TasNetworks

Opex Benchmarking

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Contents

Key points of this report

The Australian Energy Regulator (AER) has adopted economic benchmarking as a means of evaluating opex efficiency - and estimating a substitute base year opex and forecast where relevant. There are limitations associated with the techniques adopted by the AER and deterministic application of the results carry risks for network service providers.

TasNetworks current level of opex is efficient using the AER's current approach and current view of the frontier target, set as AusNet Services' efficiency score. When environmental factors are considered, as well as TasNetworks' effective control of opex growth, TasNetworks ranks well within the frontier set (top 5) networks under the AER approach.

The category analysis results confirm TasNetworks' performance in opex benchmarking, comparing favourably to peers and broader industry in all categories. The only category where TasNetworks does not have demonstrably lower cost performance than industry averages is emergency response opex, which is a function of the operating environment, rather than managerial efficiency.

Executive Summary

In November 2012 the Australian Energy Market Commission (AEMC) completed the Economic Regulation of Network Service Providers Rule Change. This rule change required the Australian Energy Regulator (AER) to develop and publish a series of guidelines on its approach to regulating network service providers (NSPs), including the approach the AER will use to assess the efficiency of operating expenditure (opex) forecasts.

The AER is required to accept a DNSP's forecast opex where it is satisfied that the forecast opex for the regulatory control period reasonably reflects the criteria (the opex criteria) in clause 6.5.6(c) of the National Electricity Rules (NER), being:

- the efficient costs of achieving the opex objectives in clause 6.5.6(a) of the NER (opex objectives);
- the costs that a prudent operator would require to achieve the opex objectives; and
- a realistic expectation of the demand forecast and cost inputs required to achieve the opex objectives.

In deciding whether or not it is satisfied that the forecast opex for the regulatory control period reasonably reflects the opex criteria, the AER must have regard to certain factors specified in clause 6.5.6(e) of the NER, including, relevantly:

- the most recent annual benchmarking report that has been published under clause 6.27 of the NER and the benchmark opex that would be incurred by an efficient DNSP over the relevant regulatory control period (clause 6.5.6(e)(4)). Under clause 6.27 of the NER, the AER must prepare and publish an annual benchmarking report which should describe the relative efficiency of each DNSP in providing direct control services over a 12 month period;
- the actual and expected operating expenditure of the DNSP during any preceding regulatory control periods (clause 6.5.6(e)(5));
- the relative prices of operating and capital inputs (clause 6.5.6(e)(6));
- the substitution possibilities between opex and capital expenditure (capex) (clause 6.5.6(e)(7)); and
- any other factor the AER considers relevant and which the AER has notified the DNSP in writing, prior to the submission of its revised regulatory proposal under clause 6.10.3 is an operating expenditure factor (clause 6.5.6(e)(12).

With the Rule change, the AER released an Explanatory Statement for the final Expenditure Forecast Assessment Guideline. It states:

> “
>
> ***We are likely to use economic benchmarking to (among other things):***
>
> 1. ***Measure the rate of change in, and overall efficiency of, NSPs. This will provide an indication of the efficiency of historical expenditures and the appropriateness of their use in forecasts;***
> 2. ***Develop a top down total forecast of total expenditure;***
> 3. ***Develop a top down forecast of opex taking into account:***
>   - ***the efficiency of historical opex***
>   - ***the expected rate of change for opex***
>
> \- AER, Better Regulation, Explanatory Statement, p78-9, “Expenditure Forecast Assessment Guideline for Electricity Distribution”, November 2013

This guidance from the AER, and the evidence of recent regulatory determinations in NSW, ACT, QLD and SA demonstrate the key role economic benchmarking now plays in the AER’s assessment of DNSP expenditure and the degree to which it is considered efficient. Of particular interest is the indication that should a DNSP be deemed not to be responding to the incentive regime then benchmarking will be used as a means for the AER to determine a substitute forecast allowance.

In this report we provide a summary of the primary techniques adopted by the AER and the advantages and disadvantages of each. We also replicate the model and process that the AER has used in recent regulatory determinations to demonstrate the likely result should the current approach be applied to TasNetworks' distribution operating expenditure. The analysis shows that, should the approach and assumptions remain the same and AusNet Services remain the frontier firm, TasNetworks' latest opex (FY 2014) is below the predicted level of efficient opex using the AER model, even before environmental factors are considered.

The models and techniques adopted by the AER are very sensitive to changes in assumptions. Within this report we have conducted sensitivity analysis to changes in some of the more critical assumptions including:

1. The model specification and technique selected;
2. The use of international data;
3. The normalisation of opex data across the networks;
4. The time period of analysis; and
5. The consideration of environmental factors.

In most cases the assumptions used by the AER for each of these attributes of the approach are more disadvantageous to TasNetworks' apparent efficiency ranking and score than beneficial. That is, the current assumptions used by the AER in recent determinations in NSW, ACT, QLD and SA provide a lower efficiency score for TasNetworks than would be provided by alternative assumptions available. We conclude, therefore, that the apparent opex efficiency performance of TasNetworks is conservative in the context of the likely range of efficiency outcomes.

The fact that TasNetworks' current opex is below that predicted by the AER using the current approach, models and assumptions combined with our view of the underestimation of efficiency inherent in the assumptions leads us to conclude that within the current framework TasNetworks opex performance is within the frontier (top 5) set of networks.

Economic Benchmarking Techniques

1

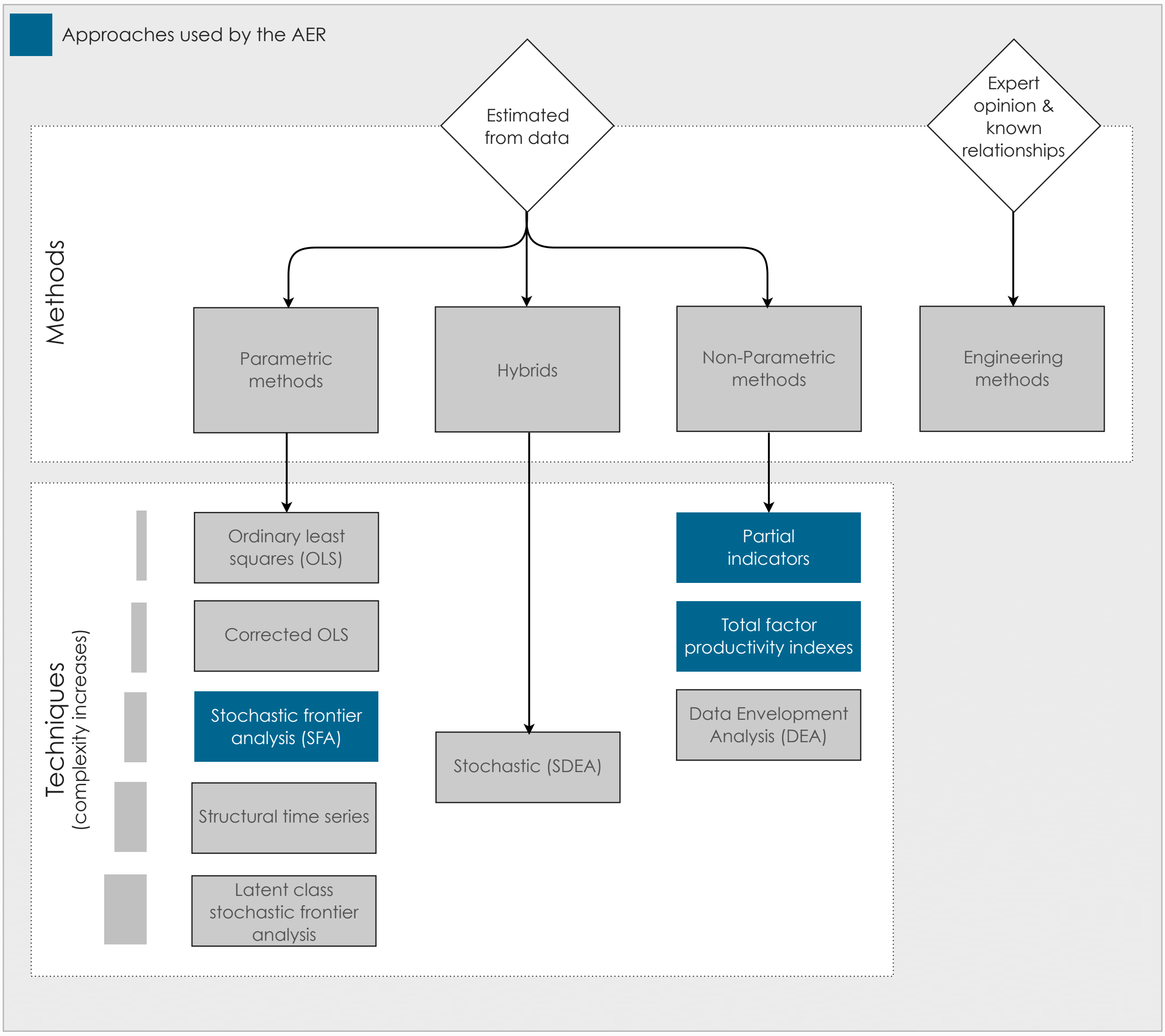
Methods and techniques of economic benchmarking

There are many types of benchmarking applied to electricity network cost and performance comparisons and many attributes of each type. For the purpose of this paper, we categorise the attributes of benchmarking in terms of:

- Benchmarking methods and techniques;
- Functional specifications; and
- Model specifications.

The hierarchy of benchmarking methods and techniques is shown below. The techniques adopted by the Australian Energy Regulator (AER) through their consultant, Economic Insights, are described in further detail in the following pages.

Figure 1: Benchmarking methods and techniques. *Benchmarking methods are categorised mainly as parametric or non-parametric. These are then broken down further into techniques which describe the basis of combining variables and the reference point of measurement.*



Total and Partial Factor Productivity

Total factor productivity (TFP) incorporates multiple outputs and inputs by using different weights derived from revenue and cost shares to aggregate them into a single output and input index. Total factor productivity is generally preferred to partial indicators because it is able to include more outputs and inputs through which to benchmark businesses.

A common criticism is that total factor productivity is unable to account for environmental differences that can influence the productivity results. This limitation requires post modelling treatment, such as second stage regression, to correct for bias when comparing networks that operate in different environments.

TFP has been utilised in electricity network regulation in New Zealand, Canada and the United States.

TFP can be disaggregated into the component measures of capital and operating partial productivity indices by omitting:

- The capital inputs to calculate opex partial factor productivity (Opex PFP); and
- The operating inputs to calculate capital partial factor productivity (Capital PFP).

The AER has chosen to use Multilateral TFP (MTFP) - a multiple input and output index over time - for benchmarking total expenditure and Opex and Capital PFP for evaluating operating and capital productivity.

Advantages

An industry cost function does not need to be assumed

DNSPs are directly compared to others within the industry and not a regression line (econometric modelling) or a hypothetical frontier business (DEA)

The amount of data required is less exhaustive than for other benchmarking techniques

MTFP benchmarking is transparent and easy to replicate

Disadvantages

MTFP does not take into account environmental variables, making it difficult to distinguish between inefficiency and the result of different operating environments

MTFP does not take into account economies of scale, making it difficult to distinguish between inefficiency and the result of scale differences

MTFP scores can change significantly depending on the choice of inputs and outputs

MTFP does not produce any statistical results which makes it difficult to determine if the results are valid

Stochastic Frontier Analysis

Stochastic Frontier Analysis (SFA) uses maximum likelihood estimation to model the relationship between costs, outputs, inputs and environmental differences. A key assumption made using this technique is the structure of the error term which is split into an inefficiency term and a random error term. This structure imposed on the error term is a fundamental difference between Stochastic Frontier Analysis and other techniques such as Ordinary Least Squares which assumes the error term is normally distributed.

The estimated model used by Economic Insights and adopted by the AER in the recent regulatory decisions is as follows:

$$\begin{aligned}\ln Opex = {} & 0.667 \ln customers + 0.106 \ln CircuitLength + 0.214 \ln RatchetedPeakDemand \\ & - 0.131 \ln ShareUnderground + 0.018 Year + 0.050 NZ + 0.157 Ontario\end{aligned}$$

Natural logs indicate the proportionate change in variables, therefore a value of 0.667 for customers indicates that a 1% increase in customer numbers results in a .667% increase in opex. Year is not included in log form and therefore is interpreted as a 1.8% increase in opex each year between 2006 and 2013 (this was included to represent the change in opex due to changes in technology). The relevance of these factors, and the materiality to the efficiency evaluation results are discussed further in Chapter 3 in the section on international data.

Having estimated the model, efficiency estimates can then be obtained for each DNSP. The SFA model used by the AER assumes that there is one efficiency score for each DNSP for the whole period.

Advantages

Estimates the relationship between different cost drivers and operational expenditure

Produces statistical results that can be used to infer which variables have a significant effect on DNSP expenditure and how well the proposed model explains variations in DNSP expenditure

Accounts for statistical noise by separating the error term into an inefficiency and a random error component

Disadvantages

Requires more data than DEA and MTFP

In the presence of multicollinearity coefficients can be unstable

A relationship between inputs and operational expenditure needs to be assumed

With a wide range of functional forms and input variables to choose from there may be a number of different models that are statistically valid but produce different estimates

Category Analysis

Category analysis is the least complex of the three techniques adopted by the AER and involves finding the ratio of a single input to output. Metrics used by the AER in the recent regulatory decisions include the following;

- Opex/customer
- Network overheads/customer
- Corporate overheads/customer
- Total overheads/customer
- Vegetation management expenditure/overhead km
- Emergency response expenditure/interruption
- Maintenance expenditure/km

The AER has relied upon data in the Regulatory Information Notices (RINs) supplied by the businesses. The AER has also generally taken a five year average of the data used to generate the category analysis ratios.

Advantages

Measures are simple ratios of readily available network attributes

Results are more easily conveyed through graphical representation of comparisons

The amount of data required is less exhaustive than for other benchmarking techniques such as SFA

Disadvantages

Businesses will appear efficient and inefficient for the same cost category depending on the denominator chosen

Cost allocation methodology differences skew the results in single cost categories

Dissimilar businesses cannot be reliably compared

Likely Benchmarking Outcomes for TasNetworks

2

The AER approach to benchmarking opex

Two regulatory determination processes are currently in progress (at the time of this report). NSW and the ACT have had a draft and final determination, whilst QLD and SA have had a preliminary determination delivered by the AER. From a benchmarking perspective:

1. The AER has relied primarily upon an econometric model (using Stochastic Frontier Analysis) to determine the efficient level of opex of the DNSPs under review.
2. The AER has used Opex PFP results to support their view of the relative efficiency of the DNSP under review.
3. The AER has used category analysis ratios selectively to support inferences of relative efficiency of the DNSP under review.

In adopting SFA, the AER's consultant has introduced international data as SFA requires a larger dataset than is available in Australia. The augmented data includes data from:

1. 37 networks in Ontario, Canada with customer bases of more than 30,000 customers; and
2. 18 networks in New Zealand with customer bases of more than 30,000 customers.

Economic Insights have included a dummy variable in their SFA model to recognise that data from each country can cause differences. However the sheer weight of numbers of networks in the sample from outside Australia, from Ontario in particular, ensures that the parameter weights of the SFA model are more representative of the Canadian conditions than Australian.

The AER has relied upon the Economic Insights SFA model to determine what it considers to be the level of expenditure an efficient business would have spent over the historical measurement period (2006 - 2013) in the circumstances of each DNSP. This approach relies upon the identification of an efficiency frontier for comparison; the DNSP or group of DNSPs with the highest efficiency score(s) using the SFA model. Adjustments to the base year opex are made on this basis by the AER.

Whilst the models and techniques have remained similar throughout the three decisions (NSW/ACT draft and final and QLD/SA preliminary), the approach has changed. In particular:

1. The AER initially used a customer weighted average of the efficiency scores of the top five performing networks in the SFA model as the frontier. After criticism from the NSW and ACT businesses, and in acknowledgement of the infancy of the approach, the AER has "relaxed" the frontier to be the efficiency score of the fifth ranked network (AusNet Services) in the SFA model. This has shifted the frontier reference point from 86% to 77%.
2. In response to criticism by the networks that the SFA model selection prohibits consideration of important operating environment differences (because the data is not available from Canada or New Zealand), the AER has allowed greater consideration of post SFA modelling adjustments for what it terms Operating Environment Factors (OEFs). These OEFs are AER estimates of the impact of various exogenous factors relative to the impact on the frontier business which are then used to adjust the input margin in the SFA model (thereby reducing the gap to the frontier where the net effect of the OEFs is positive).

Whilst these concessions have been made in both the preliminary decision for QLD and SA and the final determination for NSW and ACT, the NSW and ACT networks are currently appealing the decision on several grounds including the benchmarking approach.

The following pages explore the potential outcomes of the AER's benchmarking methodology for TasNetworks should the current approach endure through to the Tasmanian determination process.

Econometric productivity

In the most recent revenue determinations for QLD, SA, NSW and the ACT the AER has used econometric analysis in the form of a Stochastic Frontier Analysis (SFA) model to determine what it considers the efficient level of opex for each network. Stochastic Frontier Analysis uses maximum likelihood estimation to model the relationship between a dependent variable (opex), a number of different explanatory variables (circuit length, etc.) and the cost efficiency of each unit (DNSP). An efficiency score is obtained by making assumptions regarding the distribution of the error term ($v_i + u_i$) to separate DNSP inefficiency (u_i) and random noise (v_i). Cost efficiency is then calculated as exp(u_i). The form of the econometric function is shown below, where α is a constant and BX represents the explanatory variables.

$$\ln Opex = \alpha + BX + v_i + u_i$$

The AER have selected the following explanatory variables for opex in their SFA model:

1. Customer numbers;
2. Circuit length;
3. Ratcheted maximum demand (the highest historical peak load);
4. Share of underground (the percentage of network underground, as an environmental differentiator between networks);
5. Year (as the time variable); and
6. A dummy variable for jurisdiction (Australia, NZ or Ontario, Canada)

The form of the AER SFA function is thus:

$$\ln Opex = \alpha + \ln(CustNum) + \ln(CircLen) + \ln(RMDemand) + \ln(ShareUG) + Year + NZ + Ontario + v_i + u_i$$

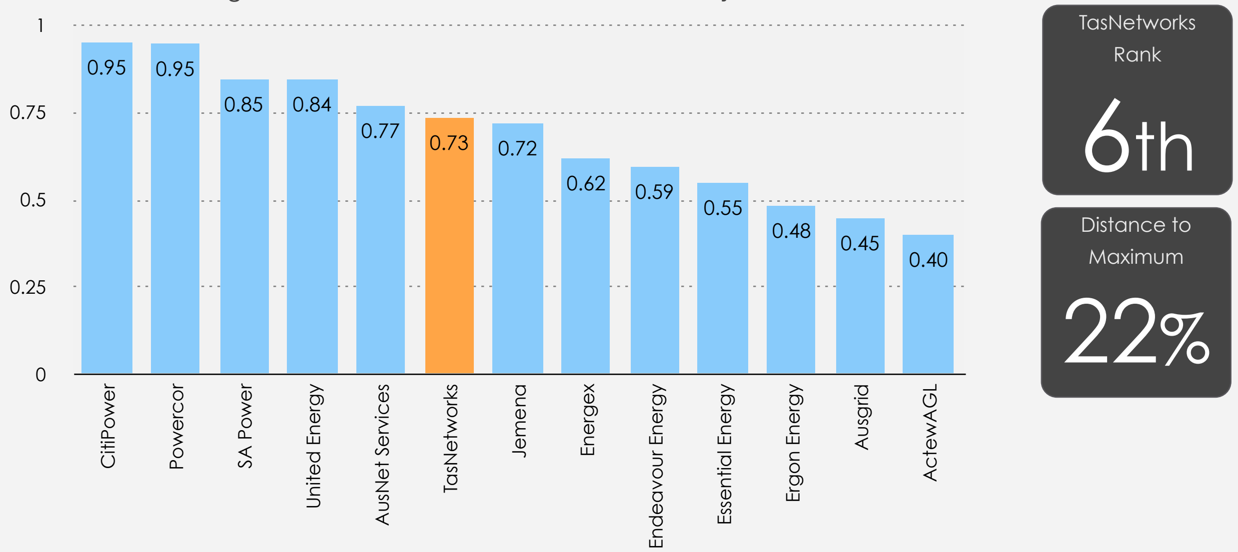
As shown, the variables are treated as natural logarithms. Assumptions of the error term are that:

1. The random noise component of the error term is assumed to be normally distributed; and
2. The efficiency component of the error term is assumed to have a truncated normal distribution.

These assumptions are decided by the analyst, in this case Economic Insights. They are important as they define the manner in which the results arrange themselves relative to the highest efficiency reference point.

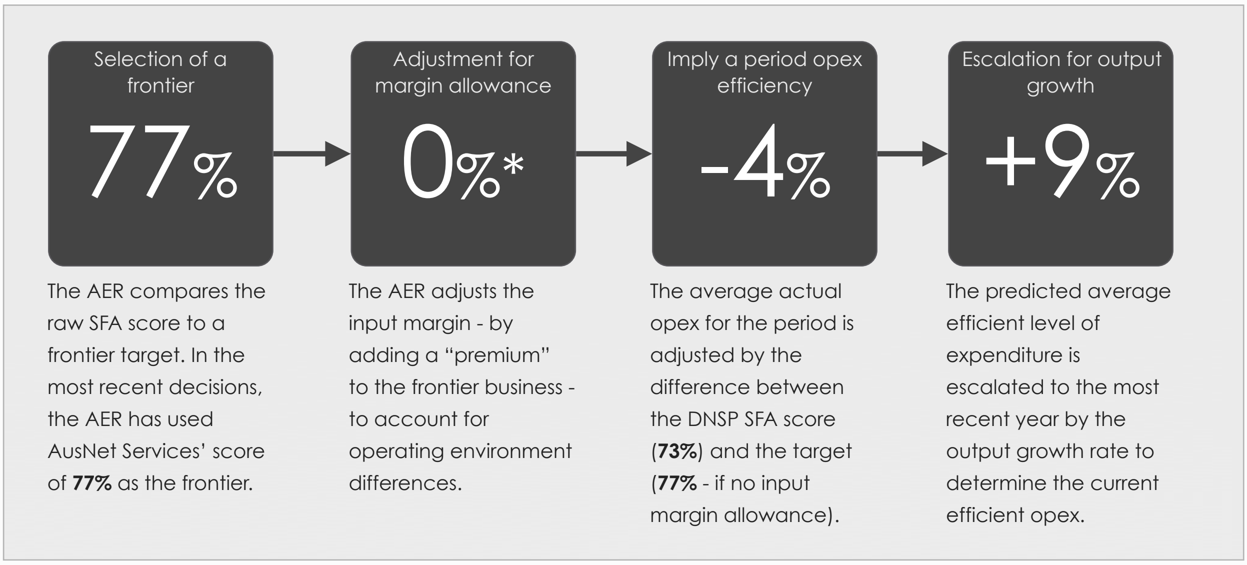
The results from the SFA model give an average efficiency score for each DNSP over the benchmarked period (2006-2013). The raw SFA model efficiency scores are shown below.

Figure 2: AER SFA Model - Raw Efficiency Scores



This efficiency score is then subject to a number of adjustments, including recognition of changes in opex in recent years and adjustments for operating environment factors (OEFs). The process for assessing the efficiency of an individual DNSP is shown below.

Figure 3: Efficient opex evaluation process. *The AER relies upon the SFA model and adjustments to predict an efficient level of opex.*

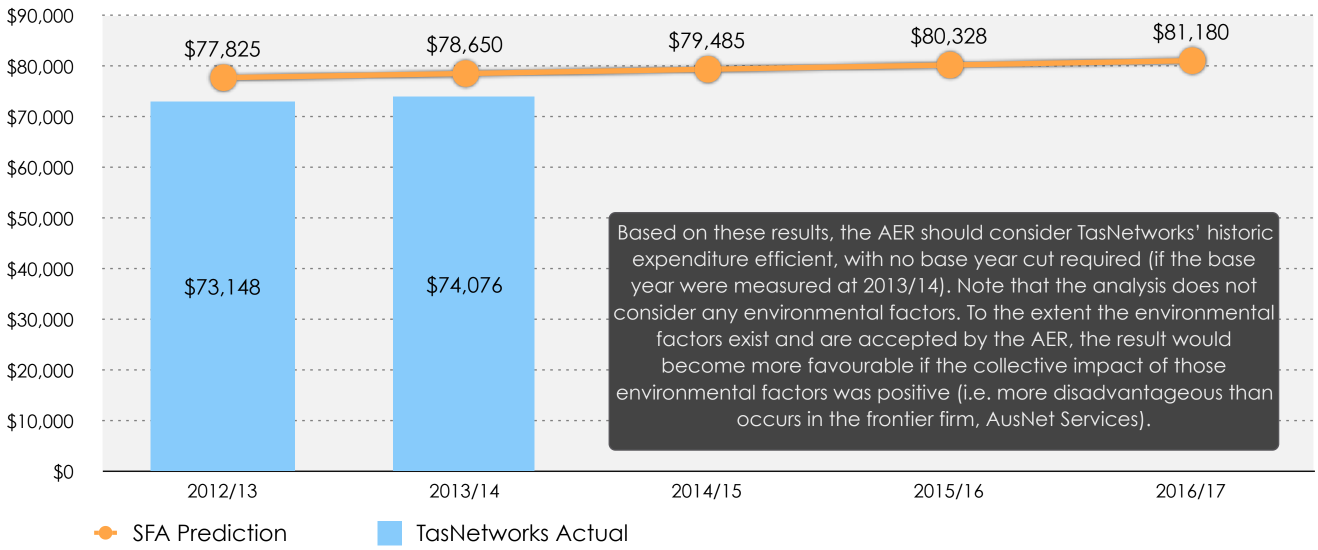


** Whilst 0% has been used for the purposes of this analysis, Huegin expects some adjustment will be allowed at this step.*

In its draft decision in NSW/ACT, the AER used a benchmark target calculated by weighting the scores (by customer) of all networks with a score of 0.75. This resulted in a target score of 0.86. In the more recent decisions (NSW/ACT final and QLD/SA draft), the AER have set the target at the equivalent score of the business at the lower end of the aforementioned group. This network is AusNet Services, with an efficiency score of 0.77.

Using the process outlined above, TasNetworks' actual opex can be compared to that predicted by the AER's model and process. Figure 4 below shows the level of opex predicted for TasNetworks in 2013, extrapolated forward using historic output growth rates. It shows that in 2013 and 2014, TasNetworks actual opex would have been below that predicted by the AER's model.

Figure 4: TasNetworks Opex - Actual and Predicted (000s, $FY14)



Whilst Figure 4 demonstrates that the current approach yields a favourable outcome for TasNetworks opex efficiency, changes in the approach and assumptions are likely between the time of this report and the regulatory determination for TasNetworks. Figure 5 shows a number of alternative scenarios of TasNetworks' opex efficiency relative to possible frontiers, namely:

1. Scenario 1: Base case - AusNet Services as the frontier;
2. Scenario 2: Customer weighted average of the top five efficiency scores (the frontier in the original AER analysis);
3. Scenario 3: Customer weighted average of the non-urban top quartile performers (AusNet Services, Powercor and SA Power Networks); and
4. Scenario 4: The frontier firm (CitiPower).

Figure 5: TasNetworks Opex - Actual and Predicted Scenarios (000s, $FY14)

Index productivity

The AER have used Opex Partial Factor Productivity (Opex PFP) as a high level indication of relative productivity amongst DNSPs and over time. The use of Opex PFP has thus far been restricted to a comparison against the SFA model results to ensure consistency.

Opex partial factor productivity is the ratio between an index of outputs and the annual opex for each DNSP. The output index has been constructed using the following outputs with their respective weightings in brackets;

- Customer numbers (.458)
- Ratcheted maximum demand (0.176)
- Circuit line length (0.24)
- Energy throughput (0.128)
- Total customer minutes off supply (Value of customer reliability)

Note that total customer minutes is included as a negative output with weight determined using the following relationship:

(Value of customer minute * Total customer minutes)/Total revenue

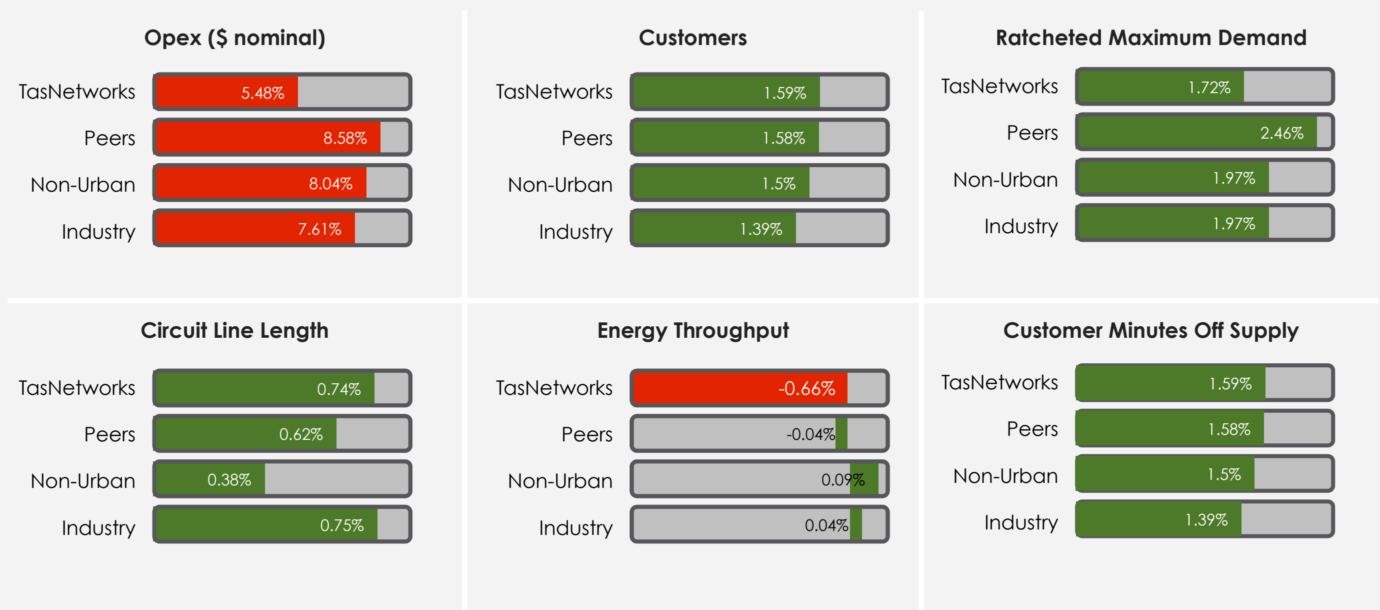
An Opex partial factor productivity (OPFP) score is then obtained using the following equation:

OPFP = Output index/Opex

Businesses generally have little control over the individual outputs listed above, and are therefore exposed to the risk that where these outputs remain flat or decrease, any increase in opex will be represented as decreasing productivity in an Opex PFP model. For example, where opex has increased through some legitimate need that is not captured by the variables said to represent the outputs of an electricity network, productivity will decrease and be seen as inefficiency if the appropriate adjustments are not made.

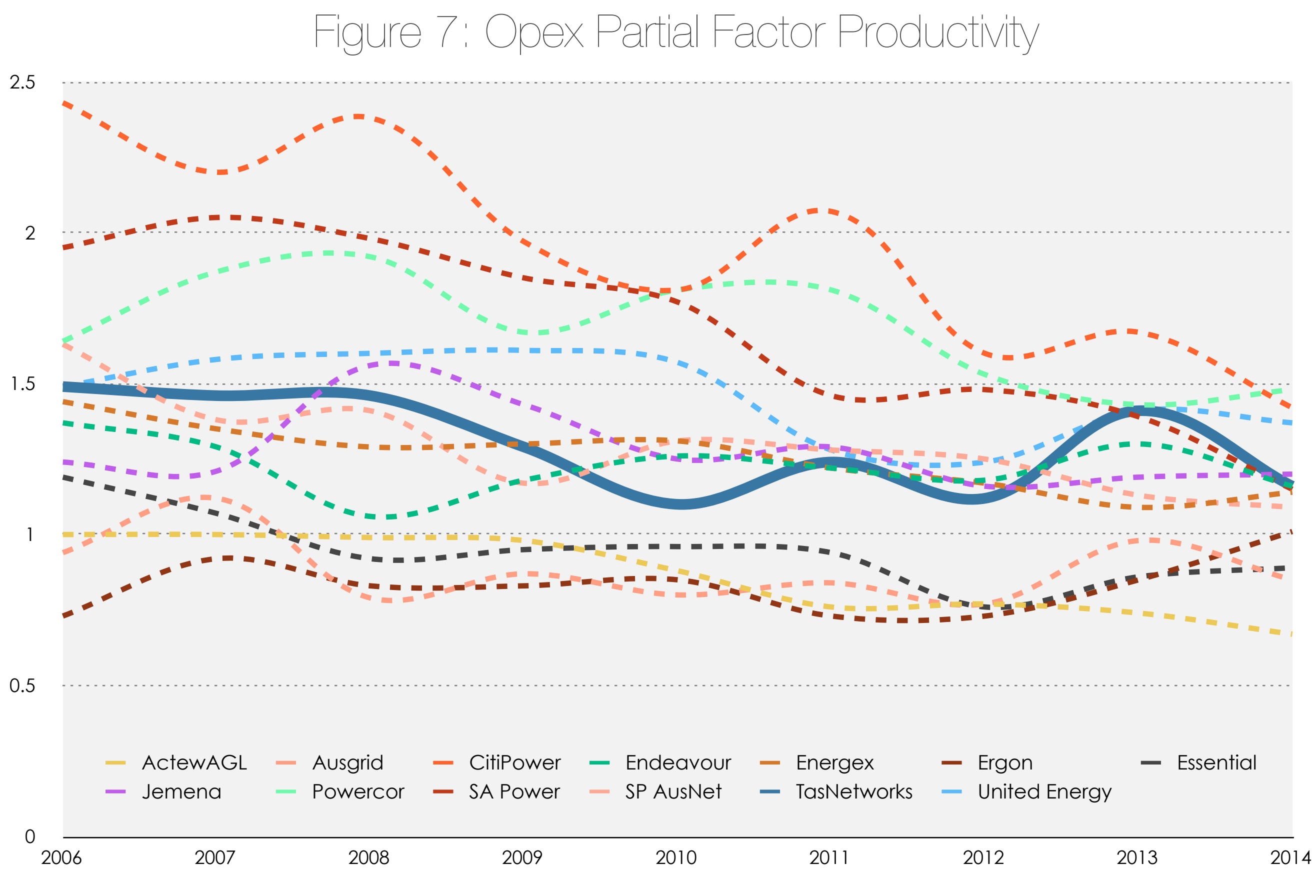
As shown in Figure 6 below, in terms of the output and opex variables, TasNetworks has had a lower growth rate of opex and generally favourable output growth compared to peers with the exception of demand and throughput.

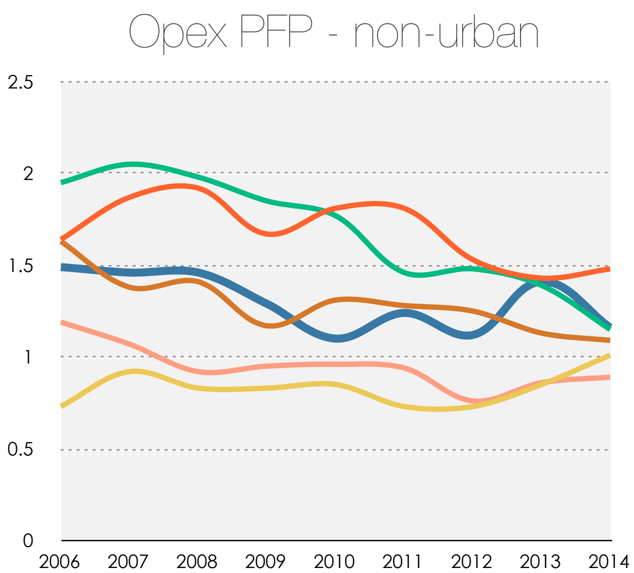
Figure 6: Productivity Component Annual Growth Rates 2006-13

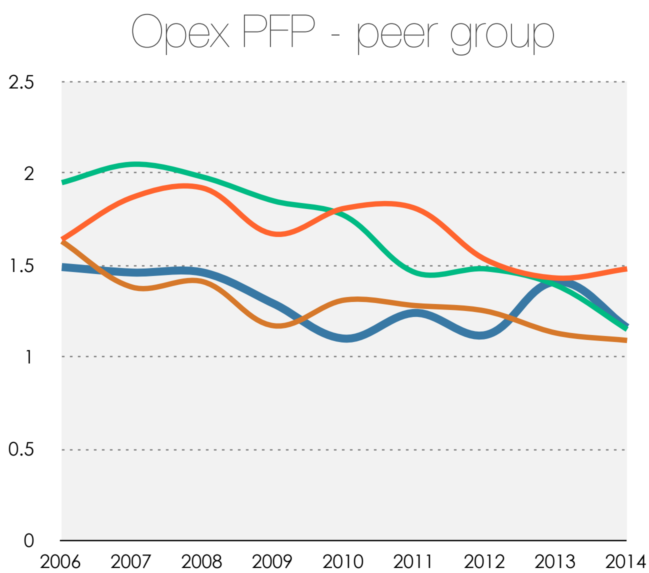


1. Peer group is the average for AusNet, Powercor, SA Power and TasNetworks
2. Non-urban group is the average for AusNet, Powercor, SA Power, TasNetworks, Ergon and Essential
3. Industry is the average for all 13 DNSPs

From the opex and output variable data, Opex PFP can be plotted over time between 2006 and 2014. The change in this index is shown below for the industry, non-urban businesses and TasNetworks' peer group (AusNet Services, Powercor and SA Power Networks).







Note that in 2013 and 2014, TasNetworks' Opex PFP is above that of the frontier firm from the SFA analysis, AusNet Services.

Issues with the Approach and Models of the AER

3

Understanding economic benchmarking sensitivity

As shown in the previous chapter, TasNetworks benchmarks reasonably well against the industry and its closer peers using the models and approach adopted by the AER in the recent and current regulatory determinations. The AER has, however, provided a rather narrow view of efficiency through their approach; partly due to the selection of SFA which has necessitated using international data and therefore restricted the level of sensitivity analysis possible. This approach appears to be inconsistent with the AER's original view on sensitivity analysis in the Expenditure Forecast Assessment Guideline:

> “
>
> ***...We will perform sensitivity analysis on model specifications, benchmarking methods, and changes in key assumptions to test the robustness of the results.***
>
> ***...We consider sensitivity analysis is a critical process in developing and finalising our model specifications.***
>
> ***...Sensitivity analysis is a method for testing a model to identify where there may be sources of uncertainty. It is an important step in testing the robustness of our economic benchmarking analysis.***
>
> ***...We will test multiple model specifications for each economic benchmarking technique.***
>
> - AER, Better Regulation, Explanatory Statement, pp163-165, "Expenditure Forecast Assessment Guideline", November 2013

Huegin believes that the AER has not met the requirements of adequate sensitivity testing of its models; naturally the AER disagrees with this position. Throughout this chapter we will demonstrate the uncertainty and sensitivity of the benchmarking results to changes in some key assumptions. The areas of sensitivity testing are summarised below.

Sensitivity testing is possible on key assumptions

A single economic benchmarking model will never fully describe the relationship between electricity network outputs and operating expenditure - particularly across 68 different networks in three countries. Models are merely proxies for the actually drivers of costs and relationships with opex. Modellers must also make several assumptions when generating efficiency results. We have grouped the more material assumptions into the following categories:

Model Selection

The variables chosen, technique applied and functional specification set will have an influence on the efficiency scores generated by a model.

Every model exhibits bias in a diverse sample, the ability to correct for this bias is limited by the extent to which it is recognised.

International Data

The introduction of international data was driven by Economic Insights' desire to use SFA modelling. Inclusion of international data introduces new issues, such as data validation and the relevance of not only the data, but the structure of the businesses between jurisdictions.

Data Normalisation

A long standing criticism of regulatory benchmarking has been the inability to generate comparable data, despite the significant effort in populating benchmarking RINs. Whilst some normalisation of data has been conducted, other issues with comparability remain.

Measurement Period

The period of measurement has a significant influence on the efficiency results. The AER uses a historical average efficiency score between 2006 and 2013. The relevance of data dating back as far as 2006 is debatable.

Environmental Factors

The AER has acknowledged the influence of environmental factors and attempts to adjust post model results accordingly. The accuracy of these adjustments has come under scrutiny, as has the decision to apply them post modelling - which itself relies on the assumption that such factors are not significant.

The selected models

Model selection is a critical exercise that has a highly significant influence on the outcome of efficiency evaluation. Any model that takes a handful of variables and tries to explain operating expenditure through a function of those variables will leave a proportion of costs unexplained by the model. There is a bias that is inherent in economic benchmarking models where the relationship between opex and the chosen variables differs between networks and where the chosen variables (which are proxies for the real accumulation of spend) do not adequately represent cost drivers. In this sense, all models are wrong. The extent to which they are relied upon to determine an efficient level of opex then becomes the issue. In the recent AER decisions, we have observed that the AER has placed significant reliance on a single model specification and has applied it deterministically in its estimate of efficient opex for an individual network.

The AER has defended the selection of the SFA model as appropriate. It uses a number of arguments to support this position, including:

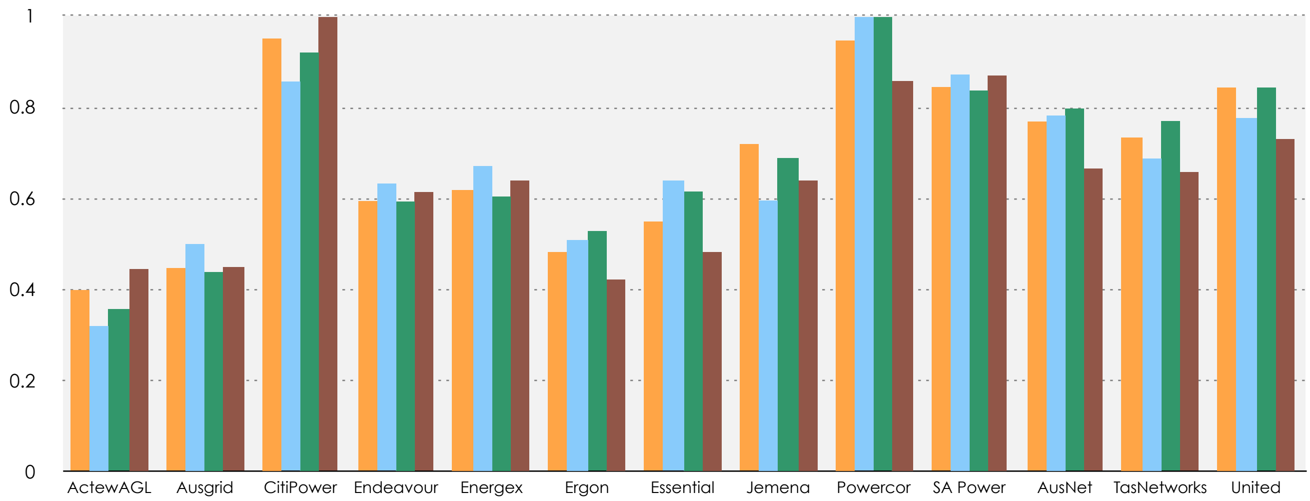
1. That the Opex PFP model results, being similar, validate the SFA estimates;
2. That with the data available the SFA model results were the best available to the AER; and
3. That none of the advisors to the DNSPs presented superior models or results.

In our view there are a number of issues with this argument. Specifically, and to each of the points above respectively:

1. Finding two models (or even four, as presented by Economic Insights) amongst the almost infinite set available that produce "similar" results does not validate those results. Limited sensitivity testing and no hypothesis testing has been conducted on the models. Further, the representation of the model results as similar is misleading, as will be demonstrated in this section.
2. Any limitation on the ability to explore a broader range of outcomes with the data available is directly attributable to the Economic Insights choice of SFA modelling.
3. Huegin's submissions on behalf of the NSW and ACT networks in particular included the presentation of many of the models that the AER had considered itself at some stage leading up to the NSW and ACT decisions. These were not presented as preferential models, rather to demonstrate the degree to which the results change with small changes in assumptions.

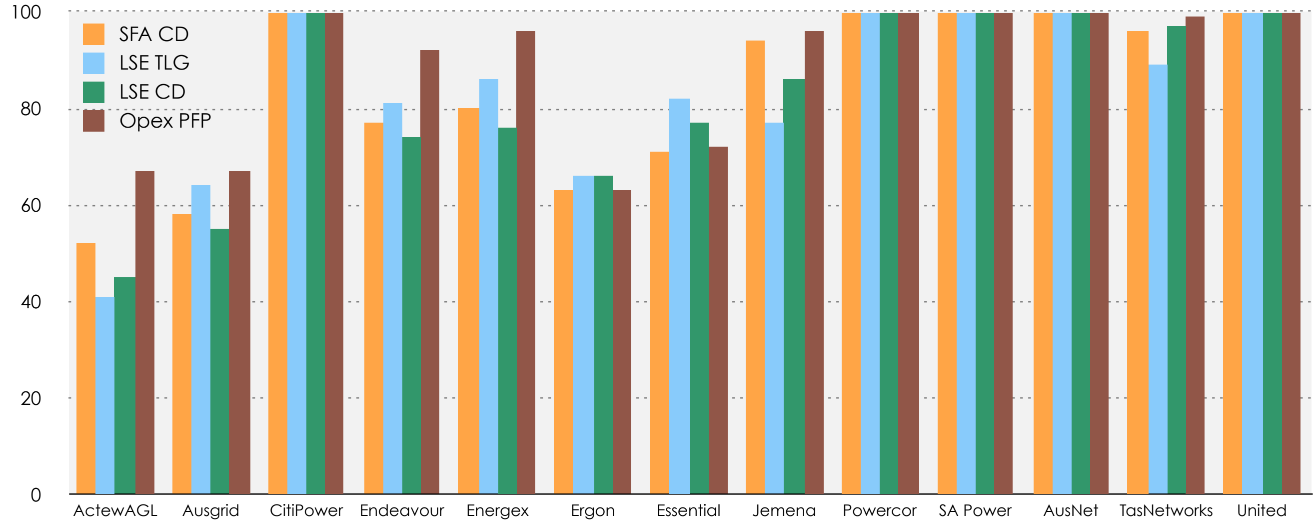
On the extent to which the AER considered alternative models, the AER points to Economic Insights' presentation of efficiency scores for their preferred SFA model against an Opex PFP model and two other opex models (Translog and Cobb-Douglas Least Squares Estimation models). The graphic referred to is represented below:

Figure 8: Economic Insights Model Comparison



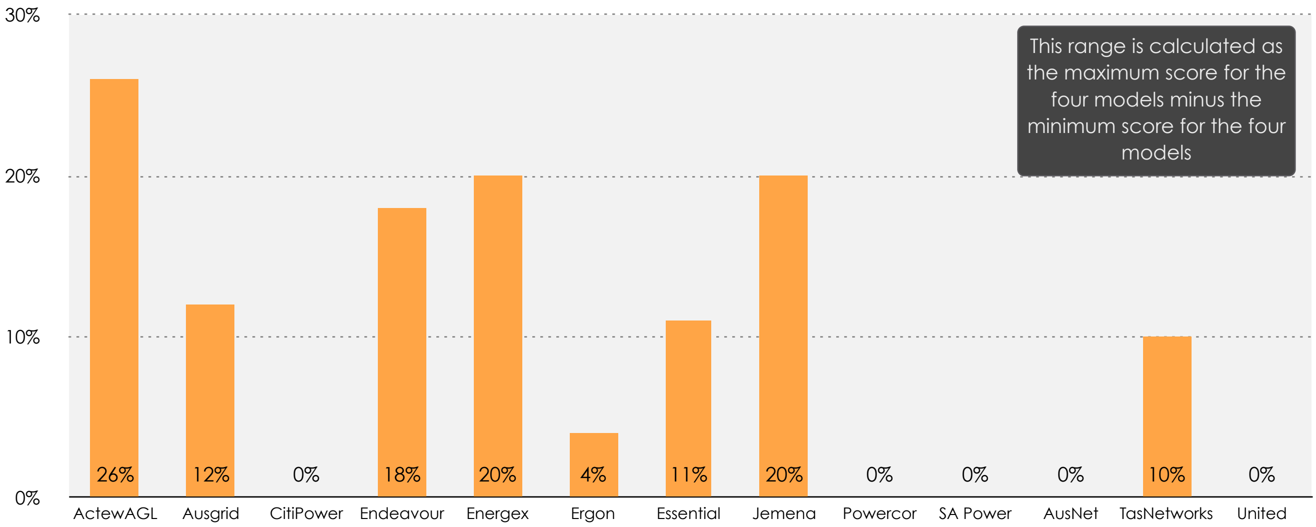
Whilst the presentation of results in this manner may appear to be a similar set of outcomes, the significance of the variation for non-frontier businesses is underestimated. That is, the range of possible outcomes for businesses not considered on the frontier varies greatly with the model chosen, even amongst this limited set presented by the AER. Figure 9 below illustrates the efficiency estimate *relative to the fifth ranked DNSP (the frontier)* for each model. It shows that the variation in efficiency scores is more significant than the AER has acknowledged for some networks, and the consequences a selecting one model over another to estimate a replacement forecast of opex (as the AER has done for those networks not on the frontier) are material.

Figure 9: Economic Insights Model Comparison - Relative to the Frontier (5th ranked DNSP)



To highlight the consequences of model selection even further, Figure 10 below depicts the range between the minimum and maximum efficiency gap for each DNSP relative to the frontier across all four models.

Figure 10: Range of Base Year Efficiency Adjustments Possible



As shown above, it is misleading to suggest that the selection of one model over another is relatively insignificant amongst the four models presented. The AER may argue that the SFA model is preferred above the others tested based on advice it has received; however no other regulator in the world takes such a selectively narrow view of efficiency adjustment when using economic benchmarking.

The use of international data

The justification for introducing international data is the adoption of SFA as a modelling technique, which requires more data than is available from the Australian networks. The AER and Economic Insights were aware of how many data points were available (thirteen DNSPs times eight years of data) prior to the NSW and ACT decision, therefore the representation of SFA adoption as a reaction to limited data availability appears somewhat curious. Given the absolute reliance on the SFA results, the decision also seems premature given the AER's own caution in its Expenditure Forecast Assessment Guideline:

> ***We consider international collaboration of economic benchmarking to be an appropriate goal in the long term and our economic benchmarking should not be limited to a comparison of Australian NSPs. In our view, potential problems with availability of consistent and reliable international data and other analytical issues, may make implementation of an international benchmarking exercise difficult in the short term.***
>
> - AER, Better Regulation, Explanatory Statement, p140 "Expenditure Forecast Assessment Guideline for Electricity Distribution", November 2014

The AER may (and has) argued that the data introduced from New Zealand and Ontario is suitable due to the regulated nature of data collection in those jurisdictions. However the concern is not so much the accuracy or provenance of that data, rather it is the significantly limited availability of data that restricts testing or inclusion of important factors that influence opex. Economic Insights themselves have acknowledged this limitation:

> ***With regard to operating environment variables, due to the lack of operating data available for Ontario, we were limited to the inclusion of the share of underground cable length in total line and cable length in this instance.***
>
> - Economic Insights, p32, "Economic Benchmarking of NSW and ACT DNSP Opex", 17 November 2014

Again, this position is at odds with the assurance of the AER to the networks that appropriate recognition would be given to the inability of economic benchmarking models to account for environmental variation in operating conditions:

> ***Our broad range of data requirements is designed to allow for rigorous sensitivity analysis in order to test the robustness of our economic benchmarking analysis and to further understand the relationships between inputs, outputs and environmental variables. This will also assist in identifying and correcting for potential shortcomings or econometric issues, such as 'missing-variable bias', in the proposed econometric models.***
>
> - AER, Explanatory Statement, p138, "Better Regulation Explanatory Statement, Expenditure Forecast Assessment Guideline", November 2013

It also renders much of the data collected in the benchmarking RINs as unused and untested in the modelling. But perhaps the greater issue with the inclusion of international data is the influence on the variable coefficients. Economic Insights insists that the similarity in technology facilitates the use of a single econometric cost function. However the most insidious issue inherent in the introduction of the international data is the influence of the international networks on the *form* of the econometric model. The coefficients for each variable explain the relationship between that variable as a proxy for cost and total opex. These coefficients are effectively a weighted average across the three jurisdictions.

The inclusion of the international data would not be an issue if the relationship between opex and outputs where the same between these countries. However, a brief consideration of the differences in climate, service area, share of underground, scale, cost allocation methods and measurement of outputs used would suggest that the effect of increasing customer numbers by 1% (or peak demand, and circuit length) is unlikely to have the same effect on opex in Ontario as it is in Australia. One way to test the assumption that there are differences in the relationship between opex and outputs is to use dummy variables to see if there are significant differences between coefficients. In the example below, the SFA model favoured by the AER has been adjusted to include dummy variables for the Ontario DNSPs.

Variable	Coefficient for Aus/NZ	Coefficient for Ontario	Coefficient used by the AER
Customers	0.699	0.753	0.667
Circuit Length	0.223	0.031	0.106
Ratcheted Demand	0.033	0.21	0.214
Share Underground	-0.016	-0.189	-0.131
Year	0.028	0.009	0.018

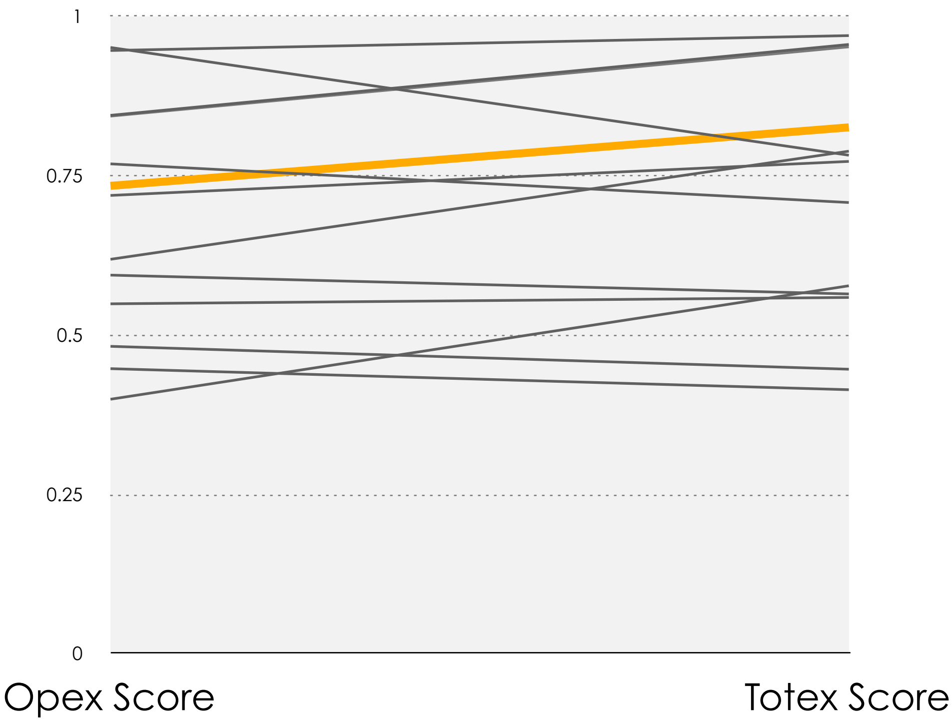
The results above illustrate the relationship between the different variables used by the AER on opex. A value of 0.699 indicates that a 1% increase in customers results in a 0.699% increase in opex. Comparing the results above, there are much different coefficients for Ontario than Australia/New Zealand for circuit length, ratcheted maximum demand, share of underground and year. This suggests that had the AER used only Australian data, or even just Australian and NZ data, the results would have been much different than those obtained by Economic Insights.

As an indication of the materiality of this impact, if the coefficients obtained above for Australia/New Zealand were used instead of those used by the AER, TasNetworks' efficient level of opex in 2013 would be **$78.8m** instead of **$75.2m**.

Comparability of data

Even within the single jurisdiction of Australia, the absence of complete normalisation of the data will influence the efficiency scores of the SFA model. The single greatest influence on the efficiency scores related to the lack of comparability of the data is the capitalisation of costs; this includes capex and opex tradeoffs and capitalisation of overheads. These two capitalisation issues are related - as the more direct costs that are shifted into capex, the more overheads move in the same direction. But they also vary business to business through instruments such as accounting policy and Cost Allocation Methodology (CAM) differences. Because the AER efficiency model only benchmarks opex, small variations in capitalisation policy can have a significant influence on the outcome.
Consider the results of the AER SFA model, but using total expenditure, instead of opex only. The graph below shows the change in efficiency score associated with a move to total, rather than operating expenditure only. TasNetworks (the orange line) moves from sixth with an efficiency score of **73%** to fourth with an efficiency score of **83%** with the inclusion of total expenditure in the SFA model.

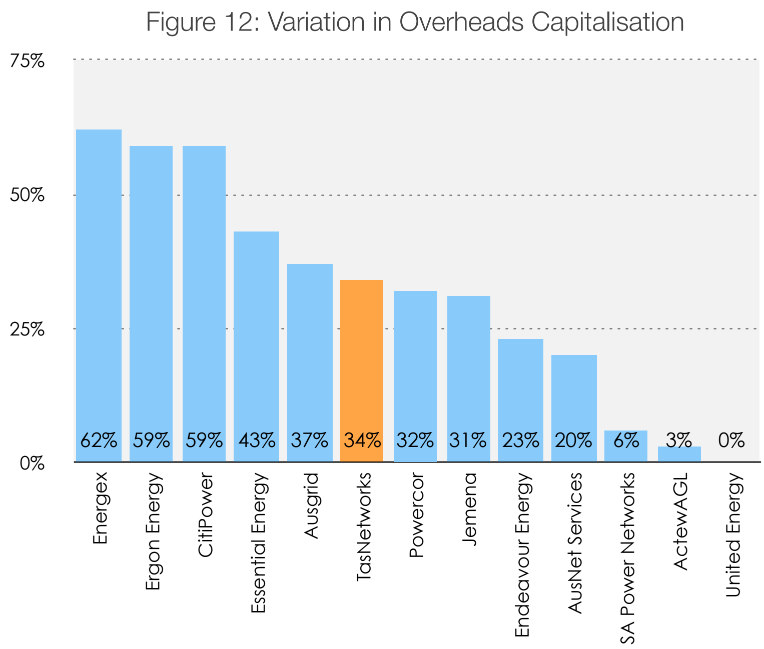
Figure 11: SFA Efficiency Scores - Opex vs Totex



It is the smaller businesses that are affected most by the variation in capital and operating expenditure divisions. This is due to the amplified effect of small changes in capitalised amounts of dollars relative to the total opex. As shown above, the inclusion of total costs in the SFA model also benefits some businesses and disadvantages others; this is reflective of the variation in the capex and opex split across the industry. Whilst we do not suggest that the totex model is a more robust representation of relative efficiency, the analysis does raise several questions about the efficacy of the SFA opex model relied upon by the AER, including:

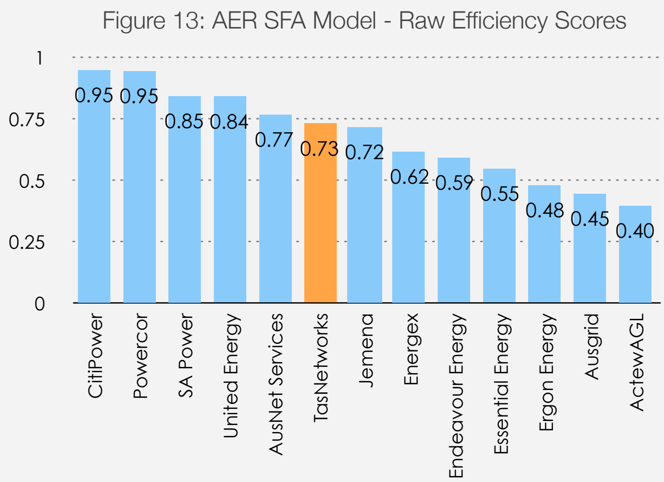
1. To what extent is the AER opex efficiency model interpreting differences in accounting treatments as differences in efficiency?
2. Is it reasonable to expect that a business would have a materially different efficiency performance for opex than it does for opex plus capex?
3. With so much volatility in the rankings when opex is isolated from total expenditure, how can the AER be confident that the opex SFA efficiency scores are truly reflective of managerial efficiency?

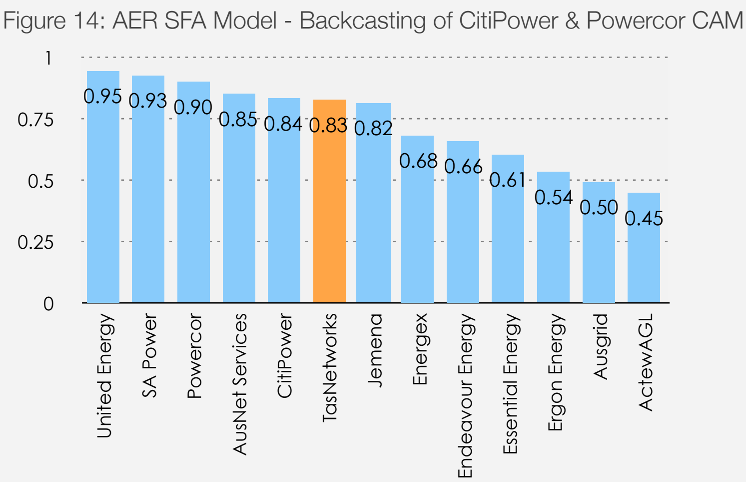
Within the capex and opex split of a network business is the allocation of overheads. As with the allocation of total costs to either capital or operating expenditure, the smaller businesses are similarly most affected (either positively or negatively) by the variation in overhead capitalisation rates. Figure 12 below shows the significant variation in overhead capitalisation rates for the historical data used in the SFA model.



Clearly networks that capitalise greater amounts of overhead will be favoured by a SFA model that measures efficiency of opex only.

CitiPower and Powercor recently amended their CAM (October 2014), with CitiPower in particularly historically having high rates of overhead capitalisation. The changed CAM will drive more overheads into opex. The graphs below shows the impact of this change on the entire industry's efficiency scores using the AER's SFA model. Figure 13 shows the raw efficiency scores from the SFA model of opex efficiency that the AER relied upon in recent regulatory decisions using historical data. Figure 14 shows the results of the same SFA model, however with the historical opex for CitiPower and Powercor amended for the backcast opex (representative of the opex had the CAM change been applied to the historical opex. TasNetworks remains ranked sixth in Figure 12, however the analysis shows the significant effect on the industry efficiency scores. If each network's overhead capitalisation rate were normalised to a consistent basis, the efficiency scores would differ considerably from those shown in Figure 13.





The time period of measurement

The AER have used historical data from 2006 to 2013 to generate SFA efficiency scores. The efficiency score is taken as the average over that period. There are a number of issues related to the selection of the time period of analysis, including:

1. Data from as far back as 2006 is unlikely to be as accurate as data from more recent years;
2. Structurally, the industry was much different prior to 2009. The AER had not started regulating DNSP expenditure, many of the networks were merging regions or even network boundaries that were previously different and reliability standards and licence conditions were different to what they are today.
3. In the latter years of the period, Networks NSW has formed, Queensland has undergone industry reform and SA Power Networks has been privatised. Importantly for TasNetworks, the merger of Tasmania's transmission and distribution network businesses has only occurred at the very end of the period. The relevance of 2006 data in the context of these changes is significantly diminished.
4. Taking an average of data over the 2006 to 2013 period provides an advantage to those network businesses that have significantly increased opex over that time. The AER escalates the efficiency score forward to 2013 to take into account the change in opex since the midpoint of measurement prior to making adjustments, however the efficiency score itself being based on the period average is more favourable for networks if they spent less in the early years.

Regarding the last point, TasNetworks' 2013 opex is **8.8%** higher than the 2006 to 2013 average, whilst the industry total opex is **20.3%** higher in 2013 than the 2006 to 2013 average.

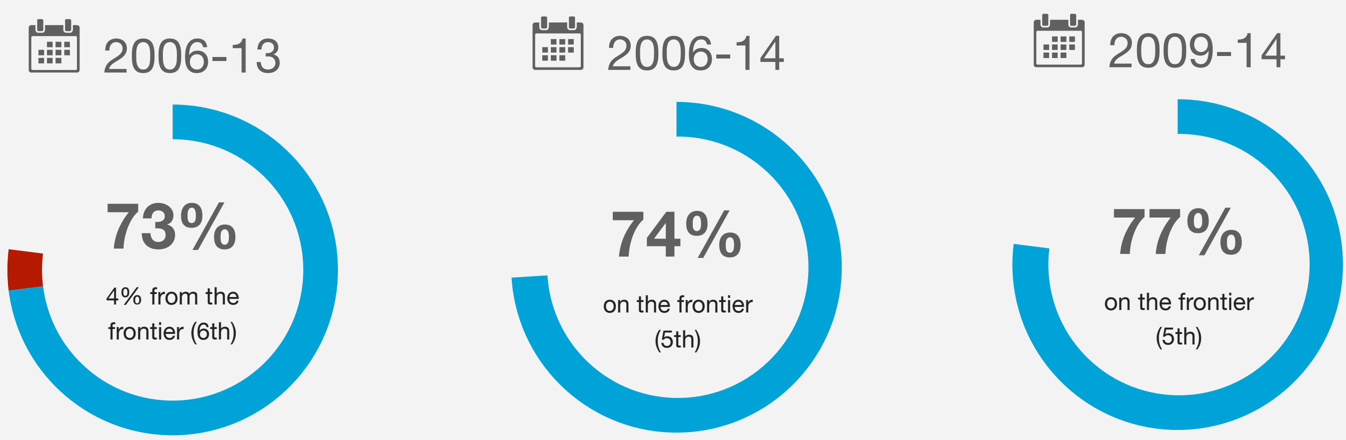
Clearly the more recent the data used, the more appropriate the model becomes to evaluate current opex efficiency. There is a clear benefit for TasNetworks if:

1. The 2014 data (which is now available to the AER) is included in the analysis period; and
2. The start data is adjusted to reflect a period more suited to the current industry structure, e.g. 2009.

The graphs below show the SFA opex efficiency scores if:

1. The current AER analysis period (2006-13) is used;
2. The latest year is added - TasNetworks moves onto the frontier; and
3. The starting point of the period is moved to 2009 - TasNetworks remains the frontier business (5th ranked), but gains another increase in efficiency score.

Figure 15: TasNetworks SFA efficiency - the AER model



Variation in operating conditions

After the NSW and ACT draft decision, the AER was criticised for the lack of consideration of differences in operating conditions when relying upon the Economic Insights SFA model. Economic Insights largely dismissed the criticism, but in the final NSW/ACT decision and the preliminary decision in QLD, the AER attempted to make adjustments to the efficiency model results by adding and subtracting amounts for what it terms Operating Environment Factors (OEFs).

The list of OEFs was largely driven by the response to the AER's question to the QLD (and others) networks about the nature and scale of any factors that they considered were unique to their network. The AER then ascribed a percentage factor to each that it adjusted the frontier firm (AusNet Services) target efficiency score by to reflect the difference in conditions. The list of OEFs and the value assigned to them (in equivalent dollar terms) is listed below. There are several issues with this approach, some of which are discussed on the following page.

The AER's Adjustments for Operating Environment Factors - NSW, ACT, QLD (all figures in $M)

Factor	ACT	AGD	END	ENX	ERG	ESS
Activity scheduling	-	-	-	-	-	-
Advanced metering infrastructure	-	-	-	-	-	-
Asset age	-0.2	1.6	1.0	-1.4	1.2	-1.3
Backyard reticulation	2.0	-	-	-	-	-
Building regulations	0.2	1.6	1.0	1.4	1.2	1.3
Bushfires	0.2	-1.6	-1.0	-1.4	-6.2	-1.3
Capital contributions	-	-	-	-	-	-
Capitalisation practices	3.0	-1.6	1.0	1.4	-1.2	-1.3
Communication networks	-	-	-	-	-	-
Competition from mining	-	-	-	-	1.2	-
Contaminated land management	-	-	-	-	-	-
Contestable services	-	-	-	-	-	-
Corrosive environments	0.2	1.6	1.0	1.4	1.2	1.3
Critical national infrastructure	-	-	-	-	-	-
Cultural heritage	0.2	1.6	1.0	1.4	1.2	1.3
Customer density	-	-	-	-	-	-
Cyclones	-	-	-	-	11.1	-
Demand management	-	-	-	-	-	-
Division of responsibility for veg mgmnt	-	1.6	1.0	9.5	9.8	1.3
Economies of scale	-	-	-	-	-	-
Environmental regulations	0.2	1.6	1.0	1.4	1.2	1.3
Environmental variability	-0.2	-1.6	-1.0	-1.4	1.2	1.3
Extreme weather events	-0.2	1.6	1.0	7.4	7.2	1.3
Fire ants	-	-	-	0.3	-	-
Grounding conditions	0.2	1.6	1.0	1.4	1.2	1.3
Licence conditions	-	3.8	1.4	-	1.7	3.1
Line length	-	-	-	-	-	-
Line sag	-	-	-	-	-	-
Load factor	-	-	-	-	-	-
Load growth	-	-	-	-	-	-
Mix of demand & non-demand customers	-	-	-	-	-	-
Network accessibility	0.0	-0.4	1.1	-0.1	2.6	1.1
Network control centres	-	-	-	-	-	-
Subtotal	**5.6**	**11.4**	**9.5**	**21.3**	**34.6**	**10.7**

Factor	ACT	AGD	END	ENX	ERG	ESS
OH&S regulations	0.2	1.6	1.0	1.4	1.2	1.3
One off base year costs	-	-	-	-	-	-
Outsourcing	-	-	-	-	-	-
Past ownership	-	-	-	-	-	-
Planning regulations	0.2	1.6	1.0	1.4	1.2	1.3
Population growth	-	-	-	-	-	-
Private power poles	-	-	-	-1.4	-1.2	-
Proportion of 11kV and 22kV lines	0.2	1.6	1.0	1.4	1.2	1.3
Proportion of wood poles	-	-	-	-	-	-
Rainfall and humidity	0.2	1.6	1.0	1.4	1.2	1.3
Reliability outcomes	-	-	-	-	-	-
Rising and lateral mains	-	-	-	-	-	-
Risk appetite	-	-	-	-	-	-
Safety outcomes	-	-	-	-	-	-
Service classification	1.4	-	-	-	-	-
Shape factors	-	-	-	-	-	-
Skills required by different DNSPs	0.2	1.6	1.0	1.4	1.2	1.3
Solar uptake	-0.2	-1.6	-1.0	1.4	1.2	-1.3
Special customer requirements	-	-	-	-	-	-
Subtransmission	-	16.8	9.6	9.0	11.0	8.2
SWER	-	-	-	-	-	-
Taxes and levies	-	-	-	7.5	4.1	-
Temperature	-	-	-	-	-	-
Termite exposure	0.0	0.1	0.4	0.6	1.3	1.5
Topography	0.2	1.6	1.0	1.4	1.2	1.3
Traffic management	0.2	1.6	1.0	1.4	1.2	1.3
Transformer capacity owned by customers	0.1	-0.5	0.2	-0.4	-0.8	-
Transmission connection point charges	-	-	-	-	-	-
Underground services	0.1	-	-	-	-	-
Undergrounding	-	-	-	-	-	-
Unregulated services	-	-	-	-	-	-
Work conditions	-	-	-	-	-	-
Subtotal	**2.8**	**26**	**16.2**	**26.5**	**24**	**17.5**
Total	**8.4**	**37.4**	**25.7**	**47.8**	**58.6**	**28.2**

ACT = ActewAGL	ENX = Energex
AGD = Ausgrid	ERG = Ergon Energy
END = Endeavour Energy	ESS = Essential Energy

The manner in which the OEFs have been introduced to the evaluation process has been somewhat rushed in the short timeframe available between the NSW draft and final decisions. Specific issues with the use of post modelling adjustments in this manner include:

1. The scope of factors considered seems rather arbitrary. There is little explanation of what each factor represents and why specific factors have or have not been considered.
2. There is little evidence or analysis to support the calculation of the value of many of the OEFs.
3. The OEF value has been adjusted by the difference between an individual DNSP's efficiency score and the frontier target (assuming that the spend by an inefficient DNSP will also be inefficient on that particular OEF). This creates a circular argument - if the OEF is material, then the initial efficiency evaluation and frontier are invalid.
4. One of the premises cited to support the use of SFA and inclusion of 68 networks in the data sample is that the technology and conditions for each network is predominately homogenous - clearly if adjustments are made after modelling of up to 20% of the value of some networks' opex, the assumption of homogeneity does not hold.

In rejecting these criticisms, the AER has stated that the post model adjustments are reasonable and mathematically similar to the result if consideration of the OEFs was included in the model, rather than on the results. This is simply untrue as demonstrated by the change in efficiency scores when CitiPower and Powercor's CAM changes are considered. Adjusting one or more OEFs after modelling for a single DNSP in isolation of the others will generate significantly different results than adjusting the opex prior to running the SFA model for all networks (i.e. normalisation).

In dismissing many of the environmental factors, or downplaying the significance, the AER (and Economic Insights) have also failed to consider options available to them such as second stage regression of the Opex PFP model. In the report that Economic Insights provided to the AER in support of their draft decision in NSW and the ACT, Economic Insights outlined how they had tested a number of density factors using second stage regression:

> “
> ***To test whether the model specification was adequately adjusting for differences in network densities (via the output specification) and to see whether other factors not explicitly included in the model had a statistically significant impact on the index number results, we undertook second stage regression analysis of the opex MPFP results.***
>
> - Economic Insights, p23, “Economic Benchmarking of NSW and ACT DNSP Opex”, November 2014

We note that the AER and Economic Insights did not test many of the factors raised by Huegin and other advisors in this same manner. Three of the more significant factors raised repeatedly by Huegin were:

1. The line voltage and capacity differences between networks - with higher voltage, higher capacity lines of some networks driving higher costs;
2. Differences in reliability standards - with more stringent SAIDI targets driving higher costs; and
3. Capitalisation - with the different rates of capitalisation directly influencing the opex benchmarking scores.

Note that we addressed the last of these in the data normalisation section as it technically is not an exogenous factor, however if the AER continues to decline to address it as a normalisation issue, it should at least be considered as an environmental factor.

The differences in the composition of the network, in terms of ratings of line length, is a particularly important environmental factor. One of the weaknesses of the SFA CD model relied upon by the AER is that the variables do not reflect the attributes of the asset which influence cost. Line length gives some indication of scale, but there is a large differential in cost per line length driven by the voltage and capacity ratings of those lines.

The analysis below replicates the significance testing process relied upon by Economic Insights but includes a variable we have called asset intensity. Asset intensity is the ratio of sub-transmission lines (MVA-kms of lines greater than 33kV) and route line length. This is used as a proxy for the "heaviness" of a network, i.e. businesses with a high ratio will operate at higher voltages per km and consequently incur higher opex costs to maintain these networks.

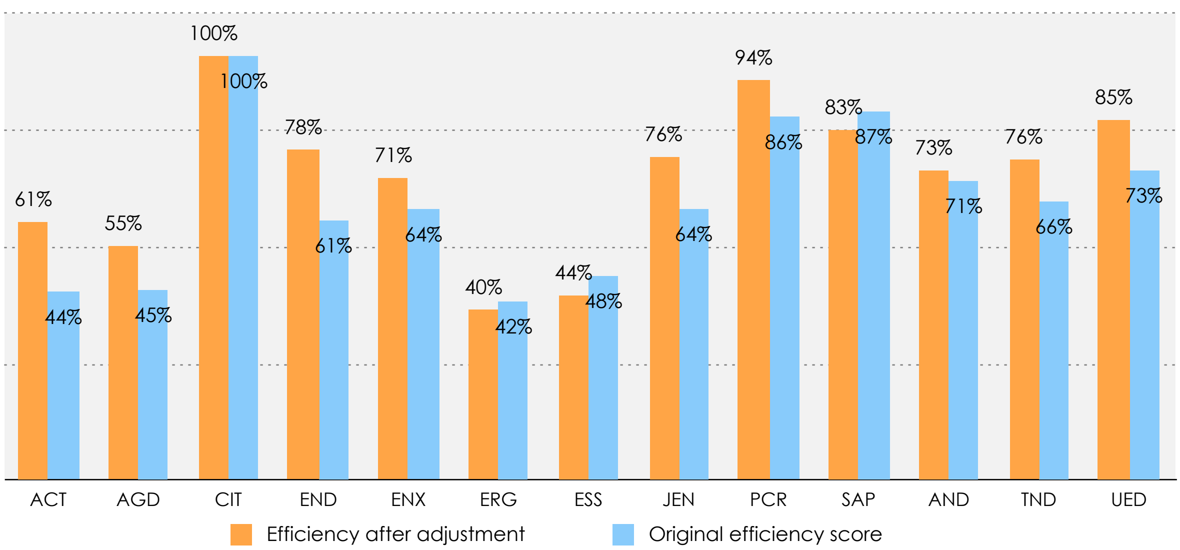
Variable	Estimate	Standard error	T-ratio	P-value	Significant at 5%
Customers	-0.0311	0.1564	-0.1992	0.843	No
Customer density	0.0467	8.35E-02	0.5589	0.578	No
Energy density	-0.55659	0.3500	-1.590	0.115	No
Demand density	0.0247	0.1110	0.2227	0.824	No
Share underground	-0.0486	0.1042	-0.4664	0.642	No
Share single stage transformation	-0.08144	0.1827	-0.4459	0.657	No
SAIDI	-0.19287	5.48E-02	-3.517	0.001	Yes
Asset intensity	-0.24301	0.1072	-2.266	0.026	Yes
Year	-0.028054	1.06E-02	-2.649	0.009	Yes
Constant	3.1277	1.275	2.453	0.016	Yes

F STATISTIC = 3.4382227 WITH 8 AND 94 D.F. P-VALUE= 0.00163

The statistical results of the test show that asset intensity is significant. These results suggest that as asset intensity increases it has a negative impact on a businesses opex PFP scores (as does changes in SAIDI and time - two other factors not accounted for by the AER). This means that businesses that operate higher voltages and/or lower SAIDI are going to have lower opex PFP scores.

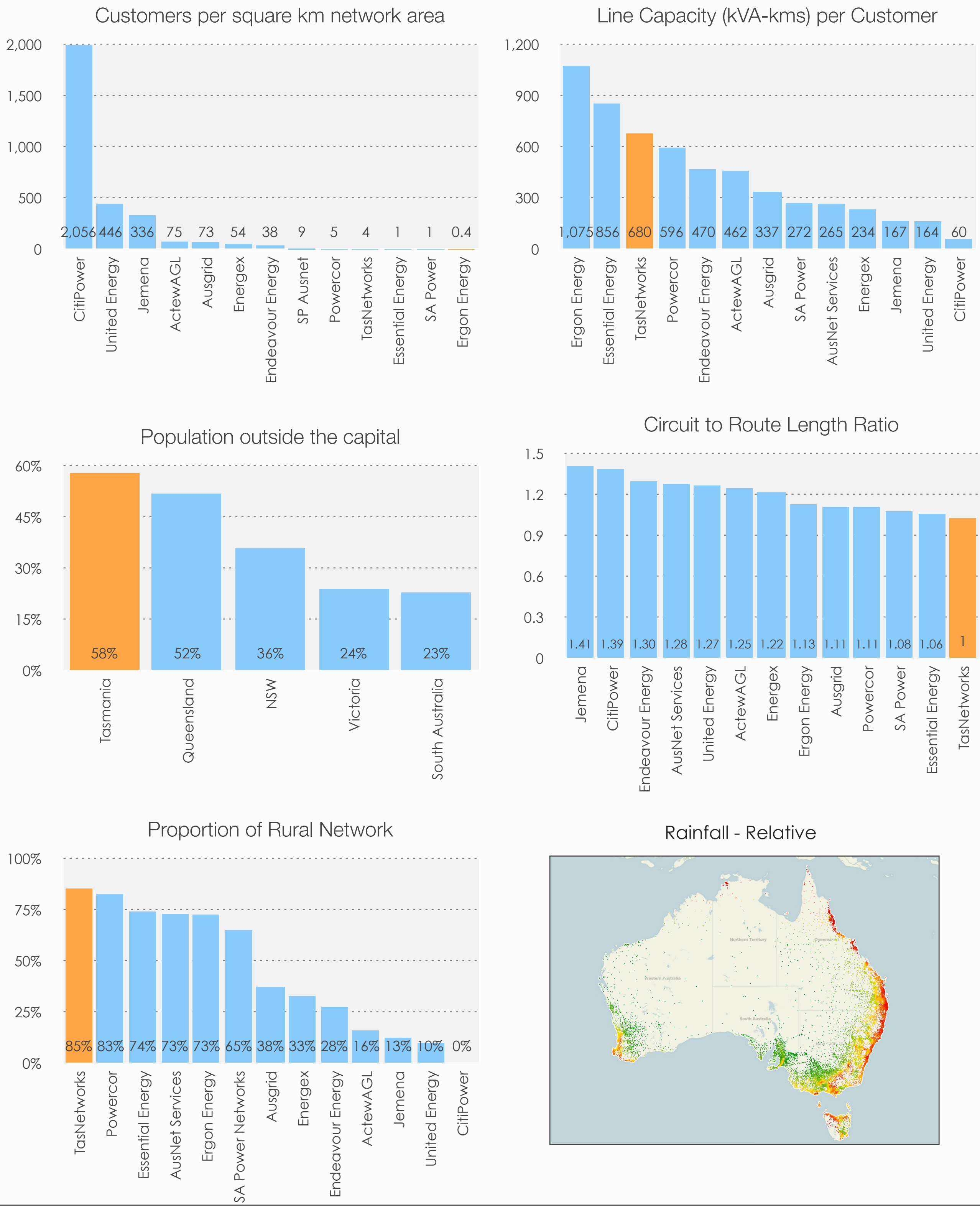
To show the effect of subtransmission assets on the efficiency scores we have adjusted the Opex PFP scores using a technique endorsed by Economic Insights to account for environmental variables and referenced in their original benchmarking report (Economic Benchmarking of NSW and ACT DNSP Opex). The graph below shows the change in Opex PFP scores when the results have been adjusted for asset intensity. TasNetworks' Opex PFP score improves by 10% when adjusting for asset intensity.

Figure 16: Opex PFP Efficiency scores before and after adjustment



Asset intensity is the most material environmental factor for TasNetworks in the context of the AER's models and approach and in comparison to the frontier networks. Other relevant environmental factors for TasNetworks are shown below.

Figure 17: Environmental Factors. *TasNetworks is a sparsely populated network with a considerable spread of customers in rural areas. As such, it has a high level of radial network and significant assets required to reach customers. Parts of Tasmania also have rainfall levels similar to the NSW north coast.*



Conclusions & Recommendations for TasNetworks

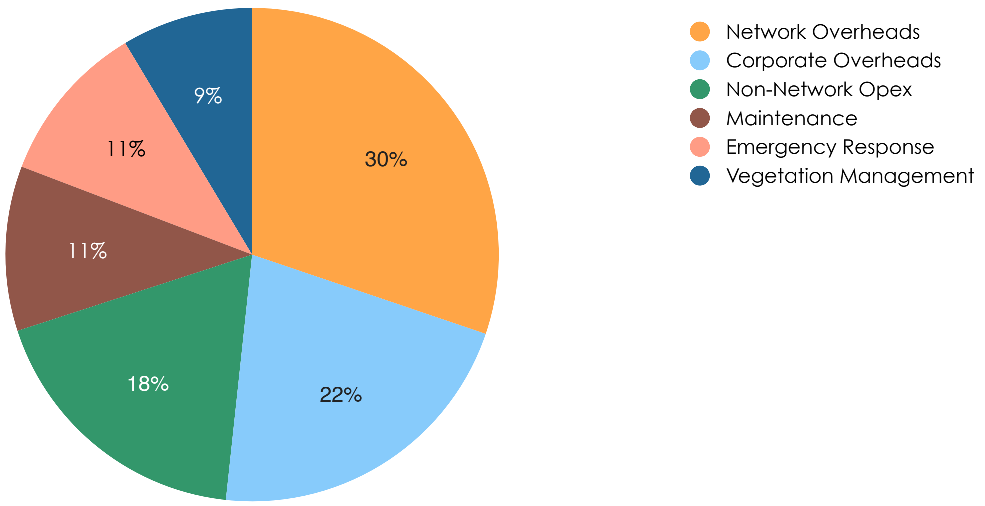
4

Category Analysis

As shown throughout this report, TasNetworks current opex appears efficient using the current AER models, method and assumptions. Category analysis can be used to determine whether any components of TasNetworks' opex appear anomalous in comparison to peers and the broader industry. High level category benchmarks for major opex categories are shown in the following graphs.

Figure X below shows the major components of TasNetworks opex by contribution to total opex for the FY09-FY14 period (based on the AER categories of opex).

Figure 18: Opex by category FY09-14



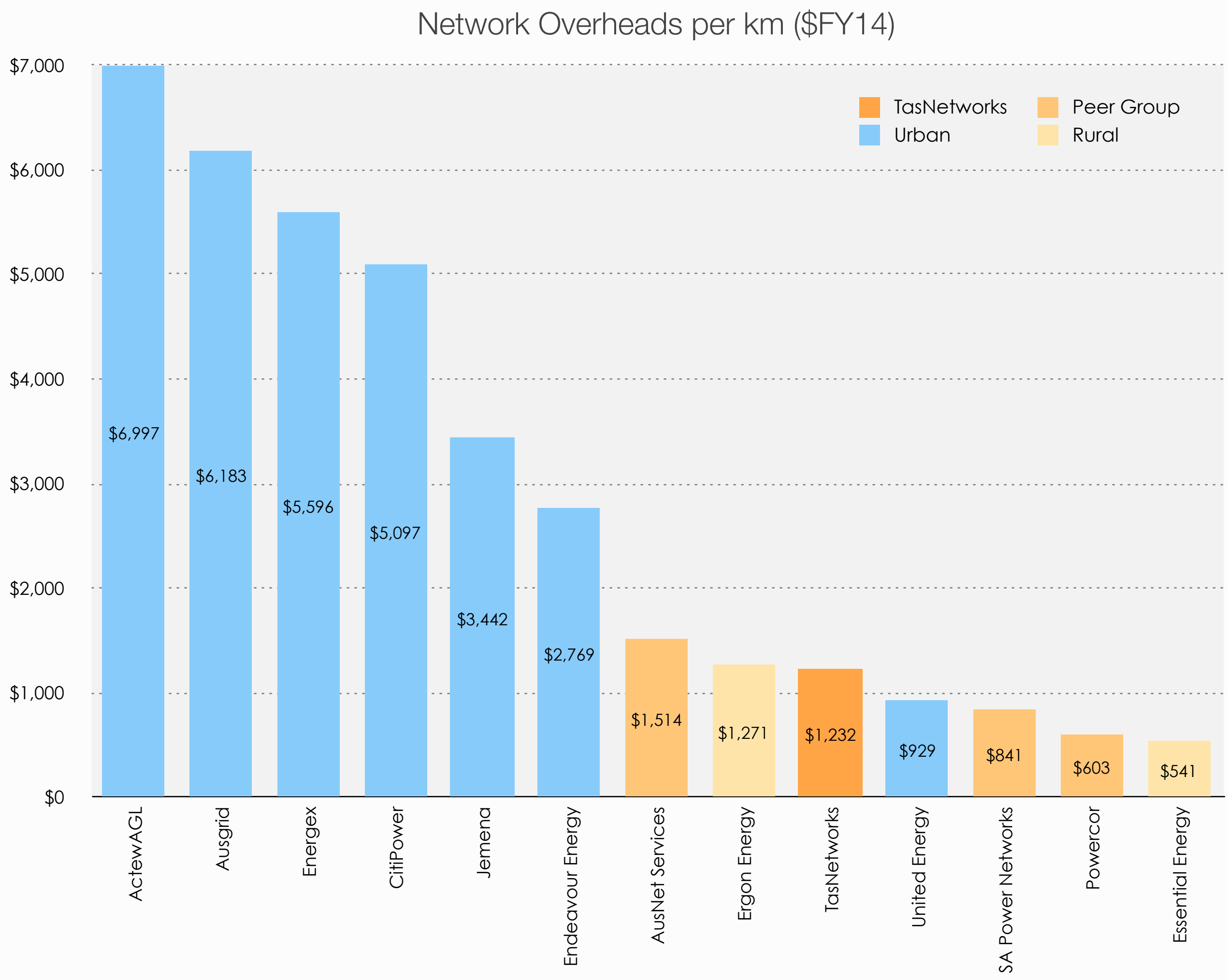
Partial productivity indices

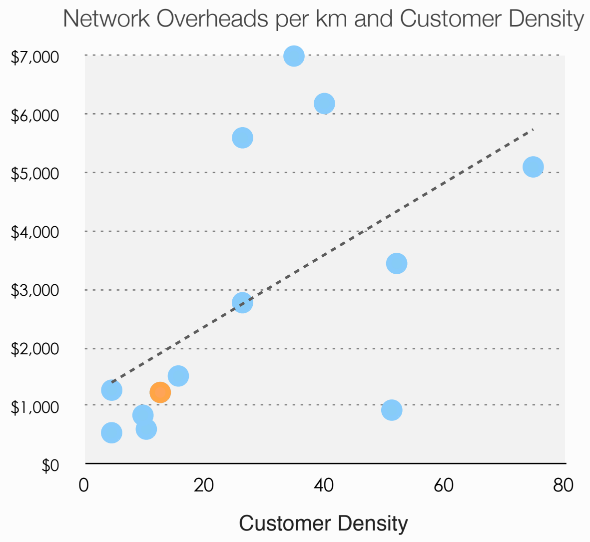
The following pages present the opex categories listed above as partial productivity indices, specifically:

1. Network overheads per kilometre
2. Corporate overheads per customer
3. Non-Network opex per employee
4. Maintenance expenditure per kilometre
5. Emergency response opex per overhead kilometre
6. Vegetation management opex per overhead kilometre

Each ratio is also regressed against a number of scale or density factors.

Figure 19: Network Overheads. *TasNetworks' network overheads per km is similar to that of its peers and below industry average when normalised against customer density and asset value (RAB) per circuit km.*





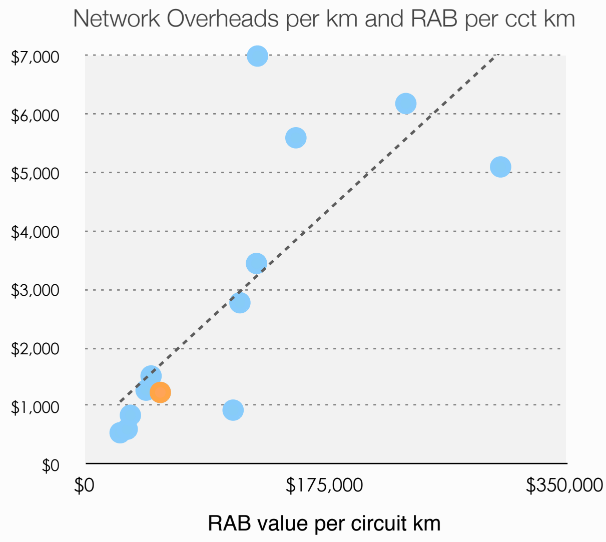
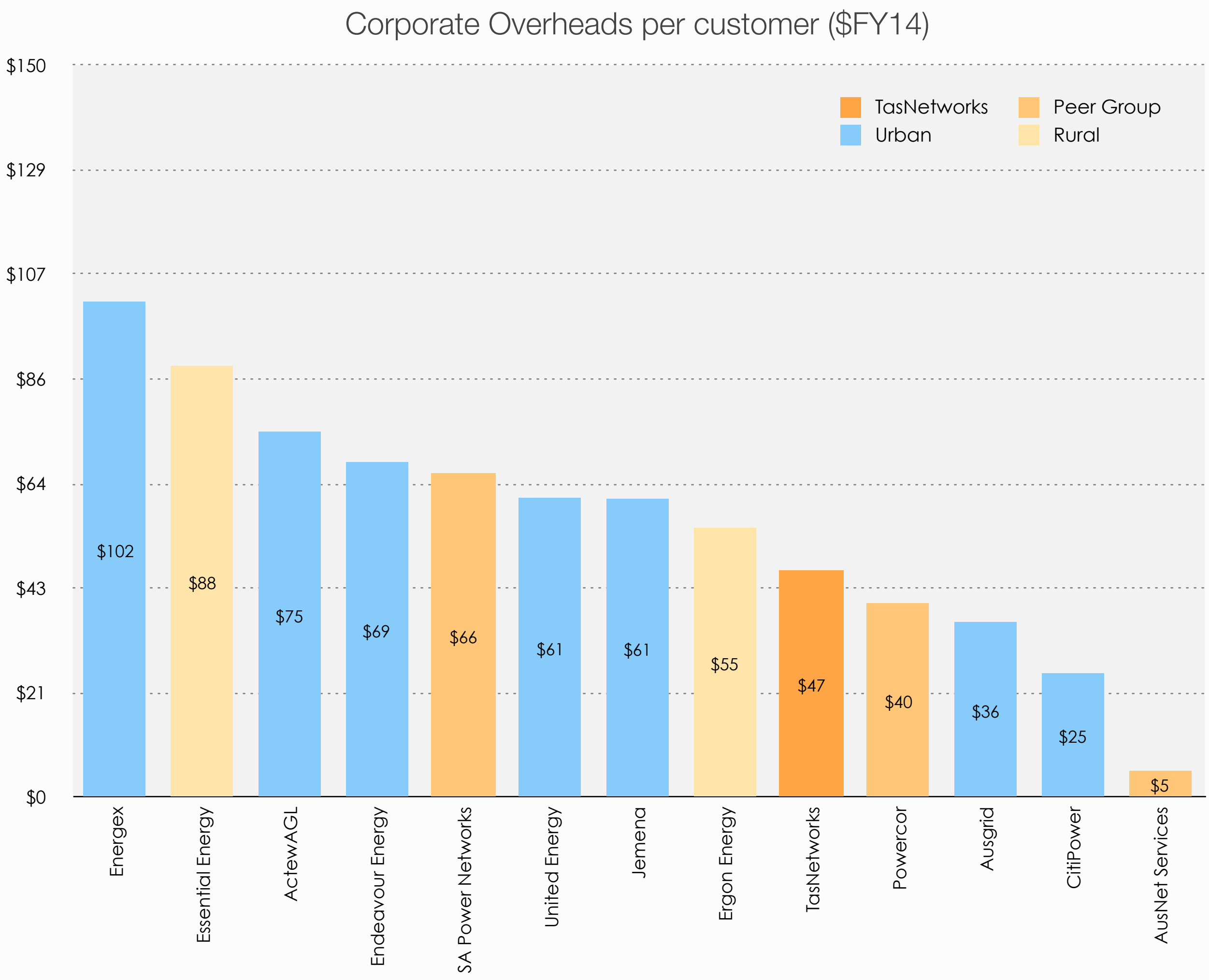
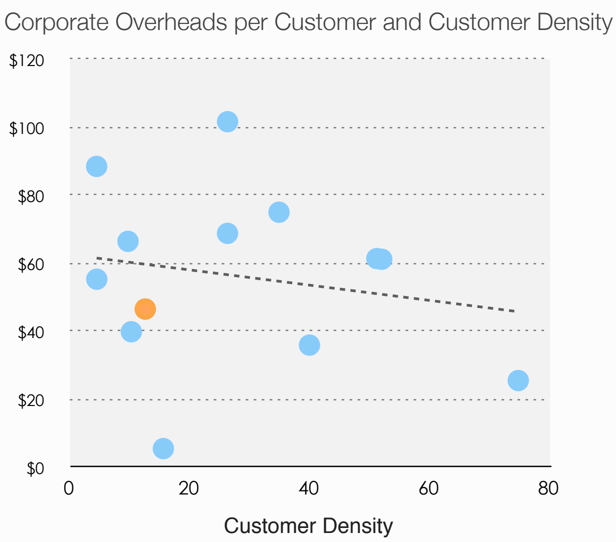


Figure 20: Corporate Overheads. *TasNetworks' corporate overheads per customer is similar to that of its peers and at or below industry average when normalised against customer density and scale (number of customers)*





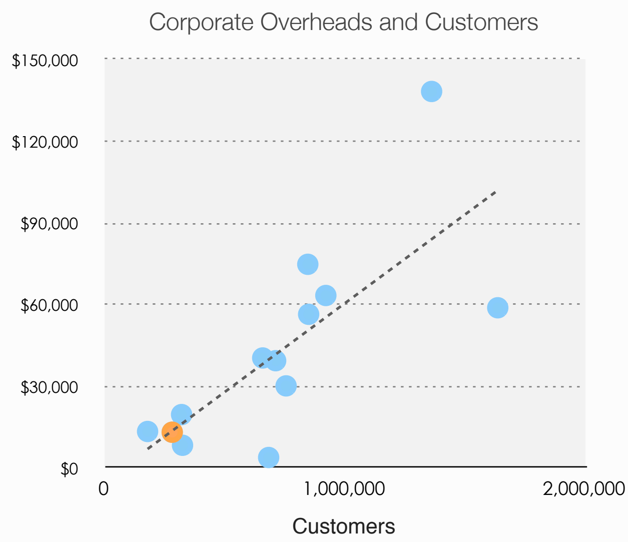
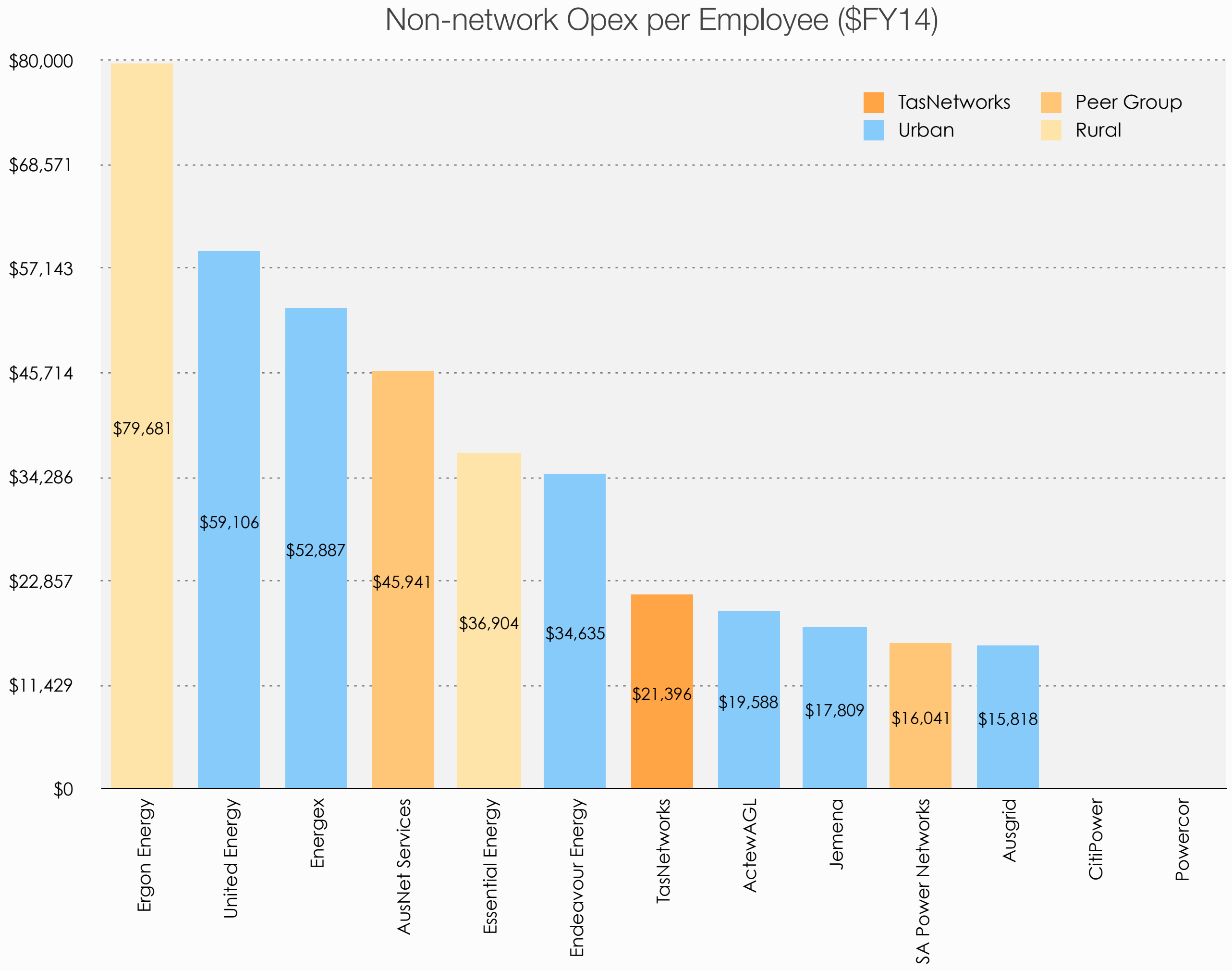
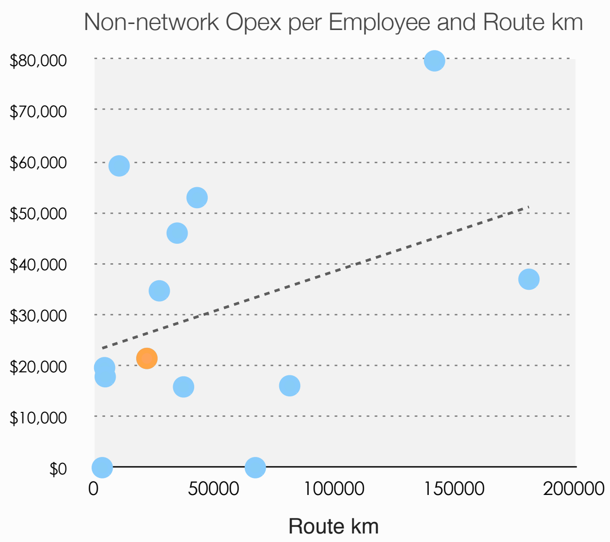


Figure 21: Non-Network Opex. *TasNetworks' non-network opex per employee is at the lower end of the range of its peers and at or below industry average when normalised for scale (km and total opex).*





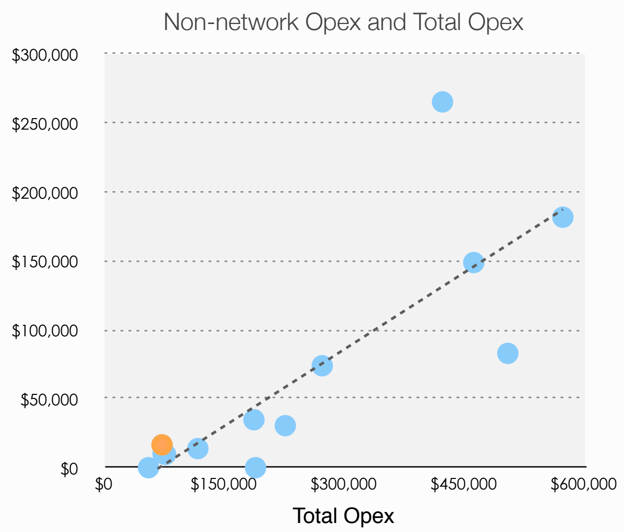


Figure 22: Maintenance Opex. *TasNetworks' maintenance opex per km is the lower end of the range of its peers and below industry average when normalised against customer density and RAB per cct km.*

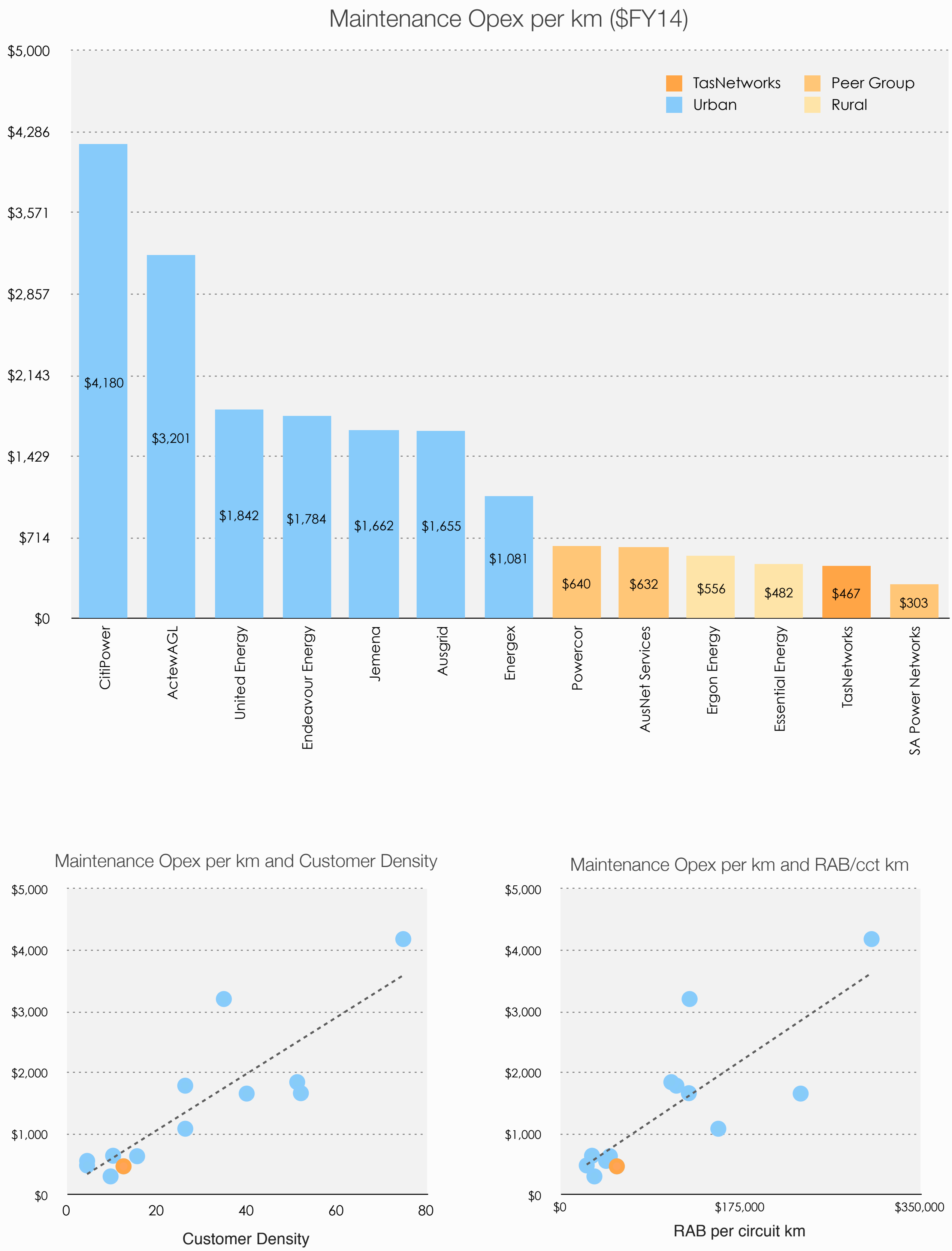
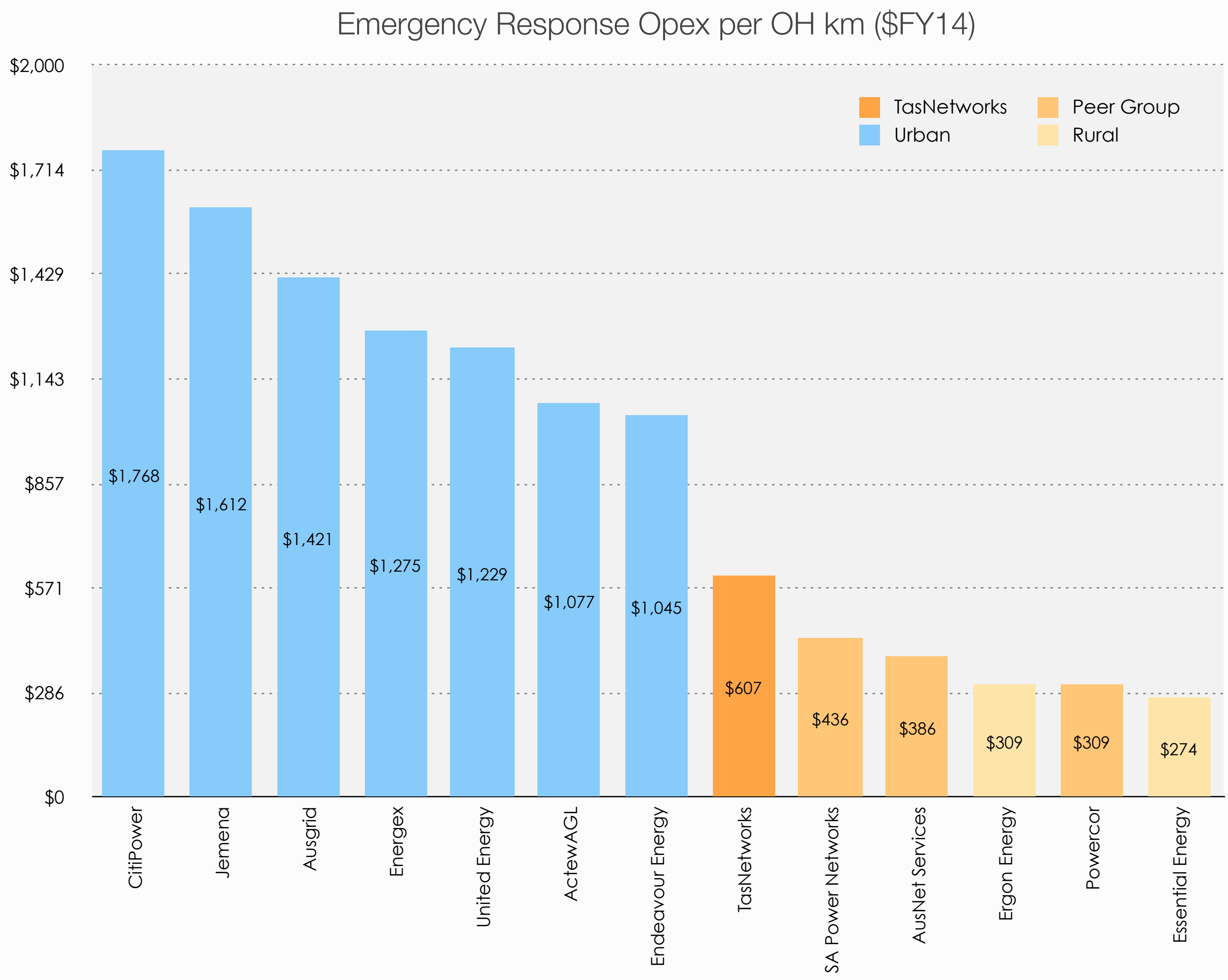
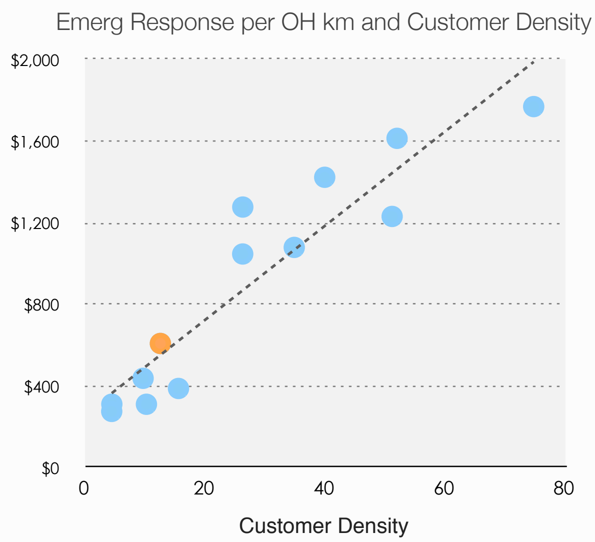


Figure 23: Emergency Response. *TasNetworks' emergency response opex per OH km is slightly higher than that of its peers but around industry average when normalised against customer*





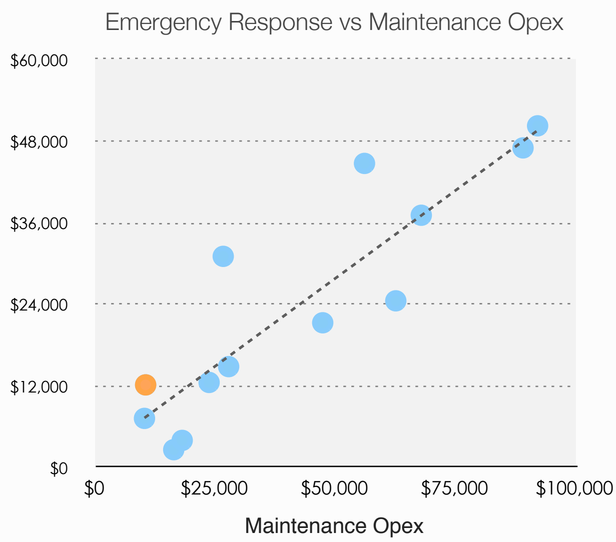
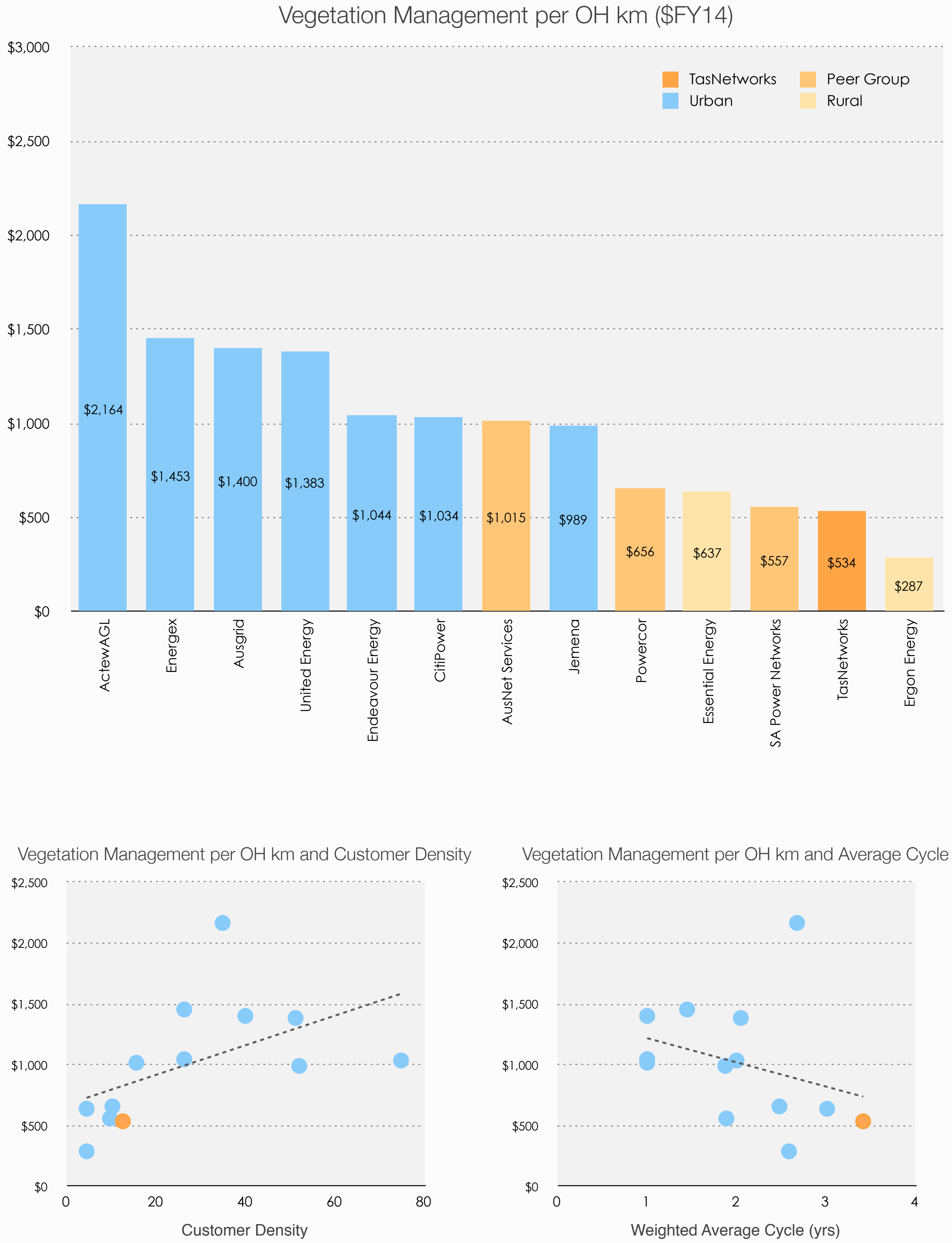


Figure 24: Vegetation Management. *TasNetworks' vegetation management opex per overhead km is below that of its peers and below industry average when normalised against customer density and the weighted average trimming cycle.*



Further Work

TasNetworks' distribution network operating expenditure appears to be comfortably within the bounds of what the current AER approach considers efficient at this stage. Of course the approach and assumptions can, and most probably will, change over time. There will also be at least two extra years of data available to the AER by the time the TasNetworks determination is underway. It is therefore in the best interest of TasNetworks to work toward strengthening its benchmark position, now that it has a preliminary understanding of where it ranks under the current approach.

There are a number of activities that we recommend TasNetworks initiate or continue to conduct between now and the regulatory determination to ensure a solid benchmarking foundation is maintained, such as:

1. Update the models and analysis included in this report as further information becomes available, particularly the AER efficiency models which will change with both the determinations made and over time.
2. Explore in more detail the Operating Environment Factors (OEFs) that the AER has considered in NSW, ACT, QLD and SA and determine the extent to which they are relevant and quantifiable for TasNetworks. Note that these OEFs are likely to change in both scope and application with each regulatory determination (e.g. QLD and SA final and Vic preliminary).
3. Explore in greater detail the information in the network overhead expenditure category to determine the extent to which it:
    a. Varies in scope from that reported by SA Power Networks and Powercor particularly.
    b. Differs through unique conditions, such as network complexity, geography, climate, work practices, etc.
4. Explore further the environment in which TasNetworks operates and the relationship to emergency response opex.
5. Test the emerging operating expenditure forecast against the AER's SFA model of predicted efficient opex at regular intervals to ensure TasNetworks is continuing to operate at expenditure levels below the threshold of what the AER considers efficient.

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