Benchmarking results for Networks NSW businesses

A review of the AER Annual Benchmarking Report

huegin

28 August 2014
Version: 1.00

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Introduction

Huegin Consulting Group has reviewed the draft AER Annual Benchmarking Report on behalf of Networks NSW, in particular focusing on the results for the three NSW Distribution Network Service Providers (DNSPs). The results of that review are detailed within this report. The scope of the review covered the following main topics:

- The methodology
- The model specification
- The lack of adjustment for exogenous factors
- The data and units of measurement

Each of these is discussed in the sections of this report.

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The AER's benchmarking methodology

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The AER's benchmarking methodology

Huegin has previously reviewed the benchmarking framework and methodology outlined in the AER's Expenditure Forecast Assessment Guideline released in late 2013. Representing the two Queensland businesses, Huegin raised concerns with the method and some of the techniques proposed by the AER. Our initial observation, however, upon reviewing the draft Annual Benchmarking Report is that the methodology adopted differs to that described in the Expenditure Forecast Assessment Guideline. The main deviations from the originally published methodology are:

- Data Envelopment Analysis (DEA) has not been conducted; and
- Econometric analysis to estimate an opex partial factor productivity value has not been conducted.

DEA was proposed by the AER as a "complementary" technique to the Multilateral Total Factor Productivity (MTFP) analysis for calculating productivity. The intention was to use DEA to observe if the results were similar to the MTFP. Huegin notes that not only has the DEA been excluded from the draft Annual Benchmarking Report, but there is also no explanation of why the technique has been omitted.

Econometric models of the type described in the Expenditure Forecast Assessment Guideline also have not been utilised in the draft Annual Benchmarking Report. From previous analysis Huegin has observed that econometric analysis using the data and specifications from the Australian DNSPs presents a significant challenge, with the stability of the models difficult to attain. In particular, many of the models produce negative variable weights. There is no mention in the draft Annual Benchmarking Report of why econometric modeling has been omitted. The opex partial factor productivity has instead been estimated using the results from the MTFP model. Huegin notes that this method of estimating opex partial factor productivity is subject to the same limitations as MTFP, most significantly that it does not account for differences in scale or operating conditions.

There has also not been any consideration of exogenous or environmental variables as drivers of differences in productivity in the MTFP; this point is discussed in section 3 of this report.

The specification of the MTFP model has also changed; the change in specification is the topic of the following section.

The changes to the MTFP specification result in three new variables and one omitted variable from the previously preferred specification. The net result is two extra variables utilised in the current MTFP model. More variables (particularly in small sample sizes) make DEA more challenging and less reliable. When those variables are highly correlated (such as customer numbers, peak demand and energy distributed) econometric modelling is also more challenging.

The MTFP model specification

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The MTFP model specification

A reasonable amount of effort during the development of the Expenditure Forecast Assessment Guideline was dedicated to the identification and justification of a model specification for MTFP. The AER and its advisor, Economic Insight, argued the merits of the nominated preferred specification through a combination of precedent, theory and expert opinion. That preferred specification has been discarded in the draft Annual Benchmarking Report.

With the benefit of the data collected through the Regulatory Information Notices (RINs) – which were not available at the time of nomination of the previously preferred specification – the AER has been able to test many combinations of input and output variables. Huegin questions, however, the validity of using observations of the results as the determinant of the most appropriate specification. Such an approach seems open to influence of the practitioner's a priori expectations of what the results should be, rather than any objective evidence that one model is better than another. Whilst the AER may argue that the results were studied for signs of bias toward or against urban vs rural or small vs large distributors, these were not analytical tests, merely visual observations. Other issues with this selection process are:

- It relies on the observer to be able to discriminate between model configuration bias and actual productivity differences – something MTFP itself cannot do; and
- It uses only two very high-level measures of differences between businesses (location and size) – in reality there are many more.

The second point is significant. The Australian National Electricity Market (NEM) is unique amongst the world's electricity network jurisdictions. There are very few other regions in the world with such diverse operating conditions, network sizes and variations in legislative, regulatory and statutory requirements across industry participants. The networks in Australia are very, very different and finding a single model specification that fits the industry is impossible – each change just shifts the inherent bias to a different corner of the model. Many of these are too complex to determine through visual observations of the relative results for "urban" and "rural" networks.

Huegin conducted analysis on over 30 different combinations of the input and output variables identified in the Economic Insights Memorandum accompanying the AER's draft Annual Benchmarking Report. The merit of each variable as an input or output has been accepted in isolation of the others, therefore the selection process for the actual combination of variables in the model is subjective. The range of productivity rankings observable within the possible model configurations is significant. The table below shows the upper and lower limits of rankings available to each of the NSW businesses through model specification changes within the limited set of input and output variable combinations.

DNSP	Ranking	Input Variables	Output Variables
Ausgrid (high)	3rd	Opex, constant price depreciation	Residential customers, commercial customers, small customers, industrial customers
Ausgrid (low)	13th	Opex, constant depreciated asset value	Energy, ratcheted peak demand, customer numbers, circuit line length, minutes off supply
Endeavour (high)	5th	Opex, constant price depreciation	Customer numbers, ratcheted peak demand, minutes off supply
Endeavour (low)	11th	Opex, OH MVA-kms, UG MVA-kms, Transformers and other (ex 1st stage)	Energy, kVA-kms, customer numbers, minutes off supply
Essential (high)	2nd	Opex, OH MVA-kms, UG MVA-kms, Transformers and other (ex 1st stage)	Energy, kVA-kms, customer numbers, minutes off supply
Essential (low)	13th	Opex, OH MVA-kms, UG MVA-kms, Transformers and other (ex 1st stage)	Energy, ratcheted peak demand, customer numbers, minutes off supply

Of note in these results (apart from the variability in the range) is that the output specification that gives Ausgrid the worst result is identical to that used by the AER in their currently preferred model. Also, it is only a single variable change in the output specification that moves Essential between 2nd and 13th, an indication of the sensitivity of the results to specification change. Given the range of results possible, it is entirely possible that the poor rankings for the three NSW DNSPs in the AER's MTFP modeling is significantly influenced by model bias for at least one of them.

To further test the veracity of the MTFP models for the NSW businesses, Huegin modeled the level of opex required to move each to the position of the frontier firm. If the MTFP model truly does reflect the industry cost productivity function, then any business in the sample should be capable of achieving results that place it on the efficient frontier. Of all of the input and output variables in the MTFP model specification, opex is the only variable that the DNSPs can change readily in the short term. On the output side, customer numbers and the energy they use is not within the control of the DNSP. Peak demand is difficult to influence (and as an output, encouraging higher peaks to improve productivity would seem a perverse action) and reductions in customer interruptions of any magnitude that would affect the productivity score would not be possible in a short timeframe, and certainly not without an increase in cost that would cancel out any benefit of the improvement. On the input side, the already installed transformers, underground cable and overhead conductor are hardly likely to be decommissioned to increase productivity. This leaves opex; holding all other variables constant, the level of opex required in 2013 for each of the three NSW businesses to reach the frontier can be calculated (see the table below). Using the AER's MTFP specification, the combined level of opex required to place the three NSW businesses on the frontier is less than the opex of one of the NEM's smallest businesses, CitiPower; CitiPower's customer base is around 12% the size of that serviced by the three combined NSW businesses.

DNSP	2013 Actual Opex	Opex Required*
Ausgrid	$367.1m	$12.9m
Endeavour Energy	$197.7m	$17.2m
Essential Energy	$312.7m	$25.7m
* this is the nominal opex required to be the frontier firm in 2013		

The analysis shows that under the current MTFP model specification the three NSW businesses will never be anywhere near the frontier through any credible adjustment to their current opex. The results also highlight that somewhere in the output or input index there must be another variable where an imbalance between the NSW businesses and other industry businesses exists. This is explored later in this report (section 4).

The issues with the model specification highlight the imperative to adjust results for the influence of exogenous factors if MTFP results continue to be relied upon for efficiency assessments. This is discussed in the next section.

Adjusting for Exogenous Factors

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Adjusting for Exogenous Factors

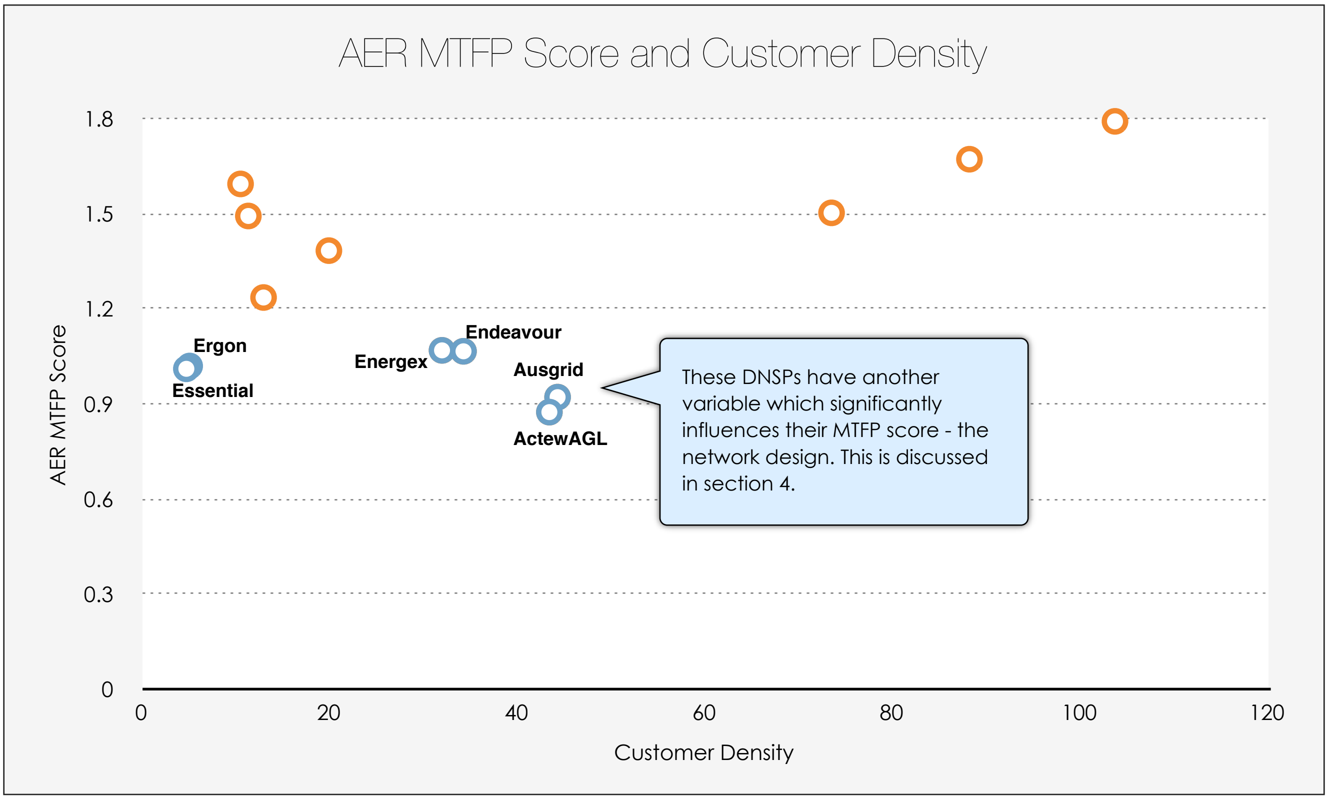
Huegin notes that despite the collection of 19 different environmental variables in the benchmarking RINs, none have been utilised. Further, no allowance for adjustment of the MTFP results due to the exogenous factors has been given at all. This is against the previous guidance of the AER. Recognition of environmental and other exogenous influences is particularly important when relying upon MTFP in the Australian context, as:

- The inability to account for differences in scale and other operating factors is a specific weakness of MTFP; and
- The Australian conditions vary so broadly.

Work conducted by Huegin previously for various DNSPs has highlighted the importance of different cost drivers inherent to, or inherited by, each of the businesses. One of the most significant is the area over which the assets are spread. The distance between assets is significant to opex as for most businesses a large majority of operating expenditure is related to vegetation management and maintenance – and a large majority of maintenance spend is on inspecting assets at regular intervals. These costs are not driven by energy, peak demand or customers and they are only moderately correlated to network length; it is the distance that must be travelled that is the main driver of these costs. These distances and therefore costs increase with more sparsely populated states and regions. Customer density does not fully account for this variation (as it is only a linear measure), but it is at least a reasonable proxy. The AER considers it has accounted for customer density because both customers and line length are included in the MTFP model. This is not the case; consider the following:

- Customers have a weight of 45% in the output index whilst circuit length has a weight of 23%. This means that distributors with more customers relative to line length (higher customer density) are going to have a higher output index.
- In addition, as line length increases relative to customers (lowering customer density) a distributor's input index is going to increase because its measure of MVA-kms will increase.

If customer density has been accounted for in the model then if we plot customer density and MTFP scores there should be no relationship between them - the scatter graph should appear random as customer density has no impact on which distributors appear productive or unproductive.



Looking at the scattergraph it appears that as customer density increases a distributors MTFP score increases (this is also statistically significant). ActewAGL and Ausgrid appear as outliers because they have quite a high customer density but benchmark poorly, we believe this can be explained largely because of the significant proportion of 132kV lines that these two distributors have. This is discussed in the next section.

The Data and Units of Measurement

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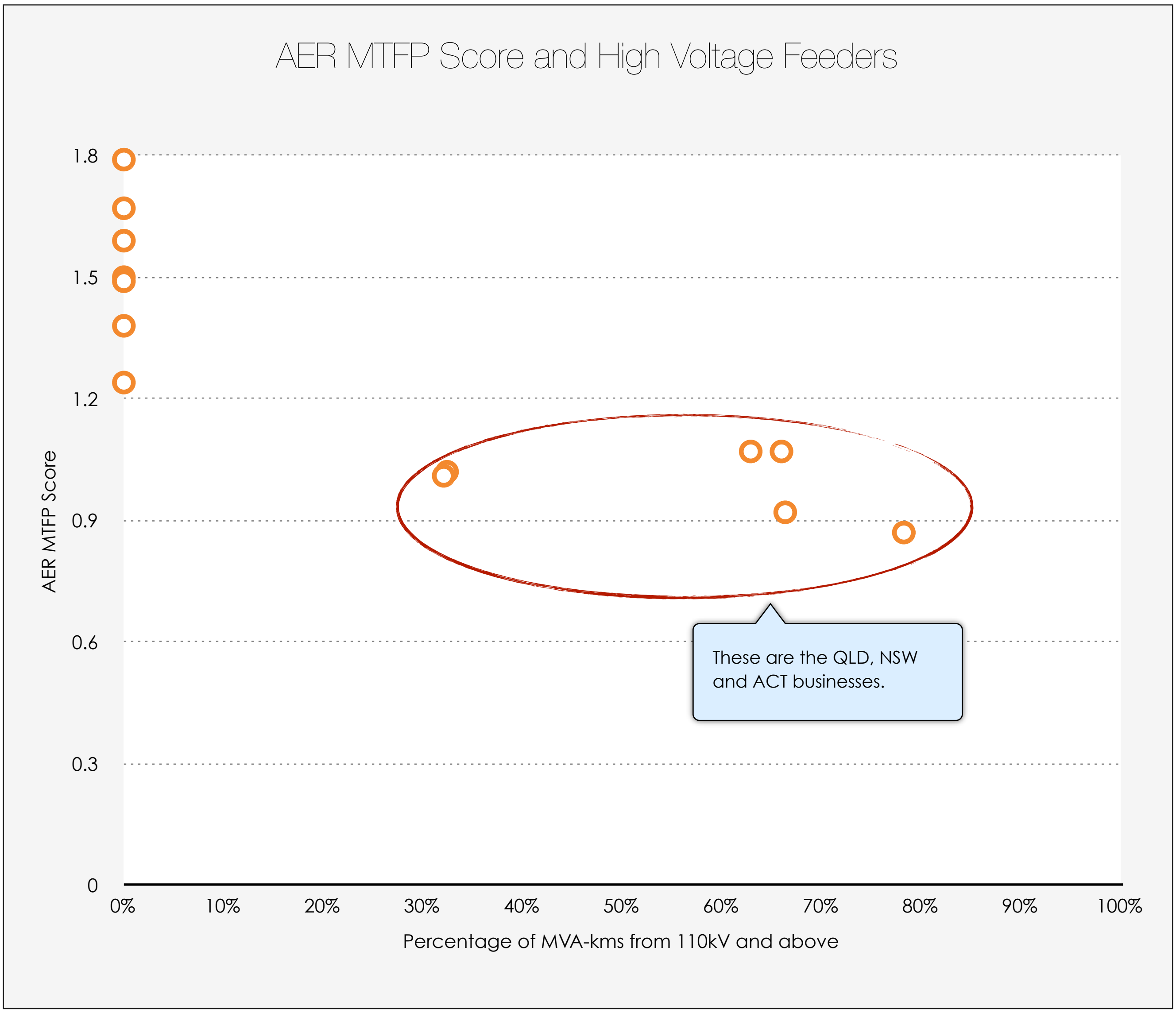
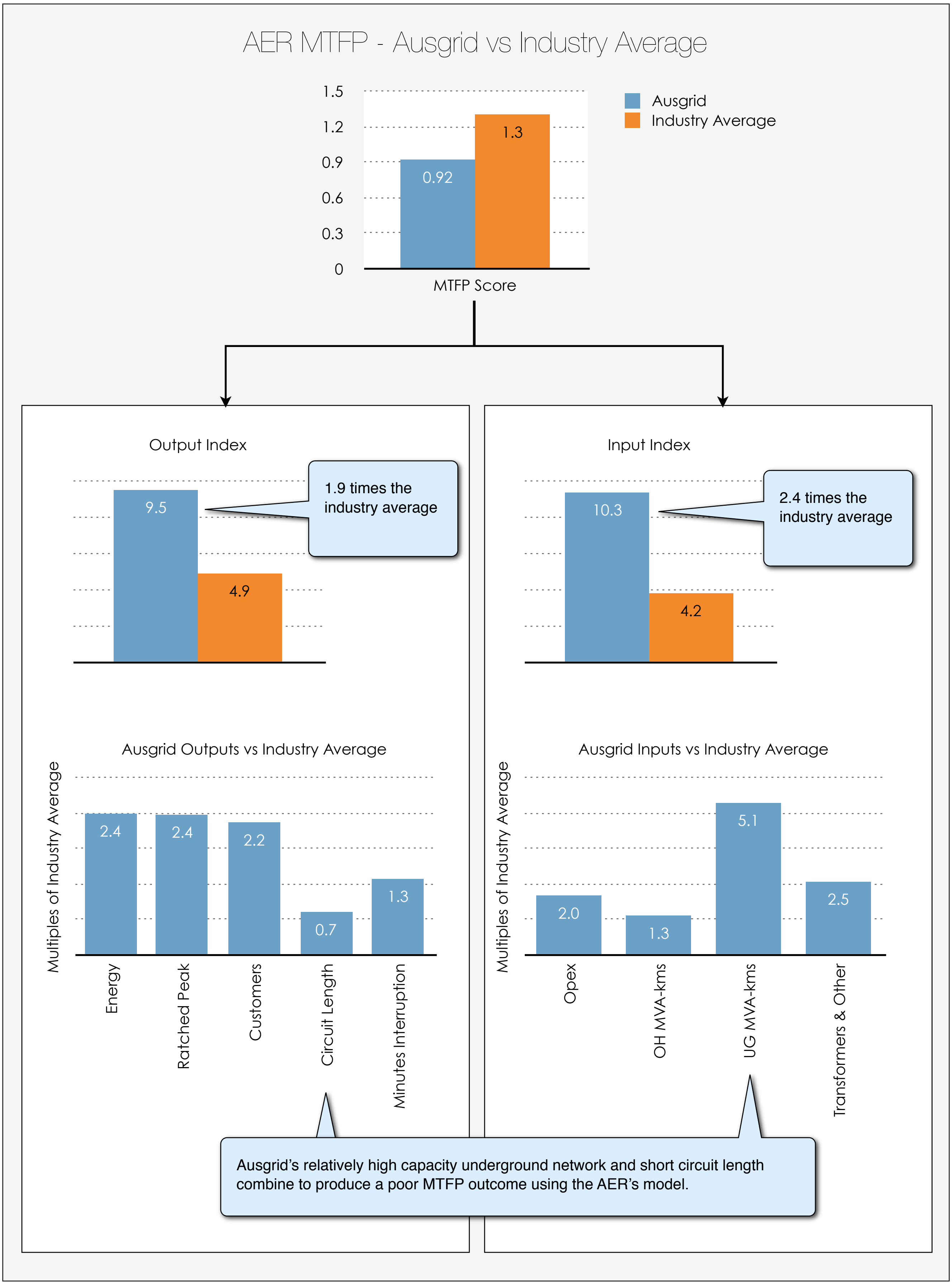
The Data and Units of Measurement

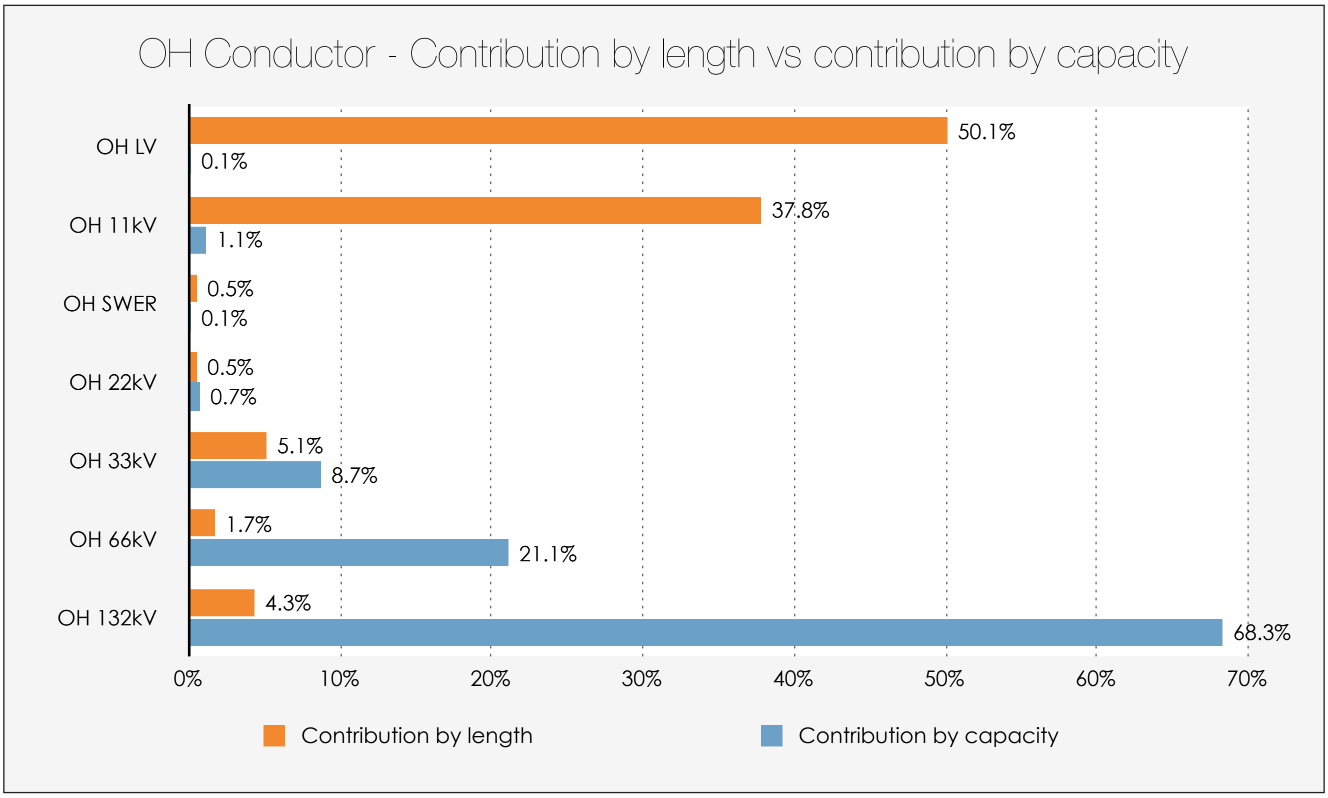
Despite being included in the specification preferred by the AER in the Final Expenditure Forecast Assessment Guidelines, MVA-kms has not been included as an output in the productivity analysis used in the Draft Benchmarking Report because Economic Insights believe that the multiplicative measure of system capacity (capacity measured in MVA multiplied by line length) biases the results in favour of some DNSPs at the expense of others. A similar bias remains in the model through the use of MVA-kms to measure overhead km and underground cables (both inputs). This biases the model against DNSPs that have a high proportion of their network at higher voltages. These businesses will benchmark poorly, appearing inefficient, through the influence of the network design and the boundary between the transmission and distribution systems in different regions. Below is a plot of the AER model MTFP score and the contribution of 110/132/220kV network to the MVA-kms total; it shows that businesses with high voltage feeders have lower MTFP scores.

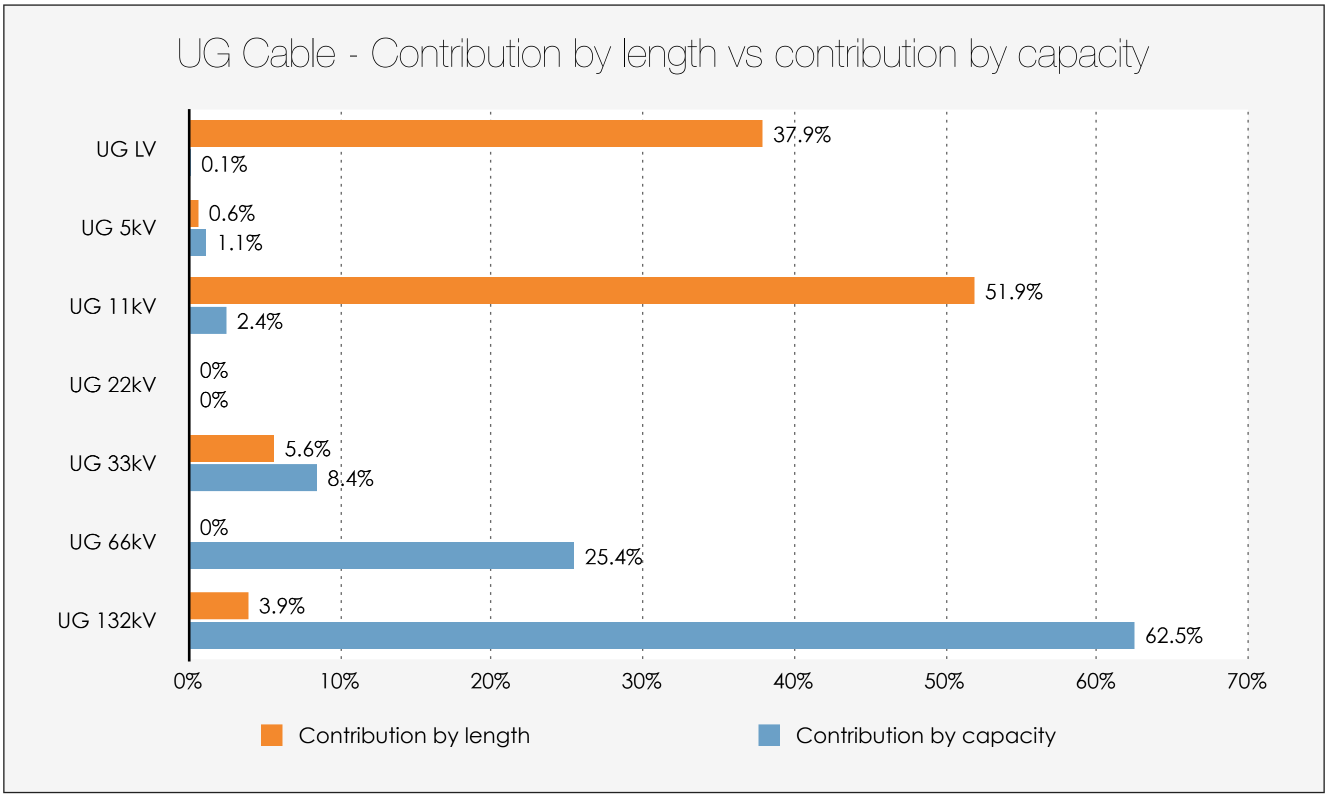


The calculation of MVA-kms of underground and overhead network is particularly detrimental to businesses such as Endeavour Energy and Ausgrid, where there is a small amount of high voltage and high capacity network, but overall circuit lengths (an output) are not significantly higher than the industry average. The breakdown of Ausgrid's input and output index (next page) shows this disparity.


AER MTFP - Ausgrid vs Industry Average
Ausgrid
Industry Average
1.5
1.2
0.9
0.6
0.3
0
0.92
1.3
MTFP Score
Output Index
9.5
4.9
1.9 times the industry average
Input Index
10.3
4.2
2.4 times the industry average
Ausgrid Outputs vs Industry Average
Multiples of Industry Average
2.4
2.4
2.2
0.7
1.3
Energy
Ratched Peak
Customers
Circuit Length
Minutes Interruption
Ausgrid Inputs vs Industry Average
Multiples of Industry Average
2.0
1.3
5.1
2.5
Opex
OH MVA-kms
UG MVA-kms
Transformers & Other
Ausgrid's relatively high capacity underground network and short circuit length combine to produce a poor MTFP outcome using the AER's model.

As shown, MVA-kms of network is an anomaly for businesses such as Ausgrid. A breakdown of the contribution by length vs contribution by MVA-kms is detailed below:





Whilst a general observer might contend that the presence of these high voltage, high capacity assets illustrates that the DNSP should be servicing much higher outputs, or has built in unproductive inputs to its network, this is not the case. In the case of Ausgrid, more than 80% of its 132kV network was installed in the 1960s and 1970s and is a reflection of the legacy design issues of the entire electricity supply chain (particularly the boundary between transmission and distribution). It is obviously unrealistic to expect DNSPs such as Ausgrid to remove these assets, and the scale of outputs required to "balance out" their influence in the AER MTFP model specification are clearly unrealistic. As discussed in an earlier section, the level of opex required to overcome the skew caused by these assets is also unrealistic.

As such, if the current model specification for MTFP remains as proposed, DNSPs such as Ausgrid and Endeavour Energy will always be chasing a frontier that they can never be expected to reach.

As discussed earlier, given that the only criteria to “test” for model bias was observations based on urban/rural and large/small businesses, influences such as network design have been ignored. The changes in the model specification have moved the bias against a different group of businesses – those with high voltage cable and conductor in their network.

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