526	832,768	4.6
Ergon Energy	152,658	687,766	4.9

Source: Category analysis RIN, Table 2.7.1; Economic benchmarking RIN, Table 5.2.1; AER analysis.

In terms of comparison with other peers, in Figure A-23 we compare cost per overhead route line length over the 2008–09 to 2012–13 period. In this metric, Essential Energy appears unfavourably compared to Ergon Energy (its closest comparator) and TasNetworks, but is only marginally costlier than Powercor. Essential Energy also appears favourably compared to a combined (for confidentiality reasons) SA Power Networks, JEN and AusNet services. However, given Essential Energy's substantially longer line length, we would expect the cost per kilometre of line length to be lower than all of these service providers.

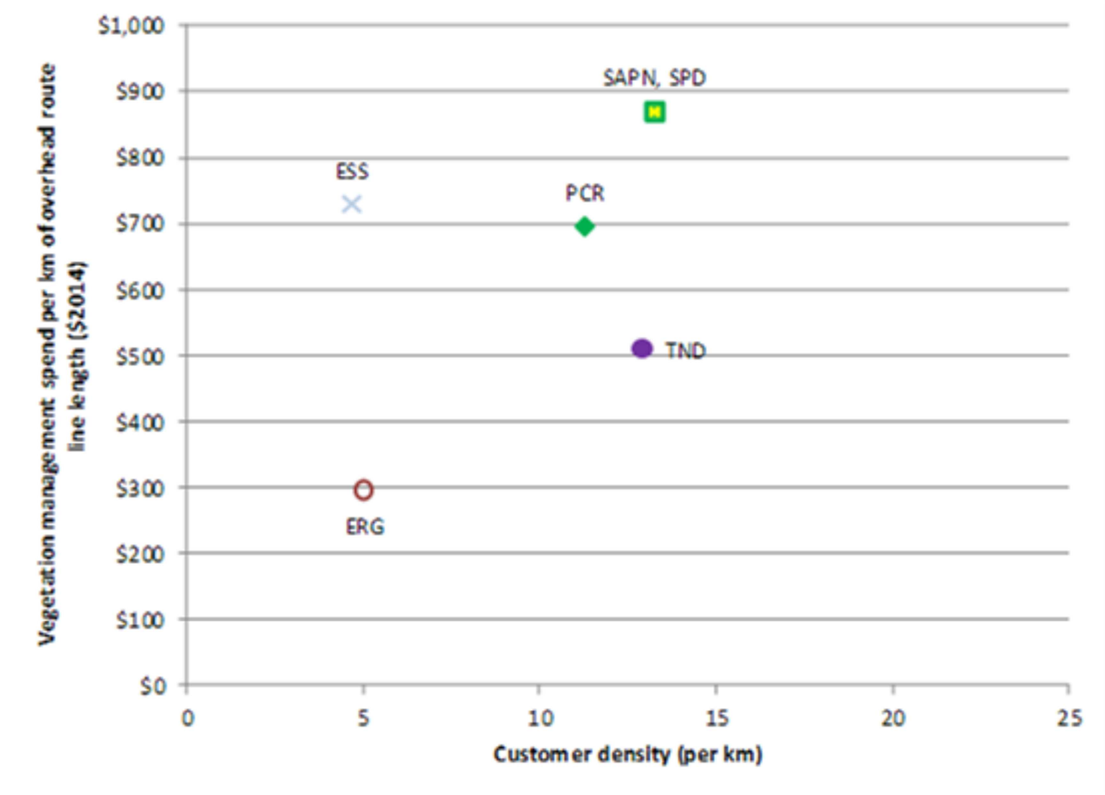
Figure A-23 Average vegetation management costs per overhead route line length for 2008–09 to 2012–13 per customer density for rural service providers ($ 2013–14)



Source: Category analysis RIN, Table 2.7.1 and Table 2.7.2; Economic benchmarking RIN, Table 5.2.1; AER analysis.

In addition, Figure A-24 shows that if we examine the same metric but for the 2012–13 year (rather than the five year average), the gap between Essential Energy and Ergon Energy increases substantially. This is because Ergon Energy has reduced its expenditure but Essential Energy's has increased. The gaps between Essential Energy, Powercor and the SA Power Networks/JEN/AusNet Services average are similar because the expenditure of each of these service providers has also increased compared to the average.

Figure A-24 Vegetation management costs per overhead route line length for 2012–13 per customer density for rural service providers ($ 2013–14)

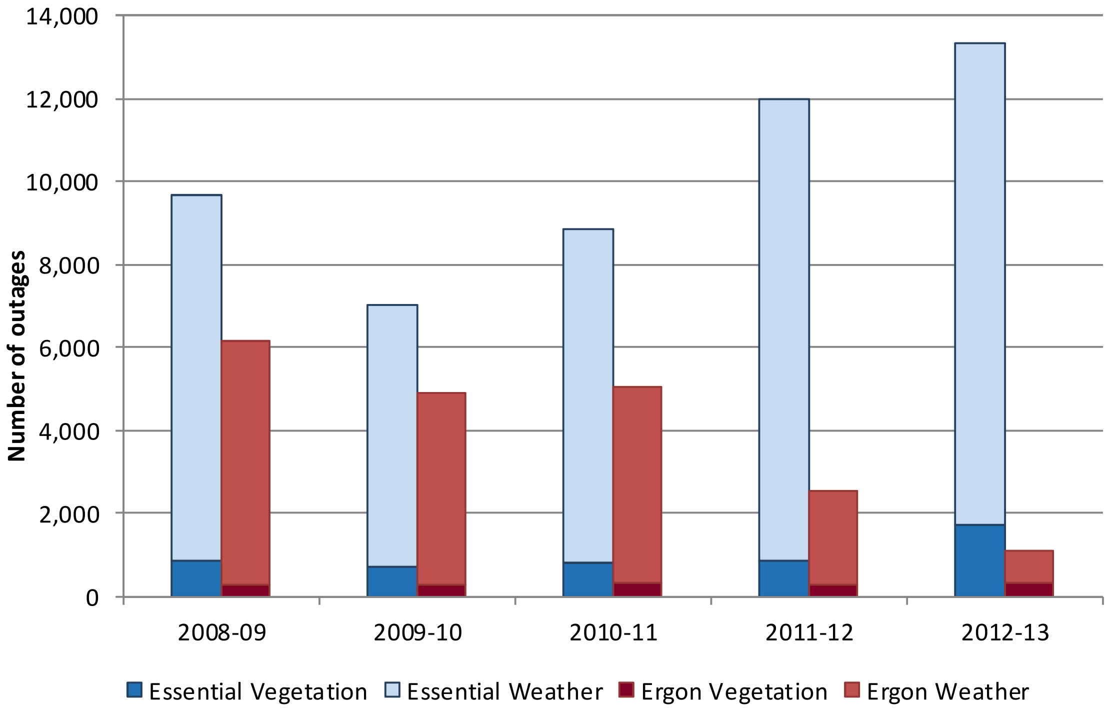


Source: Category analysis RIN, Table 2.7.1 and Table 2.7.2; Economic benchmarking RIN, Table 5.2.1; AER analysis.

As we state above, Ergon Energy is the most similar to Essential Energy in terms of network characteristics. Importantly, our economic benchmarking and category analysis results show Ergon Energy's opex is materially inefficient. Figure A-22 also shows that Ergon Energy has one of the highest spends on vegetation management compared to its peers (although it has reduced in 2012–13 to match the level of Powercor).

However, it is nonetheless useful, given the similarities that exist between Essential Energy and Ergon Energy, to compare their sustained interruption performance as well as their expenditure. In Figure A-25, we compare outages due to vegetation and due to weather because – since weather can cause problems with vegetation – a close relationship may exist.

Figure A-25 Comparison of network outages due to vegetation and weather for Essential Energy and Ergon Energy



Source: Category Analysis RIN, Table 6.3.1; AER analysis.

Figure A-25 shows that a significant gap in performance exists for both vegetation and weather events between Essential Energy and Ergon Energy. This difference is particularly stark in 2012–13 where Ergon Energy's performance is at its best and Essential Energy's is at its worst. In this year, the biggest difference between expenditure exists as well (see Figure A-22 and Figure A-24).

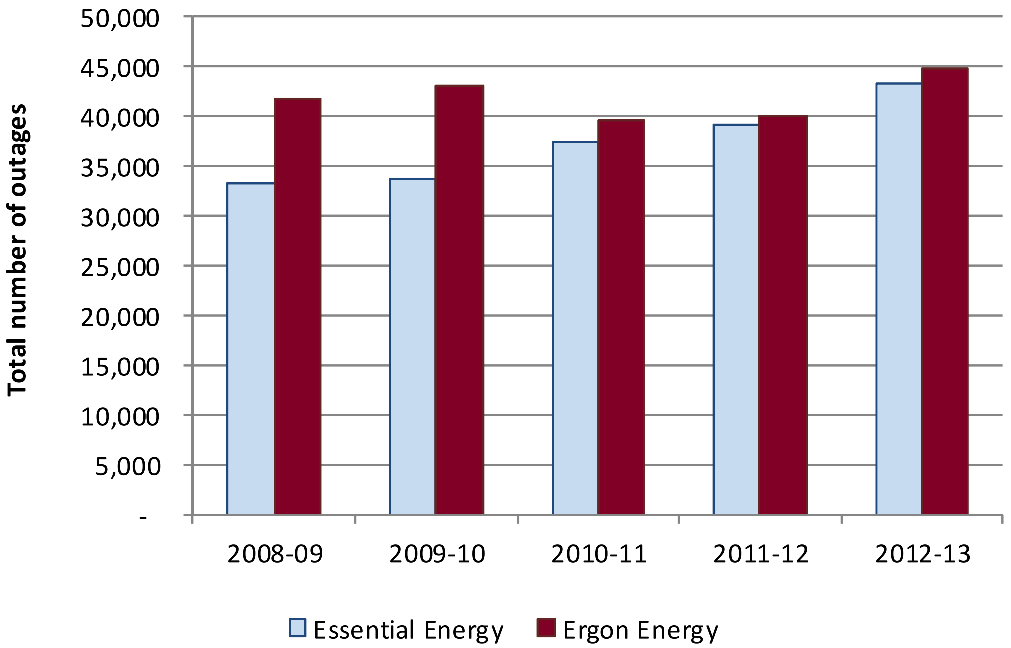
We investigated major natural disasters in 2012–13 to determine whether any particular event occurred that could explain this difference. However, the one significant event in 2012–13 was flooding as a result of ex-tropical cyclone Oswald in January 2013. While floods could result in vegetation-related outages, this flooding affected coastal areas in both Queensland and NSW.[201] Therefore, it is unlikely this is the cause of the difference.

Importantly, service providers may choose how to categorise each sustained interruption. As a result, we should exercise some caution when comparing by vegetation management and weather in isolation. For completeness, it is prudent to compare sustained interruption performance overall.

For example, Figure A-26 shows that – despite outperforming Essential Energy on vegetation and weather events – Ergon Energy is a slightly worse performer for total number of sustained interruptions. However, Figure A-26 also shows that Essential Energy's overall performance is worsening over time.

[201] Bureau of Meteorology, *Special Climate Statement 44 – extreme rainfall and flooding in coastal Queensland and New South Wales*, 1 May 2013.

Figure A-26 Comparison of all network outages for Essential Energy and Ergon Energy



Source: Category Analysis RIN, Table 6.3.1; AER analysis.

Table A-16 shows that Ergon Energy has reported substantially more outages in relatively non-descript categories such as 'Other', 'Unknown' and 'Third Party'. Some of the sustained interruptions in any of these three categories could potentially be vegetation-related, particularly those in the 'Unknown' category. Due to what appears to be less accurate reporting, however, we cannot be definitive.

Table A-16 Comparison of non-descript outage categories for Essential Energy and Ergon Energy (averages for 2008–09 to 2012–13)

	Other	Unknown	Third Party
Essential Energy	1,594	-	505
Ergon Energy	2,991	7,618	12,625

Source: Category Analysis RIN, Table 6.3.1; AER analysis.

Regardless, Essential Energy's vegetation management absolute expenditure is significantly higher than all of its NEM peers, including its closest comparator. Further, its performance has deteriorated for vegetation and weather events, and overall.

Reasons for high expenditure

Essential Energy proposed 2012–13 as the base year for estimating (the majority of) its total forecast opex proposal using a hybrid base-step-trend approach. Likewise, we are using this year to determine an estimate of total forecast opex using the single year revealed expenditure approach. This means that while we are interested in understanding Essential Energy's historical inefficiency, we are particularly interested in Essential Energy's practices as at 2012–13.

Essential Energy has forecast a step down in vegetation management opex in the 2014–19 period, based largely on modelling by Select Solutions. This is relevant because it demonstrates that Essential Energy acknowledges its practices and expenditure in the 2012–13 base year were inefficient. However, our view is that Essential Energy's forecast reduction in expenditure may not be capturing the extent of the inefficiency. For example, we found we could increase Essential Energy's forecast reduction by as much as 28 per cent by adjusting the maintenance cycle and action rate in the Select Solution model.[202]

In this section, we examine Essential Energy's practices as at 2012–13 and then explain why they are not reflective of ongoing efficient costs.

Current practice as at 2012-13

The *Vegetation Management Strategy and Implementation Plan for Additional Expenditure* for 2013–14 explains Essential Energy's vegetation management approach as at 2012–13 is to clear vegetation in accordance with the 2005*ISSC 3 guideline for managing vegetation near power lines*.[203] As at 2012–13, Essential Energy undertook the majority of vegetation management work by:[204]

- a systematic and regular program of vegetation clearance work carried out on power lines based on a prescribed cutting cycle (‘cyclic vegetation clearance’)
- reactive ‘spot cutting’ of defects arising from annual aerial patrols carried out to remove higher risk, individual incursions of vegetation into the clearance envelope.

Essential Energy outsourced vegetation cutting to contractors, with most contracts on an agreed hourly rate basis. Essential Energy conducted all other activities internally. This includes strategy development, program management 'scoping' (identifying and defining the cutting work) and customer management. As a result, Essential Energy also employs in-house staff in addition to its contractors.[205]

Essential Energy's *Strategy and Implementation Plan* identified several improvement opportunities from current practice, recognising it is inefficient. Existing problems are:[206]

- committing too many resources to spot cutting of defects identified by aerial patrols
- an inefficient balance of cyclic clearing versus spot cutting
- a sub-optimal target frequency for cyclic maintenance
- ineffective commercial arrangements with contractors.

These findings primarily stem from a December 2012 review of Essential Energy's vegetation management strategy by Select Solutions.[207] Select Solutions' review found that Essential Energy must move to a "significantly more efficient" vegetation management model to reduce the impact of its

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202 The adjustment to the maintenance cycle involved making urban and rural inspection cycles consistent (3 years), which we consider eliminates the management complexity of maintaining different cycles for urban and rural areas. The adjustment to the action rate involved reducing the proposed 100% action rate to the historical actual rate for urban maintenance (68%).

203 Industry Safety Steering Committee, *ISSC 3 Guideline for managing vegetation near power lines*, December 2005.

204 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, pp. 8–9.

205 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, p. 9.

206 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, pp. 10–11.

207 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, pp. 10–11.

expenditure on customer prices.[208] Select Solutions identified sixteen recommendations to improve efficiency, 12 of which it considered were very high priority.[209]

Although Essential Energy claimed confidentiality over the recommendations in the Select Solutions report, its *Strategy and Implementation Plan*[210] and *Vegetation Clearance Asset Management Plan*[211] identify most of them, which we can summarise as:

- introduce a more fit-for-purpose vegetation management system similar to systems used by some distributors in Victoria
- increase the proportion and frequency of proactive cyclic management
- demobilise existing corridor reclamation program
- Implement better approaches to tree removal and trimming
- optimise aerial patrol use
- manage stakeholders better
- employ contractors on an agreed rate per fixed unit of work
- outsource additional scope and cut work.

The current approach is inefficient

Based on the Select Solutions review, Essential Energy acknowledges its approach in the 2012–13 base year is inefficient. While it could improve its practices in many areas, in particular, it acknowledges that resourcing is not optimal. First, Essential Energy is attributing too much vegetation management effort to reactive spot clearing. Select Solutions considered a more effective use of aerial patrols would be to focus on audit on high fire risk areas, rather than as a primary source of defect identification.[212]

Select Solutions further considered that Essential Energy undertakes too many activities such as corridor reclamation, excessive tree removal and unnecessary trimming. Essential Energy also normally does not enforce third party tree trimming responsibilities.[213] The result is Essential Energy is maintaining much more vegetation than it is legally required to. These activities divert resources away from more cost effective cyclic work and consequently results in sub-optimal cutting cycles. Essential Energy estimates its rural cutting cycle is 6.5 years on average; the optimal weighted average rural cycle is three years.[214]

Second, the majority of its contracts for cutting are hourly rate agreements. That is, Essential Energy pays its contractors per hour of work they spend cutting vegetation. This provides no incentive for the contractor to perform work quickly because the longer the contractor spends cutting, the more money it receives. It may additionally incentivise the contractor to cut more vegetation than necessary. Select Solutions recommend Essential Energy employ its contractors on an agreed rate per fixed unit of

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208 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, p. 13.
209 Select Solutions, *Review of Essential Energy Vegetation Management Strategy–Final Report*, 22 March 2013, pp. 15–16.
210 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, pp. 11, 21–24.
211 Essential Energy, *Asset Management Plan – Vegetation Clearance Management:2012–2019*, May 2014, pp. 39–46.
212 Essential Energy, *Asset Management Plan – Vegetation Clearance Management:2012–2019,* May 2014, pp. 47–48.
213 Essential Energy, *Asset Management Plan – Vegetation Clearance Management:2012–2019*, May 2014, p. 48.
214 Essential Energy, *Asset Management Plan – Vegetation Clearance Management:2012–2019*, May 2014, pp. 39–46.

work, such as dollar amount per span, for the majority of routine work.[215] Such an arrangement is more efficient because it shifts the productivity driver to the contractor. Other distribution network service providers share the view that hourly rate agreements are inefficient.[216]

Finally, we observed above that Essential Energy does not outsource all vegetation management work; it outsources only the cutting tasks.[217] As we discuss in the section on labour above, our view is that a major cause of Essential Energy's inefficiency is due to excess internal labour resources.

The combination of all the above factors is, in our view, likely to be a significant cause of Essential Energy's inefficiency in performing vegetation management in 2012–13. Further, we consider Essential Energy's operating environment should not materially disadvantage it compared to other service providers.

Operating environment

The operating environment conditions facing Essential Energy are complex and may present a challenge for undertaking vegetation management activities. However, on balance, we are not convinced that Essential Energy's operating environment should significantly disadvantage it such that it would materially impact its opex performance compared to other rural service providers.

The Essential Energy service territory is very large and predominantly rural. It includes both flat and mountainous terrain, which will impact travel times, site accessibility and vehicle stability. However, being predominantly rural, it also reduces the overall requirements for traffic management, customer consultation and access requirements.

Figure A-27 shows that (similar to Ergon Energy's territory) Essential Energy's territory includes a wide variation in the types of native vegetation. While it includes a relatively large amount of native forests and woodlands, a significant proportion is pasture, shrublands or grasslands. Essential Energy's *Vegetation Clearance Management* asset management plan suggests the vast majority (more than 80 per cent) of its total route line length has low foliage projective cover.[218] So, while some parts of Essential Energy's network may have dense vegetation, the majority does not.

Bushfire risk is significant in some Essential Energy regions such as South Eastern and Central West but less so in the Far North Coast, Mid North Coast and Far West regions.[219] As we discuss in section A.5.4, we consider overall fire risk for Essential Energy is likely less than for areas of Victoria but greater than many areas in Queensland.

Overall, we are not satisfied Essential Energy's territory is, in a physical sense, likely to be any more challenging than other rural service providers, particularly Ergon Energy.

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215 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, p. 11.

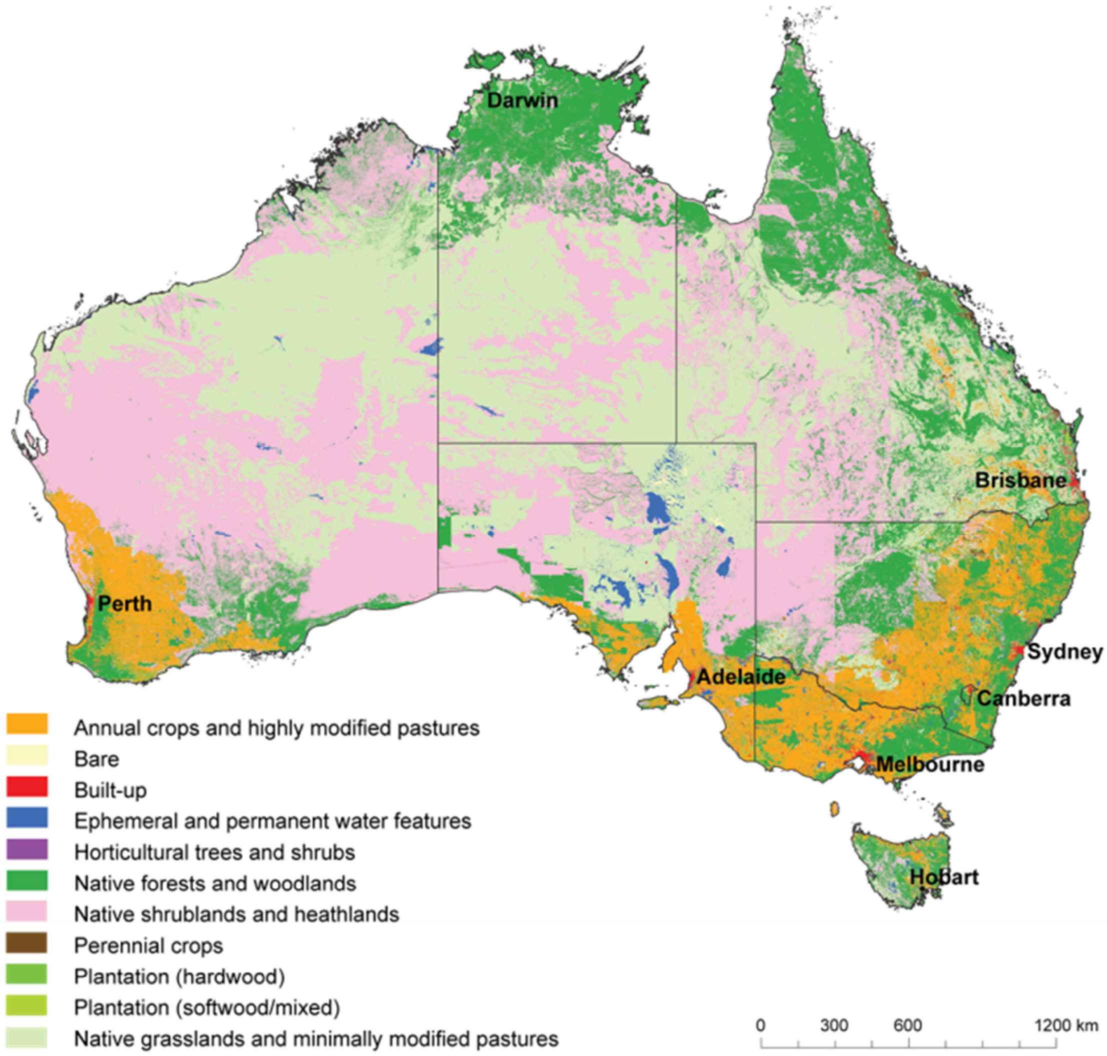
216 Aurora Energy, *Submission on the AER's draft determination on ActewAGL's cost pass through application*, 20 June 2014, p. 1.

217 Essential Energy, *Vegetation Management Strategy and Implementation Plan for Additional Expenditure – FY 2013 to 14*, February 2013, p. 23.

218 Essential Energy, *Asset Management Plan – Vegetation Clearance Management:2012–201*9, May 2014, pp. 11–13.

219 Essential Energy, *Asset Management Plan – Vegetation Clearance Management:201– 2019*, May 2014, p10.

Figure A-27 Extent of all forms of vegetation across Australia, 2009



Source: Australian Bureau of Agricultural and Resource Economics and Sciences. Land use and land management information for Australia: workplan of the Australian Collaborative Land Use and Management Program (ACLUMP). Canberra: ABARES, 2010 (accessed from: http://www.environment.gov.au/science/soe/2011-report/5-land/2-state-and-trends/2-3-vegetation).

In terms of legislative obligations, vegetation management within the Essential Energy service area is the same as for other NSW service providers. The relevant document is the *ISSC 3 Guideline for Managing Vegetation near Power Lines*,[220] which includes similar obligations to other states (except Victoria).

The NSW *Electricity Supply (Safety and Network Management) Regulation 2014* sets out the statutory objectives for Essential Energy relating to vegetation clearance and bushfire risk. The regulation requires Essential Energy to prepare a safety management system. Part of this plan relates to vegetation management. While one of the primary objectives of the safety management system is to ensure protection of the environment (for example, preventing bush fires that may be ignited by

[220] Industry Safety Steering Committee, *ISSC 3 Guideline for Managing Vegetation near Power Lines*, December 2005.

network assets)[221] it promotes tree preservation rather than removal and does not mandate minimum clearance standards.[222]

Conversely, in Victoria, the Victorian Bushfires Royal Commission imposed obligations that are more onerous than those currently in place in NSW. For example, the amended Victorian *Electricity Safety (Electric Line Clearance) Regulations 2010* prescribe (among other things) minimum clearance spaces for power lines that become progressively stricter in areas of higher bushfire risk.[223] It would seem, therefore, that the legislative obligations in NSW are not as strict as those in Victoria, which should give Essential Energy a comparative advantage.

On balance, we consider that Essential Energy's operating environment factors should not materially affect its overall vegetation management costs to a greater extent than other service providers.

There is evidence that vegetation management costs in the 2012-13 base year are higher than Essential Energy's ongoing efficient costs and that this will be reflected in our benchmarking results for Essential Energy. Essential Energy has accounted for this potential inefficiency in the base year by proposing a step change down in its proposed forecast. In addition, it proposes the application of a penalty be applied to its expenditure under the carryover provisions of the EBSS, which appears to be due in large part to high levels of expenditure on vegetation management in the base year.

We have developed our forecast in a different manner. We think it is appropriate to adjust the base year expenditure in accordance with our benchmarking results. This reduces our starting point for forecasting total opex. However, to complement our approach, we have not applied a carryover penalty to Essential Energy in this draft determination and we have not applied a step change down for reduced vegetation management costs. In our view, this appropriately establishes a forecast of total opex that reasonably reflects the opex criteria and which leaves discretionary decisions in spending that allowance to the service provider.

221 *Electricity Supply (Safety and Network Management) Regulation 2014*, section 6(d).
222 *Electricity Supply (Safety and Network Management) Regulation 2014,* Part 5.
223 *Electricity Safety (Electric Line Clearance) Regulations 2010*, Schedule, 27 February 2013.

A.5 The net impact of operating environment adjustments

We are satisfied that differences in operating environment factors, not accounted for in Economic Insights' econometric models, may account for up to 10 per cent of the apparent difference in efficiency between the NSW service providers and the comparison service providers.[224] We have come to this conclusion after assessing 33 different operating environment factors that we, service providers, and other stakeholders identified in the process of this review and in response to our draft benchmarking report.

To account for operating environment factors not adjusted for in our benchmarking techniques, we have identified operating environment adjustments. For each operating environment factor identified, we considered if it is necessary to provide an operating environment adjustment for it. We determined which factors require an adjustment using three operating environment adjustment criteria. Where we were satisfied that an operating environment adjustment is required we assessed the factor to estimate its impact on service providers' opex.

We identified three operating environment factors that require operating environment adjustments. The first adjustment is to account for the effect of differences in subtransmission configurations on service providers' opex. The second accounts for the impact of OH&S regulations on service providers' opex. The third accounts for differences in the cost of managing bushfire risk across jurisdictions on opex. The table below summarises the adjustments.

Table A-17 Summary of material operating environment adjustments

Service provider	Subtransmission adjustment	OH&S regulations	Bushfire regulations	Total
Ausgrid	5.5%	0.5%	-2.4%	3.6%
Endeavour	5.0%	0.5%	-2.4%	3.1%
Essential	2.5%	0.5%	-2.4%	0.6%

Source: AER analysis.

During the course of our investigation we identified additional operating environment factors that did not meet the operating environment adjustment criteria because they would not create material differences in opex. These include:

- Building regulations
- Corrosive Environments
- Environmental regulations
- Grounding Conditions
- Natural disasters
- Planning regulations
- Proportion of 11kV and 22kV lines

224 The comparison service providers are all service providers that have efficiency scores above 0.75 on our Cobb Douglas SFA benchmarking model, which is our preferred economic benchmarking method. The efficiency target is based on the customer weighted average efficiency score for these service providers.

- Proportion of hardwood poles
- Shape factors
- Skills required by different service providers
- Topography
- Traffic management.

Although individually the effects of these operating environment factors on opex may not be material, their combined effect may be.[225]

We are satisfied that the total operating environment adjustment to the efficiency scores for Ausgrid, Endeavour Energy and Essential Energy should be positive 10 per cent. We consider that it is appropriate to take a more holistic view of the possible effects of operating environment factors on the NSW service providers' opex. As a result, we have used the operating environment adjustments identified as an indication of the total impact that operating environment factors may have on these service providers' costs.

We have considered all of the submissions made to us on operating environment factors, but not all service providers have had the same opportunities to provide information on the operating environment factors that affect their costs yet. Our review has focused on the operating environment factors affecting ActewAGL and the NSW service providers in the context of the current draft determinations for those service providers. In future we expect that other service providers and stakeholders will provide further information on the effect of operating environment factors.

Following the AEMC,[226] we have separated the analysed factors into five groups which are considered separately below:

- Customer factors
- Endogenous factors
- Geographic factors
- Jurisdictional factors
- Network factors.

A.5.1 Approach to operating environment factors

It is important to recognise that service providers do not operate under exactly the same operating environment conditions. Operating environment conditions may have a significant impact on measured efficiency through their impact on a service provider's opex. It is desirable to adjust for material operating environmental differences to ensure that when comparisons are made across service providers, we are comparing like with like to the greatest extent possible. Oakley Greenwood

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225 We note that these operating environment factors may not all affect costs in the same direction. That is some of these factors may advantage the NSW service providers and some may disadvantage them.

226 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.

note that by identifying the effect of operating environment factors on costs we can determine the extent to which cost differences are exogenous or due to inefficiency.[227]

In our assessment, we have directly incorporated operating environment factors into our models where possible. Where we have not been able to do this, we have considered the quantum of the impact of the operating environment factors on the NSW service providers' opex relative to the comparison service providers. The operating environment adjustment serves to account for differences in opex between the NSW service providers and the comparison firms not related to efficiency.

We have used three criteria to help us decide whether or not an operating environment factor should be accounted for:

1. **Is it outside of the service provider's control?** The first criterion is that an operating environment factor should be outside the control of service provider's management. Where the effect of an operating environment factor is within the control of service provider's management we would not generally provide an adjustment for the operating environment factor.[228] Adjusting for that factor may mask inefficient investment or expenditure.

2. **Is it material?** The second criterion is that an operating environment factor should create material differences in service providers' opex. Where the effect of an operating environment factor is not material, we would generally not provide an adjustment for the factor. Many factors may influence a service provider’s ability to convert inputs into outputs

3. **Is it accounted for elsewhere?** The third criterion is that the operating environment factor should not have been accounted for elsewhere. Where the effect of an operating environment factor is accounted for elsewhere, we have not provided an adjustment for that factor. To do so would be to double count the effect of the operating environment factor. [229]

A.5.2 Customer factors

Customer Density

We are satisfied that it is not necessary to provide an operating environment adjustment for customer density. An adjustment for customer density does not satisfy operating environment adjustment criterion three. On the basis of second stage regression analysis of the opex MPFP results, we are satisfied that output variables sufficiently account for the effects of customer density.

Ausgrid, Endeavour Energy, and Essential Energy have all raised topographic conditions as an operating environment factor that will affect the benchmarking results.[230] [231] [232]

Customer density is a useful proxy for identifying the distance between customers. As each service provider has an obligation to serve existing customers, we assume that this is therefore an exogenous

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227 Oakley Greenwood, *Review of NSW DBs Regulatory Submissions*, 5 August 2014, p. 16.

228 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.

229 For example, our models capture the effect of line length on opex by using circuit length as an output variable. In this context, an operating environment adjustment for circuit length would double count the effect of route line length on opex. Another example is that we exclude metering services from our economic benchmarking data. In this case, an operating environment adjustment would remove the metering services from services providers' benchmarked opex twice.

230 Ausgrid, *Attachment 5.33* to *Regulatory proposal*, p. 3.

231 Endeavour Energy, *Attachment 0.12* to *Regulatory proposal*, May 2014, p. 3.

232 Essential Energy, *Attachment 5.*4 to *Regulatory proposal*, May 2014, p. 5.

factor. Customer density, in and of itself, does not drive costs. Factors correlated with customer density are the underlying cost drivers. These include:

- Asset exposure - A shorter line will have be less exposed to degradation from the elements and damage from third parties.
- Asset numbers - The need to service customers that are spaced further apart will require additional substations, length of lines or cables to provide the same level of service.
- Travel times - the time taken to travel between customers or assets increases as those assets or customer are spaced further apart.
- Traffic management - traffic management requirements typically increase proportionally to the volumes of traffic on, or adjacent, to the worksite.
- Asset complexity - The complexity of assets in a given location - for example; multiple circuits on a pole, or circuits in a substation.
- Proximity to third party assets - Increased urban density results in more third-party overhead and underground asset being in proximity to electrical assets. This proximity requires increased co-ordination, planning, design, and installation costs.
- Proportion of overhead and underground - Increased urban density can result in greater obligations or constraints on the service providers in relation to the augmentation or construction of underground/overhead assets. Maintenance of underground assets is typically reduced compared with overhead.
- Topographical conditions - adverse topographical conditions such as swamps, mountainous terrain, amongst other things will typically result in less habitable areas and increased costs associated with access to these areas.

Each of the above factors will affect network opex differently. It is obvious that some will have more of an adverse effect on rural services, while others will have a more adverse effect on urban services. The following table summarises the effect of the factors on networks depending on their respective customer density.

Table A-18 Customer density factor impacts

Factor	Opex benchmark benefit
Asset exposure	Urban networks
Asset numbers	Urban networks
Travel times	Urban networks
Traffic management	Rural networks
Asset complexity	Rural networks
Proximity to third-party assets	Rural networks
Proportion of overhead and underground	Urban networks
Topographical conditions	Urban networks

The cost relationships explored in the table are simplifications. In reality, some may not be linear. For example, travel times may initially decrease as customer density increases but then increase again. This is because traffic congestion is likely to affect CBD areas more than urban or rural areas. We have made these simplifications to help demonstrate the effect that customer density may have on costs.

The fact that it is a simplification aside, the table demonstrates that it is not evident what the overall impact of customer density is on service providers' opex. Given the complexity of the above factors, it is clear that it is important to consider the impacts of customer density in any benchmarks that are undertaken.

We have considered a number of measures for aggregating the impacts from the above factors. Historically, industry benchmarks have used a number of representative measures including:

- Customer density measured as customers per (circuit) km of line (cust/km)
- Energy density measured as energy delivered per (circuit) km of line (kWh/km)
- Demand density measured as demand per (circuit) km of line (MVA/km)
- Customer density measured as customers per square kilometre of service territory.

The use of service territory as a density measure has proven problematic. This is due to the difficulty in accurately measuring service territory items such as lakes, national parks, and unpopulated areas. As the networks do not incur costs for areas that are un-serviced, customers per square kilometre of service area is not a useful measure for opex or service comparisons.

A number of benchmarking studies and reviews have considered the relative merits of the different remaining density measures identified above (customer, energy and demand).[233] [234] [235] As the ratios of energy and demand are relatively similar on a per customer basis, it is not clear whether there is any greater intrinsic benefit from any one of these density measures.

As customer density per kilometre is a relatively easy concept to understand, we have adopted this as our standard approach.

We are satisfied that an adjustment for customer density is not required. It raises the third operating environment criterion. The effect of customer density appears to have been captured by other variables in Economic Insights' benchmarking models. Economic Insights carried out statistical analysis that shows that the MPFP benchmarking models account for customer density.[236]

Because the MTFP opex cost function models use customer numbers, line length and demand as outputs (like the MPFP model) we are satisfied that they will also account for customer density. Density measures are ratios of customer numbers, energy throughput, and demand to line length.

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233 Benchmarking Opex and Capex in Energy Networks, Working Paper no.6, May 2012, p. 18.
234 Western Power: Transmission & Distribution Network cost analysis & Efficiency benchmarks Volume II, Theoretical framework June 2005, Benchmark Economics.
235 Aurora Energy, A comparative analysis: Aurora Energy's Network cost structure, Benchmark Economics.
236 EI, *Economic Benchmarking of Operating Expenditure for NSW and ACT Electricity DNSPs*, November 2014, p. 24.

Customer requirements

We are satisfied it is not necessary to provide an operating environment adjustment for customer requirements. An adjustment for customer requirements raises the issues in our operating environment adjustment criterion three. Special customer requirements are accounted for elsewhere in Economic Insights' benchmarking models. This is because our economic benchmarking data only capture information on network services. An adjustment would therefore be likely to lead to double counting.

ActewAGL said in its regulatory proposal that the requirements of some of its customers affect its costs.[237]

All service providers have customers with high security of supply requirements. Examples of these include hospitals, state parliaments, military installations, banks, stock exchanges, and telecommunications facilities. Many manufacturing industries also have very high requirements for supply security due to the costs of lost production and equipment damage.

We are satisfied that an adjustment for customer requirements would not be appropriate because connection services are excluded from our economic benchmarking data. Connection services are not included in network services. Because connection services are excluded from network services, connection services cannot affect benchmarking that uses network services data. Connection services include the opex and capex incurred for new connections or the modification of connections. These services can include the addition of feeders to a customer's premises for increased redundancy or upstream augmentation. Therefore, the services required to provide additional security of supply to customers with special requirements are connection services. We acknowledge that the modifications required by special customers may lead to service providers incurring additional opex to service the new assets. However, the additional inputs are also reflected in outputs, such as line length and ratcheted peak demand, in Economic Insights' benchmarking models.

Further, customers with high reliability and security of supply requirements will tend to take non-network measures to protect themselves from potential outages. For example, they often have back-up supply systems and generators to provide continuous supply in the event of a distribution system outage. They also often also have systems such as batteries and powerline conditioners to prevent temporary disruptions in supply from affecting sensitive systems such as computer servers. In addition, customers may be required to fund non-standard connections through capital contributions.

Mix of demand to non-demand customers

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in the ratio of demand to non-demand customers in our economic benchmarking. It also raises the issues we identify in operating environment factor criteria three. To the extent that the ratio of demand to non-demand customers does have an impact on costs, Economic Insights' benchmarking models account for it.

Ausgrid's consultant Evans and Peck raised differences in customer classifications as a factor that may impede like for like comparisons.[238] They said this would affect line lengths and value per

237 ActewAGL, *Regulatory proposal*, p. 243.

238 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. iii.

customer. The AEMC also raised the mix of industrial and residential customers as an exogenous factor that may be relevant when benchmarking service providers.[239]

An adjustment for the ratio of demand to non-demand customers is not necessary because to the extent that the ratio of demand to non-demand customers has an effect on costs, our Economic Insights' benchmarking models account for that effect. The models takes into account peak demand and customer numbers, which should capture the effect of differences in the ratio of demand to non-demand customers. The data used also exclude metering and connection costs. Therefore, Economic Insights' benchmarking models account for the main factors through which demand customers may impose higher costs on service providers than non-demand customers.

Population growth

We are satisfied that it is not necessary to provide an operating environment adjustment for population growth. An adjustment for population growth and its effect on customer numbers would raise operating environment adjustment criterion three. Economic Insights' models account for population growth through customer numbers and peak demand.

Evans and Peck have identified population growth as an operating environment factor it considers would affect benchmarking results.[240] It did not say that the process of customer growth in itself manifests itself in cost differences,[241] but that the location of growth may create differentials in costs. Evans and Peck list a number of reasons for why it considers brownfields developments are higher cost than green-fields developments.[242] It also says that because there is a relatively high proportion of a brownfields development in Ausgrid's network area, Ausgrid will have a natural cost disadvantage.[243] It also says other service providers in NSW and Queensland have natural cost disadvantages due to population growth, but does not explain why.[244]

Population growth (or decline) affects all service providers. Some service providers will experience higher growth than others and some areas of their networks will experience more growth than others.

We are satisfied that it is not necessary to provide an operating environment adjustment for population growth because Economic Insights' benchmarking models account for it. Customer numbers and peak demand are output variables in Economic Insights' MTFP, MPFP and opex cost function benchmarking models.

We are also satisfied that it is not necessary to provide an operating environment adjustment for differences in population growth in greenfields and brownfields developments because connection costs are not included in our economic benchmarking data. Brownfields developments may have higher connection costs than greenfields developments. However Economic Insights' benchmarking models use network services data. Network services exclude connection services. Because network services do not include connection services, connection services cannot affect benchmarking that uses network services data.

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239 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.

240 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 53–5.

241 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 28.

242 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 28–9.

243 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 54–5.

244 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 55, Table 19.

Further, of Australia's capital cities, Melbourne had the largest increase in population over the ten years ending June 2011 followed by Brisbane.[245] Melbourne had strong growth in inner city areas, its northern suburbs, western suburbs and south-eastern suburbs.[246] The graphs illustrating population growth presented by Evans and Peck indicate that Melbourne and Sydney have a comparable proportion of brownfields developments.[247] The growth rates in inner Melbourne seem similar to those in inner Sydney. Evans and Peck however interpret the graphs as indicating a larger proportion of brownfields developments in Sydney.[248] This difference in interpretation may be because the two graphs use different colour scales.

Load growth

We are satisfied that it is not necessary to provide an operating environment adjustment to account for differences in load growth. It raises operating environment adjustment criterion three. Economic Insights' benchmarking models account for load growth.

Ausgrid's consultant Evans and Peck raised load growth as a possible operating environment factor that may impede like for like comparison between service providers.[249]

An adjustment for load growth is not necessary because to the extent that load growth has an effect on costs, Economic Insights' benchmarking models accounts for that effect. Economic Insights' MTFP, MPFP, and opex cost function models account for changes in network capacity by including ratcheted peak demand as an output variable.

Load factor

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in load factor. It raises operating environment adjustment criteria two and three. It is unlikely that load factor will to lead to material differences in opex between services providers. The relevant cost driver is peak demand, which are accounted for in Economic Insights' benchmarking models.

Evan’s and Peck say that the Load factor and duration for SA and Victoria give service providers in those states a natural cost advantage.[250] Load factor is a network's average demand divided by its peak demand.

Service providers design electricity networks to taking into account the expected peak demand for electricity services. While the actual energy usage on a network is important from a billing perspective, energy is not the driver for capital expenditure, and as a result, it is not the driver for opex either. The higher peak demand, the more assets will be required to accommodate those peaks.

We are satisfied that an adjustment for load factor is not necessary because load factor does not drive costs. The relevant cost driver is peak demand. As mentioned above service providers design

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245 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 53.

246 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 55, Figure 3–43.

247 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 54-55, Figures 3-42 and 3-43.

248 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 54.

249 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 28–29.

250 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, pp. 26–27.

electricity networks accounting for the expected peak demand. While the "peakiness" of the load may alter the timing of some demand driven projects, the magnitude of the peak will be the primary driver for this form of expenditure.

Further, we are satisfied that an adjustment for load factor is not required because Economic Insights' benchmarking models account for differences in peak demand. Ratcheted peak demand is an output in Economic Insights' MTFP, MPFP and opex cost function benchmarking models. As mentioned above it is peak demand that determines the capacity required by a network, not load factor.

Route line length

We are satisfied that it is not necessary to provide an operating environment adjustment to account for differences in route line length. It raises operating environment adjustment criterion three. Economic Insights' benchmarking models account for route line length.

An adjustment for route line length is not necessary because to the extent that route line length has an effect on costs, Economic Insights' benchmarking models account for that effect. The MTFP, MPFP, and opex cost function models account for changes in route line length. Circuit length is included as an output in all of these models.

Economies of scale

We are satisfied that it is not necessary to provide an operating environment adjustment for economies of scale. It raises operating environment adjustment criterion three. The benchmarking model that we are using as the basis of our forecast of base opex, the Cobb Douglas SFA opex cost function, accounts for economies of scale.

ActewAGL has claimed that because it is the smallest service providers it does not have access to the same economies of scale as other service providers. As a result, they consider that their costs will appear to be higher than for all other services that have access to greater economies of scale.[251]

We are satisfied that an adjustment for economies of scale is unnecessary because the Cobb Douglas and Translog functional forms, which are used in Economic Insights' opex cost function benchmarking models, account for economies of scale. This is because both functions permit the estimation of the cost elasticities of the output variables. That is, the estimated coefficients of the output variables.

Cost elasticity with respect to an output represents how responsive opex is to a change in that output. The sum of the cost elasticities of individual outputs gives the returns to scale factor. If the sum of the cost elasticities is less than one, the underlying technology exhibits increasing returns to scale. Conversely, decreasing returns to scale will result if the sum of cost elasticities is greater than one. Equal cost elasticities, therefore, will result in constant returns to scale. For example, if opex increases by one per cent as a result of each output increasing by the same proportion, then this implies constant returns to scale.

[251] ActewAGL, *Regulatory proposal*, p. 243.

A.5.3 Endogenous factors

Capitalisation policy

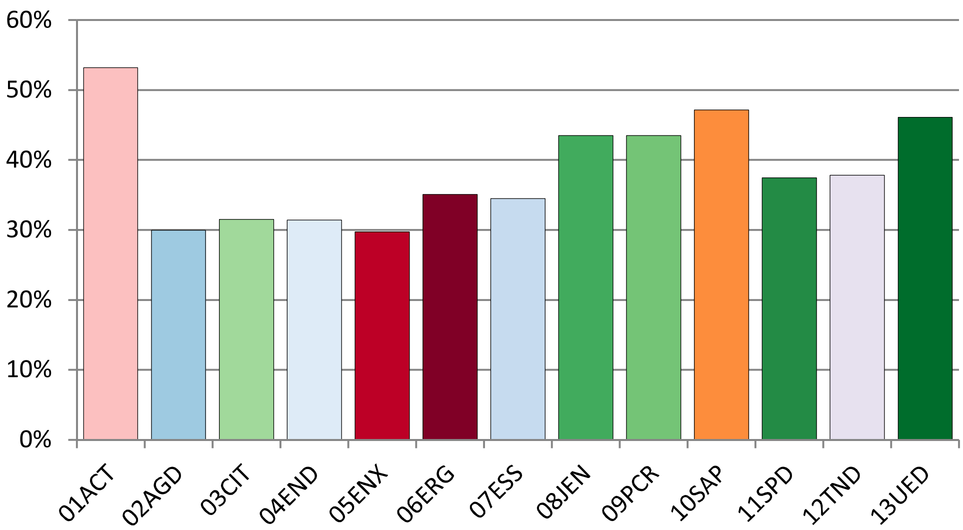
We are satisfied that it is not necessary to provide the NSW service providers with an operating environment adjustment for differences in capitalisation. An adjustment for differences in capitalisation policy between the NSW service providers and the comparison firms would not satisfy operating environment factor two. Differences in capitalisation policy will not lead to material differences in opex between the NSW service providers and the comparison service providers.

The NSW service providers raised capitalisation as an issue that may affect benchmarking results.[252]

Capitalisation policies may affect the amount of opex recorded. Utilisation of capital will affect the amount of opex required. The relative efficiency of a service provider's opex and capex will also affect the opex to capex ratio, as will service providers' location in their asset replacement cycles. A high opex to capex ratio may simply reflect the efficient utilisation of opex and capital. For instance, SA Power Networks and United Energy, which are two of the best ranking service providers in our benchmarking results, have high opex to capex ratios. Where service providers are spending more on capex, we would also expect more overheads to be allocated to capex.

We are satisfied that differences in capitalisation policies will not materially affect the NSW service providers' benchmarking results relative to the comparison service providers. This is because they expense a similar amount of their costs relative to most NEM service providers. However, the NSW service providers expense fewer costs, as a percentage of total expenditure, than all of the comparison service providers except for CitiPower. This is shown in Figure A-28 below. This suggests that it is likely that any operating environment adjustment to the NSW service providers' benchmarking results for capitalisation policies would be negative.

Figure A-28 Average opex as a percentage of totex, 2006 to 2013



Source: Economic benchmarking RIN

[252] Ausgrid, *Regulatory Proposal: Attachment 5.33*, May 2014, p. 19.
Endeavour Energy, *Regulatory Proposal: Attachment 0.12*, May 2014, p. 20.
Essential Energy, *Regulatory Proposal: Attachment 5.4*, May 2014, p. 26.
Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 5.

Risk appetite

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in the risk appetites of service providers' network owning corporations. Service providers choose their risk appetite.

Ausgrid's consultant Evans and Peck said differences in the risk appetites of service providers' network owning corporations may shape the costs of service providers and therefore impede like for like comparison.[253] Evans and Peck did not provide any further explanation about how differences in risk appetite would impede comparisons.

Part of the role of a corporation's management is to select the level of risk that they are willing to bear.[254] The quality of a firm's management is an endogenous factor that does not require an adjustment.[255]

Work and operating procedures

We are satisfied that it is not necessary to provide an adjustment for work and operating procedures. Work and operating procedures are under the direct control of service providers' management.

Evans and Peck raised the issue of work and operating procedures as an operating environment factor in its report for Ausgrid. Evans and Peck indicate that differences work and operating procedures may affect both operating and capital cost drivers.[256]

It is the role of service providers' management to seek and implement ways to improve the effectiveness and efficiency of the service provider's work and operating procedures. Because the effectiveness and efficiency of a service providers' work and operating procedures are a result of the quality of a service providers management, they are endogenous to the business and we do not consider it appropriate to account for them when benchmarking.[257]

Work conditions

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in work conditions. Service providers' managements are able to negotiate the agreements that they make with their workers.

Evans and Peck raised the issue of wage rates as an operating environment factor in its report for Ausgrid. Evans and Peck indicate that differences in wage rates and stand-down provisions in awards may affect both operating and capital cost drivers.[258]

The service providers in the NEM all have enterprise agreements.[259] A service provider's management has discretion in reaching an agreement that it strikes with its workforce. The deal that it

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253 Evans and Peck, Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs, November 2012, p. i.

254 Nocco, B. W. and Schultz, R. M. 2006, 'Enterprise Risk Management: Theory and Practice', *Journal of Applied Corporate Finance*, vol. 18, no. 4, p. 11.

255 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.

256 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 63.

257 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.

258 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 63.

makes represents a trade-off. The agreement might provide for lower wage rates in return for higher non-salary conditions. Alternatively, it might provide higher wage rates in exchange for productivity improvements. This is a simplification of reality but it illustrates the trade-off. Depending on the service provider's goals, it may be efficient to negotiate various entitlements with employees.

The two service providers with the highest efficiency scores on our Cobb Douglas SFA opex cost function, Powercor and CitiPower, have on average the highest and second highest labour cost per average staffing level in the NEM.[260] Both of these service providers are Victorian but economy wide Victorian wage rates are on average lower than those in the ACT, NSW, and Queensland.[261]

We therefore do not consider it appropriate to make a further adjustment for work conditions.

A.5.4 Geographic factors

Bushfire risk

We are satisfied that it is necessary to provide an operating environment adjustment for bushfire risk. An operating environment adjustment for differences in bushfire risk between the NSW service providers and the comparison service providers satisfies all of our operating environment adjustment criteria. While service providers can take action to manage their bushfire risk, the natural environment and regulations with which they must comply are beyond their control. Differences in bushfire regulations between the NSW service providers and the comparison service providers appear to cause material differences in opex. Also, bushfire risk is not explicitly accounted for in Economic Insights' models.

Evans and Peck raised bushfire risk as an issue that may affect service providers' benchmarking results. It states that the Fire Danger Index published by the Australasian Fire and Emergency Service Authorities implies that the NSW service providers and Victorian service providers have an equal risk of fire danger.[262]

Based on the evidence available to us, it seems that the NSW service providers do not face the same level of bushfire risk as the comparison service providers. The information available suggests bushfire risk is higher in parts of Victoria and South Australia, where the comparison service providers operate, than in NSW. Information on the impact of bushfires and the regulations relating to bushfires that apply in Victoria and NSW suggest that bushfire risk is higher in Victoria. The value of step changes and pass through applications after the Black Saturday bushfires provide an indication of the cost disadvantage that the Victorian service providers may face due to relatively higher bushfire risk.

Although some of our comparison service providers are not likely to face high bushfire risks, such as CitiPower, we have weighted the NSW service provider's efficiency target according to the number of customers that the comparison service providers have. This means that the efficiency target is weighted towards predominantly rural service providers with higher bushfire risk.

Forecasts from Deloitte Access Economics of the total economic costs of bushfires for 2014, Table A-19 suggests that the forecast economic cost of bushfires for 2014 is higher in Victoria and South Australia than in NSW. We have normalised the average annual cost of bushfires by Gross State

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259 Fairwork Commission, *Find an agreement*, available at: https://www.fwc.gov.au/awards-and-agreements/agreements/find-agreement. [last accessed 20 August 2014].

260 Category Analysis RIN data.

261 ABS, 6302.0 - Average Weekly Earnings, Australia, May 2014.

262 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, pp. 62–63.

Product. This is to prevent population and physical size from interfering with comparisons. While not a perfect measure, we are satisfied that it is preferable to normalising by area or population.

Table A-19 Forecast economic cost of bushfires 2014

	ACT	New South Wales	Queensland	South Australia	Tasmania	Victoria
GSP ($m 2013)	35 088	476 434	290 158	95 123	24 360	337 493
Forecast cost of bushfires 2014 ($m 2013)	55	45	0	46	41	178
% of GSP	0.16%	0.01%	0.00%	0.05%	0.17%	0.05%

Source: Deloitte Access Economics[263] and ABS.[264] [265]

Major bushfires have also tended to occur more frequently in South Australia and Victoria than in NSW. In the table below, which shows the location, and impacts, of major Australian bushfires of the 1900 to 2008 period, demonstrates this.

Table A-20 Significant bushfires and bushfire seasons in Australia 1900–2008

Date	States	Homes destroyed	Deaths
February 14, 1926	Victoria	550	39
January 8-13, 1939	Victoria and NSW	650	79
Summer 1943-44	Victoria	885	46
February 7, 1967	Tasmania	1557	64
January 8, 1969	Victoria	230	21
February 16, 1983	Victoria and SA	2253	60
February 18, 2003	ACT	530	4
January 11, 2005	South Australia	93	9

Source: Haynes et al.[266]

Also when normalised by population, South Australia, and Victoria experienced more deaths as a result of bushfire than NSW. We have normalised by population rather than area because bushfires in unpopulated areas are unlikely to cause many deaths. This is shown in Table A-21.

263 DEA, *Scoping study of a cost benefit analysis of bushfire mitigation: Australian Forest Products Association*, May 2014, p. 12.

264 ABS, 5220.0 - Australian National Accounts: State Accounts, 2012-13.

265 ABS, 6401.0 - Consumer Price Index.

266 Haynes, K. et al., *Australian bushfire fatalities 1900-2008: exploring trends in relation to the 'prepare, stay and defend or leave early' policy, Environmental Science & Policy, vol. 13 no. 3*, May 2010, p. 188.

Table A-21 Deaths as a result of bushfires per 100,000 people by state 1900 to 2008

	ACT	New South Wales	Queensland	South Australia	Tasmania	Victoria
Deaths	5	105	17	44	67	296
Average population 1900-2008[267]	122 524	3 804 434	1 688 122	911 524	324 896	2 818 053
Deaths per 100,000 residents	4	3	1	5	21	11

Source: Haynes et al[268] and ABS.[269]

Another indicator of bushfire risk is the bushfire related regulations that apply to a service provider. The regulations that a service provider must comply with are a direct imposition on a service provider's costs. The regulations related to mitigating bushfire risk were more stringent in Victoria than in NSW during the benchmarking period. There were increased regulatory obligations placed on the Victorian service providers after the Black Saturday bushfires, which occurred in 2009. Also, for the majority of the benchmarking period, vegetation management regulations were stricter for Victorian service providers than for the NSW service providers.

The 2009 Victorian Bushfires Royal Commission (VBRC) recommended changes to the operation and management of the Victorian distribution system. These obligations do not exist in NSW and include: reducing the length of asset inspection cycles, improving the efficacy of asset inspections, modifying the operation of reclosers, retrofitting vibration dampers to longer spans of power line, and fitting spreaders to power lines to minimise clashing.

The vegetation management obligations for the Victorian service providers have also been stricter over the benchmarking period. The Victorian *Electricity Safety (Electric Line Clearance) Regulations 2010* and *2005,* prescribe (among other things) minimum clearance spaces for power lines that become progressively stricter in areas of higher bushfire risk.[270] The NSW *Electricity Supply (Safety and Network Management) Regulation 2014, 2008 and 2002* set out the statutory objectives for the NSW service providers relating to vegetation clearance and bushfire risk. The regulations require(d) the NSW service providers to prepare a safety management system. Part of this plan relates to vegetation management. The NSW regulations however do not mandate minimum vegetation clearance distances.[271] [272] [273]

The 2002 regulations required the NSW service providers to comply with minimum clearances as required by the Director General of the Department of Energy, Utilities and Sustainability. It is not clear what these requirements were, however for the majority of the benchmarking period the NSW service providers had the ability to set their own minimum clearance requirements. This provided the NSW service providers with a greater degree of flexibility on how to manage vegetation clearance than service providers in Victoria. Further, changes to the Victorian *Electricity Safety (Electric Line Clearance) Regulations 2010* after the Black Saturday bushfires lead to an increase in costs for the Victorian service providers.

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267 We used the average population over 1900 to 2008 rather than the current population to account for how population size may have changed over the period.

268 Haynes, K. et al., *Australian bushfire fatalities 1900-2008: exploring trends in relation to the 'prepare, stay and defend or leave early' policy, Environmental Science & Policy, vol. 13 no*. 3, May 2010, p. 188.

269 3105.0.65.001 - Australian Historical Population Statistics, 2014

270 *Electricity Safety (Electric Line Clearance) Regulations 2010*, Schedule, 27 February 2013.

271 *Electricity Supply (Safety and Network Management) Regulation* 2014, section 7(1)(iv).

272 *Electricity Supply (Safety and Network Management) Regulation 2008*, section 12.

273 *Electricity Supply (Safety and Network Management) Regulation 2002*, section 9.

During the 2011 regulatory determination for the Victorian Service Providers, and subsequent pass throughs, we quantified the forecast impact of changes in bushfire regulations, including those recommended by the VBRC and the implementation of the *Electricity Safety (Electric Line Clearance) Regulations 2010*. On average, weighted by opex for the 2011–2015 period, the new regulatory obligations related to bushfires were forecast to be 8.3 per cent of total opex for the Victorian service providers.[274] [275] [276] [277] [278] [279] [280] [281] [282] Some of these costs may be temporary in nature as the Victorian service providers transition to the new obligations rather than representing an ongoing cost disadvantage.

On balance, we consider that while bushfire may be a serious risk for most service providers, the NSW service providers do not appear to have as high bushfire risk as the comparison service providers, which are located in South Australia and Victoria. This indicates that the NSW service providers may have a cost advantage relative to the comparison service providers.

We are satisfied that an adjustment for bushfire risk is appropriate because the service area of a network and the regulations that apply are not chosen by service providers.

In addition, it has the potential to create material differences in the opex required to operate the comparison service providers' opex relative to the NSW service providers. In Victoria for the 2011–2015 period, the increase in regulatory obligations related to bushfires was forecast to be 8.3 per cent of total opex. There are no variables in our economic benchmarking models that represent bushfire risk.

With regard to the quantum of the operating environment adjustment for bushfire risk, we consider that it should take into account that we base efficiency rankings on average performance over the 2005–06 to 2012–13 period and that not all comparison firms are Victorian. Therefore, we should base the operating environment adjustments on the average effect of the operating environment factor on the comparison firms over the benchmarking period. The new regulatory obligations only came into force in Victoria in 2010–11 so the Victorian service providers only had this cost disadvantage in the final three years of the benchmarking period. SA Power Networks did not have this disadvantage. We have therefore weighted the bushfire risk operating environment adjustment by the customer numbers of the comparison firms and the length of the benchmarking period affected.

We are satisfied that it is necessary to provide a negative 2.4 per cent operating environment adjustment for differences in bushfire regulations between the NSW service providers and the comparison service providers.

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274 AER, *Final decision: CitiPower Ltd and Powercor Australia Ltd vegetation management forecast operating expenditure step change*, August 2012, p. 2.

275 AER, *CitiPower Pty Distribution determination 201–-15*, September 2012, p. 17.

276 AER, *Powercor Australia Ltd Distribution determination 2011-15*, October 2012, p. 26.

277 AER, *Final decision: Powercor cost pass through application of 13 December 2011 for costs arising from the Victorian Bushfire Royal Commission*, May 2011, p. 96

278 AER, *Final decision - appendices: Victorian electricity distribution network service providers – Distribution determination 2011-2015*, October 2011, pp. 301–304.

279 AER, *Final Decision: SP AusNet cost pass through application of 31 July 2012 for costs arising from the Victorian Bushfire Royal Commission*, 19 October 2012, p. 3.

280 AER, *SPI Electricity Pty Ltd Distribution determination 2011-2015*, August 2013, p. 20.

281 AER, *Jemena Electricity Network (Victoria) Ltd: Distribution determination 2011–2015*, September 2012, p. 22.

282 AER, *United Energy Distribution: Distribution determination 2011-2015*, September 2012, p. 19

Corrosive environments

We are satisfied that an operating environment adjustment is not necessary for corrosive environments. An adjustment for corrosive environments raises our operating environment adjustment criterion two. All service providers have assets that corrosive elements affect.

Evans and Peck raise the issue of corrosion as an operating environment factor. They consider that the presence of corrosive atmospheres containing things such as salts (in coastal environments) and acid sulphates (in soils) affect maintenance costs.[283]

While salts affect assets in coastal areas, dusts affect assets in inland areas. These differences may lead to differences in design and operational considerations. However, there is not sufficient evidence to conclude that these differences will lead to material differences in opex. We have, however, included this factor as part of the overall allowance for operating environment factors.

Grounding conditions

We are satisfied that an operating environment adjustment is not necessary for grounding conditions. An adjustment for grounding conditions raises operating environment adjustment criterion two. The installation of earth grids is a very small part of service providers' costs. Also, there is likely to be as much variation in grounding conditions within service providers' service areas as between service providers.

Evans and Peck say that rocky terrain and high resistivity soils make the installation of earth grid, to provide effective protection, more complex.[284] Evans and Peck provide no further information on how this will affect service providers differently.

Electricity distribution requires the use of earthing or grounding connection to aid in the protection and monitoring of the network. In rural areas, service providers use the earth as the return path for some forms of electricity distribution[285]. These systems require service providers to create an electrical earth, usually from embedding conductors or rods in the ground. The effectiveness of these earths varies depending on the soil type and the amount of moisture in the soil.

The installation and maintenance of earth grids are a very small part of service provider's costs. Further, all service providers will have areas of their networks that provide more challenging grounding conditions than others do. It is likely that there is a greater degree of difference in grounding conditions within networks than between networks. Although there may be differences in grounding costs between networks, there is not sufficient evidence to conclude that these differences are material. We have, however, included this factor as part of the overall allowance for operating environment factors.

Natural disasters

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in the natural disasters faced by the NSW service providers and the comparison service providers. An operating environment adjustment to the NSW service providers' benchmarking results for natural disasters raises operating environment criterion two. Although the human impact of natural

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283 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 38.

284 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 38.

285 Single Wire Earth Return (SWER).

disasters is considerable, on average, the economic costs to the NSW service providers are not likely to lead to material differences in opex relative to the comparison service providers.

When considering the effect of natural disasters, we have not considered bushfires because we consider them above. Bushfires may also have a human cause whereas natural disasters do not.

Evan's and Peck identified major weather events as an operating environment factor that may affect benchmarking results.[286] Evans and Peck present analysis from the Bureau of Transport Economics (BTE) that estimate the magnitude of the costs imposed by disasters in Australia. These costs include the estimated costs of bushfires, cyclones, earthquakes, floods, landslides, and severe storms in Australia over the period 1967–1999.[287] Evans and Peck note that NSW has the highest cost of these disasters for the period 1967 to 1999. Evans and Peck also note that severe storms are the most damaging type of natural disasters according to the BTE.

We are satisfied that natural disasters are not likely to create material differences in opex between the NSW service providers and the comparison service providers. Data from BTE suggest that natural disasters are not likely to create material differences in opex between service providers. Data from the category analysis RIN also suggest that natural disasters do not create a material difference in opex between the NSW service providers and the comparison service providers.

When considering the impact of natural disasters on service providers' costs, it is appropriate to consider the average cost impact. While the cost of a natural disaster may be material when compared to total expenditure for a given year, service providers insure themselves against the costs of natural disasters. This mitigates the financial impact of natural disasters. Effectively, service providers amortise the costs of responding to natural disasters through insurance. This helps to alleviate cash flow volatility that natural disasters may cause. Because service providers amortise the cost of natural disasters, the average cost of natural disasters is more appropriate for the purpose of comparisons across service providers.

Data from the BTE suggests that natural disasters are unlikely to materially affect service providers' costs. These data estimate the total economic cost of natural disasters over the period 1967 to 1999. Table A-22 shows these data. We have normalised the average annual cost of natural disasters by Gross State Product. This is to prevent population and physical size from interfering with comparisons. While not a perfect measure, we are satisfied that it is preferable to normalising by area or population.

We have also excluded costs associated with bushfires because we have considered bushfires separately from natural disasters. We have also excluded earthquakes because they only affect NSW in the sample period, and Victoria and South Australia have a similar earthquake risk to NSW.[288] Even if the NSW service providers were four times more likely to incur costs than a hypothetical state average firm, on average less than 0.5 per cent of their costs would be due to natural disasters.

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286 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 66–7.

287 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 66.

288 Geoscience Australia, *Earthquake Hazards*, available at http://www.ga.gov.au/darwin-view/hazards.xhtml. last accessed 18 August 2014.

Table A-22 Average cost of natural disasters as a percentage of GSP 1967-1999: comparison by state

	ACT	NSW	QLD	SA	TAS	VIC
GSP in 2013 ($m 2013)	35088	476434	290158	95123	24360	337493
Average annual cost of natural disasters ($m 2013)	0.3	492.3	360.5	51.8	11.6	92.1
% of GSP	0.00%	0.10%	0.12%	0.05%	0.05%	0.03%

Source: BTE[289] and ABS.[290] [291]

Our category analysis data also suggest that differences in costs due to natural disasters are unlikely to cause material differences in opex between the NSW service providers and the comparison service providers. Emergency response expenditure on major events and major event days provides some indication of the effect of natural disasters on service providers costs. On average the share of major event day emergency response expenditure, as a percentage of opex expenditure is less than 1 per cent for most service providers.

Endeavour and Essential appear to incur more emergency response costs, as a percentage of total opex, than Ausgrid or the comparison service providers. However, as a percentage of total opex the difference between the percentage of opex made up of emergency response between Essential and the customer weighted average for the comparison service providers is relatively small. The difference is 0.38 per cent for Essential and 0.69 per cent for Endeavour. Further, not all emergency response expenditure on major event days will relate to natural disasters. We have, however, included this factor as part of the overall allowance for operating environment factors.

Shape factors

We are satisfied that it is not necessary to provide an operating environment adjustment for shape factors. An operating environment adjustment for shape factors raises operating environment adjustment criterion three. To the extent that service providers must extend their networks to accommodate natural boundaries, our economic benchmarking models account for this through circuit length.

Evans and Peck say that natural boundaries, such as water and national parks, surrounding electricity networks impose costs on service providers.[292] These costs manifest themselves through imposing constraints on network planning.

We are satisfied that our economic benchmarking accounts for the effect of shape factors through circuit length. Although some service providers may be required to traverse or travel around natural boundaries, when this occurs, the service providers' line length will also increase. As circuit length is an output variable in our MTFP, MPFP, and opex cost functions, our benchmarking models account for this effect. We have, however, included this factor as part of the overall allowance for operating environment factors.

289 BTE, *Economic costs of natural disasters in Australia,* 2001, p. 35.

290 ABS, 5220.0 - Australian National Accounts: State Accounts, 2012–13.

291 ABS, 6401.0 - Consumer Price Index.

292 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 45 and p. 46.

Skills required by service providers

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in skills required by service providers. An adjustment for differences in skills required by service providers raises operating environment adjustment criterion two. Differences in the skills required by service providers are not likely to lead to material differences in costs. All service providers require broadly the same skills.

Ausgrid's consultant Evans and Peck identified differences in the skills required by service providers an operating environment factor that may affect benchmarking results.[293] Evans and Peck do not provide any explanation as to how this may impede like for like comparisons.

An adjustment is not necessary because differences in the skills required by service providers are unlikely to lead to a material difference in costs. Service providers require employees with similar qualifications and skills. We are benchmarking the same core services provided by all networks. We have, however, included this factor as part of the overall allowance for operating environment factors.

Temperature

Ausgrid's consultant Evans and Peck said differences in temperature provide some service providers cost advantages as differences in air conditioning penetration affect peak demand. Evans and Peck submit the number and duration of warm days is greater in NSW and Queensland when compared to Victoria, stating it is reasonable to assume that this exposes the NSW and Queensland service providers to air conditioning penetration increases more than Victorian and SA service providers.[294]

We are satisfied that ratcheted peak demand captures all increases in demand including those due to differences in air conditioning penetration. Economic Insights' MTFP, MPFP, and opex cost function benchmarking all include ratcheted peak demand as an output variable. This captures the effect of temperature on opex.

Topographical conditions

We are satisfied that it is not necessary to provide an operating environment adjustment for topographical conditions. An operating environment adjustment for topographical conditions does not meet operating environment adjustment criterion two. All service providers are likely to have areas where topography adversely affects costs.

Ausgrid, Endeavour, and Essential have all raised topographic conditions as an operating environment factor that will affect the benchmarking results.[295] [296] [297] The AEMC also raised topography as an exogenous factor that may affect benchmarking. [298]

Evans and Peck, in the report commissioned by Ausgrid, state that service providers in NSW and Victoria have a natural cost advantage due to the topography of those regions.[299] They do not explain

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293 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, pp. 38.

294 Evans and Peck, Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs, November 2012, p. 64–65.

295 Ausgrid, *Attachment 5.33* to *Revenue proposal*, p. 3.

296 Endeavour, *Attachment 0.12* to *Revenue proposal*, p. 3.

297 Essential *Attachment 5*.4 to *Revenue proposal*, p. 5.

298 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.

299 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 41.

why they consider this is the case for NSW, but they do mention that the major population centres of Victoria are flat with little vegetation. Evans and Peck provide three maps that use different scales to support this.

Adverse topographical conditions affect many NEM service providers. For example, the Great Dividing Range runs through some distribution networks areas. Also, there are the Flinders Range in South Australia and the West Coast Range in Tasmania. Operating in mountainous regions may lead to higher costs in some operating areas such as maintenance, emergency response, and vegetation management due to access issues. Most of the comparison service providers operate in a relatively flat area compared to the NSW service providers. Therefore, the NSW service providers may have a cost disadvantage relative to some of the comparison service providers due to topography. On the other hand, AusNet Services, one of the comparison service providers, has a great deal of topographical variation in its operating area and may arguably have a cost disadvantage relative to the NSW service providers.

We are satisfied that an adjustment for topographical conditions is not necessary because many service providers are likely to be affected by topography to some extent. Further, the NSW service providers have not provided any evidence of the quantum of the cost advantage that operating in relatively flat terrain may afford other service providers. We have, however, included this factor as part of the overall allowance for operating environment factors.

A.5.5 Jurisdictional factors

Building regulations

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in building regulations across jurisdictions. It raises environment adjustment criterion two. The Building Code of Australia (BCA) provides a set of nationally consistent, minimum necessary standards of relevant safety (including structural safety and safety from fire), health, amenity and sustainability objectives for buildings and construction.[300]

Ausgrid's consultant Evans and Peck identified differences in building regulations as an operating environment factor that may affect benchmarking results.[301] Evans and Peck do not provide any explanation as to how this may impede like for like comparisons.

The Australian Building Codes Board (ABCB) is a Council of Australian Government standards writing body that is responsible for the National Construction Code (NCC) that comprises the BCA and the Plumbing Code of Australia (PCA). It is a joint initiative of all three levels of government in Australia and was established by an intergovernment agreement (IGA) signed by the Commonwealth, States and Territories on 1 March 1994. Ministers signed a new IGA, with effect from 30 April 2012.[302] The BCA contains technical provisions for the design and construction of buildings and other structures, covering such matters as structure, fire resistance, access and egress, services and equipment, and energy efficiency as well as certain aspects of health and amenity.[303]

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300 ABCB, The Building Code of Australia, available at; http://www.abcb.gov.au/about-the-australian-building-codes-board . [last accessed 4 September 2014].

301 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 5.

302 ABCB, About the Australian Building Codes Board, available at; http://www.abcb.gov.au/about-the-australian-building-codes-board . [last accessed 4 September 2014].

303 ABCB, The Building Code of Australia, available at; http://www.abcb.gov.au/about-the-australian-building-codes-board . [last accessed 4 September 2014].

We are satisfied that an operating environment adjustment for differences in building regulations is unnecessary because there will not be material differences in opex between service providers in different jurisdictions due to consistent building regulations. We have, however, included this factor as part of the overall allowance for operating environment factors.

Capital contributions

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in capital contribution policies. This raises operating environment criterion three. Our economic benchmarking uses network services data, which exclude services for which capital contributions are payable.

Ausgrid's consultant Evans and Peck said differences in capital contribution policies may affect benchmarking of service providers.[304] Evans and Peck said that differences in capital contributions policies make it difficult to draw any conclusions on the effect of capital contributions on different service providers.

We are satisfied that differences in capital contribution policies do not affect the data used in our economic benchmarking for the NSW providers and therefore, an adjustment for differences in capital contribution policies does not meet operating environment criterion three. Users will make a capital contribution when they connect to the network, depending on the type of connection, or require a change to their connection. New connections and changes to connections are connection services for the purpose of our economic benchmarking RIN.[305] Network services do not include connection services in our economic benchmarking RIN. 306 Because the data that we have used for our economic benchmarking exclude connection services, capital contributions cannot affect the results of the benchmarking.

Contestable services

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in contestable services across jurisdictions. This raises operating environment adjustment criterion three. Our economic benchmarking only includes costs incurred in providing Network services. Network services do not include contestable services.

Ausgrid, Endeavour Energy, and Essential Energy all raised contestability of services as an operating environment factor that will affect benchmarking results.[307] [308] [309] Beyond saying that they 'play a major part in explaining differentials in cost structures' none of the NSW service providers gave any explanation of how differences in markets for contestable services would affect benchmarking.

We are satisfied that that it is not necessary to provide an adjustment for differences in contestable services. Our economic benchmarking only includes costs incurred in providing network services. Contestable services are not included in network services. Because we have excluded contestable services from network services, contestable services cannot affect benchmarking that uses network services data.

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304 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 31-32.

305 AER, *Economic Benchmarking RIN for distribution service providers: Instructions and Definitions*, November 2013, p. 44.

306 AER, *Economic Benchmarking RIN for distribution service providers: Instructions and Definitions*, November 2013, p. 44.

307 Ausgrid, *Attachment 5.33* to *Regulatory proposal*, May 2014, p. 3.

308 Endeavour Energy, *Attachment 0.12* to *Regulatory proposal*, May 2014, p. 3.

309 Essential Energy, *Attachment 5.*4 to *Regulatory proposal*, May 2014, p. 5.

Environmental regulations

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in environmental regulations across jurisdictions. It raises operating environment adjustment criterion two. Environmental regulations are not likely to create material differences in costs between the NSW service providers and the comparison service providers.

Ausgrid's consultant Evans and Peck identified differences in environmental regulations as an operating environment factor that may affect benchmarking results.[310] Evans and Peck did not provide any explanation as to how this may impede like for like comparisons, nor did they identify environmental regulations that would affect service providers' costs.

We investigated how environmental regulations may lead to material differences for the opex that service providers require, but were unable to find any reliable evidence that such differences exist. The way various jurisdictions administer environmental regulation varies considerably.[311] While the Commonwealth has some involvement, most environmental planning functions are carried out by state or local governments. We consider it is likely that differences in environmental regulations faced by service providers will lead to differences in costs, but we do not have any evidence to suggest that these differences are material.

We are satisfied that an adjustment for environmental regulation because we were unable to identify any environmental regulations that would lead to material differences in opex. We have, however, included this factor as part of the overall allowance for operating environment factors.

Occupational Health and Safety regulations

We are satisfied that it is necessary to provide the NSW service providers with a positive 0.5 per cent operating environment adjustment for differences in Occupational Health and Safety Regulations (OH&S). This is because an operating environment adjustment criterion for OH&S regulations satisfies all three operating environment factor criteria. OH&S regulations are outside of the control of service providers. Differences in OH&S regulation are likely to create material differences in opex between the NSW service providers and the comparison firms. Economic Insights' benchmarking models do not account for differences in OH&S regulations.

Ausgrid's consultant Evans and Peck identified differences in OH&S regulations as an operating environment factor that may affect benchmarking results.[312] Evans and Peck did not provide any explanation as to how this may impede like for like comparisons.

We are satisfied that an operating environment factor adjustment for OH&S regulations meets operating environment adjustment criterion one. The decision on the form that OH&S regulations take belongs to the legislative bodies of the Commonwealth, States and Territories. An operating environment factor adjustment for OH&S regulation meets operating environment adjustment criterion two because it has the potential to materially affect service providers' costs. An operating environment adjustment for OH&S regulations meets operating environment adjustment criterion three because there are no variables in Economic Insights' benchmarking models that reflect differences in OH&S regulations.

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310 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 38.

311 Productivity Commission, *Performance Benchmarking of Australian Business Regulation: Local Government as Regulator*, July 2012, p. 386–390.

312 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 38.

In the NEM, all jurisdictions, except Victoria, have enacted the Work Health and Safety Act and Work Health and Safety Regulations.[313] While enforcement activities may vary slightly across jurisdictions the main cost driver of OH&S costs will be the regulations and law with which businesses must comply. In this respect, we are satisfied that there will not be material cost differences between jurisdictions that have enacted the model laws. However, there is likely to be a cost differential between service providers in Victoria and those in other jurisdictions. Because the comparison firms are predominantly Victorian, this is likely to likely to lead to cost differentials between the comparison firms and the NSW service providers.

We are satisfied that a positive 0.5 per cent operating environment adjustment for the NSW service providers is appropriate. The Victorian state government employed PricewaterhouseCoopers (PwC) to estimate the costs of implementing the new OH&S laws would impose on commerce in Victoria. According to PwC, the annual impost of the implementing the laws would be up to $796 million ($2011–12).[314] The Gross State Product for Victoria in FY 2012 was $328 595 million ($2011–12).[315]

This would mean that the impact of complying with the Act on the Victorian economy would be equivalent to 0.24 per cent of Gross State Product. Electricity distribution work environments may present more danger than the average work environment across the economy. With this in mind, a 0.24 per cent adjustment may underrepresent the potential cost advantage for Victorian Electricity distribution businesses. The PwC report suggests that the annualised ongoing costs for power generators would be almost two and a half times greater than for the majority of other businesses.[316]

Therefore, we have assumed that an electricity distributor would face two and a half as many costs due to a change in OH&S laws compared to the hypothetical economy wide average firm. This suggests that relative to a Victorian service provider, service providers in other NEM jurisdictions require 0.6 per cent more opex. When this is weighted by the proportion of customers Victorian service providers have of the comparison firms, this leads to a 0.5 per cent adjustment.[317]

Licence conditions

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in licence conditions across jurisdictions. It raises operating environment adjustment criteria two and three. Licence conditions are not likely to materially affect opex because reliability standards are similar for the NSW service providers and most of the comparison service providers over the 2014–19 period. Also, Economic Insights' benchmarking models take reliability requirements into account in two ways: reliability is an output and so are some measures of physical assets.

All of the NSW service providers identified license conditions as a major part in explaining cost differentials between jurisdictions.[318] [319] [320]

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313 Safework Australia, Jurisdictional progress on the model work health and safety laws, available at: thehttp://www.safeworkaustralia.gov.au/sites/swa/model-whs-laws/pages/jurisdictional-progress-whs-laws. [last accessed 4 September 2014].

314 PricewaterhouseCoopers, *Impact of the Proposed National Model Health Work and Safety Laws in Victoria*, April 2012, p.7.

315 ABS, *5220.0 - Australian National Accounts: State Accounts, 2011-12*, November 2012.

316 PricewaterhouseCoopers, *Impact of the Proposed National Model Health Work and Safety Laws in Victoria*, April 2012, p.9.

317 We note that we have not provided a step change to TransGrid for the change in Work Health and Safety legislation. We note that although the change from the NSW laws to the model laws may not be material it appears that the change from the Victorian laws to the model laws may be.

318 Ausgrid, *Attachment 5.33* to *Regulatory proposal*, May 2014, p. 3.

319 Endeavour Energy, *Attachment 0.12* to *Regulatory proposal*, May 2014, p. 3.

320 Essential Energy, *Attachment 5.*4 *to Regulatory proposal*, May 2014, p. 5.

We are satisfied that an adjustment for licence conditions would not be appropriate. While the NSW service providers were subjected to mandated design planning conditions during the benchmarking period, the impact of these conditions was predominantly capital in nature. To this end, having invested more capex over the benchmarking period, the NSW service providers will benefit from younger assets and higher reliability.

In addition, since recent AEMC reviews of distribution reliability, the NSW government has relaxed the reliability standards to allow the NSW service providers to adopt probabilistic planning. This removes the primary difference between NSW service providers and the comparison service providers, with regard to licence conditions, in the forecast period.

We are satisfied that an adjustment for licence conditions would not meet operating environment adjustment criterion three because Economic Insights' benchmarking models account for reliability and physical assets. Reliability is an output in the MTFP and MPFP models. Also all of the benchmarking models include output measures that are correlated with service providers' capital stocks such as circuit length.

Planning regulations

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in planning regulations across jurisdictions. It raises operating environment adjustment criterion two. Differences in planning regulations are not likely to create material differences in opex across jurisdictions.

Ausgrid's consultant Evans and Peck identified differences in planning regulations as an operating environment factor that may affect benchmarking results.[321] They say that in Sydney costs are higher due to council requirements.[322] Specifically, they say that requirements for laying and relaying of concrete pavements are more onerous in Sydney than other parts of Australia. They say that the concrete in Sydney is thicker and therefore more costly. They also say that councils in NSW do not allow businesses to reseal roads themselves after works. Instead councils reseal the roads themselves and charge businesses a fee.

Regardless of the overall average difference in concrete depths, reinstatement is a very small component of overall operating expenditures. Also the practice of certain councils requiring road and pavement reinstatement to be undertaken by the council and not the service provider is relatively common across most urbanised municipalities. On this basis, we consider that differences in concrete reinstatement will not have a material impact on benchmarking.

Also the Productivity Commission carried out a review of planning regulations in April 2011.[323] The finding of this review was that given the extent of differences, it is a challenge to compare the planning systems of the states and territories: individual indicators are often heavily qualified and thus so are comparisons between jurisdictions.[324] As a result, the Commission did not attempt to construct an overall ‘league table’ of state and territory performance.[325] This suggests that although planning

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321 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australian service providers*, November 2012, p. 6.

322 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, pp. 39–40.

323 Productivity Commission, Performance Benchmarking of Australian Regulation: Review of Planning Regulations, April 2011.

324 Productivity Commission, review of planning regulations, April 2011, Volume 1, p. XXVIII.

325 Productivity Commission, review of planning regulations, April 2011, Volume 1, p. XXXI.

regulations differ across jurisdictions, and are therefore likely to create some differences in costs, that differences in planning regulations are not likely to lead to material differences in costs.

We are satisfied that the NSW service providers have not identified relevant planning regulations that would materially increase their opex relative to the comparison service providers. We have, however, included this factor as part of the overall allowance for operating environment factors.

Service classification

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in service classifications between the NSW service providers and the comparison service providers. Our economic benchmarking techniques only use data that relate to the provision of network services.

Ausgrid, Endeavour, and Essential all raised service classification as an operating environment factor that will affect benchmarking results.[326] [327] [328] None of the service providers provided any explanation of how this would impede like for like comparison or a quantification of its effect.

Our economic benchmarking takes into account differences in service classifications across jurisdictions by using data on network services. Network services only include the provision of the core 'poles and wires' component of distribution services. They exclude other services that distributors provide including metering and public lighting. Because the benchmarking techniques only use network services data, the results will only reflect differences in network services. Therefore, differences in the classification of standard control and alternative control services will not affect our economic benchmarking results.

Traffic management requirements

We are satisfied that it is not necessary to provide an operating environment adjustment for differences in traffic management requirements. Traffic management requirements are not likely to lead to material differences in opex between service providers.

Evans and Peck say that traffic management regulations may affect comparison of opex across networks. They do not explain, how or whom they would affect.[329]

As noted in the customer density section above, traffic management costs generally correlate with the volume of traffic near the worksite. We consider that traffic management will have a greater overall impact on expenditure in higher density areas than in lower density areas. However, our economic benchmarking models account for this.

We recognise that each Australian state and territory has different standards for the development and implementation of traffic control plans at roadwork sites. This includes issues such as signage, speed zones, etc. Each of the states and territories has different levels of training requirements including:

- traffic management planners (approvers and designers),
- worksite supervision and control.

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326 Ausgrid, *Attachment 5.33* to *Regulatory proposal*, May 2014, p. 3.
327 Endeavour Energy, *Attachment 0.12* to *Regulatory proposal*, May 2014, p. 3.
328 Essential Energy, *Attachment 5.4* to *Regulatory proposal*, May 24, p. 5.
329 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 38.

However, State and territory road authorities generally base their traffic control at roadwork sites requirements on AS1742 Part 3: Guide to traffic control devices for works on roads[330].

Overall, we are satisfied that differences in traffic management regulations and traffic management needs are unlikely to materially affect costs at the total opex level. Differences in traffic management regulations are likely to represent a small portion of the total difference between traffic management costs. Traffic management costs are only a portion of project costs. Not all projects incur traffic management costs. We have, however, included this factor as part of the overall allowance for operating environment factors.

A.5.6 Network factors

Asset age

We are satisfied that it is not necessary to provide an operating environment factor for differences in asset age between the NSW service providers and the comparison service providers. It raises operating environment criterion two. The age profiles of the NSW service providers and the comparison service providers are similar, and therefore should not lead to material differences in their opex.

The NSW service providers submitted that one of the reasons like for like comparisons between service providers cannot be made effectively to draw conclusions about efficiency is differences in the age of service providers' assets. [331] [332] [333]

We are satisfied that an operating environment adjustment for asset age is unnecessary because the weighted average remaining life (WARL) of the NSW service providers and the comparison service providers' assets seem to be similar. The WARL represents the average remaining life of a service provider's assets weighted by the value of those assets. Figure A.35 below compares all NEM service providers' WARLs.

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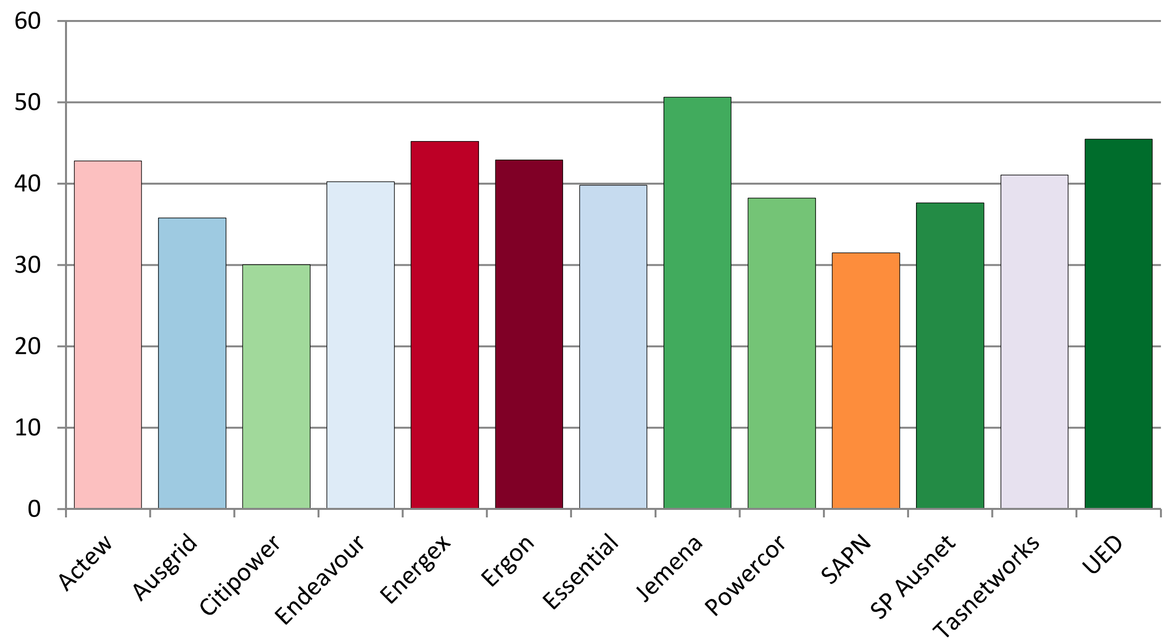
330 National Approach to Traffic Control at Work Sites, Publication no: AP-R337/09, Austroads 2009, p. 1.
331 Ausgrid, *Attachment 5.33* to *Regulatory proposal*, May 2014, p. 3.
332 Endeavour Energy, *Attachment 0.12* to *Regulatory proposal*, May 2014, p. 3.
333 Essential Energy, *Attachment 5.*4 to *Regulatory proposal*, May 2014, p. 5.

Figure A-29 Weighted average remaining life for each NEM service provider



Source: Category analysis RIN data, AER Analysis.

With the exception of UED, the WARLs for the comparison service providers slightly lower than Endeavour Energy's and Essential Energy's WARLs. Therefore, Endeavour Energy and Essential Energy may have a slight cost advantage relative to the comparison firms on maintenance opex because their networks are, on average, younger so their assets should require less maintenance.

Ausgrid does appear to have a lower WARL than Endeavour Energy and Essential Energy, but its WARL is higher than CitiPower's and SAPN's. Ausgrid's WARL is also only slightly lower than AusNet's and Powercor's. Therefore, we are not satisfied an adjustment for asset age is warranted.

Proportion of 22kV and 11kV lines

We are satisfied that it is not necessary to provide an operating environment adjustment for the proportions of 22kV and 11kV lines in the network. This is because an adjustment would not satisfy operating environment adjustment criterion two. Operating a network using a 22 kV high-voltage distribution system rather than an 11kV high-voltage distribution system is unlikely to create material differences in opex between service providers.

Evans and Peck have claimed that because Victoria operates a 22 kV high-voltage distribution system they have a cost advantage over service providers that operate 11kV distribution systems.[334] They claim that this represents a cost advantage and will manifest itself in lower operation and maintenance costs. [335]

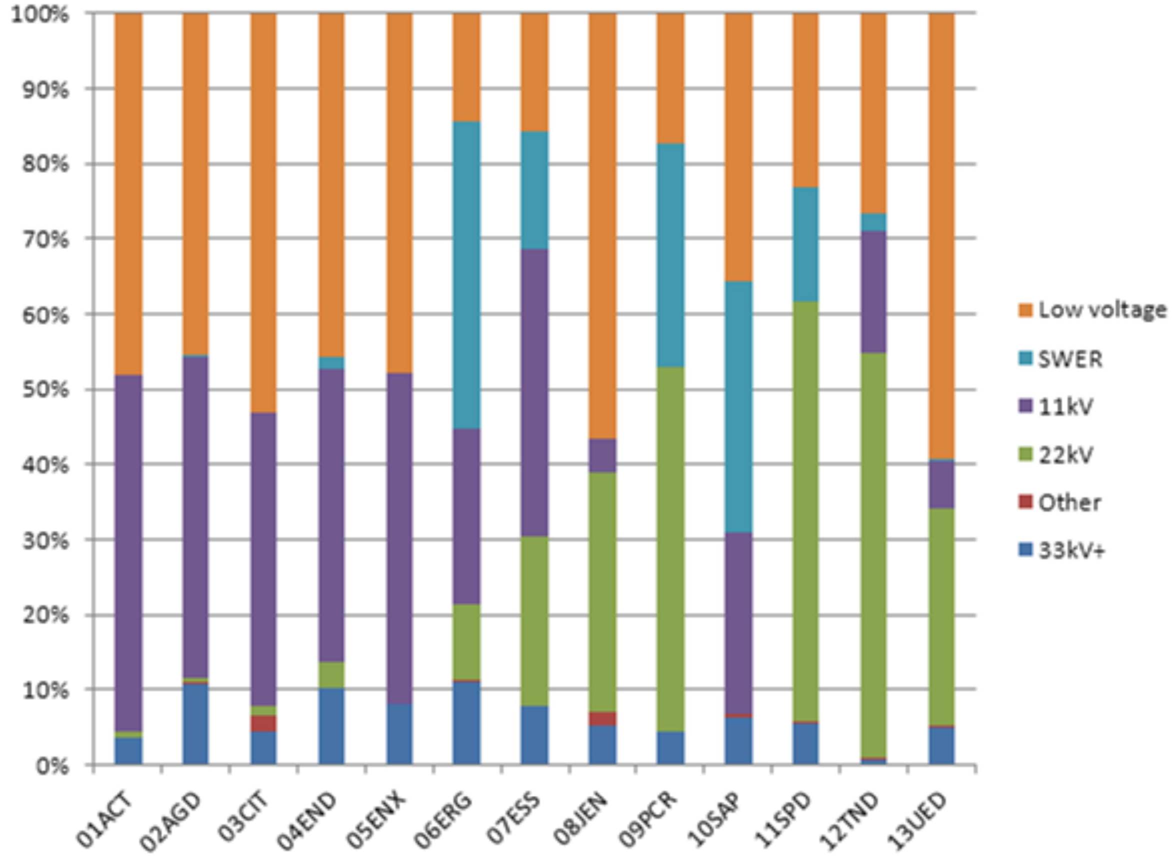
Each of the NSW service providers operates a high-voltage distribution network that is predominantly 11kV although 22kV forms a significant proportion of some NSW networks. Comparison service providers operate both 11kV and 22kV high voltage distribution networks. The Victorian service

334 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 17.

335 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 5.

providers have mostly changed their high-voltage networks to a 22kV model with the notable exception of CitiPower. CitiPower maintains a predominantly 11kV high-voltage distribution network. SA Power Networks also has a predominantly 11kV high-voltage distribution network.

Figure A-30 Line voltages by length



Source: Economic Benchmarking RIN, AER analysis.

The high-voltage distribution networks are the key means for the distribution of electricity over middle distances such as between suburbs and across small regional areas.

Simplistically, a doubling of the voltage will provide a doubling of the capacity of the line. In the case of high-voltage lines, a 22kV line will potentially have twice the capacity of an 11kV line. Electricity networks typically face two line-design limitations: distance and capacity. As mentioned above, a 22kV network has the potential to provide twice the capacity of a similar 11kV line. The 22kV line can also cover a greater distance than an 11kV line serving the same electrical load.

In practice, this will result in an 11kV network design that has more 11kV feeders to service the same customer loads and a larger number of lower capacity zone substations to service these feeders. On the other hand, a 22kV network design will have fewer feeders and a smaller number of higher capacity zone substations.

We are satisfied that an adjustment for the proportion of 11kV and 22kV lines in a network is not necessary because the configuration of the high-voltage distribution system should not materially affect opex.

We note that Powercor and AusNet, and CitiPower and SAPN, represent the two extremes in terms of 11kV and 22kV networks - Powercor and AusNet are predominantly 22kV systems while CitPower and SAPN has a predominantly 11kV system. If this factor were material to the costs of the service providers, we would expect this to be most apparent when comparing these four service providers. Our MPFP and opex cost function benchmarking indicate that SAPN, Powercor and AusNet have very similar levels of expenditure and performance suggesting that this factor is not material to overall performance.

In any case, given each of these service providers are in our group of benchmark service providers, we consider no further adjustment is necessary for this factor. We have, however, included this factor as part of the overall allowance for operating environment factors.

Ratio of overhead and underground lines

The AEMC raised the mix of underground and overhead lines as an operating environment factor that we may need to take into account when benchmarking service providers.[336]

We are satisfied that it is not necessary to provide an operating environment adjustment for the proportions of overhead and underground lines in the network. Economic Insights' opex cost function benchmarking models take the proportion of overhead and underground lines into account.

Subtransmission

We are satisfied that it is necessary to provide an operating environment adjustment for differences in subtransmission network configuration between the NSW service providers and the comparison service providers. An adjustment for differences in subtransmission network configuration raises all of our three operating environment adjustment criteria. The boundary between transmission and distribution networks is the result of historical decisions made by state governments when dividing electricity networks. Differences in subtransmission configuration are likely to lead to material differences in the cost of providing network services. Differences in subtransmission configurations are not accounted for elsewhere in our economic benchmarking.

Ausgrid, Endeavour, and Essential all raised subtransmission network configuration as an operating environment factor that will affect benchmarking results.[337] [338] [339] Ausgrid has said that because it has a higher proportion of subtransmission assets their cost structures are inherently higher for providing services to their customers. ActewAGL also raised the issue of subtransmission.[340]

Ausgrid's consultants Evans and Peck said that Victoria and Tasmania have a natural cost advantage because they have simpler subtransmission networks. The factors they cite include shorter total length of installed subtransmission cables,[341] less subtransmission transformer capacity installed[342] and fewer transformation steps.[343] Evans and Peck conclude the greater size and complexity of

336 AEMC, *Rule determination: National Electricity Amendment (Economic Regulation of Network Service Providers)*, November 2012, p. 113.
337 Ausgrid, *Attachment 5.33* to *Regulatory proposal*, May 2014, p. 3.
338 Endeavour Energy, *Attachment 0.12 to Regulatory proposal*, May 2014, p. 3.
339 Essential Energy, *Attachment 5.*4 to *Regulatory proposal*, May 2014, p. 5.
340 ActewAGL, Response to the AER's Draft Annual Benchmarking Report, 22 August 2014, p. 10.
341 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 14.
342 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 18.
343 Evans and Peck, *Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs*, November 2012, p. 21.

subtransmission networks in NSW are likely to manifest themselves in larger asset bases and that this will flow through to higher opex.

The transition point between transmission and distribution varies across jurisdictions and within service providers. All service providers take supply from transmission Grid Exit Points (GXPs) across a range of voltages. We agree with the above observations that the NSW service providers own and operate a proportionally larger group of assets at the higher voltages. Queensland GXPs are also typically at the higher voltage levels than those of other states. Tasmania has the lowest GXP voltages of all the NEM service providers on average. We also note the dual sub-transmission transformation step that accompanies the higher sub-transmission voltages. NSW, Queensland, and South Australia have all reported dual transformation assets.[344]

We are satisfied that an operating environment factor adjustment is appropriate because the divisions between transmission and distribution service providers represent boundaries that are outside the control of service providers. In addition, the information available to us indicates that subtransmission assets may be up to twice as costly to operate as other distribution assets.

Further, our MTFP model excludes only some subtransmission assets from its input variables, and our MPFP model and opex cost function model do not have any variables that account for different subtransmission configurations. Therefore part of the differences in service providers' costs observed in our economic benchmarking will be due to differences in subtransmission configuration.

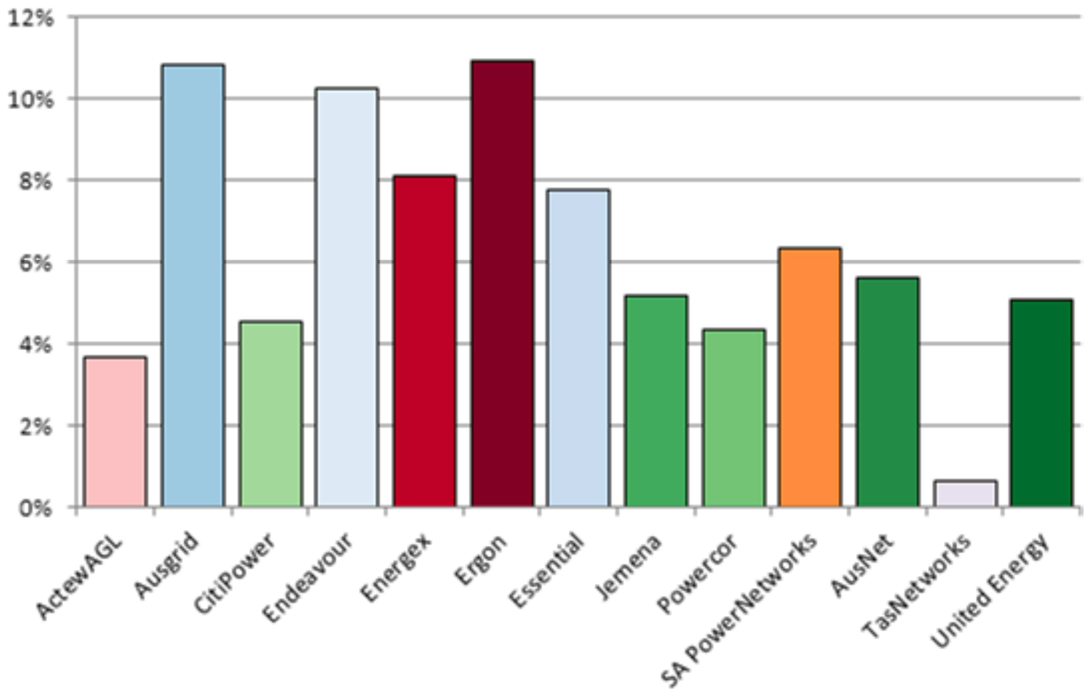
To assess the potential impact of the differences in subtransmission networks we investigated a number of approaches including:

- comparison of RAB values[345]
- comparison of replacement values[346]
- two stage transformation capacity comparisons[347]
- overall substation capacity comparisons[348]
- line length values.[349]

The most robust and consistent data set that we have for the above measures was on line length. We selected that data set because we have information to compare the volume of subtransmission assets and the operating costs of subtransmission assets by line length. This was not the case for other data sets. Figure A.37 below provides the subtransmission line length as a percentage of total line length for each service provider.

344 Economic Benchmarking RIN data.
345 Economic Benchmarking RIN data.
346 Category Analysis RIN data.
347 Economic Benchmarking RIN data.
348 Economic Benchmarking RIN data.
349 Economic Benchmarking RIN data.

Figure A-31 Subtransmission circuit length as a percentage of total circuit length



Source: Economic Benchmarking RINs.

The above figure shows that subtransmission lines represent a small proportion of total network line length. Ausgrid has the greatest proportion of sub-transmission lines - representing 10.8 per cent of the network. Endeavour Energy reported a value of 10.3 per cent and Essential Energy 7.8 per cent. The average, weighted by customer numbers, for the comparison service providers was 5.3 per cent.

Information from Ausgrid's regulatory accounts indicates that by length, their 66kV and 132kV assets are twice as costly to operate as their distribution network. Ausgrid's regulatory accounts provide the opex of operating the 66kV and 132kV part of their network and separately the opex for the rest of their network. These figures suggest that per kilometre, Ausgrid's 66kV and 132kV assets are twice as expensive to operate as their other assets.

To calculate the operating environment adjustment for each service provider, we have subtracted the length of subtransmission lines operated by the frontier firm from those operated by the relevant service provider. We note that 132kV and 66kV lines are likely to be more expensive to operate than 33kV lines. As a result we consider that this adjustment is likely to slightly favour service providers with more subtransmission assets.

Using the methodology described above, the recommended adjustment to the opex comparisons for this factor are therefore:

- Ausgrid: 5.5 per cent
- Endeavour Energy: 5.0 per cent
- Essential Energy: 2.5 per cent.

A.6 Our conclusions on base year opex

This section explains how we make an adjustment for the purpose of estimating opex that reasonably reflects the opex criteria.

We have demonstrated in the preceding sections that all the evidence (quantitative and qualitative) points towards the need for an adjustment to each service provider's base year opex. Our consultant has provided advice that the economic benchmarking results are robust and reinforce each other.[350] In turn, the category analysis results and detailed review findings corroborate the benchmarking results.

In particular, the detailed labour review provides evidence of workforce inefficiencies within Ausgrid and Essential Energy and, to a lesser extent, Endeavour Energy. While the formation of Networks NSW has generated improvements, the evidence suggests more efficiencies have yet to be realised and customers should not be asked to fund more than those costs that reasonably reflect the opex criteria.

Following the advice of Economic Insights,[351] detailed examination of operating environment factors and sources of inefficiency, we consider it is appropriate to adjust each service provider's base year opex, in two ways.

First, our assessment techniques account for material differences in the operating environments of service providers in different ways. We recognise, however, that benchmark modelling may not incorporate all possible differences between service providers. The AEMC has provided guidance on how we should have regard to benchmarking in this way:[352]

> The intention of a benchmarking assessment is not to normalise for every possible difference in networks. Rather, benchmarking provides a high level overview taking into account certain exogenous factors. It is then used as a comparative tool to inform assessments about the relative overall efficiency of proposed expenditure.
>
> …
>
> If there are some exogenous factors that the AER has difficulty taking adequate account of when undertaking benchmarking, then the use to which it puts the results and the weight it attaches the results can reflect the confidence it has in the robustness of its analysis.

Following our detailed examination of operating environment factors in the previous section, we consider it is appropriate to provide a 10 per cent allowance for those operating environment differences not completely captured by our preferred benchmarking model (Cobb Douglas SFA) alone. We have incorporated operating environment factors as a margin for additional input use into the Cobb Douglas SFA modelling, on the recommendation of our consultant, Economic Insights.[353] This results in a smaller decrease to base year opex.

Second, in the application of the benchmarking techniques (including Cobb Douglas SFA), we consider a cautious approach to making an adjustment is appropriate to mitigate the potential risk of modelling and data error. On the recommendation of Economic Insights, our ultimate adjustment is more conservative than the raw Cobb Douglas SFA results. We have done this by comparing the efficiency of the NSW service providers to a modified benchmark comparison point.

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[350] Economic Insights, 2014, p. 51.
[351] Economic Insights, 2014, p. 37.
[352] AEMC, *Rule Determination*, 29 November 2012, pp. 107–108, 113.
[353] Economic Insights, 2014, p. iv.

Economic theory suggests that the appropriate benchmark reference point for efficient opex is an efficient service provider. Using the Cobb Douglas SFA model, CitiPower, which is the most efficient service provider for this model, has a score of 95 per cent. This score represents our estimate of the efficiency at which the (Australian) benchmark efficient firm[354] would be using its opex to provide core network services, before considering service providers' unique operating factors not already accounted for in the modelling.

However, we have (in line with the approach recommended by Economic Insights) applied a benchmark comparison point that is the average of all networks with efficiency scores above 0.75.[355] This provides a margin for the potential effect of any modelling uncertainty and data error. Under this approach the (modified) benchmark comparison point is 10.5 per cent lower than the frontier as indicated by the Cobb Douglas SFA model.

We have adopted the weighted average of the top five service providers (those service providers with efficiency scores greater than 0.75) for the reasons Economic Insights outlines in its report.[356] Combined with the allowance for operating environment differences, the benchmark level of efficiency is approximately 18 per cent less than the frontier predicted by the Cobb Douglas SFA model.

A.6.1 Determining the adjustment

All our analysis indicates that the base year opex of the service providers is materially inefficient.

However, the results of the models presented in this Appendix represent the average distance from the frontier for the service providers over the benchmarking period.[357] Consequently this does not directly compare to the service providers' base year opex (which is the 2012–13 year) because the average opex will reflect their average network characteristics over the eight year period.

Hence, to calculate our estimate of efficient base year opex we have, on the recommendation of Economic Insights, trended forward the average efficient opex by the change in outputs, input prices[358] and technical efficiency to properly reflect conditions in the base year. This is consistent with our approach to trending forward expenditure for the 2014–19 period using our rate of change approach.

Table A-23 presents our comparison of the proposed base year of the NSW service providers against our estimated efficient base year opex. These estimates take into account our preferred benchmark comparison point and our additional allowance for other operating environment factors. Table A-23 shows the reduction in opex required to reach our estimate of a base year opex that is suitable for forecasting total opex to reasonably reflect the opex criteria.

354 We have measured the frontier based on Australian service providers only. If we included the international service providers in our calculations, CitiPower may not be the frontier business.
355 Economic Insights, 2014, p. 51.
356 Economic Insights, 2014, pp. 47–48.
357 Economic Insights, 2014, p. 46.
358 Also referred to as real prices in the expenditure forecast assessment guideline.

Table A-23 Comparison of estimated efficient base opex against proposed base opex

	Ausgrid	Endeavour	Essential
Proposed base opex, nominal	503.6	271.6	461.0
- debt raising costs, nominal	-0.4	0.0	-0.3
- New CAM, nominal	3.7	0.0	0.0
- New service classification, nominal	-34.8	-55.1	-59.8
Adjusted total opex, nominal	472.2	216.5	401.0
Base opex, real 2013–14 (end of year)	488.6	224.0	414.9
Substitute base, real 2013–14 (end of year)	**325.9**	**201.0**	**270.8**
Difference in base opex	162.7	23.0	144.1
Percentage opex reduction	33.3%	10.3%	34.7%

Source: AER analysis.

As we explain above, the results in Table A-23 are average efficiency scores over an eight year period. Therefore, where the base year is materially more or less inefficient relative to average performance over the period, the ultimate adjustment will reflect this. Consequently, the adjustment to Endeavour Energy, which has improved the efficiency of its opex over the period is less than its average inefficiency level. Essential Energy, on the other hand, has incurred increasingly higher costs over the period, so its adjustment is slightly higher than Ausgrid's adjustment, despite the raw modelling scores suggesting it would be slightly less.

We consider the results for the NSW service providers are reasonable, particularly when we consider them in light of the detailed review results. Our labour review, for example, suggested Endeavour Energy is more advanced than Ausgrid and Essential Energy in improving its efficiency, having commenced its journey earlier. That said, it continues to face a restrictive environment in which it cannot make changes to its workforce quickly. Therefore, it has more improvements to make before reaching a level of efficiency comparable with the frontier businesses. In addition, if Endeavour Energy looked beyond its NSW peers and compared itself to these service providers, it should be able to identify and achieve more efficiencies.

Ausgrid and Essential Energy, on the other hand, seem to have more embedded inefficiencies and compared to other service providers (even to Endeavour Energy) large permanent workforces. Essential Energy submits it is making progress in improving its efficiency in the forecast period. Its vegetation management review is an example of this. However, in 2012–13, it had not implemented most of these initiatives.

B Opex rate of change

Our forecast of total opex includes an allowance to account for efficient changes in opex over time.

There are several reasons why efficient opex for each year of a regulatory control period might differ from expenditure in the base year.

As set out in our Guideline, we have developed an opex forecast incorporating the rate of change to account for the following factors:[359]

- price change[360]
- output change
- productivity change

This appendix contains our assessment of the opex rate of change for use in developing our forecast alternative estimate of total opex.

B.1 Position

Essential Energy's rate of change in the first year of the forecast period is lower than ours and higher in the last four years of the forecast period. Overall our forecast of the rate of change is lower than Essential Energy's over the forecast period. Table B-1 shows Essential Energy and our overall rate of change in percentage terms for the 2014–19 period.

The differences in each forecast rate of change component are:

- our forecast of price change is on average 0.27 percentage points lower than Essential Energy's
- our forecast of output change is on average 0.04 percentage points higher than Essential Energy's,
- our forecast of productivity is the same as Essential Energy's.

Our rate of change assessment methodology and the reasons for taking this position are discussed in the sections below.

[359] AER, *Better Regulation explanatory statement expenditure forecast assessment guideline*, November 2013, p. 61.

[360] We note the guidelines referred to price growth, output growth and productivity growth. We have changed the term growth to change to reflect that these components can be either positive or negative.

Table B-1 Essential Energy and AER rate of change (per cent)

	2014–15	2015–16	2016–17	2017–18	2018–19
Essential Energy	0.28	1.24	1.85	1.88	1.95
AER	1.14	0.95	1.23	1.39	1.32
Difference	0.87	–0.29	–0.61	–0.50	–0.63

B.2 Essential Energy's proposal

Table B-2 shows Essential Energy's proposed annual change in opex for each rate of change component reported in Essential Energy's reset RIN. Essential Energy used a different methodology to form its view about the opex rate of change than set out in our Guideline.

Each of these components is discussed below.

Table B-2 Essential Energy's proposed opex by rate of change drivers for standard control services opex ($'000 2013–14)

	2014–15	2015–16	2016–17	2017–18	2018–19
Base opex	469 169	469 169	469 169	469 169	469 169
Price change (cumulative)	635	4 388	11 047	18 058	25 402
Output change (cumulative)	1 978	4 062	6 199	8 322	10 594
Productivity change (cumulative)	–	–	–	–	–

Note: Step changes and other adjustments also affect the annual change in opex.
Source: Essential Energy reset RIN tables 2.16.1.

Forecast price change

Essential Energy's forecast price change includes price changes for labour and non-labour.

Essential Energy engaged Independent Economics to provide forecast real labour escalators and CEG to provide forecast real materials escalators.[361]

For the first year of Essential Energy's labour rate of change, it applied an annual pay rise of 2.7 per cent for internal labour in nominal terms. For the remainder of the period Essential Energy applied Independent Economics' forecast labour price of the electricity, gas, water and waste services (EGWWS) industries.[362]

For Essential Energy's external labour and external contractors it applied Independent Economics forecast for the general labour market. [363]

For the non-labour proportion of opex, Essential Energy applied no real price change. [364]

361 Essential Energy, *Regulatory proposal*, May 2014, p. 75.
362 Essential Energy, *Regulatory proposal*, May 2014, p. 75.
363 Essential Energy, *Regulatory proposal*, May 2014, p. 75.
364 Essential Energy, *Regulatory proposal*, May 2014, p. 75; and Attachment 5.7 Cost escalation model.

Forecast output change

Essential Energy proposed an increase in opex due to growth related capital expenditure which increases the size of the network and the number of assets to be maintained, operated and managed.[365] This resulted in a 0.67 per cent asset growth factor for opex (excluding condition based maintenance) which has been calculated based on the growth in capex and capital contributions as a percentage of replacement cost.[366]

Forecast productivity change

Essential Energy proposed a productivity change of zero in its Reset RIN response as shown in Table B-3.

Rate of change

The rate of change approach applies a percentage change to the previous year's opex. Table B-2 above expresses the impact of each rate of change component in dollar terms. To allow for a like with like comparison, we have expressed each of Essential Energy's rate of change components in annual percentage terms below in Table B-3.[367]

We note the rate of change percentage has been calculated with respect to the base opex reported in Table B-2.

Table B-3 Essential Energy's opex rate of change (per cent)

	2014–15	2015–16	2016–17	2017–18	2018–19
Price change	0.07	0.80	1.39	1.44	1.48
Output change	0.21	0.44	0.45	0.44	0.46
Productivity change	0.00	0.00	0.00	0.00	0.00
Rate of change	0.28	1.24	1.85	1.88	1.95

Source: AER analysis.

B.3 Assessment approach

As discussed above, our assessment of the annual change in expenditure is made in the context of our assessment of Essential Energy's proposed total forecast opex.

The rate of change itself is a build-up of various components to provide an overall holistic number that represents our forecast of annual change in overall opex during the 2014–19 period. We consider the rate of change approach captures all drivers of changes in efficient base opex except for material differences between historic and forecast step changes. The rate of change approach takes into account inputs and outputs, and how well the service provider utilises these inputs and outputs.

The rate of change formula for opex is:

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365 Essential Energy, *Regulatory proposal*, May 2014, p. 75.

366 Essential Energy, *Regulatory proposal*, Attachment 6.4 Asset growth escalator, May 2014.

367 Since a rate of change driver such as price change is made up of various escalators, such as labour and materials. Our conversion from a dollar figure impact to a percentage impact is the equivalent of applying a weighted average of all the escalations used in the price change measure.

$$\Delta Opex = \Delta price + \Delta output - \Delta productivity$$

Where ∆ denotes the proportional change in a variable.

Our starting point for assessing the service provider's proposed change in annual expenditure is to disaggregate the service provider's proposal into the three rate of change components. This enables us to identify where there are differences in our estimate and the service provider's estimate of the components of the rate of change. While individual components in the service provider's proposed annual change in expenditure may differ from our rate of change component forecasts, we will form a view on the overall rate of change in deciding what to apply to derive our alternative opex forecast.

We also take into account whether the differences in the rate of change components are a result of differences in allocation or methodology. For example, a service provider may allocate economies of scale to the output change component of the rate of change, whereas we consider this to be a productivity change. Irrespective of how a service provider has built up or categorised the components of its forecast rate of change, our assessment approach considers all the relevant drivers of the opex rate of change.

Since our rate of change approach is a holistic approach we cannot make adjustments to one component without considering the interactions with other rate of change components. For example, if we were to the adjust output to take into account economies of scale, we must ensure that economies of scale have not already been accounted for in our productivity change forecast. Otherwise, this will double count the effect of economies of scale.

Price change

Under our rate of change approach we escalate opex by the forecast change in prices. The price change is made up of labour price changes and non-labour (which includes materials) price changes. The change in prices accounts for the price of key inputs that do not move in line with the CPI and form a material proportion of Essential Energy's expenditure.

To determine the appropriate forecast change in labour prices we have assessed forecasts from Independent Economics, BIS Shrapnel and Deloitte Access Economics. These forecasts are based on the consultants' view of general macroeconomics trends for the utilities industry and the overall Australian economy. Our consideration of the choice of labour price forecast is discussed below in section B.4.2.

Output change

The 'output change' captures the change in expenditure due to changes in the level of outputs delivered, such as increases in the size of the network and the customers serviced by that network. An increase in the quantity of outputs is likely to increase the efficient opex required to service the outputs.

Under our rate of change approach, a proportional change in output results in the same proportional change in expenditure. For example, if the only output measure is maximum demand, a 10 per cent increase in maximum demand results in a 10 per cent increase in expenditure. Any subsequent adjustment for economies of scale is considered as a part of productivity.

To measure output change, we select a set of output measures and apply a weighting to these measures. We have chosen the same output change measures and weightings as used in Economic

Insights' economic benchmarking report.[368] This ensures output change is measured consistently through time and across service providers.

The historical output change for Essential Energy has been obtained from our Economic Benchmarking RIN. The Economic Benchmarking RIN provides a consistent basis to benchmark the inputs and outputs of each service provider. This allows us to consistently compare the change in output overtime and across service providers.

The forecast output change has been calculated based on forecasts obtained from the reset RIN which have been prepared on the same basis as the Economic Benchmarking RIN.

More information on how we have estimated output change is discussed below in section B.4.3.

Productivity

Our change in productivity measure is based on our expectations of the productivity an efficient service provider in the distribution industry can achieve. Our forecast productivity is based on analysis from Economic Insights' economic benchmarking analysis.[369] However, we have also assessed whether the historical productivity from 2006–13 reflects a reasonable expectation of the benchmark productivity that can be achieved for the forecast period.

If inputs increase at a greater rate than outputs then a service provider's productivity is decreasing. Changes in productivity can have different sources. For example, changes in productivity may be due to the realisation of economies of scale or technical change, such as the adoption of new technologies. We expect efficient service providers to pursue productivity improvements over time.

In the explanatory statement to our Guideline we noted that we would apply a rate of change to estimate final year opex (taking into account an efficiency adjustment, if required), to account for the shift in the productivity frontier.[370]

Since forecast opex must reflect the efficient costs of a prudent firm, it must reflect the productivity improvements it is reasonable to expect a prudent service provider can achieve. All else equal, a price taker in a competitive market will maintain constant profits if it matches the industry average productivity improvements reflected in the market price. If it is able to make further productivity improvements, it will be able to increase its profits until the rest of the industry catches up, and this is reflected in the market price. Similarly, if a service provider is able to improve productivity beyond that forecast, it is able to retain those efficiency gains for a period.[371]

Since both outputs and inputs are taken into account, our productivity measure accounts for labour productivity and economies of scale. The effect of industry wide technical change is also included.

More information on how productivity has been estimated is discussed below in section B.4.4.

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368 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, pp. 40–41

369 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 38.

370 AER, *Better regulation explanatory statement expenditure forecast assessment guideline*, November 2013, p. 65.

371 AER, *Better regulation explanatory statement expenditure forecast assessment guideline*, November 2013, p. 66.

Other considerations

Interaction with our base opex and step changes

As noted above, the rate of change approach is used in conjunction with our assessment of efficient base opex and step changes to determine total opex. We cannot make adjustments to base opex and step changes without also considering its effect on the opex rate of change, and, in particular, productivity.

For example, if we adjust an inefficient service provider's base opex to that of an efficient service provider we must also set the productivity to reflect an efficient service provider's productivity.

This interrelationship is also important for our step change assessment. Our forecast rate of change is influenced by historical data. Our measured productivity will include the effect of past step changes which typically increase a service provider's inputs. This will lower our measured productivity. If we include an allowance for step changes in forecast opex, there is a risk that a service provider will be compensated twice for step changes.[372]

Comparison with our previous cost escalation approach

Under our previous approach to setting the trend in opex, we assessed real cost escalations (this is similar to price change) and output change separately. Any productivity changes were assessed based on labour productivity for real cost escalations and economies of scale for output change.

This approach is less robust than our opex rate of change approach because accounting for both labour productivity and economies of scale separately could result in double counting productivity effects.

In practice, this meant that we could either apply labour productivity or economies of scale but not both. In our recent determinations we applied an adjustment for economies of scale rather than labour productivity because economies of scale estimates were more robust than labour productivity estimates. However, we noted this approach did not account for all productivity changes and that a single productivity measure would be more accurate.[373]

B.4 Reasons for position

To provide greater detail on how we have estimated our forecast rate of change, the sections below have been separated into the three rate of change components. Where relevant these components have been compared to Essential Energy's rate of change using information provided in the reset RIN.

B.4.1 Overall rate of change

To forecast our overall opex, we have adopted a lower average rate of change than Essential Energy's forecast rate of change. This difference is driven by our different forecasts for labour price and output change. However since Essential Energy's rate of change in the first year of the forecast period is lower than ours, the net effect of the rate of change in percentage terms is similar over the forecast period.

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372 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 42.

373 AER, *Final decision SP AusNet Transmission Determination 2014–15 to 2016–17*, January 2014, pp. 64–65.

Our forecast price change is lower than Essential Energy's. This is driven by the difference in labour price changes. Essential Energy used forecasts from Independent Economics and its enterprise bargaining agreement (EBA) to establish its estimates whereas we have used an average of Deloitte Access Economics (DAE) and Independent Economics forecasts.

Our forecast output change is lower than Essential Energy's. This is driven by the difference in the methodologies used to forecast output change. Our forecast is based on the weighted average increase in customer numbers, circuit length and ratcheted maximum demand used in Economic Insights' opex cost function.[374] Essential Energy's output change is based on its asset growth from capex which increases the size of the network and the number of assets to be maintained.

In estimating our rate of change, we considered Essential Energy's proposed method and forecast changes in prices, outputs and productivity, as set out in its opex model and reset RIN response.

Table B-4 shows that Essential Energy's rate of change, in cumulative terms, is lower than ours in the first two years, the same in the third and higher in the last two years of the forecast period. So the net outcome between the two approaches is nearly the same over the forecast period.

Table B-4 AER and Essential Energy overall rate of change (per cent)

	2014–15	2015–16	2016–17	2017–18	2018–19
Essential Energy					
Price change	0.07	0.80	1.39	1.44	1.48
Output change	0.21	0.44	0.45	0.44	0.46
Productivity change	0.00	0.00	0.00	0.00	0.00
Overall rate of change	**0.28**	**1.24**	**1.85**	**1.88**	**1.95**
Cumulative index[375]	**1.003**	**1.015**	**1.034**	**1.053**	**1.074**
AER					
Price change	0.55	0.54	0.87	1.00	0.89
Output change	0.59	0.41	0.36	0.38	0.43
Productivity change	0.00	0.00	0.00	0.00	0.00
Overall rate of change	**1.14**	**0.95**	**1.23**	**1.39**	**1.32**
Cumulative index	**1.011**	**1.021**	**1.034**	**1.048**	**1.062**

Source: AER analysis.

374 Our approach to setting the rate of change is consistent with Economic Insights' econometric modelling which we have also used in assessing and adjusting ActewAGL's base opex.

375 The cumulative index shows the overall trend in the rate of change. This takes into account the greater impact earlier years will have compared to the later years on the overall opex forecast. For example a price change in year one will affect all five years of the forecast period whereas an price change in year five will only affect the last year of the opex forecast.

B.4.2 Price changes

For the forecast opex price changes we adopted a 62 per cent weighting for labour price and 38 per cent non-labour. Our forecast of the labour price change is based on forecasts of the Electricity, Gas, Water and Waste services (EGWWS) industry and our forecast of non-labour price change is the CPI. Table B-5 shows Essential Energy's proposed forecast price change and our price change.

Table B-5 AER and Essential Energy forecast price change (per cent)

	2014–15	2015–16	2016–17	2017–18	2018–19
Essential Energy forecast price change	0.07	0.80	1.39	1.44	1.48
AER forecast price change	0.55	0.54	0.87	1.00	0.89

Source: AER analysis.

The difference in the price change forecasts is driven by the following three reasons.

1. Essential Energy attributed a higher proportion of labour to opex than we did. Opex for labour increases at a faster rate than non-labour under both price approaches so, all else equal, a higher proportion of labour will result in a higher price change.

2. Essential Energy proposed the use of its EBA until June 2015. Since Essential Energy's EBA is similar to the CPI and lower than consultant forecasts of the labour price, Essential Energy's price change in the first year of the forecast period is lower than ours.

3. Essential Energy used Independent Economics' labour price forecast, for the years without an EBA, which are higher than our use of an average of Independent Economics and Deloitte Access Economics.

Essential Energy's forecast average input price change over the forecast period is higher than ours. However, this is mitigated by Essential Energy's lower 2014–15 forecast input price change which, due to compounding, has a greater effect on overall opex than price changes in later years. So overall the effect of Essential Energy and our approach to forecasting input prices results in a similar effect on opex over the forecast period.

Opex price weightings

The forecast price change is weighted to account for the proportion of opex that is labour and non-labour. Since opex is not comprised entirely of labour costs, it would not be appropriate to adjust opex by only labour prices.

We have adopted a 62 per cent weighting for labour and 38 per cent for non-labour. The labour component is forecast based on the Electricity, Gas, Water and Waste Services (EGWWS) industry and the non-labour component is forecast based on the consumer price index (CPI).

These weightings are broadly consistent with Economic Insight's benchmarking analysis which applied weight of 62 per cent EGWWS wage price index (WPI) for labour and 38 per cent for five producer price indexes (PPIs) for non-labour. The five PPI's cover business, computing, secretarial, legal and accounting, and public relations services.[376]

Although Essential Energy did not provide explicit weights for its internal labour, external labour and non-labour proportions of opex, we can compare Essential Energy's labour price change to the percentage change in Table B–4.

For example, Essential Energy's price of internal labour and external labour for 2017–18 is forecast to increase by 2.1 per cent and 1.8 per cent respectively. Meanwhile the input price change for 2017–18 is 1.44 per cent. Essential Energy's proportion of labour could range from 69 per cent to 80 per cent of total opex for 2017–18. So based on our analysis it appears that Essential Energy's labour proportion of opex is higher than ours.

Our weightings, which have been used in our economic benchmarking, represent a benchmark weighting between labour and non-labour. We consider these weighting represent the weightings for a prudent firm because it has been used in previous economic benchmarking analysis by Pacific Economic Group Research and Economic Insights.[377]

Forecast of producer price indices and CPI

For the purposes of forecasting we have applied the forecast CPI rather than forecasts for each PPI. We recognise that the use of PPI's for historical purposes and CPI for forecasts may be inconsistent. However, sensitivity analysis from Economic Insights showed there to be no material difference between using the CPI or PPI in the economic benchmarking results. This is because the change in PPI's follows a similar trend to the change in CPI.[378]

To forecast CPI we adopt the Reserve Bank of Australia's (RBA's) Statement of Monetary Policy and for the years beyond that we apply the mid-point of the RBA's target band. We consider forecasts of the CPI to be more robust than forecasts of the PPI's because the CPI is a more aggregated measure and forecasts of the CPI are more readily available. Further the CPI is subject to the RBA's Statement of Monetary Policy's target band which provides a more robust basis for economists to produce their forecasts. For this reason we have used forecast CPI, rather than PPI's, to forecast the non-labour component of price changes. Economic Insights noted that while the use of these PPIs is likely to be more accurate for historic analysis, it is unlikely to be practical for applications requiring forecasts of the opex price index such as the rate of change. This is because it is very difficult to obtain price forecasts at a finely disaggregated level other than by simple extrapolation of past trends.[379]

If the forecasts of the five PPI's can be forecast with similar accuracy to the CPI, then we would consider the five PPI's to also be an appropriate opex price deflator. However, at this stage we do not consider robust forecasts of the five PPI's are available.

Labour price change

Our choice of the labour price measure seeks to select the efficient labour price for an efficient service provider on the opex frontier. To determine the efficient labour price we require a forecast of the

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[376] Economic Insights, *Measurement of Inputs for Economic Benchmarking of Electricity Network Service Providers*, 22 April 2013, p. 4.
[377] Economic Insights, *Measurement of Inputs for Economic Benchmarking of Electricity Network Service Providers*, 22 April 2013, p. 4.
[378] Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 13.
[379] Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 13.

benchmark labour price. We consider forecasts of the EGWWS industry, produced by expert forecasters, to be an appropriate benchmark for Ausgrid's labour price. This is because the EGWWS classification includes labour in the electricity industry and provides a benchmark labour price for comparable staff within the utilities industry. Since Ausgrid's labour is classified within the EGWWS industry, this provides a reasonable comparison with similar labour.

Labour industries

We consider only EGWWS labour should be applied for the labour component of the price change.

Essential Energy commissioned labour forecasts for the following industries:

- utilities
- general labour.

The labour price forecasts for these industries are then applied to varying degrees depending on the costs of its specific inputs to undertake activities to deliver services.[380]

The Australian Bureau of Statistics (ABS) previously advised:

> ... regardless of the type of job, if the job was selected from a business classified to the electricity, gas, water and waste services industry, the jobs pay movements contributes to this industry.[381]

The ABS takes into account the nature of the business, not the nature of the work undertaken, when allocating a job to an industry. The ABS labour price statistics for the EGWWS industry reflects both specialised electricity distribution network related labour and general labour.

We consider regardless of the nature of the task, if labour is employed by a business that operates in the utilities industry, then it should be escalated by the EGWWS industry forecast. For this reason we have adopted the EGWWS classification for all labour.

Choice of labour forecast

To forecast labour we have adopted the average of Deloitte Access Economics and Independent Economics wage price index (WPI) forecasts for the EGWWS sector.

We consider an averaging approach that takes into account the consultant's forecasting history, if available, to be the best methodology for forecasting labour price change.

This is based on our previous analysis in relation to SP AusNet's gas distribution network which was corroborated by Professor Borland.[382] When considering appropriate labour price change forecasts for the SP AusNet gas distribution network we adopted an average of the forecasts prepared by Deloitte Access Economics (DAE) and BIS Shrapnel. We took this approach because DAE typically forecasts lower than actual WPI and BIS Shrapnel typically forecast higher than actual WPI for the Australian EGWWS sector.

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380 Essential Energy, *Regulatory proposal*, May 2014, p. 75.
381 ABS, *Email from Kathryn Parlor to Fleur Gibbons*, 8 July 2010.
382 AER, *Access arrangement final decision SPI Networks (Gas) Pty Ltd 2013–17, Part 3: Appendices*, March 2013, p. 7.

Previous analysis by DAE and the AER showed that DAE's forecasts under forecasted price change at the national level. In contrast BIS Shrapnel's over forecasted price change and by a greater margin.[383]

We previously adopted the average of the forecasts from BIS Shrapnel and DAE to obtain a labour price measure for SP AusNet's gas distribution network.[384]

Essential Energy engaged Independent Economics to provide labour forecasts. We cannot compare the past accuracy of Independent Economics labour forecasts to DAE and BIS Shrapnel because Independent Economics were not engaged by service providers to provide labour forecasts in our past decisions.

However, we can compare Independent Economics forecasts against DAE's and BIS Shrapnel's forecasts of the NSW EGWWS sector for 2013–14 to 2018–19. These forecasts are shown in Table B-6. Independent Economics has the highest forecasts in both nominal and real terms. This indicates that taking an average of DAE and Independent Economics forecasts produce similar results to taking an average of DAE and BIS Shrapnel.

Table B-6 Comparison of consultant labour forecasts for NSW EGWWS industry (per cent)

	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	Average
Nominal							
Deloitte	3.20	3.30	2.90	3.40	3.50	3.30	3.27
Independent Economics	3.07	3.59	3.94	4.56	4.87	4.71	4.12
BIS Shrapnel	3.60	3.40	3.70	4.20	4.50	4.70	4.02
Real							
Deloitte	0.60	0.60	0.40	0.50	1.00	0.90	0.67
Independent Economics	1.53	1.11	1.46	1.95	1.94	1.93	1.65
BIS Shrapnel	0.80	0.60	1.20	1.70	2.00	2.20	1.42
CPI							
Deloitte	2.70	2.50	2.50	2.90	2.50	2.40	2.58
Independent Economics	1.52	2.45	2.45	2.56	2.88	2.72	2.43
BIS Shrapnel	2.80	2.80	2.50	2.50	2.50	2.50	2.60

Source: Deloitte Access Economics, Independent Economics and BIS Shrapnel

We note Independent Economics forecasts were produced earlier than DAE's and BIS Shrapnel's. The Independent Economics forecasts that were used in CEG's report were dated December 2013.[385]

DAE and BIS Shrapnel's forecasts were produced more recently. BIS Shrapnel's report for Jemena Gas Networks (JGN) was dated April 2014[386] and DAE's report was dated July 2014. This means both

383 AER, *Powerlink Final decision*, April 2012, p. 54.
384 AER, *Access arrangement final decision SPI Networks (Gas) Pty Ltd 2013–17, Part 3: Appendices*, March 2013, p. 7.
385 CEG, *Escalation factors affecting expenditure forecasts*, December 2013.

BIS Shrapnel and DAE's forecasts potentially reflect more recent data than Independent Economics' forecasts. We would expect the updated forecasts from the consultants to be lower for the revised proposal.

The Australia wide EGWWS for 2013–14 was 3.04 per cent in nominal terms[387] and CPI was 3.02 per cent for the same period.[388] This results in a 0.02 per cent real increase in the price of national EGWWS labour. All consultant forecasts for 2013–14 EGWWS labour are higher than the ABS' actual figures.

The Major Energy Users (MEU) noted forecasts by DAE and BIS Shrapnel typically overestimate the WPI and that the AER does not assess the actual accuracy of the forecasts over time.[389]

Oakley Greenwood in its review of the NSW DNSP's proposals noted that different forecasters will inevitably provide different results and therefore it is important for the AER to obtain an alternate forecast to assess the robustness of the forecasts presented by the NSW DNSPs.[390]

Oakley Greenwood also noted there would be implied reduction in the demand for labour by NSW DNSPs as a result of its reduced capital expenditure programs and a move to more sustainable labour levels as a result of the creation of Networks NSW.[391] We have assessed the forecasting performance of both DAE and BIS Shrapnel and, as noted above, we have found that DAE typically forecasts below the actual WPI and BIS Shrapnel forecasts above. We have addressed this issue by averaging consultants' forecasts.

We consider the consultants should take the recent ABS data into account when providing updated forecasts. We cannot assess the consultants' models; however, we consider the forecasts should reflect current expectations of the forecast period such as the implied reductions in the demand for labour identified by Oakley Greenwood.

We note labour price escalation numbers are not finalised and will be updated prior to the final decision to reflect the most up to date data.

For the purpose of this draft decision, we take the view that an average of DAE and Independent Economics forecasts would be the most reliable predictor of labour price changes.

Labour productivity

Our preferred approach to productivity is to adopt an overall electricity distribution specific productivity adjustment rather than adjusting the forecast EGWWS labour price change for EGWWS labour productivity.

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386 BIS Shrapnel, *Real labour and material cost escalation forecasts to 2019/20 – Australia and New South Wales*, April 2014.

387 ABS, 6345.0 - Wage Price Index, Australia, Table 9b. Ordinary Hourly Rates of Pay Excluding Bonuses: Sector by Industry, Original (Quarterly Index Numbers), 12 August 2014

388 ABS, 6401.0 - Consumer Price Index, Australia, TABLES 3 and 4. CPI: Groups, Weighted Average of Eight Capital Cities, Index Numbers and Percentage Changes, 22 July 2014

389 Major Energy Users, *Tasmanian Electricity Transmission Revenue Reset A response by the Major Energy Users Inc*., August 2014, p. 28.

390 Oakley Greenwood, *Review for NSW DBs regulatory submissions prepared for Energy Australia, Origin and AGL*, 6 August 2014, p. 26.

391 Oakley Greenwood, *Review for NSW DBs regulatory submissions prepared for Energy Australia, Origin and AGL*, 6 August 2014, p. 25.

The use of electricity distribution specific productivity rather than EGWWS wide productivity is supported by Independent Economics which noted:[392]

> There are significant difficulties in measuring productivity in the utilities sector generally and the electricity distribution sector in particular. Hence, it is suggested adjusting for productivity is better undertaken on the basis of a detailed assessment of specific sources of productivity gains within the industry rather than attempting to infer productivity gains using the broader data published by the ABS.

Since the data for a distribution industry specific productivity measure is available, from our economic benchmarking analysis and this is preferred over an EGWWS labour productivity adjustment, we have applied a distribution industry specific measure.

Further discussion on how we have accounted for productivity is discussed below in section B.4.4.

Use of enterprise bargaining agreements

We have not adopted Essential Energy's enterprise bargaining agreement (EBA) in our price change component. Our alternative estimate is based on setting base opex and the rate of change for an efficient and prudent service provider to achieve the opex objectives rather than the NSP's actual costs. We note Essential Energy's EBA is lower than the consultants' forecasts for the same period.

EBAs do not necessarily only reflect the labour price. For example a NSP may negotiate a lower increase in salary but change redundancy provisions. This may result in a lower price increase but may also affect the quantity of labour a NSP employs which will impact its labour productivity. This means EBAs may include both a labour price and productivity component.

We have accounted for productivity as a separate component of the opex rate of change. If we were to adopt a NSP's EBA as the labour price and then adjust for productivity separately this could potentially result in double counting of productivity effects. The rate of change approach has been developed to ensure that productivity can be accounted for explicitly without the risk of double counting productivity.

Also an EBA may result in a deviation from the forecast industry average if it is adopted at the beginning of the period and a forecast industry average is used following the end of the current enterprise agreement. For example, if early in the period a NSP has a lower EBA than the average, then there may be an expectation for its next EBA to be higher than average.

It is not symmetrical to apply an EBA for some years and then a consultant's forecast for the remaining years without considering the salary level. For example, if a NSP negotiates a lower EBA in the current period than other NSP's, assuming the other provisions are equal, then it may be reasonable to expect a higher EBA in the next period to 'catch up' to other NSPs. Applying a benchmark labour price following the end of an EBA would not recognise this catch up.

The Consumer Challenge Panel submitted that:

> The AER must ensure that the electricity networks do not continue with their previous approach of effectively treating EBA outcomes as a "pass through". The AER needs to determine efficient allowances for labour costs that better reflect the long-term interests of consumers.[393]

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[392] Independent Economics, *Labour cost escalators for NSW, the ACT and Tasmania*, 18 February 2014, p. 6

[393] Consumer Challenge Panel, *AER Consumer Challenge Panel (CCP6 Sub Panel) submission on the TransGrid revenue proposal*, p. 11, 8 August 2014.

The Major Energy Users also submitted that adjusting costs that have been negotiated by a single firm does not necessarily reflect an efficient outcome.[394]

In taking these submissions into account, we note that we have not adopted Ausgrid's EBA when applying a rate of change in our alternative estimate. Our labour price is based on the forecast of the NSW EGWWS industry which we consider to be a benchmark appropriate for an efficient NSP.

B.4.3 Output change

We have adopted the following output change measures and their respective weightings:

- Customer numbers (67.6 per cent)
- Circuit length (10.7 per cent)
- Ratcheted maximum demand (21.7 per cent)

These output measures are consistent with the output variables used in our opex cost function analysis to measure productivity. This approach is consistent with our Guideline.[395]

The outputs chosen by Economic Insights were based on three selection criteria.

First, the output aligns with the NEL and NER objectives. The NER expenditure objectives for both opex and capex are to:

- meet or manage the expected demand for standard control services over that period;
- comply with all applicable regulatory obligations or requirements associated with the provisions of standard control services;
- to the extent that there is no applicable regulatory obligation or requirement in relation to:
  i. the quality, reliability or security of supply of standard control services; or
  ii. the reliability or security of the distribution system through the supply of standard control services,

to the relevant extent:

  iii. maintain the quality, reliability and security of supply of standard control services; and
  iv. maintain the reliability and security of the distribution system through the supply of standard control services; and

- maintain the safety of the distribution system through the supply of standard control services.

Second, the output reflects services provided to customers.

Third, only significant outputs should be included. While service providers provide a wide range of services costs are dominated by a few key outputs. Only those key outputs should be included to keep the analysis consistent with the high level nature of economic benchmarking. [396]

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[394] Major Energy Users, *Tasmanian Electricity Transmission Revenue Reset A response by the Major Energy Users Inc.*, August 2014, p. 25

[395] AER, *Better Regulation Expenditure Forecast Assessment Guideline for Electricity Distribution*, November 2013, p. 23.

We discuss the process for selecting the output specification in the appendix A of this opex attachment and Economic Insights' benchmarking report.[397]

Our rate of change approach assumes any change in output results in the same proportional change in opex. For example, a 10 per cent increase in weighted average output change results in a 10 per cent increase in opex.

We used the customer numbers, circuit length and maximum demand reported in Ausgrid's reset RIN. This produces an average annual growth rate of 1.06 per cent for customer numbers, 0.77 per cent for circuit length and zero per cent for ratcheted maximum demand.

We note Essential Energy's output change methodology is based on growth related capex which increases the size of the network and the number of assets to be maintained, operated and managed.[398]

In principle, we do not consider an output change methodology which is based on capex to be a reasonable measure of the change in outputs Essential Energy must provide.

The output change is a measure of the change in the quantity of services a service provider is required to meet. This measure should not be influenced by price changes or the service provider's investment decisions.

Capex forecasts include price changes, so if the opex output change is calculated as a function of capex, then it is no longer a pure quantity measure.

Further, a change in the price of capex does not necessarily result in a change in the costs of operating and maintaining that asset.

An output change measure based on capex will also be affected by our capex assessment. Our draft decision on capex is lower than Essential Energy's proposed capex. This would result in a lower output change for Essential Energy. The output change for opex should reflect the change in the quantity of services an efficient service provider must provide to meet its obligations rather than an increase in capex, which is an input, to meet its investment decisions.

Essential Energy's and our output change is shown below in Table B-7. At an overall level our output change is higher than Essential Energy's because we have a higher output change in 2014–15.

We consider an output change approach, which we have consistently adopted across all service providers more accurately measures the quantity of outputs an efficient service provider is required to provide. An output change approach that uses capex as the measure of how much opex is required is inherently linked to the efficiency of the service provider's capex.

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396 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 9.

397 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, pp. 9–12.

398 Essential Energy, *Regulatory proposal*, May 2014, p. 75.

Table B-7 AER and Essential Energy's forecast output change (per cent)

	2014–15	2015–16	2016–17	2017–18	2018–19
Essential Energy's forecast output change	0.21	0.44	0.45	0.44	0.46
AER forecast output change	0.60	0.42	0.37	0.39	0.43

Source: AER analysis.

B.4.4 Productivity

We have applied a zero per cent productivity change in estimating our overall rate of change. This is based on Economic Insights' recommendation to apply zero productivity change for the NSW and ACT distribution network service providers and our assessment of overall productivity trends for the forecast period.[399] Essential Energy also proposed a productivity change of zero per cent. However, Essential Energy's reasons for arriving at zero productivity change are different to ours.

Our Guideline states that we will incorporate forecast productivity in the rate of change we apply to base opex when assessing opex. The forecast productivity change will be the best estimate of the shift in the productivity frontier. [400]

We consider past performance to be a good indicator of future performance under a business as usual situation. We have applied forecast productivity based on historical data for the electricity transmission and gas distribution industries where we consider historical data to be representative of the forecast period.

To reach our best estimate of forecast productivity we have taken into account all available information. This includes Economic Insights' economic benchmarking, Essential Energy's proposal, our expectations of the distribution industry in the short to medium term, and observed productivity outcomes from electricity transmission and gas distribution industries.

We have applied a zero productivity forecast for ActewAGL and the NSW service providers for the following reasons:

- While data from 2006–13 period indicates negative productivity for distribution network service providers on the efficient frontier, we do not consider this is representative of long term trends and our expectations of forecast productivity in the medium term. The increase in the service provider's inputs, which is a significant factor contributing to negative productivity, is unlikely to continue for the forecast period.
- Measured productivity for electricity transmission and gas distribution industries are positive for the 2006–13 period and are forecast to be positive.
- ActewAGL and the NSW service providers proposed either zero or positive productivity for the forecast period.

Each of these reasons is discussed in detail in the section below.

399 Economic Insights, *Economic Benchmarking Assessment of Operating Expenditure for NSW and ACT Electricity DNSPs*, 8 September 2014, p. 52.

400 AER, *Better regulation explanatory statement expenditure forecast assessment guideline*, November 2013, p. 65.

Forecast outlook and historical productivity

As noted above the forecast productivity is our best estimate of the shift in the frontier for an efficient service provider. Typically we consider the best forecast of this shift to be based on recent data. However, this requires a business as usual situation where the historical data is representative of what is likely to occur in the forecast period. [401]

Analysis from Economic Insights using MTFP and opex cost function models showed that from 2006 to 2013, the distribution industry experienced negative productivity change.[402] This means that for the distribution industry inputs specified under the models increased at a greater rate than the measured outputs.

According to Economic Insights' modelling, the average annual output change from 2010 to 2013 for the distribution industry was 0.6 per cent.[403] During this period, the output measures of customer numbers and circuit length grew annually by 1.2 per cent and 0.5 per cent respectively. Maximum demand in 2013 decreased by 4.1 per cent from its peak in 2009.

However, total input quantity increased by 2.8 per cent per annum from 2010 to 2013.[404] This has been driven by substantial increases in both opex and capital inputs.

We consider the increase in inputs, relative to outputs, could be driven by one or all of the following factors:

- An increase in regulatory obligations which increases a service provider's costs without an increase in its outputs. Following the Victorian bushfires of February 2009, the Victorian service providers received step change increases in excess of 10 per cent of the approved opex requirement. Economic Insights considers step changes to have a significant impact on measured productivity.[405] The interaction between step change and productivity is discussed in the other considerations section below.

- Increased opex and capital to meet forecast increases in outputs, such as reliability due to regulatory obligations. For example, Endeavour Energy noted that substantial investment was required during the 2009–14 regulatory period to meet its Licence Conditions.[406] We discuss the impact of these licence conditions, and the NSW service providers' response to them, in section A.4 of appendix A.

- Inefficient use of inputs which means more inputs were required to service a service provider's outputs. Economic Insights identified substantial efficiency gaps for ActewAGL and the NSW service providers.[407]

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401 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 41.

402 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 20, p. 40.

403 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, pp. 44–45.

404 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 45.

405 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 42.

406 Endeavour Energy, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 46

407 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. v.

If these above drivers are the basis for the observed negative productivity in the recent past, we need to consider whether drivers will persist in the forecast period.

First, we do not expect the 2.8 per cent average annual growth in inputs from 2010 to 2013 to continue into the forecast period.

A key driver of the increase in opex and capital inputs during 2009–14 was the introduction of increased reliability standards in 2007.

DAE estimated the overall cost of meeting the 2007 Licence Conditions was $1.9 billion for Ausgrid, $614 million for Endeavour Energy and $465 million for Essential Energy.[408] Given the change in Licence conditions was a one off obligation, that has since been amended, we would not expect a similar increase in inputs in the forecast period.

Economic Insights considers the greater use of opex and capital inputs from 2006–13 will result in excess capacity for 2014–19.[409] This means the service providers are unlikely to require the same growth in inputs for the forecast period. Endeavour Energy noted that its investments to meet Licence Conditions have provided sufficient capacity in its existing network to meet forecast demand growth and will continue to do so in the coming years.[410] Endeavour Energy also noted that capex will shift from a focus on meeting maximum demand to maintaining reliability.[411] Essential Energy also identified the need for investment to meet capacity and Licence Conditions has subsided.[412]

Second, the increase in inputs due to regulatory obligations observed during 2009–13 is unlikely to persist into the forecast period.

For Victorian service providers, we note the one off step increase in opex to meet their regulatory obligations after the 2009 Victorian bushfires substantially increased their inputs. Further significant step changes in Victorian bushfire regulations are unlikely over forecast period.

The third potential source of observed negative productivity is the increase in inefficient use of inputs by service providers during the 2006–13 data period. After allowing for operating environment factors and modelling limitations, Economic Insights found the opex of ActewAGL and the NSW service providers was much higher than the opex incurred by a benchmark efficient service provider.[413] We do not consider that the past inefficiency of a service provider should be included in our forecast of productivity.

Other industries and proposed productivity

In estimating forecast productivity for the distribution industry we have also had regard to the electricity transmission and gas distribution industry, and ActewAGL's and the NSW service provider's productivity forecasts.

Measured declines in productivity in the electricity distribution sector are unlikely to reflect longer term trends. Economic Insights notes:

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408 Deloitte Access Economics, *NSW DNSP labour analysis draft report*, p. 9.
409 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, p. 45.
410 Endeavour Energy, *Regulatory proposal*, May 2014, p. 46
411 Endeavour Energy, *Regulatory proposal*, May 2014, p. 2.
412 Essential Energy, *Regulatory proposal*, May 2014, p. 77.
413 Economic Insights, *Economic benchmarking assessment of operating expenditure for NSW and ACT electricity DNSPs*, 20 October 2014, pp. 46–51.

> We also note that a situation of declining opex partial productivity is very much an abnormal situation as we normally expect to see a situation of positive technical progress rather than technical regress over time. While we acknowledge the distinction between the underlying state of technological knowledge in the electricity distribution industry and the impact of cyclical factors that may lead to periods of negative measured productivity growth, the latter would be expected to be very much the exception, step change issues aside.

Further both the electricity transmission and gas distribution industries experienced positive opex productivity growth during the 2006–13 period.[414] For electricity transmission network service providers average industry productivity was 0.85 per cent and for gas distribution Jemena Gas Networks proposed an average opex productivity of 0.95 per cent of which 0.83 per cent was attributed to the shift in the frontier.[415]

Cyclical factors and regulatory obligations for the distribution sector may be the reason for the lower measured productivity in the distribution industry compared to the transmission and gas distribution industries. Over the medium to long term, however, we expect the distribution network service providers to have productivity change rates comparable to the electricity transmission and gas distribution industries.

We also note ActewAGL and the NSW electricity distribution service providers forecast zero or positive productivity for the forecast period. Further, several forecasts indicated that increases in output will be offset by efficiency improvements. For example, ActewAGL and Endeavour Energy forecast economies of scale will offset most of their output growth. [416]

Essential Energy proposed zero per cent productivity change[417] and Ausgrid proposed productivity savings of $47 million[418] for its standard control services.

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414 Economic Insights, *Economic Benchmarking Assessment of Operating Expenditure for NSW and Tasmanian Electricity TNSPs*, November 2014, p. iv; Economic Insights, *Relative opex efficiency and forecast opex productivity growth of Jemena Gas Networks: Report prepared for Jemena Gas Networks*, April 2014, p. 24

415 AER, *Draft decision, Jemena Gas Networks (NSW) Ltd Access arrangement 2015–20: Attachment 7 – Operating expenditure*, November 2014, p. 40.

416 ActewAGL, *Regulatory proposal resubmitted*, 10 July 2014, p. 233; Endeavour Energy, Response to information request END003, 29 July 2014.

417 Essential Energy, Reset RIN table 2.16.1.

418 Ausgrid, Reset RIN table 2.16.1.

C Step changes

Step changes allow for adjustments to the efficient base level of opex to account for changed circumstances in the forecast period that we have not otherwise addressed in our opex forecast. We typically allow for step changes to base opex for changes to ongoing costs associated with new regulatory obligations and for efficient capex/opex trade-offs.[419] Step changes may be positive or negative.

This appendix sets out our consideration of step changes in determining our opex forecast for Essential Energy for the 2014–19 period.

C.1 Position

We have not included any step changes in our alternative opex forecast.

Essential Energy has forecast several increases in opex in the 2014–19 period related to a network reform program and the reallocation of costs from capex to opex. We are not satisfied that including these costs in our alternative opex forecast would lead to a forecast of opex that reasonably reflects the opex criteria.

Other cost drivers identified by Essential Energy as step changes relate to matters we explicitly considered in forming an efficient base level of opex. We have not considered these cost changes as step changes.

A summary of the revenue impact and the reasons for our position is outlined below in Table C-1.

Table C-1 Summary of draft position on step changes ($ million, 2013–14)

	Essential Energy proposal	AER draft position	Reason for position
Accounting treatment changes	52.7	–	Our forecast of base opex already accounts for the efficient opex a prudent and efficient service provider would need to provide standard control distribution services. A prudent and efficient service provider would not require a step change in opex for this cost driver.
Costs to implement network reform program	94.2	–	Our forecast of base opex already accounts for the efficient opex a prudent and efficient service provider would need to provide standard control distribution services. A prudent and efficient service provider would not require a step change in opex for this cost driver.
Other (including savings)	69.9	–	Our forecast of base opex already accounts for efficient opex a prudent and efficient service provider would need to provide standard control distribution services. A prudent and efficient service provider would not require a step change in opex for this cost driver.

419 AER, *Expenditure assessment forecast guideline - Explanatory Statement*, November 2013, p.51.

	Essential Energy proposal	AER draft position	Reason for position
Vegetation management	–150.4	–	Not considered as a step change. We considered the efficiency of Essential Energy's vegetation management practices in forming our view of an efficient base level of opex.
Reclassified ancillary network and metering services	–203.8	–	Not considered as a step change. We removed reclassified ancillary network and metering services from Essential Energy's actual opex in forming our view of an efficient base level of opex.
Actuarial adjustment for long service leave	11.5	–	Not considered as a step change. Actuarial adjustments for long service leave are reflected in movements in provisions. We adjusted Essential Energy's actual opex for movement in provisions in forming our view of an efficient base level of opex.

Source: AER analysis.

C.2 Essential Energy's proposal

Essential Energy proposed step changes in six categories of opex which led to changes in its forecast opex from the opex it incurred in the base year, 2012–13. These are outlined in Table C-2 below.

Essential Energy also noted that it preferred the term ' change factor' to a 'step change'. It considered that the use of 'step changes' may exclude costs that satisfy the NER criteria and factors.[420]

Table C-2 Essential Energy proposed change factors ($million, 2013–14)

	2014–15	2015–16	2016–17	2017–18	2018–19	Total
Vegetation management	–19.3	–25.5	–34.8	–35.2	–35.5	–150.4
Reclassified ancillary network and metering services	–39.5	–39.9	–41.1	–41.2	–42.1	–203.8
Actuarial adjustments	2.3	2.3	2.3	2.3	2.3	11.5
Accounting treatment changes	10.5	10.5	10.5	10.5	10.5	52.7
Costs to implement network reform program	17.0	21.6	21.6	17.0	17.0	94.2
Other (including savings)	16.3	14.3	11.5	13.5	14.4	69.9

Source: Essential Energy, Regulatory Information Notice, Table 2.17.1.

420 Essential Energy, *Response to RIN*, p. 21.

C.3 Assessment approach

When assessing a service provider's proposed step changes, we consider whether they are needed for the total opex forecast to reasonably reflect the opex criteria.[421] Our assessment approach is consistent with the approach specified in our Expenditure forecast assessment guideline (our Guideline).[422]

As noted above, Essential Energy classified many changes in costs as change factors rather than as step changes. We do not consider that how a cost is classified should affect how we assess it. We consider our framework for assessing step changes is equally applicable to a cost driver defined as a change factor. We consider that how a cost driver is labelled should not lead to a different forecast of total opex.

As a starting point, we consider whether the proposed step changes in opex are already compensated through other elements of our opex forecast, such as the base efficient opex or the 'rate of change' component. Step changes should not double count costs included in other elements of the opex forecast.

We generally consider an efficient base level of opex is sufficient for a prudent and efficient service provider to meet all existing regulatory obligations. This is the same regardless of whether we forecast an efficient base level of opex based on the service provider's own costs or the efficient costs of comparable benchmark providers. We only include a step change in our opex forecast if we are satisfied a prudent and efficient service provider would need an increase in its opex.

We forecast opex by applying an annual 'rate of change' to the base year for each year of the forecast regulatory control period. The annual rate of change accounts for efficient changes in opex over time. It incorporates adjustments for forecast changes in output, price and productivity. Therefore, when we assess the proposed step changes we need to ensure that the cost of the step change is not already accounted for in any of those three elements included in the annual rate of change. The following explains this principle in more detail.

For example, a step change should not double count the costs of increased volume or scale compensated through the forecast change in output. We account for output growth by applying a forecast output growth factor to the opex base year. If the output growth measure used captures all changes in output then step changes that relate to forecast changes in output will not be required. For example, a step change is not required for the maintenance costs of new office space required due to the service provider's expanding network. The opex forecast has already been increased (from the base year) to account for forecast network growth.[423]

By applying the rate of change to the base year opex, we also adjust our opex forecast to account for real price increases. A step change should not double count price increases already compensated through this adjustment. Applying a step change for costs that are forecast to increase faster than CPI is likely to yield a biased forecast if we do not also apply a negative step change for costs that are increasing by less than CPI. A good example is insurance premiums. A step change is not required if insurance premiums are forecast to increase faster than CPI because within total opex there will be other categories whose price is forecast to increase by less than CPI. If we add a step change to

[421] NER, cl. 6.6.5(c).

[422] AER, *Expenditure assessment forecast guideline*, November 2013, p.11, 24.

[423] AER, *Explanatory guide: Expenditure assessment forecast guideline*, November 2013, p.73. See, for example, our decision in the Powerlink determination; AER, *Final decision: Powerlink transmission determination 2012–17*, April 2012, pp. 164–5.

account for higher insurance premiums we might provide a more accurate forecast for the insurance category in isolation; however, our forecast for total opex as a whole will be too high.

Further to assessing whether step changes or change factors are captured in other elements of our opex forecast, we will assess the reasons for, and the efficient level of, the incremental costs (relative to that funded by base opex and the rate of change) that the service provider has proposed. In particular we have regard to:[424]

- whether there is a change in circumstances that affects the service provider's efficient forecast expenditure
- what options were considered to respond to the change in circumstances
- whether the option selected was the most efficient option—that is, whether the service provider took appropriate steps to minimise its expected cost of compliance
- the efficient costs associated with making the step change and whether the proposal appropriately quantified all costs savings and benefits
- when this change event occurs and when it is efficient to incur expenditure, including whether it can be completed over the regulatory period
- whether the costs can be met from existing regulatory allowances or from other elements of the expenditure forecasts.

One important consideration is whether each proposed step change is driven by an external obligation (such as new legislation or regulations) or an internal management decision (such as a decision to increase maintenance opex). Step changes should generally relate to a new obligation or some change in the service provider's operating environment beyond its control. It is not enough to simply demonstrate an efficient cost will be incurred for an activity that was not previously undertaken. As noted above, the opex forecasting approach may capture these costs elsewhere.

Usually increases in costs are not required for discretionary changes in inputs.[425] Efficient discretionary changes in inputs (not required to increase output) should normally have a net negative impact on expenditure. For example, a service provider may choose to invest capex and opex in a new IT solution. The service provider should not be provided with an increase in its total opex to finance the new IT since the outlay should be at least offset by a reduction in other costs if it is efficient. This means we will not allow step changes or change factors for any short-term cost to a service provider of implementing efficiency improvements. We expect an efficient service provider to bear such costs and thereby make efficient trade-offs between bearing these costs and achieving future efficiencies.

One situation where a step change to total opex may be required is when a service provider chooses an operating solution to replace a capital one.[426] For example, it may choose to lease vehicles when it previously purchased them. For these capex/opex trade-off step changes, we will assess whether it is prudent and efficient to substitute capex for opex or vice versa. In doing so we will assess whether the forecast opex over the life of the alternative capital solution is less than the capex in NPV terms.

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424 AER, *Expenditure assessment forecast guideline*, November 2013, p.11.
425 AER, *Expenditure assessment forecast guideline*, November 2013, p. 24.
426 AER, *Expenditure assessment forecast guideline*, November 2013, p. 24; AER, *Explanatory guide: Expenditure assessment forecast guideline*, November 2013, pp.51–52.

C.4 Reasons for position

Costs to implement network reform

We have not included any costs of implementing network reform in our alternative opex forecast. We are not satisfied that adding these costs to an efficient base level of opex would lead to a forecast of opex that reasonably reflects the opex criteria.

These forecast costs include incremental costs associated with Essential Energy's ongoing contribution to Networks NSW. Essential Energy reported that the formation of Networks NSW created a pool of costs that mainly related to employees which were previously employed separately by the three Networks NSW service providers. The proposed step change for this cost driver represents the incremental costs to Essential Energy of contributing to Networks NSW. That is, it is the contribution to Networks NSW net of the cost of the relevant employees to Essential Energy in the base year, 2012–13.[427] This forecast step change also included forecast redundancy costs associated with network reform.[428]

In assessing whether we should include costs in our alternative opex forecast, we consider whether these are costs that would be incurred by a prudent and efficient service provider. As outlined in Appendix A, benchmarking indicates that Essential Energy's opex is higher than opex incurred by a benchmark efficient service provider.

For instance, we commissioned Deloitte Access Economics to review the NSW service providers' labour and workforce practices. It found for much of the 2009–14 regulatory control period, it appears likely that the NSW service providers' labour costs were heavily impacted by:

- a relatively inflexible workforce with limited ability to innovate or respond to changing circumstances
- EBAs that include restrictive provisions and overly generous conditions, compounded by a significantly higher proportion of staff coverage, than their more efficient peers
- significantly lower proportions of outsourcing (approximately 20 to 25 per cent of opex) than more efficient peers, which are as high as 90 per cent for some Victorian service providers
- in some cases, poor management of labour costs, such as in relation to overtime and travel
- union opposition to management attempts to reduce costs and improve productivity.

We also asked Deloitte Access Economics to review the NSW service providers' approach to resourcing the change in Ministerial licence requirements in the 2009–14 regulatory control period. It found strong evidence to suggest the service providers’ expenditure and approaches to resourcing their capex programs was not consistent with that of a prudent or efficient service provider. In particular it considered there is strong evidence to indicate:[429]

- each service provider relied too heavily on internal labour resources rather than using external contractors to undertake their capex programs

427 Essential Energy, Response to AER information request 006, p. 3.
428 Essential Energy, *Response to RIN,* p. 24.
429 Deloitte, *NSW Distribution Network Service Providers Labour Analysis*, p. iii.

- labour related capex was impacted by unionised workforces that were relatively inflexible, high cost and unproductive compared to the workforces of their peers.

Based on our assessment of Essential Energy's historical expenditure, we consider that Essential Energy's network reform program is only needed because it is not currently operating as efficiently as it could. We see no reason why Essential Energy's consumers should fund Essential Energy to restructure its cost base. To do so, would mean Essential Energy's consumers would pay for the cost of a network service in the 2014–19 period that is greater than the cost that could be achieved by a benchmark efficient service provider.

Accounting treatment changes and Other (including savings)

We have not included Essential Energy's proposed accounting treatment changes in our alternative opex forecast. Nor have we included any costs from the Other (including savings) category. We do not consider that adding these costs to our alternative opex forecast would lead to a forecast of opex that reasonably reflects the opex criteria.

Essential Energy included an annual increase in its forecast opex of $10.5 million per annum relating to accounting treatment changes. Essential Energy has reallocated overheads to opex that were previously allocated to both opex and capex. This was undertaken as part of a Network Reform accounting harmonisation program carried out across the three NSW network businesses. Essential Energy stated that this reallocation of overheads was to enable better analysis of management and expenditure across the NSW network businesses.

Essential Energy stated that the costs included in the 'other' category 'mainly relate to the downstream impacts of significantly reducing the capital program in the 2014–19 regulatory control period'.[430] This reflects incremental opex associated with overheads (including labour) that are shared between opex and capex ($57 million), and some incremental fault and emergency response opex to maintain the network ($13 million). Essential Energy has stated that the proposed increase does not include some reallocated overheads that have been removed from the business. These are the savings referred to in the title of the proposed step change.

The Energy Users Association of Australia noted that we are required to approve efficient opex costs. It noted that efficient opex costs do not include inefficient resourcing decisions relating to the capex program.[431]

Origin Energy noted there was little detail on the breakdown or magnitude of Essential Energy's forecast costs. It considered Essential Energy could have foreseen this change in workforce requirements.

The costs that Essential Energy has identified as part of its accounting harmonisation project may well be better classified as opex rather than allocated to both opex and capex. Similarly, given Essential Energy has forecast a large reduction in capex relative to the historical period, it might be reasonable to expect some change in the proportion of overheads allocated to opex and capex. For instance, overheads (including labour) are commonly shared between opex and capex so when there is a reduction in capex relative to opex, the proportion of overheads allocated to opex could increase and the proportion allocated to capex could decrease.

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[430] Essential Energy, *Response to AER Essential 006*, 16 July 2014, p. 5.
[431] Energy Users Association of Australia, *Submission to regulatory proposal*, p. 3.

Nonetheless, we are not satisfied that we need to include these costs in our alternative forecast of opex. Our task under the NER is to determine forecast opex that reasonably reflects the opex criteria. As outlined at the beginning of this opex attachment and in appendix A, we have considered what total opex a benchmark efficient provider is likely to need given the outputs we estimate Essential Energy will deliver. As outlined in section A.3 of appendix A, we have benchmarked Essential Energy's historical opex against other providers in the NEM. From this, and other supporting evidence, we have determined the base level of opex needed to efficiently deliver these services. Essential Energy's historical opex is higher than opex incurred by a benchmark efficient service provider. If we re-benchmarked Essential Energy's historical opex based on its proposed allocation of overheads for the 2014–19 period, its historical opex would compare even less favourably to the opex incurred by a benchmark efficient service provider.

Nor are we satisfied an increase in base opex is needed to account for additional maintenance opex relating to faults and emergencies. As noted above, Essential Energy has attributed increased opex on faults and emergency response to its reduced capex program. Our alternative opex forecast is based on consideration of the total opex a prudent and efficient service provider would need given the outputs we forecast Essential Energy will deliver over the period. Inevitably an efficient service provider will need to devote some of its opex budget towards faults and emergencies. However, it is its responsibility to determine this given all operating and maintenance priorities it faces. We consider an efficient base opex allowance is sufficient to meet these priorities. Accordingly, we have not formed a specific view of the faults and emergency response opex Essential Energy would require.

Vegetation management efficiencies, Reclassified ancillary network and metering services, Actuarial adjustment

We have not considered Essential Energy's proposed vegetation management efficiencies, reclassified ancillary network and metering services and actuarial adjustments as step changes. We have instead had consideration to these proposals in determining an efficient base level of opex.

Essential Energy proposed a reduction in vegetation management due to achievement of efficiencies through strategic reform initiatives. We agree with Essential Energy that its historic level of vegetation management is likely to be one reason why Essential Energy's historic opex is higher when compared to the opex incurred by a benchmark efficient service provider. However, rather than make a reduction to its opex based on its estimated inefficiency in different categories, we prefer to arrive at a reduction based on its total estimated inefficiency in opex. We have taken into account Essential Energy's historic inefficiency in delivering vegetation management in arriving at our proposed reduction to its base level of opex. This is discussed in detail in appendix A.

Essential Energy also proposed a reduction to its base level of opex for ancillary network services and metering services that have been reclassified from standard control to alternative control. We agree with this reclassification and have removed these costs accordingly when considering the efficiency of Essential Energy's base level of opex. This is discussed in appendix A of this opex attachment.

Essential Energy's proposed increase in opex for an actuarial adjustment is to reverse the actuarial adjustment for long service leave Essential Energy reported in the base year 2012–13.

We recognise that Essential Energy's opex in 2012–13 was lower in this year because of a revaluation of these entitlements. However, our preference is to address this by removing all provisions from opex and replacing the provision with the cash incurred on these entitlements in the relevant year. This is called adjusting for movements in provisions. Provisions are accounting adjustments which reflect estimates of future costs. Provisions can change significantly depending on the valuation of the cost at a point in time. Our approach leads to an estimate of opex which varies less from year to year and which is based on costs actually incurred in delivering employee obligations in the relevant year. We consider this approach better reflects the underlying costs a business faces at a point in time.

By removing movements in provisions, Essential Energy's opex in 2012–13 is higher. As such, it makes Essential Energy appear more inefficient when it is benchmarked against other providers in the NEM. For this reason, in our alternative forecast of opex we do not consider it is necessary to make an adjustment to an efficient base level of opex for this factor.

D Opex forecasting method assessment

This appendix sets out our consideration of Ausgrid's forecasting methodology in determining our opex forecast for Ausgrid for the 2014–19 period.

Our estimate of total opex is unlikely to exactly match Essential Energy's forecast (see our assessment approach in this opex attachment). Broadly, differences between the two forecasts can be explained by differences in the forecasting methods adopted and the inputs and assumptions used to apply the method. We have reviewed Essential Energy's forecast method to assess whether it explains why Essential Energy's forecast opex is higher than our own estimate.

D.1 Position

We are not satisfied that Essential Energy's forecasting method produces an opex forecast that reasonably reflects the opex criteria. We have not used category specific forecasting methods to separately forecast any of Essential Energy's opex categories other than debt raising costs in our substitute total opex forecast. We formed our substitute forecast total opex using our guideline forecasting approach with all opex categories other than debt raising costs included in base opex.

D.2 Essential Energy's proposal

Essential Energy describes its opex forecasting method in its revenue proposal.[432] Essential Energy stated that it disaggregated its total opex into various costs categories. It then reviewed the nature of each cost category and chose a forecasting method it considered appropriate for each category.[433] The forecasting methods Essential Energy applied at the category level included:

- **'base year':** forecast opex was based on actual expenditure in a single year (2012–13). Base year expenditure was then adjusted to account for future changes in Essential Energy's circumstances, operating environment, regulatory obligations and changes in demand and cost inputs.[434] Essential Energy used this approach to forecast the majority of its cost categories.[435]

- **'base year variation by volume':** forecast opex was based on actual unit rates in a single year (2012–13) which was adjusted for forecast price changes and then multiplied by forecast volumes.[436] Essential Energy used this approach to forecast routine asset inspections, thermovision, and maintenance and repair.[437]

- **'base year historical averaging':** this is similar to the 'base year approach' except that rather than using a single year of actual expenditure the average expenditure between 2009–10 and 2012–13 was used.[438] Essential Energy used this approach to forecast emergency response expenditure[439]

- **bottom up:** opex was derived from a forecast of all the relevant inputs including the number of tasks, the cost types required to perform each task (such as labour and materials) and the price

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432 Essential Energy, *Regulatory proposal*, May 2014, pp. 68–78.
433 Essential Energy, *Regulatory proposal*, May 2014, pp. 68–69.
434 Essential Energy, *Regulatory proposal*, May 2014, pp. 70–71.
435 Essential Energy, *Regulatory proposal*, May 2014, p. 70.
436 Essential Energy, *Regulatory proposal*, May 2014, p. 70.
437 Essential Energy, *Regulatory proposal*, May 2014, p. 69.
438 Essential Energy, *Regulatory proposal*, May 2014, p. 71.
439 Essential Energy, *Regulatory proposal*, May 2014, p. 70.

of these cost inputs.[440] Essential Energy used this approach to forecast its vegetation management costs.[441]

D.3 Assessment approach

The first part of our assessment involved identifying any differences between Essential Energy's forecasting method and our own method as outlined in our Expenditure forecast assessment guideline (our Guideline) This involved reviewing:

- the description of Essential Energy's opex forecasting method in its revenue proposal[442]
- the description of Essential Energy's opex forecasting method in its *Expenditure forecasting methods*[443]
- the opex models used by Essential Energy to forecast total opex.

Having identified any differences we then examined the impact of them. Our analysis focussed on Essential Energy's completed RIN template which disaggregated its total opex by driver (efficient historic opex, price change, output change, productivity change and step changes). This provided an indication of the impacts of the various forecasting methods applied by Essential Energy at the category level.

D.4 Reasons for position

In assessing Essential Energy's forecasting method we sought to identify if and where Essential Energy's forecasting method departed from our guideline forecasting method. Where Essential Energy's forecasting method did depart from our guideline forecasting method we considered whether this departure explains the difference between Essential Energy's forecast of total opex and our own.

Under our guideline forecasting method we start with the actual expenditure in a base year. If actual expenditure in the base year reasonably reflects the opex criteria we set base opex equal to actual expenditure. If not we apply an efficiency adjustment to ensure base opex reflects the opex criteria. We then apply a forecast rate of change to capture forecasting changes in prices, output and productivity. We then add or subtract any step changes to account for any other efficient expenditure not captured in base opex or the rate of change.[444]

As noted above, Essential Energy's opex forecasting method differs from our guideline forecasting approach in that it disaggregated total opex into costs categories and applied different forecasting methods to different cost categories.[445] Essential Energy applied its 'base year' method, which is broadly similar to our guideline forecasting method, to the majority of its cost categories. However, it used alternative methods for some cost categories.[446]

Using category specific forecasting methods for some opex categories may produce better forecasts of expenditure for those categories but this may not produce a better forecast of total opex. Generally it is best to use the same forecasting method for all cost categories of opex because hybrid forecasting methods (that is, combing revealed cost and category specific methods) can produce

440 Essential Energy, *Regulatory proposal*, May 2014, p. 71.
441 Essential Energy, *Regulatory proposal*, May 2014, p. 70.
442 Essential Energy, *Regulatory proposal*, May 2014, pp. 68–78.
443 Essential Energy, *Expenditure forecasting approach*, November 2013, pp. 6–7.
444 AER, *Expenditure forecast assessment guideline for electricity distribution*, November 2013, pp. 22–24.
445 Essential Energy, *Regulatory proposal*, May 2014, pp. 68–69.
446 Essential Energy, *Regulatory proposal*, May 2014, pp. 69–70.

biased opex forecasts inconsistent with the opex criteria. This view is consistent with a view expressed by Frontier Economics in a previous determination process, which stated:[447]

> We consider that it would be inappropriate for the AER to review each component of controllable opex individually to see whether it conformed to the same pattern as overall controllable opex. Such 'cherry-picking' would likely result in aggregate controllable opex being systematically and inefficiently over-forecast.

This is because, once an efficient base level of opex is determined, forecast total opex will systematically exceed the efficient level of opex if a bottom up forecasting method is used to forecast opex categories:

- with low expenditure in the base year, or
- with a greater rate of change than total opex.

Within total opex we would expect to see some variation in the composition of expenditure from year to year. If we use a category specific forecasting method to forecast those categories where base year opex was low, but not for those where base opex was high, our forecast of total opex will systematically exceed the efficient level of opex.

An example of this is Essential Energy's 'base year variation by volume' method which it used to forecast routine asset inspections, thermovision, and maintenance and repair.[448] Under this method it forecasts expenditure by multiplying the forecast volume of tasks by the average cost of the task in the base year, accounting for forecast price change.

Another example of this is Essential Energy's 'base year historical averaging' method which it used to forecast emergency response expenditure.[449] Under this method it used average expenditure in the years 2009–10 to 2012–13 rather than the expenditure in the base year.[450]

Similarly, if we exclude opex categories where expenditure is rising faster than total opex then the remaining categories will be rising at a slower rate than total opex or declining. If we apply the total opex rate of change to those remaining categories then the total opex forecast will systematically exceed the efficient level of opex.

As outlined in our Guideline, base year expenditure is escalated by the forecast rate of change in opex, which includes forecast price change.[451] If we exclude opex categories from our opex rate of change where expenditure is rising faster than total opex then the remaining categories will be rising at a slower rate than total opex or declining. If we apply the total opex rate of change to those remaining categories then the total opex forecast will systematically exceed the efficient level of opex. Frontier Economics made this point when it reviewed the forecasting method adopted by SP AusNet to forecast its electricity transmission opex:[452]

> In our view, such 'cherry-picking' would likely result in aggregate controllable opex being systematically and inefficiently over-forecast. This is because with overall controllable opex fairly stable over time, the exclusion of components forecast to rise from the single base year forecasting approach would imply that the remaining components of controllable opex—those subject to the single base year approach—would exhibit a falling trend. However, as a premise of the single base year approach is that future expenditure

447 Frontier Economics, *Opex forecasting and EBSS advice for the SP AusNet final decision*, January 2014, p. iii.
448 Essential Energy, *Regulatory proposal*, May 2014, p. 69.
449 Essential Energy, *Regulatory proposal*, May 2014, p. 70.
450 Essential Energy, *Regulatory proposal*, May 2014, p. 71.
451 AER, *Expenditure forecast assessment guideline for electricity distribution*, November 2013, pp. 22–23.
452 Frontier Economics, *Opex forecasting and EBSS advice for the SP AusNet final decision*, January 2014, p 17.

should mimic past expenditure, using such an approach to forecast expenditure components known to be in a falling trend would tend to result in the forecasts for these components being too high. Therefore, combining a bottom-up approach for rising trend components of opex with a single base year approach for falling trend components of opex would tend to result in an overall controllable opex forecast that systematically exceeded the efficient level of expenditure.

We note that the market price for certain opex items can, and does, change at a different rate than total opex. If we separately forecast those opex items because they are expected to increase in price more rapidly than the total opex basket, then we must also separately forecast opex items that increase in price less rapidly to avoid forecasting bias. Not doing so will systematically exceed the forecast opex required to meet the opex criteria. Moreover, the NER requires us to form a view on forecast total opex, rather than on subcomponents such as insurance or vegetation management.

For the above reasons we have not used category specific forecasting methods to separately forecast any of Essential Energy's opex categories in our substitute total opex forecast. We formed our substitute forecast total opex using our guideline forecasting approach with all opex categories included in base opex.