



## **Concerns over the AER's use of benchmarking as it might apply in its forthcoming draft decision on Ergon**

A report prepared in the context of AER's impending draft decisions on the  
Queensland DNSPs

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Synergies Economic Consulting Pty Ltd  
[www.synergies.com.au](http://www.synergies.com.au)

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## Executive Summary

In December 2014, the AER released a series of draft decisions concerning the allowable revenue for NSW and ACT distribution network service providers ('DNSP'), ActewAGL, Ausgrid, Endeavour and Essential Energy. In 2015 the AER will release draft decisions on the Queensland DNSPs, Ergon and Energex.

### Use of benchmarking

The NSW and ACT draft decisions were notable in a number of respects, but particularly for their reliance on quantitative economic benchmarking techniques in order to assess the extent of operating cost efficiencies at each of the DNSPs. The economic benchmarking was undertaken by Economic Insights, a respected and experienced firm in the field of economic benchmarking. Synergies has a number of significant concerns with this benchmarking and with AER's reliance upon it.

It is apparent that the AER considers the analysis undertaken by Economic Insights to be a reasonable basis on which to make its draft decisions over the extent of required operating cost reductions. The AER has focused on Economic Insights' analysis of operating cost efficiency derived using SFA of SE Australian, New Zealand and Ontario DNSPs, modified with a series of *ad hoc* adjustments to be conservative and to reflect cost drivers not reflected in the econometric models.

In Synergies view, the AER's economic benchmarking is a constructive step in helping to further understand the value of such approaches for determining the efficiency of Ergon and the other SE Australian DNSPs. However, as conducted it is insufficiently robust to support the draft determinations made by the AER.

### Implications for revenues

The AER appears minded to require an immediate reduction to the levels deemed efficient by this benchmarking. Synergies has significant concerns about this approach. Even if the economic benchmarking reliably indicated the extent of *controllable* operating cost inefficiency at each DNSP, which Synergies does not consider to be the case, there are likely to be substantial adverse consequences for DNSPs and for their customers from the disruption that will result from imposing an immediate and large reduction in allowable revenues. These disruption are, themselves, sources of considerable inefficiency and certainly contrary to the long-term interests of customers.

Ergon has an estimated operating cost efficiency score of 48% under Economic Insights' Cobb Douglas SFA model. For what it termed prudence reasons, Economic Insights estimated a frontier from the most efficient five Australian DNSPs at 86%. If the AER allows a 10% shift in the frontier to account for un-modelled factors, consistent with its approach

for NSW, then the AER is likely to determine that Ergon should reduce its operating costs by approximately 28% (i.e. 86% minus [48% plus 10%]).

Synergies does not consider that the AER has robustly determined the extent of controllable operating cost inefficiency at the NSW and ACT DNSPs. Nor would the approach set out in the draft decisions accurately determine the extent of controllable operating cost inefficiency at Ergon.

## Characteristics of Ergon and the Australian DNSPs

Synergies is concerned that the database that Economic Insights has used fails to fully reflect the characteristics of Australian DNSPs generally, and Ergon particularly, in the non-Australian sample of DNSPs which predominate. As a result, Synergies considers that Economic Insights' econometric estimates of Ergon's efficiency based on this database, at least in so far as they reflect *controllable* efficiency, are deficient and an insufficient basis for regulatory revenue determinations.

Australian electricity distribution and transmission networks are characterised by widely differing network sizes, customer numbers and disposition, landscape and environment, energy consumption per customer, maximum demand and climatic conditions. In undertaking any form of economic benchmarking analysis, it is important to take into account these differing network characteristics because they will have an effect on measured productivity. Failure to do so can result in legitimate cost differences between service providers, driven by these factors, being mistaken for inefficiencies. In this regard:

- Ergon is one of the largest DNSPs in terms of the length of route line kms, which reflects the huge geographical area that it has to cover. Only Essential is larger. What is equally important is that Ergon and Essential are the largest two DNSPs in the international database on which the SFA analysis relies. Ergon is fully 36% larger than the next largest DSNP (Hydro One Networks in Ontario) and is 13 times larger than the average DSNP;
- Ontario and New Zealand, which together represent 85% of the data sample are almost all significantly smaller than 50,000km, the only exceptions being Hydro One Networks in Ontario, and Vector and Powerco in New Zealand. In contrast, only 3 Australian DNSPs (Citipower, ActewAGL and Jemena) are smaller than 50,000km. The Australian DNSPs are, on average, 8 times larger than the New Zealand DNSPs and 11 times larger than the Ontario DNSPs;
- Ergon appears to be something of an outlier in terms of customer density, with one of the lowest in Australia and in the international sample. The average density is around 39 customers per kilometre, Ergon is close to 4;

- Ergon's network has one of the lowest proportions of underground cables in Australia and amongst international peers, predisposing it towards higher operating costs;
- Ergon's whole-of-network reliability, as measured by unplanned outage minutes per customer (SAIDI) including and excluding major event days (MEDs) is the highest in Australia, and one of the highest in Australia and New Zealand. The data is not reported for Ontario. Ergon also has the highest proportion of low capital cost but less reliable single wire earth return ('SWER') lines. These are unrepresented in the operating cost efficiency models; and
- Ergon faces a unique climate which imposes significant operating costs, such as requirements to more frequently inspect and replace distribution poles.

Due to these and other unique features, there is a very high risk that Ergon is, from a statistical perspective, an outlier by Australian standards and most Australian DNSPs are themselves outliers when compared with New Zealand and Ontario (even supposing the Australian and international data are collected on the same basis, which we do consider to be the case). The paucity of international observations with characteristics similar to the Australian DNSPs, the tendency for Australian DNSPs to be found at the extremes of the sample, and the preponderance of international DNSPs in the data casts doubt on whether the Economic Insight models accurately represent Australian DNSPs in general, let alone on Ergon with its unique characteristics even by Australian standards.

There is econometric support for this conclusion. Stochastic frontier analysis ('SFA') and least squares econometrics ('LSE') analysis of DNSPs on a country by country basis suggests that the coefficients derived from the international database and from an Australian only database are considerably different. Hence Synergies does not consider that Economic Insights approach accurately assesses the efficiency of DNSPs at the extremes of the distribution and is flawed in this regard. Accordingly, the AER should not rely upon this benchmarking to assess Ergon's controllable operating cost inefficiency.

## **Concerns with the quantitative benchmarking**

In Synergies view, the AER has not robustly shown that its estimates of inefficiency for each DNSP represent controllable inefficiency. Synergies is concerned that the AER has underestimated or failed to take into account the characteristics of the networks that each DNSP operates. There is also evidence from the benchmarking and data that some of the calculated operating cost inefficiency is not controllable and is due to factors poorly or unrepresented within the SFA model.

## **Data problems**

Synergies is concerned that the database that Economic Insights has used relied on flawed. In particular data items are inconsistent across jurisdictions, data definitions are different across jurisdictions, Australian DNSP data has in some cases been estimated rather than collected, and within Australia (and perhaps elsewhere) data may not have been collected in a consistent fashion. Economic Insights included a country dummy in its models in an attempt to correct for these differences, but Synergies doubts that this approach is sufficiently effective.

## **Average efficiency scores**

The SFA and LSE econometric analysis undertaken by Economic Insights only estimates the *average* level of inefficiency for each DNSP across the whole period. It does not determine whether a particular DNSP has become more efficient relative to the frontier over time, nor whether the absolute level of efficiency at the frontier has shifted over time. Accordingly, it is not possible to determine whether the efficiency scores from the models are indicative of the current level of efficiency at each DNSP. The results of SFA and LSE econometric estimates of efficiency should not be used to assess permitted reductions in operating costs without first determining whether the current extent of controllable inefficiency is consistent with the average level reported by these models.

## **The range of results across the models is excessive**

The range of reported efficiency from Economic Insights SFA and LSE modelling is large, ranging from 40% to 100% with an average (across Australian and overseas jurisdictions) of approximately 71%. Broadly the same range of efficiency scores was observed in each jurisdiction in all three countries. It is much greater than the range of efficiencies estimated in some other studies, for example a recent total cost efficiency study from the UK.

Synergies notes that the range of efficiency scores is very sensitive to the precise model formulation that is used. There are some SFA formulations that can identify unexplained causes of inefficiency (which the firm sees but the observer does not), termed latent heterogeneity. Some of these models indicate that Australian DNSPs have efficiency scores over 95%, markedly different from those estimated by Economic Insights.

Alternative measures of efficiency, such as DEA also indicate that controllable inefficiency at some of the Australian DNSPs is lower than the Economic Insights results suggest. For example, a three output (customers, Peak MW, circuit length), three input (operating costs, MVA of transformer capacity and user cost of capital associated with distribution lines) DEA model comprising Australian and New Zealand data indicated that Ergon had a technical efficiency score of 98%, indicating controllable inefficiency of 2%.

## **Operating cost efficiency and capital**

Synergies is concerned that aspects of each of the DNSPs that are not represented by the relatively gross features of the DNSPs included in the Economic Insights databases and models are important determinants of operating costs. These are likely related to the characteristics of the network that DNSP operates, in turn determined in large part by the environment each faces.

The impact of a DNSPs network, as reflected in the quantity of capital that it deploys, for its operating costs is apparent from the MTFP analysis undertaken by Economic Insights. Opex efficiency is strongly correlated with capital efficiency. This shows that operating costs and capital costs are likely to be complementary for distribution businesses; as a DNSP increases the number and length of transmission lines that it operates, it also increases the number of employees it needs to maintain and operate them. This has important implications for the interpretation of the controllability of operating costs. It indicates that operating costs inefficiency as determined by these benchmarking models is not wholly controllable. Rather, the nature of the capital stock limits the extent to which operating costs can be reduced.

## **Summary**

Synergies believes that the benchmarking undertaken by Economic Insights is a constructive step in helping to further understand the value of such approaches for determining the efficiency of Ergon and the other SE Australian DNSPs. However, for the foregoing reasons, Synergies considers that Economic Insights operating cost efficiency estimates are an insufficiently robust basis for revenue control decision making and, if applied to Ergon, would give flawed and exaggerated estimates of Ergon's controllable inefficiency.

There is strong evidence that the models on which they are based do not fully represent the characteristics of Australian DNSPs generally and Ergon specifically. The data on which the models are based appears to have important inconsistencies which are not adequately adjusted for. The efficiency estimates do not capture the current levels of efficiency at each DNSP. And there are other reasonable models and measurement techniques which indicate that the Ergon and other Australian DNSPs have higher efficiency scores that Economic Insights has estimated.

As a result, Synergies does not believe that the AER should rely upon benchmarking as it has done in the NSW and ACT draft decisions without undertaking substantial additional work to address its shortcomings.

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# 1 Introduction

In December 2014, the AER released a series of draft decisions concerning the allowable revenue for NSW and ACT distribution network service providers ('DNSP'), ActewAGL, Ausgrid, Endeavour and Essential Energy. In 2015 the AER will release draft decisions on the Queensland DNSPs, Ergon and Energex. The NSW and ACT draft decisions were notable in a number of respects, but particularly for their reliance on quantitative economic benchmarking techniques in order to assess the extent of operating cost efficiencies at each of the DNSPs. The economic benchmarking was undertaken by Economic Insights.

Synergies has a number of significant concerns with the benchmarking that was undertaken in support of the AER's draft decisions, and upon AER's reliance upon it. This report sets out these concerns and, where appropriate, identifies related concerns from other commentators. In this regard, it is notable that Ausgrid, in its Revised Regulatory Proposal,<sup>1</sup> published a number of additional critiques of the AER's benchmarking. In Synergies view, the benchmarking that the AER has used, if applied to Ergon, would probably substantially understate Ergon's operating cost efficiency. If it is used to determine Ergon's allowable revenues, it would be likely to reduce Ergon's revenues to levels that are substantially below those needed for Ergon to efficiently undertake its activities, counter to the long-run interests of Ergon's customers.

This report is structured as follows:

- in Section 2, we set out the salient features of the AER's recent NSW and ACT draft decisions, briefly describing the economic benchmarking upon which the AER appears to have relied;
- in Section 3, we summarise the characteristics of Ergon that are relevant to the quantitative benchmarking, and identify characteristics of Ergon's business that are not adequately addressed by Economic Insights' benchmarking;
- in Section 4 we summarise our concerns over Economic Insights' benchmarking, identifying several serious shortcoming that render the results at best unreliable, more realistically, seriously misleading; and;
- in Section 5 we summarise our concerns, and provides some brief conclusions concerning the further use of economic benchmarking as a basis for estimating Ergon's efficiency and future allowable revenue.

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<sup>1</sup> Ausgrid (January 2015) *Revised Regulatory Proposal* available at <http://www.aer.gov.au/node/11483> (last viewed 27 January 2015).

## 2 Benchmarking in the recent AER draft decisions

The AER's recent draft decisions rely on economic benchmarking to assess the efficiency of each DNSPs operating costs. The quantitative benchmarking was undertaken by Economic Insights, a respected and experienced firm in the field of economic benchmarking. The benchmarking followed an extensive consultative period, acquisition of extensive data from the DNSPs through Regulatory Information Notices ('RIN') tailored to the use of benchmarking, and review of a number of alternative quantitative benchmarking approaches. It is apparent that the AER considers the analysis undertaken by Economic Insights to be a reasonable basis on which to make its draft decisions over the extent of required operating cost reductions.<sup>2</sup>

Economic Insights presented a number of different measures of efficiency. They compared *total* productivity across the SE Australian DNSPs (i.e. considering all relevant inputs and outputs including both capital and labour), using a technique called multilateral total factor productivity ('MTFP'). The AER has not made extensive use of these MTFP comparisons in its draft decisions, preferring instead to rely upon Economic Insights' analysis of operating cost efficiency based on econometrically derived comparisons of the SE Australian DNSPs with New Zealand and Ontario DNSPs. The AER has not examined (at least for the purposes of revenue assessments) comparative capital productivity nor, in detail, how differences in capital productivity might impact apparent operating cost productivity.

In this section we set out the salient features of the operating cost benchmarking. In so doing, we identify that the proposal by the AER in its recent draft decisions to immediately reduce operating costs to its estimate of the efficient level would, even if the AER's results are robust, give rise to inefficient outcomes. It is more problematic still if the benchmarking results do not give an accurate picture of controllable efficiency, which Synergies considers to be the case.

### 2.1 Economic Insights' measures of operating cost efficiency

Economic Insights adopted four measures of operating cost efficiency: a Cobb Douglas stochastic frontier analysis ('SFA') opex cost function model; Cobb Douglas and translog least squares econometrics ('LSE') opex cost function models; and opex multilateral partial factor productivity ('MPFP') indexes.<sup>3</sup> The SFA and LSE models were derived using a database of Australian, New Zealand and Ontario (Canada) DNSPs which Economic

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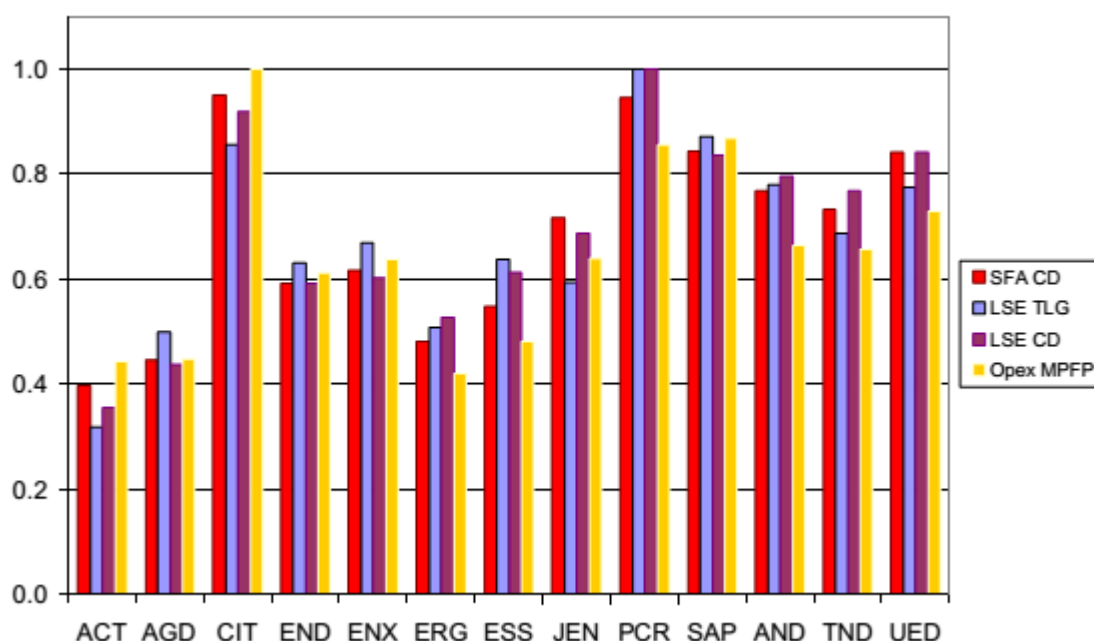
<sup>2</sup> The AER has not solely relied upon Economic Insights' benchmarking, but has used a number of other sources such as examination of DNSP explanations of costs, category analysis, detailed review of labour costs and vegetation management, and comments made by CEOs etc. that are congruent with Economic Insights analysis. We do not in this report address these additional lines of support for the AERs draft decisions.

<sup>3</sup> Economic Insights (17 November 2014) *Economic Benchmarking Assessment of Operating Expenditure for NSW and ACT Electricity* DNSP 46.

Insights compiled; the Australian data derived from the RINs. The results of the four different measures are summarised in Figure 1 below.

Economic Insights itself places greatest reliance on the SFA Cobb-Douglas model for reasons of its statistical attractiveness<sup>4</sup> explained in detail in their report. They gained confidence from the broad alignment of operating cost efficiencies across the approaches, stating that the broad concordance of the results ‘reinforces [their] confidence in the results’.<sup>5</sup> Synergies considers that the significant differences between the MTFP and other approaches particularly in respect of supply reliability do not support this conclusion. In Synergies view, the SFA and related modelling are an insufficiently robust basis for the draft determinations made by the AER.

**Figure 1. DNSP average opex cost efficiency scores (2006-2013)<sup>6</sup>**



## 2.2 Adjustments to efficiency scores

SFA analysis measures efficiency relative to the frontier of most efficient firms. In principle, if the SFA model properly and fully represents the production function of the DNSPs, then controllable inefficiency can be measured relative to the frontier firms. Assuming for the

<sup>4</sup> Ibid 48.

<sup>5</sup> Ibid.

<sup>6</sup> Economic Insights (17 November 2014) *Economic Benchmarking Assessment of Operating Expenditure for NSW and ACT Electricity* DNSP 46.

purposes of illustration that the SFA undertaken by Economic Insights properly and fully represents the production function of the DNSPs (which Synergies does not consider to be the case), Vector (of New Zealand) had the highest operating cost efficiency (at 97%).<sup>7</sup> Citipower and Powercor were the most efficient Australian DNSPs (with scores of 96% and 94%) respectively. ActewAGL, with an opex efficiency score of 42%, would in principle need to reduce its operating costs by 54% to become as operating cost efficient as the best firm. It would have to reduce its operating costs by a similar amount to achieve the apparent operating cost efficiency as Citipower or Powercor.

Economic Insights decided not to adopt this strict frontier based assessment of operating cost efficiency, but rather assumed that the 'efficient frontier' was best represented by the average operating cost efficiency of those Australian DNSPs in the top quartile of the international comparators (Citipower, Powercor, SA Power Networks, United Electricity Distribution and AusNet Distribution) resulting in a notional efficient frontier with an operating cost efficiency score of 86%.<sup>8</sup> Adopting this more conservative frontier would require ActewAGL to reduce its operating costs by 44% to become 'efficient'. The efficiency scores from the SFA analysis were broadly consistent across the SFE and LSE econometric models.

This 'conservative' adjustment to the frontier may not be as conservative as it at first seems. The 95% confidence intervals around the efficiency scores that Economic Insights reported for the SFA are around  $\pm 7.2\%$ .<sup>9</sup> Assuming that the reported confidence intervals are robust, we can only be 95% confident that the frontier (set by Vector) is above 90%. The use of the average across the 5 Australian DNSPs with scores above 75% (yielding an operating cost efficiency score of 86%) is not significantly different from adopting a 95% confidence interval.

In addition to these frontier adjustments, the AER accepted, in respect of the NSW DNSPs, that sub-transmission, OH&S regulations and bushfire regulations resulted in specifically quantifiable decreases in operating cost efficiency relative to the benchmarking, and that a number of other factors were consequential but not individually quantifiable. These included: building regulations, corrosive environments, environmental regulation, grounding conditions, natural disasters, planning regulations, proportion of 11kV and 22kV

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<sup>7</sup> This result was not published by Economic Insights but was estimated by Synergies using the 'Large' database published by the AER with their draft decisions.

<sup>8</sup> If the Large database is used TasNetworks falls into this group and the frontier is set at 85%.

<sup>9</sup> Economic Insights did not publish the confidence intervals for all DNSPs. This average was calculated by Synergies using the same data and models and Economic Insights. Some caution is needed in interpreting the confidence intervals provided by Economic Insights. They are marginal intervals estimated using an add on Stata routine, *frontier\_teci*, based on an approach discussed in the following article: Horrace W and Schmidt P (1996), Confidence Statements for Efficiency Estimates from Stochastic Frontier Models *Journal of Productivity Analysis* 7 257-282. They may not accurately represent the confidence intervals for inter-firm comparisons.

lines, hardwood poles, shape factors, skills required by different service providers, topography and traffic management. The AER determined that all of these could be conservatively included within the efficiency score by increasing the operating efficiency scores by 10%.<sup>10</sup> In the case of ActewAGL, they made a further adjustment due to leasing arrangements on certain capital goods which affected the reporting operating costs.

Despite these adjustments, it is clear that the AER has relied to a very significant extent on Economic Insight's benchmarking in reaching its conclusions on the extent of required operating cost reductions by the NSW and ACT DNSPs.

## 2.3 Required rate of change will result in inefficient outcomes

Having established the extent of operating cost inefficiency using this approach, the AER appears minded to require an immediate reduction in operating costs to immediately move the DNSP to the efficient level. The alternative, allowing the DNSP to reduce its operating costs over time would, in the AER's current view allow for 'the recovery of costs that do not reasonably reflect the opex criteria [of the NEL] and cause consumers to fund inefficient expenditure'.<sup>11</sup>

Synergies has significant concerns about this approach. Even if the economic benchmarking reliably indicated the extent of *controllable* operating cost inefficiency at each DNSP, which Synergies does not consider to be the case, there are likely to be substantial adverse consequences for DNSPs and for their customers from the disruption that will result from imposing an immediate and large reduction in allowable revenues. That disruption is likely to derive from:

- the likelihood that labour will be reduced more quickly than can be accommodated by system improvements necessary to allow the remaining labour to operate the business at frontier efficient levels; and
- strong disincentives to invest, and strong incentives to defer maintenance and related activities in order to preserve short-run services and an acceptable return on capital; and
- longer-term incentives to under-invest due to concern that precipitous decisions by regulators could undermine expected returns.

These disruption are, themselves, sources of considerable inefficiency and certainly contrary to the long-term interests of customers. On that basis, they should be considered when assessing the appropriate rate of change of operating costs. More problematically, if there are systematic biases or inadequacies in the quantitative analysis which result in excessively

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<sup>10</sup> AER (December 2014) *Ausgrid draft decision* 7-104.

<sup>11</sup> AER (December 2014) *Ausgrid draft decision* 26.

large ‘inefficiency’ scores for some DNSPs, large reductions in allowable opex will prevent them from meeting their license obligations while also earning an appropriate return on their assets.

It is notable that the Ontario Energy Board (‘OEB’) has made extensive use of benchmarking to assess the operating cost efficiency of DNSPs. It is notable that it has not used the resultant scores to immediately reduce allowed operating costs to the purported efficient level. Rather, it has used the results to determine much more modest ‘stretch’ factors. Less efficient DNSPs (assessed as a cohort rather than individually) are given a higher stretch factor than efficient DNSPs, necessitating more rapid reductions in operating costs in order to maintain a target return on capital. Even then, the stretch factor is less than 1%, implying the rate of change in operating costs need be no more rapid than 1% per annum more than that of the efficient DNSPs.<sup>12</sup>

The AER does not appear to be concerned about these possible incentives to under-invest, stating for Ausgrid that ‘we are satisfied the overall revenue allowance... provides a return sufficient to promote efficient investment, while also providing... incentives to operate its network more efficiently.’<sup>13</sup> In Synergies’ view, this is unlikely to be the case.

## 2.4 Implications for Ergon

Based on the approach set out above, Figure 2 sets out the opex changes that Economic Insights estimated were necessary for the NSW and ACT DNSP to be efficient. The required reductions in operating costs range between 13% and 45%, with Ausgrid, Essential and ActewAGL having to reduce their operating costs by one third or more.

**Figure 2. Opex efficiency scores, adjusted scores and required reductions in costs<sup>14</sup>**

| <i>DNSP</i>      | <i>Efficiency score</i> | <i>Efficiency Target</i> | <i>Implied opex reduction to reach average efficiency target</i> | <i>Reduction to 2013 network services opex</i> |
|------------------|-------------------------|--------------------------|--|--|
| Ausgrid          | 45%                     | 78%                      | 43%  | 33%  |
| Endeavour        | 59%                     | 78%                      | 24%  | 13%  |
| Essential Energy | 55%                     | 78%                      | 30%  | 35%  |
| ActewAGL         | 40%                     | 66%                      | 40%  | 45%  |

<sup>a</sup> Based on Economic Benchmarking RIN data including changes in provisions

<sup>12</sup> See Ontario Energy Board (July 14 2008) *Report of the Board on 3rd Generation Incentive Regulation for Ontario's Electricity Distributors* available at <http://www.ontarioenergyboard.ca/> (last viewed 27 January 2015).

<sup>13</sup> AER (December 2014) *Ausgrid draft decision* 13.

<sup>14</sup> Economic Insights (17 November 2014) *Economic Benchmarking Assessment of Operating Expenditure for NSW and ACT Electricity* DNSP 55.

Ergon has an estimated operating cost efficiency score of 48% under Economic Insights' Cobb Douglas SFA model. For what it termed prudency reasons, Economic Insights estimated a frontier from the most efficient five Australian DNSPs at 86%. If the AER allows a 10% shift in the frontier to account for un-modelled factors, consistent with its approach for NSW, then the AER is likely to determine that Ergon should reduce its operating costs by approximately 28% (i.e. 86% minus [48% plus 10%]).

For the reasons set out in the following sections, Synergies does not consider that the AER has robustly determined the extent of controllable operating cost inefficiency at the NSW and ACT DNSPs. Nor would the approach set out in the draft decisions accurately determine the extent of controllable operating cost inefficiency at Ergon. Accordingly, a figure of 28% for Ergon, if it was adopted, would substantially over-state Ergon's controllable inefficiency. If it were imposed, it would give rise to inefficient outcomes contrary to the long-term interests of Ergon's customers.

### 3 Characteristics of Ergon

In Synergies view, the AER's economic benchmarking is a constructive step in helping to further understand the value of such approaches for determining the efficiency of Ergon and the other SE Australian DNSPs. However, as conducted it is insufficiently robust to support the draft determinations made by the AER. Synergies is concerned that the database that Economic Insights has used fails to properly reflect the characteristics of Australian DNSPs generally, and Ergon particularly, in the non-Australian sample of DNSPs which predominate. As a result, Synergies considers that Economic Insights' econometric estimates of Ergon's efficiency based on this database, at least in so far as they reflect *controllable* efficiency, are flawed.

Australian electricity distribution and transmission networks are characterised by widely differing network sizes, customer numbers and disposition, landscape and environment, energy consumption per customer, maximum demand and climatic conditions. In undertaking any form of economic benchmarking analysis, it is important to take into account these differing network characteristics because they will have an effect on measured productivity. Failure to do so can result in legitimate cost differences between service providers, driven by these factors, being mistaken for inefficiencies. That is, mistakenly conflating controllable inefficiency, which is under managerial control, with uncontrollable inefficiency, which is not under managerial control except, perhaps, over the very long term.<sup>15</sup>

There are a number of approaches that can assist in differentiating between such controllable and uncontrollable costs. Some are inherent in the specification of the functional form of the measure. For example, including customer number and circuit km as outputs in a TFP index goes some way to taking account the effect of customer density on productivity. The relevant characteristics can be included as explanatory variables in econometric models such as SFA and LSE. However, if this approach is adopted it is important that the database is sufficiently representative such that the econometrically determined impact of each of the factors is robust across the whole sample. If this is not the case, for example, if small numbers of observations are somewhat distinct from the bulk of observations, then results are likely to be unreliable.<sup>16</sup> Some alternative benchmarking approaches such as Data Envelopment Analysis ('DEA') can avoid this problem by not assuming a functional form for each DNSP's production technology but typically require a large database.

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<sup>15</sup> By which we mean the timescale over which significant changes to the network capital can be made.

<sup>16</sup> Put differently, if the econometrically derived results from such data are used, it is under the implicit assumption that the production technology across the sample is uniform (with respect to the explanatory factors). There is no justification for this assumption in the case of the Australian DNSPs. For example, there is no reason to believe that the efficient production technology for Ergon, having adjusted for density, would be the same as the production technology for a smaller, denser Ontario DNSP.

Synergies does not believe that Economic Insights has properly<sup>17</sup> differentiated controllable inefficiency and uncontrollable inefficiency (i.e. that which is and is not amenable to managerial control) in its analysis, in part because the database it used is not sufficiently representative.

The following briefly sets out Ergon's features in the context of its Australian peers and, to the extent possible, international counterparts used in the SFA analysis. In so doing, it shows that Australian DNSP in general and Ergon in particular are very different from the other DNSPs that Economic Insights used in its analysis. It is not meant to be exhaustive, but rather to identify the main features of Ergon's network that are likely to be poorly represented or systematically misrepresented in the AER's benchmarking analysis.

### **3.1 Network size and customer density**

Network size encompasses three distinct components:

- the geographical extent of the network
- the number of customers connected to the network
- the distribution of conurbations within the network (i.e. number, size and density of cities, towns and townships).

The aggregate length in kilometres of lines provides one component measure of the size of the network. Other measures are set out below. A DNSP's network size (measured in terms of route line length km) will have a large impact on its capital and operating cost base. More geographically dispersed networks could be expected to have relatively larger asset bases and operating and maintenance costs given the greater network coverage and distances required to inspect and maintain the assets. Route line length is a reasonable, although imperfect, measure of network size. Figure 3 indicates that there is a substantial degree of variability between Australian DNSPs in terms of their respective network sizes.

Notwithstanding the large variations, it is clear that Ergon is one of the largest DNSPs in terms of the length of route line kms, which reflects the huge geographical area that it has to cover. Only Essential is larger. What is equally important is that Ergon and Essential are the largest two DNSPs in the international database on which the SFA analysis relies. Ergon is fully 36% larger than the next largest DNSP (Hydro One Networks in Ontario) and is 13 times larger than the average DSNP (see Figure 4).

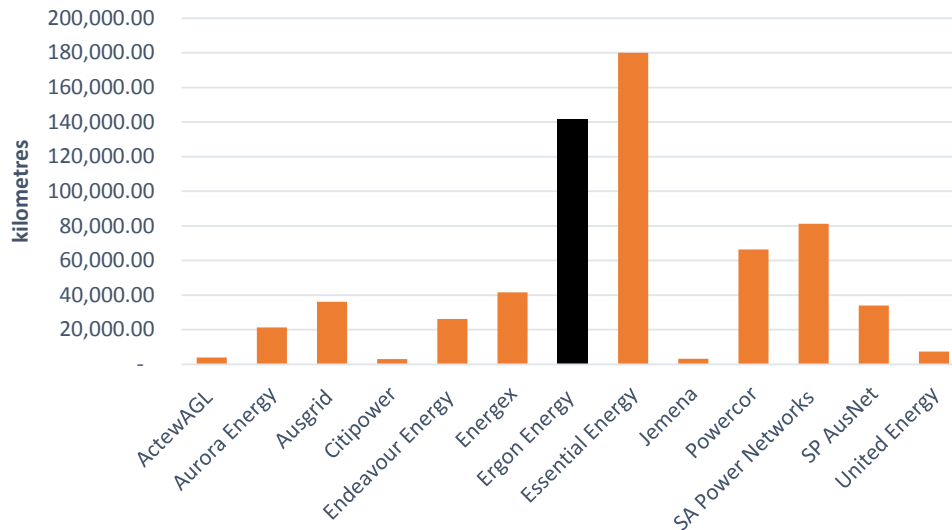
Figure 5 shows the proportion of DNSP of different sizes by country within the data sample. Ontario and New Zealand, which together represent 85% of the data sample are almost without exception significantly smaller than 50,000km, the only exceptions being Hydro

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<sup>17</sup> At a minimum, they fail to robustly demonstrate that they have done so.

One Networks in Ontario and Vector and Powerco in New Zealand. In contrast, only 3 Australian DNSPs (Citipower, ActewAGL and Jemena) are smaller than 50,000km. The Australian DNSPs are, on average, 8 times larger than the New Zealand DNSPs and 11 times larger than the Ontario DNSPs.<sup>18</sup>

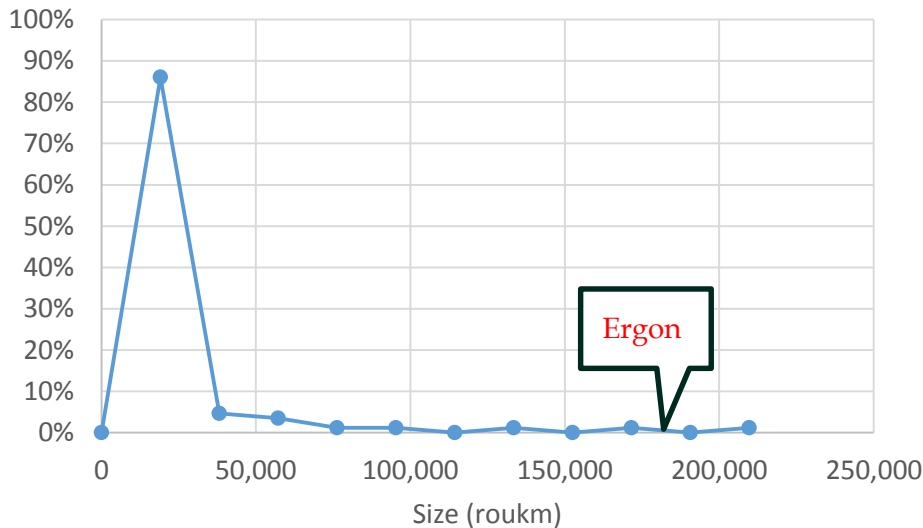
**Figure 3. Distribution network size (route km)**



**Note:** This data is based on a 5 year average

**Data source:** Various DNSP Benchmarking RINs

**Figure 4. Distribution of network sizes across the international sample**



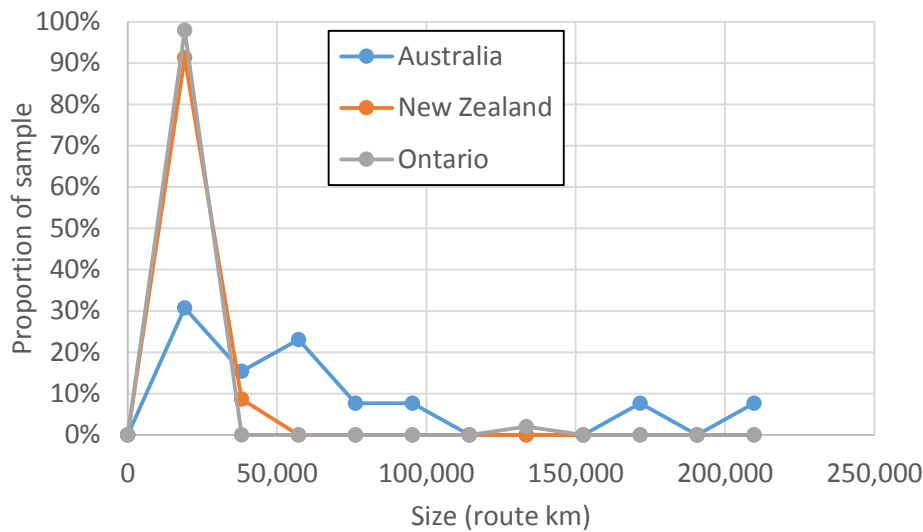
**Source** Synergies based on AER published data collected by Economic Insights

**Note:** There are differences in the definitions used in this figure and Figure 3.

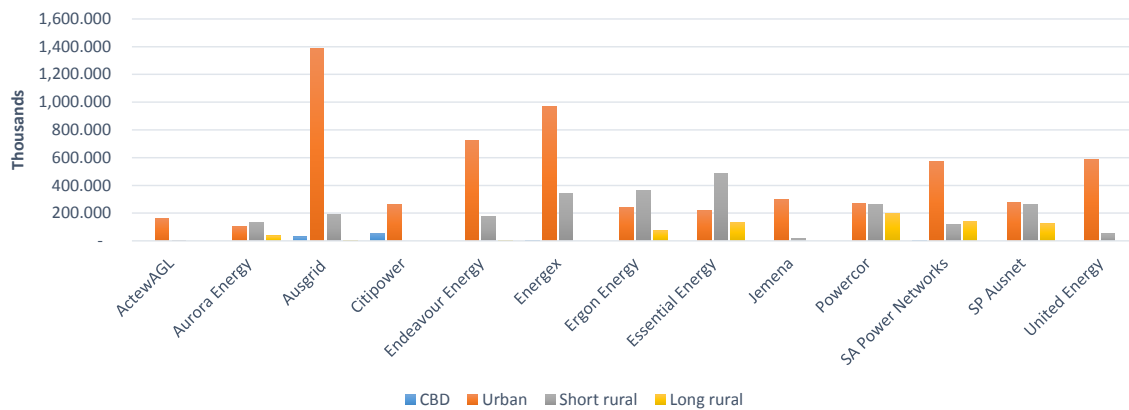
<sup>18</sup> Similar differences in sizes are observed for other scale variables including energy distributed, peak demand, peak ratcheted demand and customer numbers.

Furthermore, all of these large dispersed networks are characterised by substantial semi-rural and/or rural network components and can be contrasted with a number of primarily urban (including CBD) networks, such as Citipower, Jemena and United Energy (all in Victoria) and ActewAGL in Canberra (see Figure 6).

**Figure 5. Distribution of network sizes by country**



**Figure 6. Customer numbers by network location**



**Note:** This data is based on a 5 year average

**Data source:** Various DNSP Benchmarking RINs

### 3.1.1 Customer density

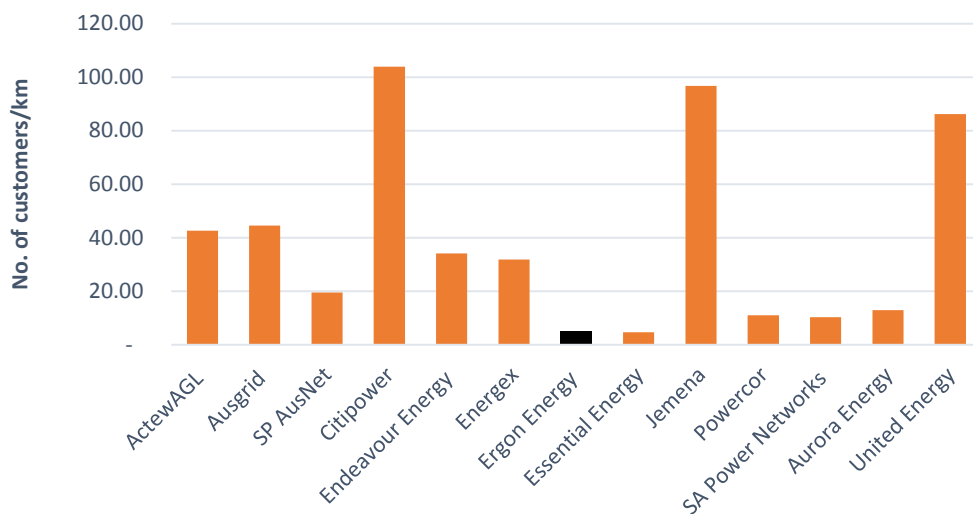
The same issue arises, albeit to a lesser degree, in respect of customer density. In general, electricity networks with relatively large distribution areas are likely to have lower customer density than networks with relatively small distribution areas. A DNSP with lower

customer density will generally need more poles and wires to reach its customers compared to a DNSP with higher customer density. The additional costs associated with meeting this requirement must be properly represented in order to form robust estimates of controllable efficiency.

Ergon appears to be something of an outlier in terms of customer density, with one of the lowest customer densities. Figure 7 shows that there is a substantial degree of variability between Australian distribution networks in terms of their respective customer densities, with an average of around 39 customers per kilometre, but with Ergon close to 4.

As noted above Ergon (and Essential) are also at the extreme lower end of the international distribution. The international data also shows systematic differences in customer density between countries, with New Zealand and Australia exhibiting similar average customer density across the sample (at 11 and 13 customers/km respectively), one quarter of the customer density observed in Ontario. Even this is somewhat misleading; the largest 9 Australian DNSPs exhibit a customer density similar to Ontario, while the smallest 4 exhibit an average below that of New Zealand. In combination, these indicate that the specific characteristics of Ergon are unlikely to be properly represented by the data used by the AER.

**Figure 7. Customers per km**



**Note:** This data is based on a 5 year average

**Data source:** Various DNSP Benchmarking RINs

### 3.1.2 Implications for benchmarking

From a statistical perspective there is a very high risk that Ergon is an outlier by Australian standards, and most Australian DNSPs are outliers by international standards, even supposing the Australian and international data are collected on the same basis. The paucity of international observations with characteristics similar to the Australian DNSPs, the tendency for Australian DNSPs to be found at the extremes of the sample, and the

preponderance of international DNSPs in the data casts doubt on whether the Economic Insight models shed light on the cost structures of efficient Australian DNSPs as a whole, let alone on Ergon with its unique characteristics even by Australian standards.

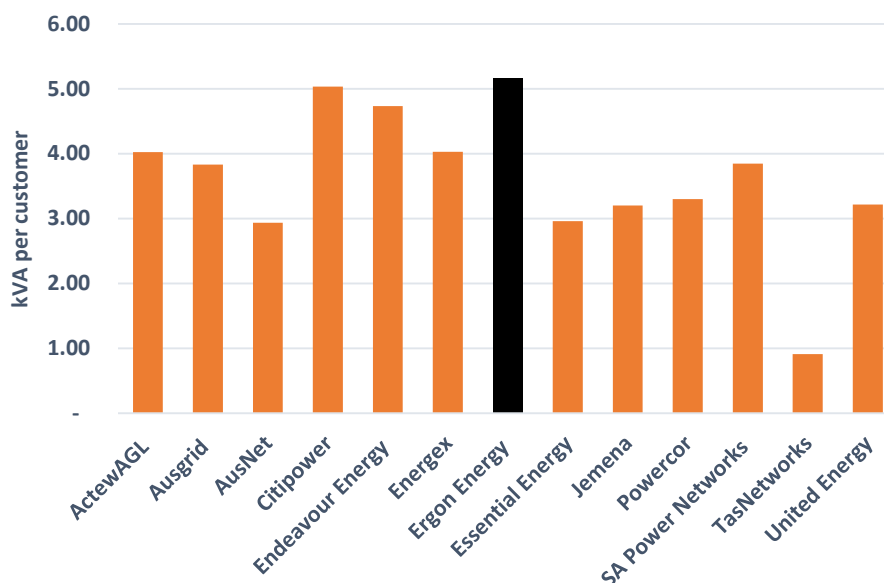
Because of these data limitations, Synergies does not consider that Economic Insights approach accurately assesses the efficiency of DNSPs at the extremes of the distribution. Accordingly, the AER should not rely upon the benchmarking to assess Ergon's controllable operating cost inefficiency for revenue control purposes.

### 3.2 Demand density

Demand density (kVA non-coincident peak demand per customer) provides a broad measure of the peakiness of demand (as opposed to average consumption), with peak demand a key driver of network capital costs. Figure 8 below indicates that there is a significant variability across Australian distribution networks in terms of their respective demand densities. Demand density across the networks falls within the range from 0.91 to 5.16 per customer, with an average of around 3.58 kVA per customer.

Ergon is, on this measure, at the extremes of the Australian distribution. Not only does Ergon have a very large area and low customer density, but has to serve high peak demand per customer. This indicates that, on average, Ergon's customers have relatively higher demand than the other networks, which potentially has network planning and cost implications in terms of the need for additional capacity to meet maximum demand at zone sub-stations across the distribution network. The greater requirements for assets per customer are likely to adversely affect operating costs.

**Figure 8. Network demand density**



**Note:** This data is based on a 5 year average

Data source: Various DNSP Benchmarking RINS

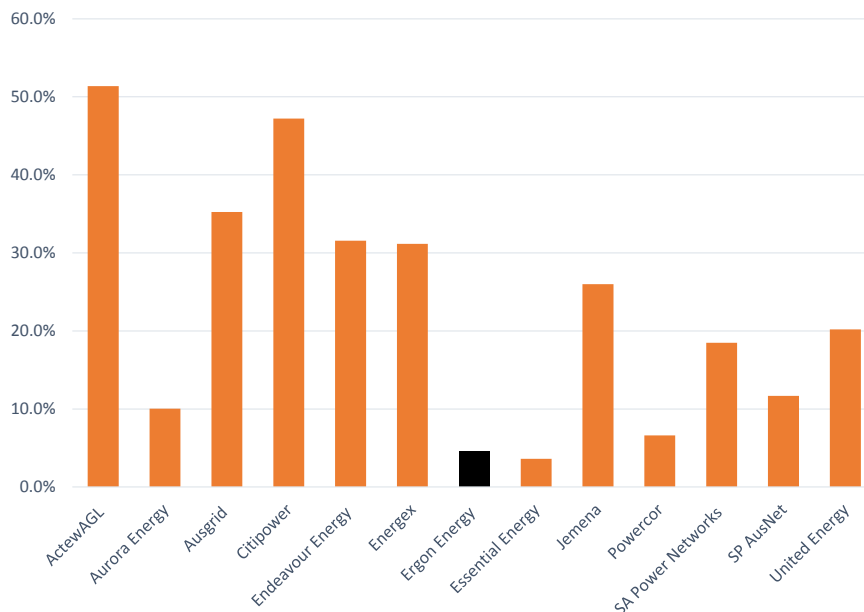
### 3.2.1 Implications for benchmarking

The international database does not allow the same comparison so it is difficult to draw conclusions as to whether Ergon's relatively extreme position in the Australian data results in bias in the econometric analysis. This uncertainty is itself problematic given the reliance that the AER places on the quantitative operating cost benchmarking for revenue control purposes.

### 3.3 Network characteristics

Network reliability is also partially affected by whether a distribution network has a large proportion of overhead wires, which are more susceptible to severe weather events, such as storms and bushfires, than underground cables. Underground cables are more expensive to construct, thereby resulting in a higher capital cost per circuit km, but generally can be expected to have lower maintenance costs over their life. As noted above, underground cables are also likely to contribute to higher network reliability. Figure 9 indicates that the underground proportion of Ergon's network is at the low end of the spectrum across all Australian DNSPs. Figure 10 shows that it is also at the extremes in the international database, at less than 5%. This reflects the fact that it is one of the largest, lowest density rural networks in the sample.

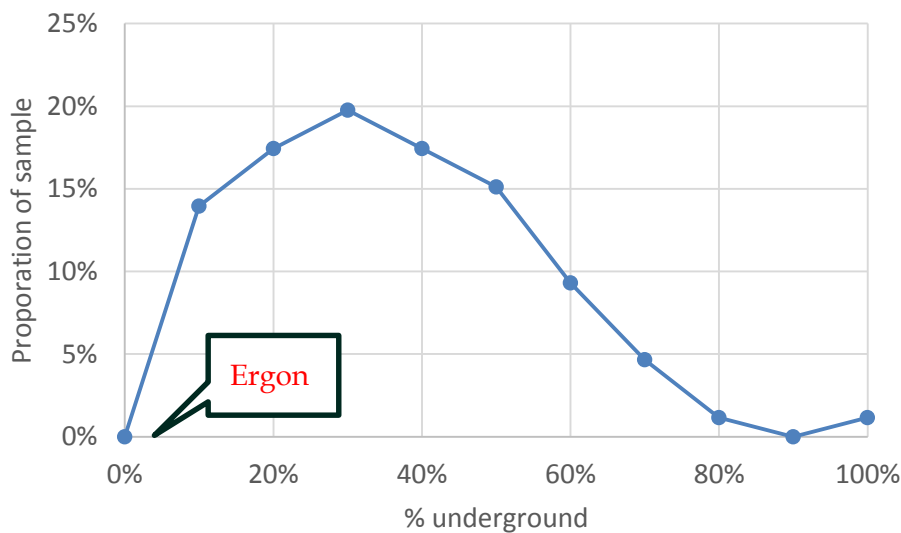
**Figure 9. Percentage of underground network**



**Note:** This data is based on a 5 year average

**Data source:** Various DNSP Benchmarking RINs

**Figure 10. Proportion of underground cable**



**Source** Synergies based on AER published data collected by Economic Insights

### 3.3.1 Implications for benchmarking

From a statistical perspective Ergon is an outlier; Ergon is ranked 82 out of 86 DNSPs on this measure (using the large database).<sup>19</sup> For reasons set out above, even though the Economic Insights models include this variable as an adjustment factor in their models, Synergies does not consider that their approach accurately assesses the impact on efficiency. Their models are flawed in this regard and likely to systematically under-estimate the costs associated with very low levels of undergrounding. Accordingly, the AER should not rely upon these benchmarking models to assess Ergon's controllable operating cost inefficiency.

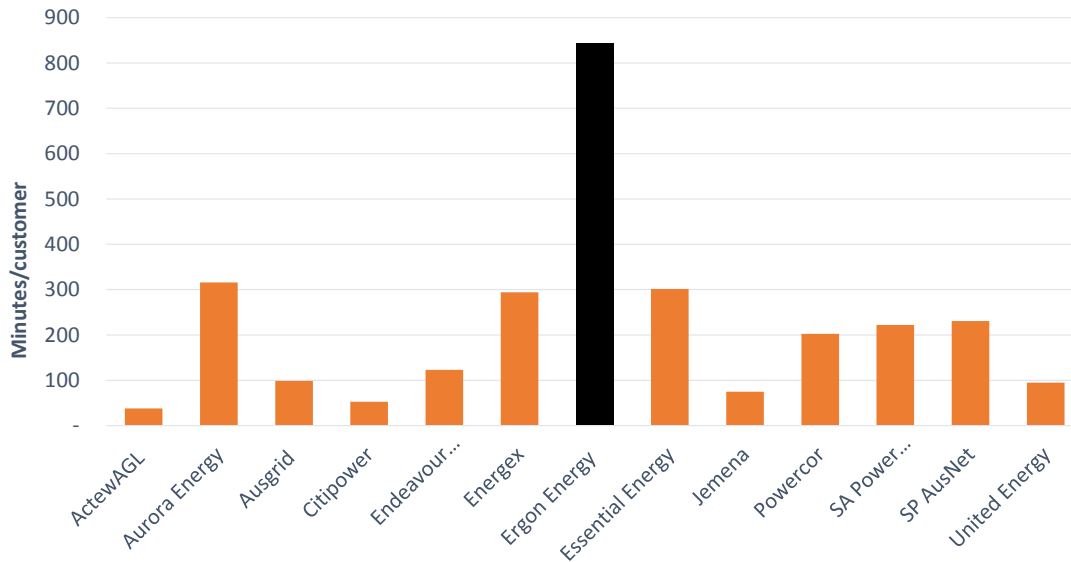
## 3.4 Network reliability and design choices

Relatively sparsely populated networks provide significant challenges for achieving reliability and service quality targets. Longer distribution lines are more prone to failure than shorter lines, and it takes longer to identify, travel to and fix the fault. Network reliability is a performance-related variable over which a DNSP is generally subject to legislative and/or regulatory obligations limiting the discretion that a DNSP has over the standard to which it builds its network. Figure 11 indicates that Ergon's whole-of-network reliability, as measured by unplanned outage minutes per customer (SAIDI) including

<sup>19</sup> Economic Insights developed a number of different international databases which differed in terms of which DNSPs were excluded, primarily on the grounds of size. In most of this analysis Synergies adopted the large database with the fewest deletions. The choice over the database makes small differences to the reported efficiency scores but does not materially change the overall results.

major event days (MEDs) is in excess of 800 minutes, close to three times the level experienced by the other DNSPs.

**Figure 11. Unplanned SAIDI including MEDs**

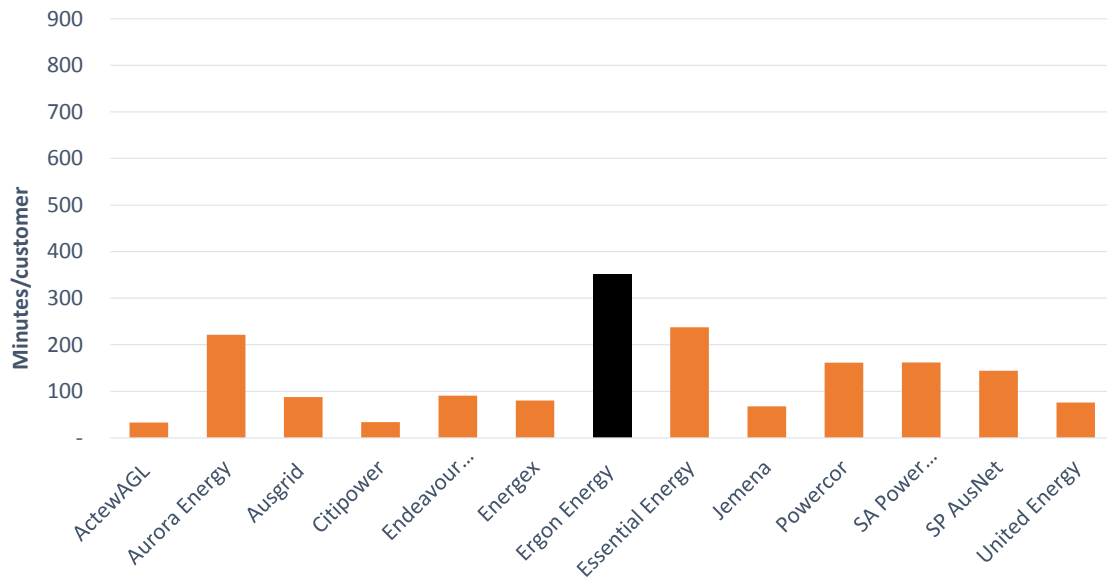


**Note:** This data is based in a 5 year average

**Data source:** Various DNSP Benchmarking RINs

Adjusting for major event days (MEDs) shows, in part, the impact of extreme events (such as storms and severe floods) on network performance (see Figure 12). It is apparent that half of Ergon's network interruptions are the result of major event days, which is unsurprising given the environmental factors that Ergon faces. It is apparent that Ergon is an outlier in the Australian context.

**Figure 12. Unplanned SAIDI excluding MEDs**

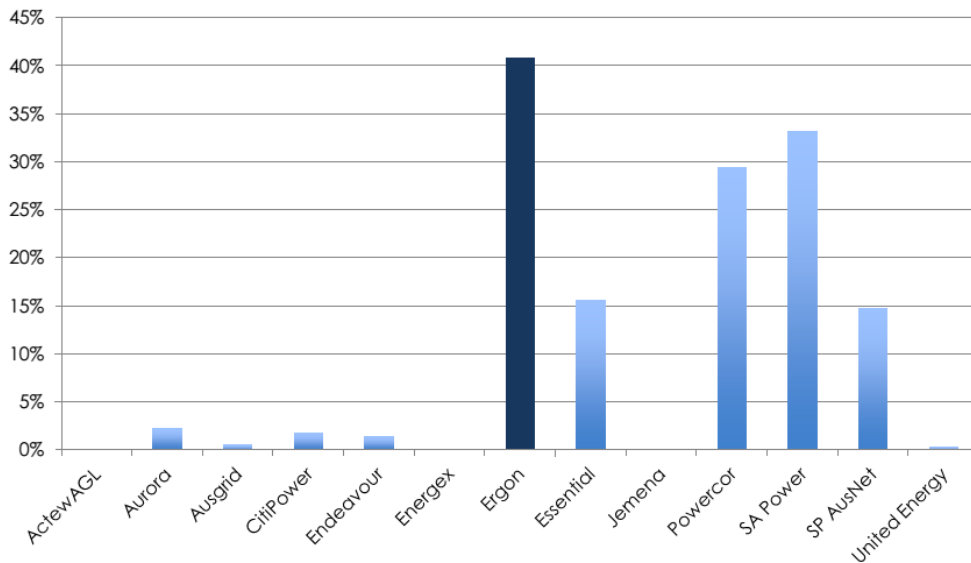


### 3.4.1 Single Wire Earth Return ('SWER')

SWER is a low capital cost approach to serving low density customer bases because of conductor savings. It results in less network redundancy, greater network failure rates and, by dint of the low density and its predominant use in remote rural areas, longer repair times (all other things being equal). Ergon has a substantially higher proportion of SWER than other Australian DNSPs (see Figure 13). These, collectively, translate into higher SAIDI figures and higher operating costs involved in network restoration.

The relationship between investment costs, operating costs to restore supply, SAIDI and efficiency is complex and subtle. It is possible that the pattern of high SAIDI and high SWER is efficient given the large distances, extreme weather and high incidence of major event days that Ergon exhibits. Ergon's performance in this regard may well be more efficient than, say, a low SAIDI in a low percentage SWER, high density network. However, elucidation of the efficiency consequences of this trade-off requires a more sophisticated analysis of capital operating costs substitution decisions, the costs of interrupted supply (particularly in an environment with increased penetration of embedded solar generation), than the AER has undertaken.

**Figure 13. Proportion of single wire earth return ('SWER') network**



Source: Ergon quoting Huegin

### 3.4.2 Implications for benchmarking

From the perspective of benchmarking, the SAIDI, SWER and operating cost trade-offs that Ergon has made are difficult to interpret. Synergies is concerned that the AER is not able to robustly determine the mix that is efficient using the benchmarking approaches that it has used in the NSW and ACT draft decisions.

SAIDI is represented as an output in Economic Insights MTFP analysis.<sup>20</sup> In the MTFP, a high SAIDI appears to lower outputs (as measured by the output index) relative to a low SAIDI. As result of the very high weight associated with supply reliability (a function of the high value placed on continuity of supply by customers), SAIDI substantially influences the efficiency scores. If there are aspects of the DNSPs technology that:

- predispose high SAIDI, such as single wire earth return, weather extremes, long distance between customers, long distance for repair teams to travel etc; and
- predispose high operating costs for repair (long distances to travel, for example)

then the MTFP analysis, as MPFP conducted by the AER will give rise to both a decrease in outputs and an increase in inputs. It is by no means clear that this will be offset by also including the length of distribution lines as an output. Rather, it is very likely that the MTFP and MPFP analysis undertaken by the AER seriously under-estimates the efficient level of operating costs necessary to maintain a target SAIDI for Ergon's network. It is not a reasonable solution to remove SAIDI as an output in the model because it undoubtedly the

<sup>20</sup> The results of the MTFP do not appear to be relied upon by the AER. Were the AER to rely upon the MTFP, this would give rise to a range of additional concerns beyond the scope of this paper.

case that Ergon expends considerable operating costs in order to maintain supply to its customers, the quantum of which differs from the expenditure of its Australian peers.

Unfortunately, SAIDI is not reported by the Ontario DNSPs, so SAIDI was not included in the SFA and related analysis. It is reported by the New Zealand DNSPs. Only two of these had higher minutes of interruption than Ergon, Top Energy and Powerco. Within the limits of the data that is available, Ergon is again something of an outlier, shedding doubt on whether it is accurately represented by either the index number or econometrically determined efficiency scores.

Finally, in so far as the PFPF and MTFP analysis is biased against networks that exhibit high SAIDIs and high costs to restore customer supply in the face of interruption, which is likely to be the case for Ergon, then any correlation between the opex MPFP efficiency scores and the SFA/OLS efficiency scores must be viewed as problematic. With such different models, it is not clear why their broad concordance should reinforce their collective validity.<sup>21</sup>

### 3.5 Operating environment factors

In an electricity economic benchmarking context, the 'operating environment' refers to those factors associated with providing network services that are generally beyond the control of managers but which materially affect the quantities of inputs needed to provide those services. Operating environment factors can have a large impact on network costs and measured efficiency.

The AER has shown some willingness to accept these, making a 10% adjustment to efficiency scores to adjust for them all, which it considers to be a conservative adjustment. However, Synergies is concerned that the impact of these factors on costs is, in Ergon's case, likely to be substantially larger than this figure (even supposing that the *ad hoc* adjustments the AER made in its draft decisions are robust).

#### 3.5.1 Climatic effects

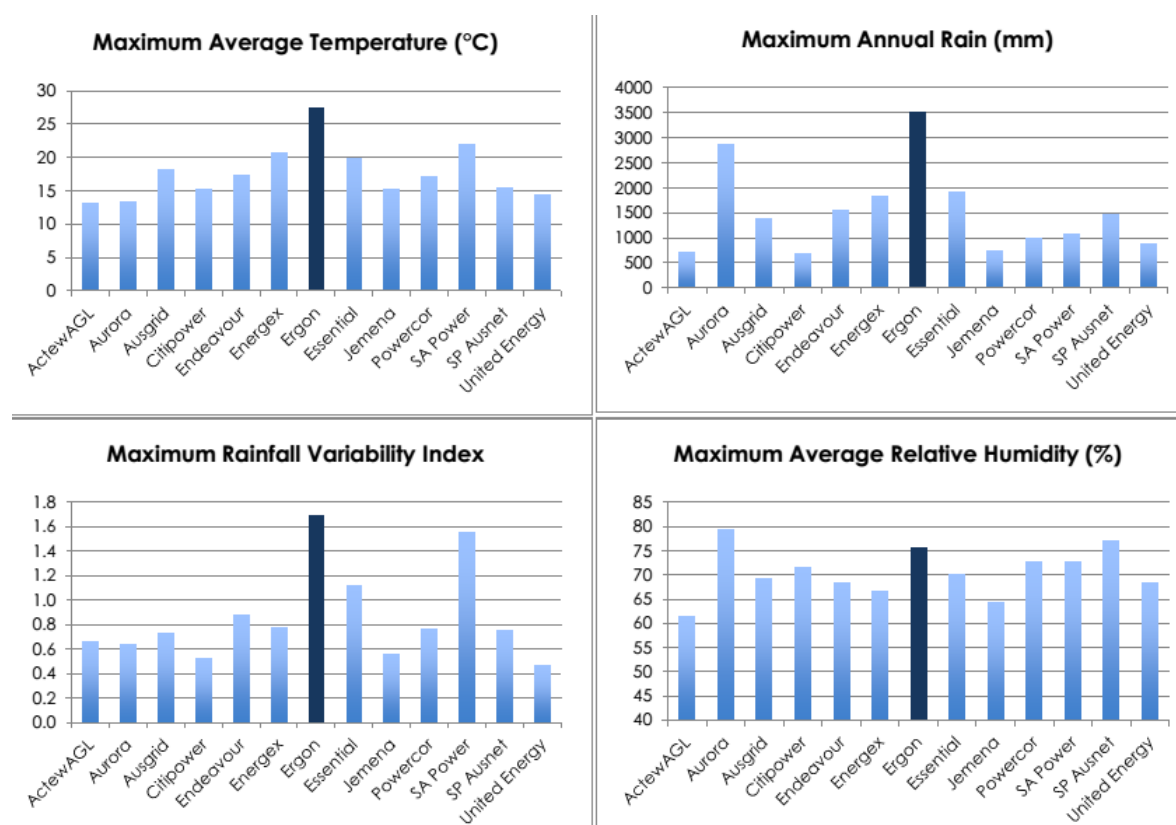
Weather conditions impact network costs and are clearly exogenous to the DNSPs. Days of extreme heat (in networks where there is a large cooling load) and extreme cold (in networks where the main source of space heating is electricity) place unusually high demand on distribution networks and networks must be built to handle such extremes or demand side measures implemented to manage them. Similarly, extreme wind can increase the likelihood of trees and windborne debris making contact with lines. Flooding can also give rise to higher network failure rates, increase fault correction times, and lead to changes in network design and disposition that have consequences for network operating costs. It follows that if one DNSP operates in an environment with greater weather extremes compared to

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<sup>21</sup> Ibid.

another, it would be at a relative disadvantage in unadjusted efficiency comparisons. Under a range of measures, Ergon has a uniquely difficult climate in Australia, being the only tropical DNSP (see Figure 14).<sup>22</sup> Nor does any other DNSP in the international sample face similar climatic conditions. Indeed climatic conditions in Ontario, which constitutes more than half the sample of DNSPs, are dramatically different from both Australia and New Zealand.

**Figure 14. Ergon's climatic conditions**



Source: Ergon

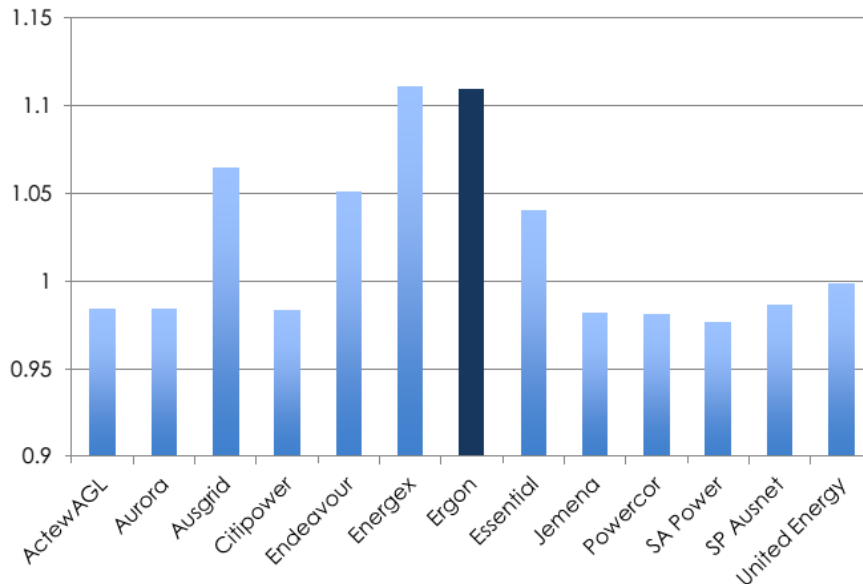
The benchmarking models adopted by the AER do not take account of such climatic conditions except indirectly, to the extent for example, that extreme temperatures impact peak demand through air conditioning.<sup>23</sup> By way of a tangible example, Ergon's tropical climate necessitates more frequent inspections of wood poles in the distribution network, more frequent replacement and more frequent refurbishment, which impact operating costs, depreciation and capital expenditure (see Figure 15). Those costs are then exacerbated by large distances which necessitate longer travel times for maintenance and inspection crews and/or additional maintenance depots. Similarly, supply interruptions due to inclement

<sup>22</sup> It is the only tropical DNSP in the international sample.

<sup>23</sup> Even then, the pattern of peak demand is very different between Ontario, which has severe winters, New Zealand which is more temperate, Australia which has a summer peak, and Ergon which is tropical.

weather, such as flooding (even when it does not amount to a major event day are likely to be more frequent.

**Figure 15. Rate of climate driven pole degradation across networks**



Source: Ergon quoting Huegin

### 3.5.2 Network characteristics

Synergies is concerned that the SFA and LSE analysis fails to take into account important characteristics of the DNSPs networks that influence operating costs. By way of example, the networks are simplistically represented in terms of network length and transformer capacity. Other network factors no doubt influence operating costs, for example:

- past substitution decisions between capital and operating costs, such as the SWER example identified above;
- the precise disposition of demand and supply within the network will materially affect costs in a manner that is unlikely to be fully captured by a customers per line km figure;
- similarly, decisions on the size, location and sophistication of maintenance sites within the network will affect the operating cost.

In Synergies view, these are likely to be increasingly important if the DNSPs are outliers in important respects.

## 3.6 Econometric support

Some quantitative support for the foregoing problems with the sample can be derived from an analysis of the coefficients from the SFA and LSE econometrics based on the Cobb

Douglas production function. Across the whole sample, the coefficients for outputs are all of the appropriate sign (positive) meaning that operating costs rise with increasing energy distributed, customer numbers, circuit length and peak demand. The negative coefficient for undergrounding is also appropriate indicating that operating costs decline with increased use of underground cables. Energy is not a significant determinant of operating costs. This accords with a reasonable view of distribution cost drivers.

**Figure 16. Coefficients for outputs from the SFE and LSE Cobb Douglas models**

|   |                        | All     | Australia | New Zealand | Canada   |
|---|------------------------|---------|-----------|-------------|----------|
| Linear regression with panel-corrected standard errors for Cobb Douglas (LSE) | Energy                 | 0.020 * | 1.400     | 0.405       | 0.005 *  |
|   | Number of customers    | 0.642   | 1.539     | 0.469       | 0.631    |
|   | Circuit length         | 0.136   | -1.348    | 0.273       | 0.125    |
|   | Ratched peak demand    | 0.147   | -0.645    | -0.252      | 0.194    |
|   | Proportion underground | -0.124  | 0.214     | 0.047 *     | -0.150   |
| Stochastic Frontier Analysis  | Energy                 | 0.018 * | 1.413     | 0.400       | -0.022 * |
|   | Number of customers    | 0.622   | 0.126 *   | 0.447       | 0.687    |
|   | Circuit length         | 0.105   | 0.180 *   | 0.264       | 0.061 *  |
|   | Ratched peak demand    | 0.189   | -0.734    | -0.193 *    | 0.219    |
|   | Proportion underground | -0.098  | -0.076 *  | 0.049 *     | -0.126   |

\*Denotes not significant at the 95% level.

If the models are run only on the data from individual jurisdictions, this is no longer the case. On the Australia only LSE model, the signs of the coefficients on circuit length and ratcheted peak demand are negative and significant indicating that operating cost *decline* as circuit length and peak demand rise. Similarly, undergrounding appears to *raise* costs. New Zealand also has a counterintuitive coefficient on peak demand. It is only when Canada is included that these anomalous results are reversed. Qualitatively similar results are seen in the SFA model, in which circuit length and undergrounding are not significant in the Australia model (although the coefficients signs are as expected), and the peak demand coefficient is again negative.

Although these sub-models are run on smaller data sets with the attendant statistical problems that this can cause, these results indicate that Australian DNSPs are very different from New Zealand and Ontario DNSPs. It further indicates that the results from the overall database cannot be relied upon to predict the efficiency of Australian DNSPs and that the Cobb Douglas production function used in these models is of doubtful validity. Accordingly, the AER should not rely upon these models to assess Ergon's controllable operating cost inefficiency.

### 3.7 Summary

This review is not meant as an exhaustive list of the detailed features of Ergon's business that give rise to higher operating costs than peers, and are which are compelled legislation, license conditions or by the particular features of Ergon's franchise area. Nor is it suggesting

that some of the operating cost impediments that Ergon faces are not, at least in part, captured by the AER's benchmarking (such as customer density).

Rather, we consider that a number of important characteristics of Ergon's businesses that are outside of its control (or only controllable over the network investment cycle) are insufficiently represented in the benchmarking work that has been performed. This is apparent from country-specific econometric analysis. This may arise because the data is not available across the Australian and international sample to understand the impact on costs (e.g. SWER), or because Ergon (and often all Australian DNSPs) is an outlier in the data and likely to be poorly represented in econometric analysis.

## 4 Concerns with the quantitative benchmarking

In Synergies view, the AER has failed to robustly show that the estimated inefficiency for each DNSP is controllable. Synergies is concerned that the AER has ignored or underestimated the fixed characteristics<sup>24</sup> of the networks that each DNSP operates. There is evidence (presented below) from the benchmarking and data that some of the calculated operating cost inefficiency is not controllable and is due to factors poorly or unrepresented within the SFA model. Accordingly, Synergies is concerned that the AER, by accepting these the results of the SFA, will force allowable revenues below the level required by a prudent operator to meet its obligations under the NEL and the NER.<sup>25</sup>

In this section, Synergies briefly summarises its concerns over the quantitative benchmarking. The main focus of the critique is on the econometric estimates of operating cost inefficiency using SFE as this is the analysis on which the AER appears to have placed most reliance.

### 4.1 Data issues

Before addressing the shortcomings of the econometric analysis, it is necessary to express some concern about the data which Economic Insights has used. In particular, Synergies is concerned that shortcomings of the data may have biased the results. Specifically:

- there are substantial differences in the data that is available from each jurisdiction – by way of example, reliability of supply data (SAIDI), length of high voltage circuits, distribution transformer capacity and value of the capital stock are not found in the Ontario data all of which limit the models that can be adopted;
- the Australian data has been ‘backcast’ to 2006 which, in some cases, is very likely to have introduced inaccuracies and, potentially, biases into the figures and models based on them; and
- there are inconsistencies within and between countries in the definitions of each variable, most notably in the definition of operating costs.

In respect of the latter, Economic Insights recognised this, stating that ‘we cannot be certain that we have exactly the same opex coverage’.<sup>26</sup> There are, for example, very precise and extensive headings for reporting operating costs in Ontario in contrast to much broader categorisations in Australia, suggesting the characterisation of operating costs across the

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<sup>24</sup> Fixed in the sense of being difficult or impossible to change without significant capital investment and/or reconfiguration of the network design and disposition.

<sup>25</sup> AER (December 2014) *Ausgrid draft decision* 12.

<sup>26</sup> Economic Insights (17 November 2014) *Economic Benchmarking Assessment of Operating Expenditure for NSW and ACT Electricity* DNSP 31.

two jurisdictions will be different. Even within Australia, it is unclear whether the opex data has been appropriately modified to adjust for different approaches to leasing capital goods or for subcontracting certain capital reliant services across the DNSPs.

Economic Insights included a country dummy to pick up these differences, but Synergies doubts that this approach is effective. For example, if the differences in reporting vary over time, as would seem likely, they will not be captured by the dummy variable which affects only the constant in the regressions. Nor can the dummy variable be expected to account for differences in opex reporting within each country.

In Synergies view, considerably more work should be undertaken to understand the differences in data reporting across the jurisdictions before relying upon econometric analysis based on that data for revenue control purposes.

## 4.2 Average efficiency scores

The SFA and LSE econometric analysis undertaken by Economic Insights only estimates the *average* level of inefficiency for each DNSP across the whole period. Hence, an efficiency score of 80% means that, on average, the DNSPs efficiency over the period 2006 to 2013 is 80%. It does not indicate whether a particular DNSP has become more efficient relative to the frontier over time, nor whether the absolute level of efficiency at the frontier has shifted over time.

It is possible that Australian DNSPs with low average efficiency scores from these measures have, in fact, exhibited substantial efficiency gains in later years. If this be so, then reducing 2013 operating costs by an amount equal to the average level of inefficiency over the study period would have the effect of reducing operating costs below the efficient level for that DNSP.<sup>27</sup>

In Synergies view, the results of SFA and LSE econometric estimates of efficiency should not be used to assess permitted reductions in operating costs without first determining whether the current extent of controllable inefficiency is consistent with the average level reported by these models.

## 4.3 The range of results across the models is excessive

The range of reported efficiency from Economic Insights SFA and LSE modelling<sup>28</sup> is large, ranging from 40% to 100% with an average (across Australian and overseas jurisdictions) of

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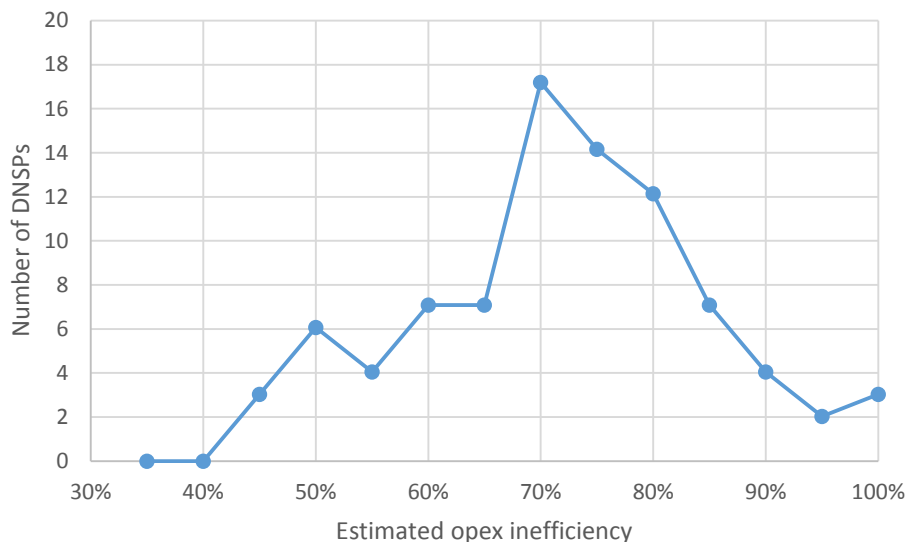
<sup>27</sup> The MTFP and operating cost MPFP analysis provide some information on rates of change of efficiency over time. However, Synergies does not believe that these results are comparable with the SFA and LSE results because of the substantial differences in the underlying production models.

<sup>28</sup> And also from their MTFP analysis.

approximately 71% (see Figure 17).<sup>29</sup> Broadly the same range of efficiency scores was observed in each jurisdiction in all three countries (see Figure 18).

In contrast, Frontier<sup>30</sup> conducted an analysis of the efficiency of total expenditure (investment and operating costs) of the UK distributors having regard to their customer density. They assessed total costs comprising, in broad terms, network investment and operating costs, which they termed totex. They expressly eschewed the use of a capital consumption measure (as used by Economic Insights in its MTFP analysis in deriving input cost shares) due to concerns over the data.<sup>31</sup> In contrast, the approach AER adopted an approach which focused solely on operating costs, ignoring capital expenditure in its entirety (in the SFA analysis which was ultimately relied upon).<sup>32</sup>

**Figure 17. Distribution of efficiency scores across the international data (SFA CD)**



It is beyond the scope of this report to analyse which of these approaches is preferable or gives better results. In the absence of totex analysis by AER it is difficult to do so. What is notable is that the efficiency range across the 14 UK DNSPs was much narrower than that reported by the AER across its international sample. Frontier reported a totex efficiency

<sup>29</sup> The MTFP analysis of Australian firms alone also resulted in a large range of more than 50%. In 2013, the best performer, Citipower (which serves the city of Melbourne only), used 13% fewer inputs, on a weighted quantity basis, than the next best performer, and was 29% better than the average, and 47% above the worst performer, Essential. In effect, on the basis that the MTFP model properly accounts for material environmental and related factors, the results suggest that Citipower uses half the level of inputs to serve its customers than does Essential.

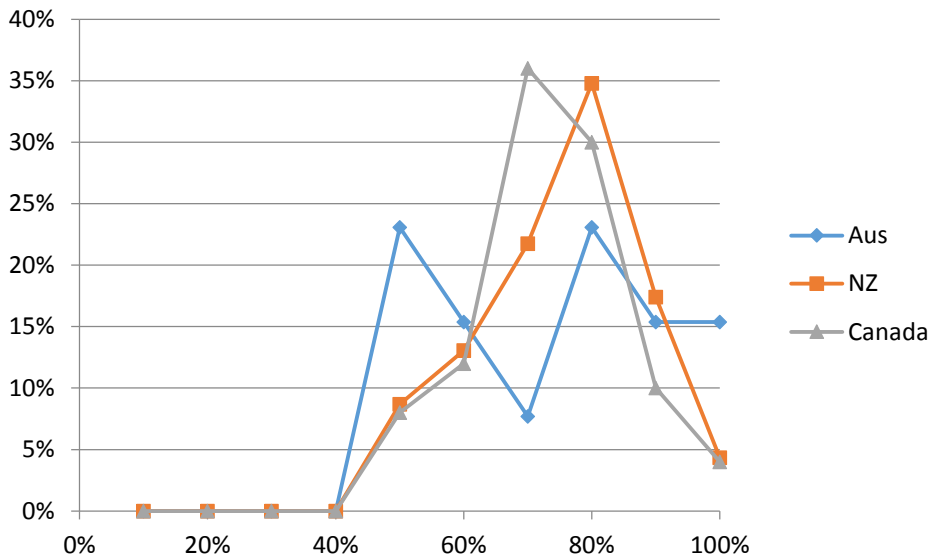
<sup>30</sup> Frontier (April 2013) *Total cost benchmarking at RIIIO-ED1 – Phase 2 report – Volume 1. A Report Prepared for OFGEM.*

<sup>31</sup> In Synergies view, those same concerns apply in respect of the AER's use of MTFP.

<sup>32</sup> Note that some components of capital stock (transformer capacity, line lengths etc) were included in the model, but not capital flows.

range of no more than 20% (i.e. the least efficient firm was only 20% less efficient than the most efficient firm).

**Figure 18. Distribution of efficiency scores across the international data by country**



Since these efficiency scores have been made using different underlying models and definitions of expenditure, it is unsurprising that they give qualitatively different results. It is, however, surprising that:

- the range of efficiency scores across Australia, New Zealand and Ontario DNSPs are much larger than the UK range, even though all these jurisdictions have implemented incentive-based models of economic regulation<sup>33</sup> that have been in place for a considerable length of time;
- the average efficiency score across the international sample, at around 70%, is lower than the worst UK efficiency score;

<sup>33</sup> It is notable that New Zealand has operated a light-handed model of regulation that should have results in considerable payoffs to the business owners from reductions in operating costs. It is therefore particularly surprising that these businesses exhibit such a wide range of operating efficiency scores.

It is possible that the UK distributors are much more efficient than their international counterparts perhaps by reason of their longer tenure under economic regulation, or by reason of consistent regulatory failure in other jurisdictions. In Synergies view, it is more likely that the benchmarking approach adopted by the AER has failed to:

- identify features of the DNSPs in the international database that affect whether operating costs are controllable; and/or
- fully recognise the extent to which certain characteristics of the DNSPs affect operating costs, which could extend to customer density, scale; and/or
- due to the limitations of the data and techniques, developed a production function (the Cobb Douglas production function) that does not effectively represent the production choices that DNSPs can and have made.

#### 4.3.1 Econometric support

It is accepted by the AER that not all of the environmental factors that each DNSP faces (and which affect operating costs) are represented in the econometric models. This is the rationale behind some of the *ad hoc* adjustments to the efficiency scores apparent in the draft decisions. The models developed by Economic Insights include few environmental factors, taking no account of, *inter alia*, climate, terrain, vegetation, bush fire mitigation, age of assets, network complexity and design, all of which can be expected to influence operating costs.

These unexplained causes of inefficiency (which the firm sees but the observer does not) are termed latent heterogeneity, namely heterogeneity that is not captured by an explanatory variable but stems from unknown origin and manifests itself as differences in the reported scores. Economic Insights tried to explain some of this latent heterogeneity through country dummy variables. These suggested that Ontario DNSPs were at a 16% operating cost disadvantage to Australian DNSPs, and that New Zealand DNSPs were at a 5% operating cost disadvantage to Australian DNSPs. However, this approach is somewhat limited as there are likely to be non-country specific sources of latent heterogeneity, there are no reasons to believe latent heterogeneity is constant across time, and the dummies are likely to conflate latent heterogeneity with inadequacies or inconsistencies in the data and, perhaps, other factors such as exchange rate assumptions.

The *xtfrontier* Stata command used by Economic Insights to estimate its SFA model provides only for the estimation of a normal-truncated normal models with time-invariant inefficiency. The *sffpanel* command allows for a wider range of time-varying inefficiency models accommodating both inefficiency location and scale effects.<sup>34</sup> Under these model

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<sup>34</sup> See Belotti F et al. (2012) Centre for Economic and International Studies, "Stochastic frontier analysis using Stata" *Research Paper Series* 10 12.

formulations, the operating cost efficiency scores of all the Australian DNSPs appear to be much higher, at above 95%.<sup>35</sup>

#### 4.3.2 Implications

The foregoing serves to indicate the sensitivity of the efficiency scores to model formulation. It is not meant to identify which of the various model formulation is preferred. In Synergies view it nevertheless indicates that the AER may have systematically and substantially over-estimated the controllable operating cost inefficiency of the NSW and ACT DNSPs by over-reliance on (essentially) a single quantitative measure of operating cost efficiency. It is likely that the same approach applied to Ergon would result in similar or larger overestimates. On that basis, Synergies believes that the estimates of controllable inefficiency derived from the Economic Insights models are likely to significantly understate the extent to which adjustments to efficiency scores are appropriate, particularly for revenue control purposes.

### 4.4 Correlation between opex and capex partial productivity

Synergies is concerned that aspects of each of the DNSPs that are not represented by the relatively gross features of the DNSPs included in the Economic Insights databases and models are important determinants of operating costs. These are likely related to the characteristics of the network that DNSP operates, in turn determined in large part by the environment each faces.

Figure 19 shows the relationship between the operating cost MPFP scores of the DNSPs and the capital MPFP scores, derived from the MTFP analysis. It indicates that capital MPFP ranges between 1 and 1.8, indicating that the most productive DNSP uses just over half the capital to produce equivalent outputs as does the least efficient. It also shows a qualitatively similar range of operating cost MPFP.<sup>36</sup>

It is apparent that there is a strong relationship between capital and operating cost MTFP. One might say that capital MTFP 'explains' 43% (the  $R^2$  of the linear relationship between them in 2013) of the observed variation in operating cost MTFP. The same basic trend can be seen over the full dataset from 2006 to 2013.

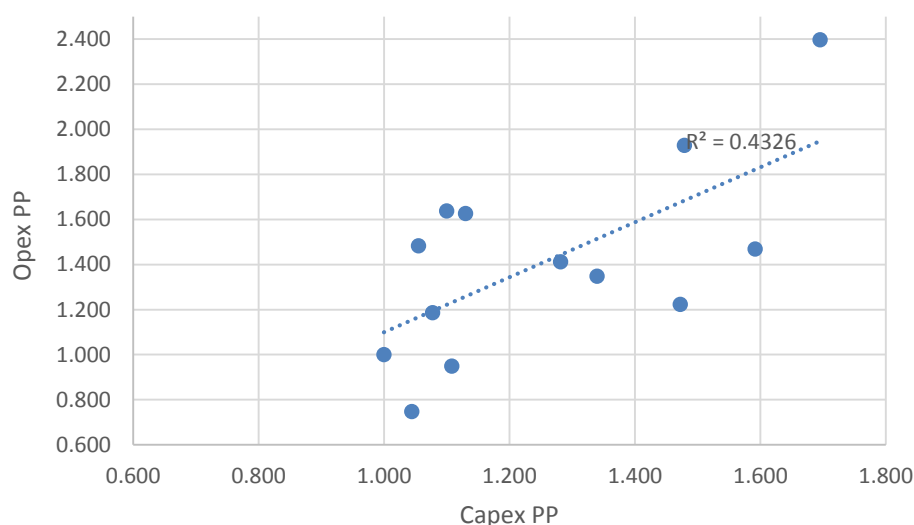
It is possible to draw a number of inferences from this. It shows that that operating costs and capital costs are likely to be complementary for distribution businesses; as a DNSP increases the number and length of transmission lines that it operates, it also increases the number of employees it needs to maintain and operate them. In so far as there are

<sup>35</sup> See Ausgrid Revised Proposal (January 2015) Attachment 1.05 p 21 for a summary of results for these model formulations performed by Frontier. Synergies has not verified these results.

<sup>36</sup> Capital in the MTFP model is represented by all of the capital stock of the DNSP (i.e. its full quantity of lines, transformers and other assets) with a cost share equal to the user cost of capital associated with each asset class. Operating costs are represented, in effect, by a hours of labour quantity figure and a

opportunities to substitute capital for labour, they are likely to relate to capital equipment such as automation and control equipment that represent a relatively modest proportion of the DNSPs capital base. These results suggest that, if a DNSP has invested in twice as many assets to produce a unit of output than a counterpart (i.e. 100% more than its counterpart), it is likely that it will require, on average, 43% more staff per unit of output to operate and maintain those assets.

**Figure 19. 2013 relationship between capital and opex partial productivity**



This has important implications for the interpretation of the controllability of operating costs as revealed by the operating cost MPFP analysis. It indicates that operating costs are not controllable in the manner suggested by the operating cost MPFP figures alone. Rather, the nature of the capital stock limits the extent to which operating costs can be reduced to the rate at which excessive capital can also be reduced, i.e. over the lifetime of investments rather than the single regulatory cycle. In so far as the amount of capital is excessive (i.e. inefficient), a matter which the AER has not addressed in its draft decisions, it remains the case that complementary operating cost inefficiency can only be efficiently reduced at a pace determined by changes in capital efficiency.

Based on this, it seems unlikely that operating cost MPFP scores solely represent controllable inefficiency. This is consistent with the view set out above that latent heterogeneity due to unobserved determinants of costs have been mistaken for controllable efficiency. It is much more likely, in Synergies view, that they represent, to a significant degree, the costs needed to operate the DNSPs network as it is currently constituted. The constitution of the network is likely to reflect a range of factors such as terrain, the disposition of supply and demand, customer density, a license or regulatory condition necessitating a certain reliability margin across the network. For these reasons, apparent operating cost inefficiency is likely to be in part, perhaps in large part, uncontrollable.

#### **4.4.1 Extending the analysis to the international data**

The international database collated by Economic Insights does not have the same level of detail on the capital of the DNSPs as the RIN data for the Australian DNSPs. Hence it is not possible to undertake similar analysis of the relationship between operating cost and capital partial productivity across the wider sample.

There is just sufficient data across the Australian and New Zealand DNSPs to superficially investigate whether a similar relationship might exist as that observed in the Australian operating and capital MPFP results. The Australian and New Zealand data does include the current value of each DNSP's capital stock. This is not an exact proxy for the capital quantity index used in the MTFP analysis, but is likely to be correlated to at least a limited degree with the quantity of assets that each DNSP owns and operates. If one is further willing to assume that:

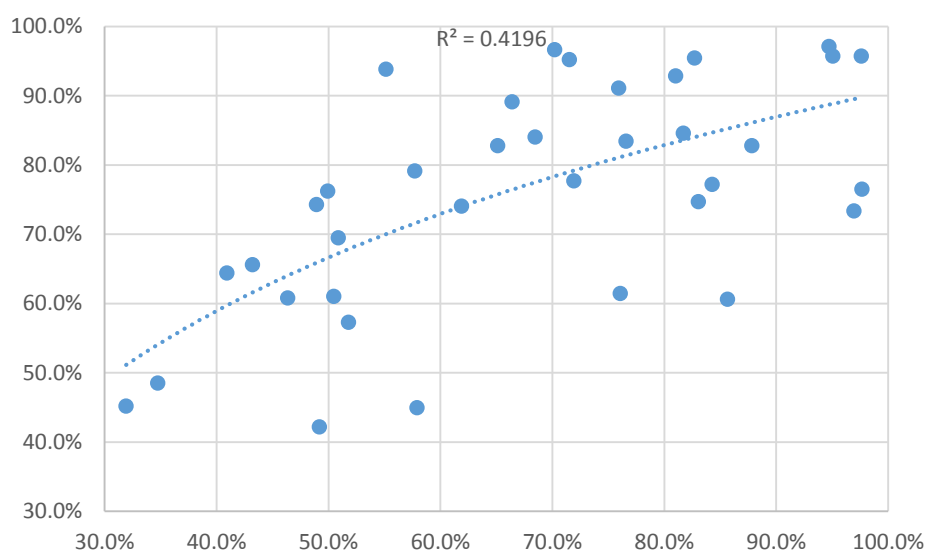
- the networks are of similar age;
- individual assets are of similar costs to each DNSP;
- depreciation lives, WACC and valuation approaches are similar; and
- PPP currency conversion places the valuations onto a comparable basis

then this value of the capital stock will correlate well with measures of capital consumption that may be appropriate for measurement of capital productivity. Using this data (log of the value of capital stock), with the other data used in the model, it is possible to calculate a simple SFA CD capital productivity model (similar to the opex SFA CD model but with log capital rather than log opex as the dependent variable). Figure 20 plots the relationship between the capital and operating cost productivity results using this approach.

Synergies does not suggest that this analysis is robust as it rests on a number of strong assumptions and is tainted by the data problems identified earlier in this section. However, it does suggest that operating cost and capital productivity are related in the international sample consistent with the results of the MTFP.

The AER's benchmarking of operating costs, at least as it relates to the quantum that can be efficiently achieved by each DNSP, is likely to be deficient because it has failed to robustly determine the relationship between a DNSPs capital stock and operating cost, beyond the very high level descriptors such as output mix, density and, to a very limited extent, complexity.

**Figure 20. Relationship between opex and capex productivity (SFA CD models)**



Source: Synergies estimates

#### 4.4.2 Implications

In Synergies view, this suggests that controllable operating cost inefficiency is influenced by a considerable degree by unobservable factors that are nevertheless managed by the DNSP in its choice of network investments and its legacy capital stock. The MTFP analysis has a more comprehensive representation of each DNSPs capital stock than the SFA and LSE benchmarking (in which it is rudimentary at best), and suggests that this is an important determinant of controllable costs. The SFA and LSE benchmarking is, in Synergies view, inherently unreliable if it does not represent the capital employed by each business with sufficient sophistication.

### 4.5 Data envelopment analysis ('DEA')

There are other economic measures of efficiency that are better able to take account of the characteristics of the DNSPs in assessing controllable efficiency. DEA, which the AER appears to have rejected due to the data intensity of the approach, effectively derives the production technology or production function from that which is observed in the sample of businesses or firms that are examined. DEA uses linear programming to determine a frontier of efficient firms that may differ in terms of their mix of inputs and outputs. It then estimates the distance of each firm from the nearest point on that frontier. It therefore tends to compare firms with similar mixed of outputs and inputs. It does not impose a particular form (such as the Cobb Douglas or translog) on the firm's production technology. DEA can assume constant or variable returns to scale. Under the latter DEA can evaluate at the level of the individual firm the extent to which estimated efficiency is controllable or related to scale effects (in which case it is likely to be uncontrollable).

Due to its reliance on linear programming and its assessment of production technologies from the actual observations, it typically requires a large database and can be quite sensitive to small change in that database.

There is sufficient data from Australian and New Zealand DNSPs published by the AER to construct a working DEA model with multiple inputs and outputs. The resultant model is not ideal because, while there are 327 separate observations, they comprise only 40 DNSPs, 13 from Australia and 27 from New Zealand, with multiple years of data from each. Synergies has not had time to explore the ramifications of these data shortcomings, but advises they should be considered before finalising any conclusions.

Synergies explored a number of different models which produced broadly consistent results. A three output (customers, Peak MW, circuit length), three input (operating costs, MVA of transformer capacity and user cost of capital associated with distribution lines) gave the results set out in Figure 21 below.

**Figure 21. Sample from initial 3 input, 3 output DEA model (averages over all years)**

| Organisation | Overall technical efficiency | Controllable efficiency | Pure technical efficiency | Scale efficiency | Nature of scale returns** |
|--------------|------------------------------|-------------------------|---------------------------|------------------|---------------------------|
| ACT          | 52%                          | 53%                     | 53%                       | 99%              | CRS                       |
| AGD          | 57%                          | 100%                    | 100%                      | 57%              | DRS                       |
| CIT          | 92%                          | 93%                     | 94%                       | 98%              | CRS                       |
| END          | 71%                          | 91%                     | 93%                       | 79%              | DRS                       |
| ENX          | 69%                          | 94%                     | 97%                       | 73%              | DRS                       |
| ERG          | 68%                          | 91%                     | 98%                       | 74%              | DRS                       |
| ESS          | 79%                          | 89%                     | 97%                       | 89%              | DRS                       |
| JEN          | 84%                          | 85%                     | 85%                       | 99%              | CRS                       |
| PCR          | 92%                          | 99%                     | 99%                       | 93%              | DRS                       |
| SAP          | 87%                          | 96%                     | 96%                       | 90%              | DRS                       |
| SPD          | 80%                          | 85%                     | 86%                       | 93%              | DRS                       |
| TND          | 75%                          | 82%                     | 82%                       | 91%              | DRS                       |
| UED          | 91%                          | 96%                     | 97%                       | 95%              | DRS                       |
| NZ*          | 85%                          | 87%                     | 88%                       | 97%              | CRS                       |

\*The New Zealand scores are the arithmetic averages across all New Zealand DNSPs.

\*\* CRS = constant return to scale, DRS = decreasing returns to scale, IRS = increasing returns to scale.

A number of observations can be made from these results. The overall efficiency scores of the Australian DNSPs are qualitatively similar to the efficiency scores reported by the AER, and the most efficient Australian DNSPs remain Citipower and Powercor. The overall levels of inefficiency appear to be less than those estimated using opex MPFP, SFA or LSE<sup>37</sup> which could be a consequence of the size of the model relative to the size of the available database.<sup>38</sup>

<sup>37</sup> Noting that the DEA efficiency score relates to both opex and aspects of capital.

<sup>38</sup> As the number of inputs and outputs approaches the limits of the degrees of freedom supported by the data, so the efficiency scores under DEA tend to 100%.

The most significant difference is the *cause* of the efficiency which for some of the Australian DNSPs including Ergon is related to scale effects (decreasing returns to scale) which are outside of the control of the business. That is, using this model Ergon's controllable inefficiency is approximately 2%. Synergies does not suggest that this is a precise or robust estimate of Ergon's controllable inefficiency having had insufficient time to determine which if any of the DEA models best represent DNSP performance. Rather, the figure illustrates that different models give very different estimates of controllable inefficiency, in most cases substantially below the levels estimated using the models preferred by Economic Insights.

Noting the limitations of the data and approach, this DEA analysis is consistent with the analysis of latent heterogeneity presented above. It suggests that the operating cost inefficiency estimated by Economic Insights and relied upon by the AER substantially over estimates the extent to which it is controllable. It further suggests that operating cost reductions of the magnitude suggested by the AER will, in some cases, result in substantial decreases in efficiency, contrary to the objectives of the NEL.

#### **4.5.1 Implications**

In the foregoing analysis, Synergies has identified that the differences in SFA and LSE model formulation result in different estimates of DNSP efficiency. Some of these models indicate that controllable operating cost inefficiency is less than 5%. DEA provides an alternative means of determining comparative efficiency using an underlying model of each firm's production technology based on that observed in the sample. The DEA model presented above reinforces this conclusion, suggesting that Ergon's controllable inefficiency may be as low as 2%.

## **4.6 Conclusions**

In Synergies view, the AER's benchmarking cannot be relied upon to determine the extent of controllable operating cost inefficiency at Ergon or other Australian DNSPs. It is likely that the benchmarking by Economic Insights, upon which the AER relies has:

- failed to properly ensure that the data from different jurisdictions is consistent, and in so far as this is not the case, failed to robustly adjust for the misalignment in its models;
- estimated average efficiency scores over time which do not indicate the current level of DNSP efficiency; and
- failed to properly differentiate between what is controllable operating cost inefficiency and uncontrollable inefficiency by failing to robustly model the disparate factors that impact costs, including scale and the characteristics of each DNSPs actual network.

As a result, the AER's benchmarking is likely to have over-estimated the level of controllable inefficiency at Australian DNSPs which, using reasonable alternative models, does not appear to be great.

## 5 Conclusions

In December 2014, the AER released a series of draft decisions concerning the allowable revenue for NSW and ACT distribution network service providers ('DNSP'), ActewAGL, Ausgrid, Endeavour and Essential Energy. In 2015 the AER will release draft decisions on the Queensland DNSPs, Ergon and Energex.

### 5.1 Use of benchmarking

The NSW and ACT draft decisions were notable in a number of respects, but particularly for their reliance on quantitative economic benchmarking techniques in order to assess the extent of operating cost efficiencies at each of the DNSPs. The economic benchmarking was undertaken by Economic Insights, a respected and experienced firm in the field of economic benchmarking. Synergies has a number of significant concerns with this benchmarking and with AER's reliance upon it.

It is apparent that the AER considers the analysis undertaken by Economic Insights to be a reasonable basis on which to make its draft decisions over the extent of required operating cost reductions. The AER has focused on Economic Insights' analysis of operating cost efficiency derived using SFA of SE Australian, New Zealand and Ontario DNSPs, modified with a series of *ad hoc* adjustments to be conservative and to reflect cost drivers not reflected in the econometric models.

In Synergies view, the AER's economic benchmarking is a constructive step in helping to further understand the value of such approaches for determining the efficiency of Ergon and the other SE Australian DNSPs. However, as conducted it is insufficiently robust to support the draft determinations made by the AER.

### 5.2 Implications for revenues

The AER appears minded to require an immediate reduction to the levels deemed efficient by this benchmarking. Synergies has significant concerns about this approach. Even if the economic benchmarking reliably indicated the extent of *controllable* operating cost inefficiency at each DNSP, which Synergies does not consider to be the case, there are likely to be substantial adverse consequences for DNSPs and for their customers from the disruption that will result from imposing an immediate and large reduction in allowable revenues. These disruption are, themselves, sources of considerable inefficiency and certainly contrary to the long-term interests of customers.

Ergon has an estimated operating cost efficiency score of 48% under Economic Insights' Cobb Douglas SFA model. For what it termed prudency reasons, Economic Insights estimated a frontier from the most efficient five Australian DNSPs at 86%. If the AER allows a 10% shift in the frontier to account for un-modelled factors, consistent with its approach

for NSW, then the AER is likely to determine that Ergon should reduce its operating costs by approximately 28% (i.e. 86% minus [48% plus 10%]).

Synergies does not consider that the AER has robustly determined the extent of controllable operating cost inefficiency at the NSW and ACT DNSPs. Nor would the approach set out in the draft decisions accurately determine the extent of controllable operating cost inefficiency at Ergon.

### 5.3 Characteristics of Ergon and the Australian DNSPs

Synergies is concerned that the database that Economic Insights has used fails to fully reflect the characteristics of Australian DNSPs generally, and Ergon particularly, in the non-Australian sample of DNSPs which predominate. As a result, Synergies considers that Economic Insights' econometric estimates of Ergon's efficiency based on this database, at least in so far as they reflect *controllable* efficiency, are deficient and an insufficient basis for regulatory revenue determinations.

Australian electricity distribution and transmission networks are characterised by widely differing network sizes, customer numbers and disposition, landscape and environment, energy consumption per customer, maximum demand and climatic conditions. In undertaking any form of economic benchmarking analysis, it is important to take into account these differing network characteristics because they will have an effect on measured productivity. Failure to do so can result in legitimate cost differences between service providers, driven by these factors, being mistaken for inefficiencies. In this regard:

- Ergon is one of the largest DNSPs in terms of the length of route line kms, which reflects the huge geographical area that it has to cover. Only Essential is larger. What is equally important is that Ergon and Essential are the largest two DNSPs in the international database on which the SFA analysis relies. Ergon is fully 36% larger than the next largest DNSP (Hydro One Networks in Ontario) and is 13 times larger than the average DSNP;
- Ontario and New Zealand, which together represent 85% of the data sample are almost all significantly smaller than 50,000km, the only exceptions being Hydro One Networks in Ontario, and Vector and Powerco in New Zealand. In contrast, only 3 Australian DNSPs (Citipower, ActewAGL and Jemena) are smaller than 50,000km. The Australian DNSPs are, on average, 8 times larger than the New Zealand DNSPs and 11 times larger than the Ontario DNSPs;
- Ergon appears to be something of an outlier in terms of customer density, with one of the lowest in Australia and in the international sample. The average density is around 39 customers per kilometre, Ergon is close to 4;

- Ergon's network has one of the lowest proportions of underground cables in Australia and amongst international peers, predisposing it towards higher operating costs;
- Ergon's whole-of-network reliability, as measured by unplanned outage minutes per customer (SAIDI) including and excluding major event days (MEDs) is the highest in Australia, and one of the highest in Australia and New Zealand. The data is not reported for Ontario. Ergon also has the highest proportion of low capital cost but less reliable single wire earth return ('SWER') lines. These are unrepresented in the operating cost efficiency models; and
- Ergon faces a unique climate which imposes significant operating costs, such as requirements to more frequently inspect and replace distribution poles.

Due to these and other unique features, there is a very high risk that Ergon is, from a statistical perspective, an outlier by Australian standards and most Australian DNSPs are themselves outliers when compared with New Zealand and Ontario (even supposing the Australian and international data are collected on the same basis, which we do consider to be the case). The paucity of international observations with characteristics similar to the Australian DNSPs, the tendency for Australian DNSPs to be found at the extremes of the sample, and the preponderance of international DNSPs in the data casts doubt on whether the Economic Insight models accurately represent Australian DNSPs in general, let alone on Ergon with its unique characteristics even by Australian standards.

There is econometric support for this conclusion. SFA and LSE analysis of DNSPs on a country by country basis suggests that the coefficients derived from the international database and from an Australian only database are considerably different. Hence Synergies does not consider that Economic Insights approach accurately assesses the efficiency of DNSPs at the extremes of the distribution and is flawed in this regard. Accordingly, the AER should not rely upon this benchmarking to assess Ergon's controllable operating cost inefficiency.

## **5.4 Concerns with the quantitative benchmarking**

In Synergies view, the AER has not robustly shown that its estimates of inefficiency for each DNSP represent controllable inefficiency. Synergies is concerned that the AER has underestimated or failed to take into account the characteristics of the networks that each DNSP operates. There is also evidence from the benchmarking and data that some of the calculated operating cost inefficiency is not controllable and is due to factors poorly or unrepresented within the SFA model.

#### **5.4.1 Data problems**

Synergies is concerned that the database that Economic Insights has prepared used is flawed. In particular data items are inconsistent across jurisdictions, data definitions are different across jurisdictions, Australian DNSP data has in some cases been estimated rather than collected, and within Australia (and perhaps elsewhere) data may not have been collected in a consistent fashion. Economic Insights included a country dummy in its models in an attempt to correct for these differences, but Synergies doubts that this approach is sufficiently effective.

#### **5.4.2 Average efficiency scores**

The SFA and LSE econometric analysis undertaken by Economic Insights only estimates the *average* level of inefficiency for each DNSP across the whole period. It does not determine whether a particular DNSP has become more efficient relative to the frontier over time, nor whether the absolute level of efficiency at the frontier has shifted over time. Accordingly, it is not possible to determine whether the efficiency scores from the models are indicative of the current level of efficiency at each DNSP. The results of SFA and LSE econometric estimates of efficiency should not be used to assess permitted reductions in operating costs without first determining whether the current extent of controllable inefficiency is consistent with the average level reported by these models.

#### **5.4.3 The range of results across the models is excessive**

The range of reported efficiency from Economic Insights SFA and LSE modelling is large, ranging from 40% to 100% with an average (across Australian and overseas jurisdictions) of approximately 71%. Broadly the same range of efficiency scores was observed in each jurisdiction in all three countries (see Figure 18). It is much greater than the range of efficiencies estimated in some other studies, for example a recent total cost efficiency study from the UK.

Synergies notes that the range of efficiency scores is very sensitive to the precise model formulation that is used. There are some SFA formulations that can identify unexplained causes of inefficiency (which the firm sees but the observer does not), termed latent heterogeneity. Some of these models indicate that Australian DNSPs have efficiency scores over 95%, markedly different from those estimated by Economic Insights.

Alternative measures of efficiency, such as DEA also indicate that controllable inefficiency at some of the Australian DNSPs is lower than the Economic Insights results suggest. For example, a three output (customers, Peak MW, circuit length), three input (operating costs, MVA of transformer capacity and user cost of capital associated with distribution lines) DEA model comprising Australian and New Zealand data indicated that Ergon had a technical efficiency score of 98%, indicating controllable inefficiency of 2%.

#### **5.4.4 Operating cost efficiency and capital**

Synergies is concerned that aspects of each of the DNSPs that are not represented by the relatively gross features of the DNSPs included in the Economic Insights databases and models are important determinants of operating costs. These are likely related to the characteristics of the network that DNSP operates, in turn determined in large part by the environment each faces.

The impact of a DNSPs network, as reflected in the quantity of capital that it deploys, for its operating costs is apparent from the MTFP analysis undertaken by Economic Insights. Opex efficiency is strongly correlated with capital efficiency. This shows that operating costs and capital costs are likely to be complementary for distribution businesses; as a DNSP increases the number and length of transmission lines that it operates, it also increases the number of employees it needs to maintain and operate them. This has important implications for the interpretation of the controllability of operating costs. It indicates that operating costs inefficiency as determined by these benchmarking models is not wholly controllable. Rather, the nature of the capital stock limits the extent to which operating costs can be reduced.

### **5.5 Summary**

Synergies believes that the benchmarking undertaken by Economic Insights is a constructive step in helping to further understand the value of such approaches for determining the efficiency of Ergon and the other SE Australian DNSPs. However, for the foregoing reasons, Synergies does not consider that Economic Insights operating cost efficiency estimates are a sufficiently robust basis for revenue control decision making and, if applied to Ergon, would give flawed and exaggerated estimates of Ergon's controllable inefficiency.

There is strong evidence that the models on which they are based do not fully represent the characteristics of Australian DNSPs generally and Ergon specifically. The data on which the models are based appears to have important inconsistencies which are not adequately adjusted for. The efficiency estimates do not capture the current levels of efficiency at each DNSP. And there are other reasonable models and measurement techniques which indicate that the Ergon and other Australian DNSPs have higher efficiency scores that Economic Insights has estimated.

As a result, Synergies does not believe that the AER should rely upon benchmarking as it has done in the NSW and ACT draft decisions without undertaking substantial additional work to address its shortcomings.