Jemena Electricity Networks (Vic) Ltd

2021-26 Electricity Distribution Price Review
Revised Proposal

Attachment 05-05

CEPA review of the impact of capitalisation and model reliability - AER's opex benchmarking

The Australian Energy Regulator's operating expenditure benchmarking – a review of the impact of capitalisation and model reliability

Jemena

13 November 2020

DRAFT REPORT

Important notice

Contents

1. EXECUTIVE SUMMARY

Jemena has engaged CEPA to review the Australian Energy Regulator's (AER's) and its consultants, Economic Insights,[1] most recent (August and October 2020) benchmarking analysis and the AER's September 2020 draft decision for Jemena,[2] and to provide our advice on:

1. Whether an adjustment(s) should be made to Jemena's econometric operating expenditure (opex) efficiency scores for the impact of distribution network service providers' (DNSPs') capitalisation policies, which are part of their Cost Allocation Methodologies (CAMs).
2. Whether there are benchmarking models that the AER should place less reliance on.

In this report, we show that:

1. **DNSPs' capitalisation policies (i.e. their accounting decisions) have a material impact on Jemena's efficiency score; Jemena's efficiency score increases by 15-17% using current rather than historical CAMs.** This impact is distinct from DNSPs' opex/ capital expenditure (capex) trade-off decision (e.g. using capex instead of opex to provide outputs). This finding is in contrast to the AER's findings which rely on, as acknowledged by the AER, imperfect combined measures (ratios) of capitalisation and opex/ capex trade-offs.
2. **The translog models estimated by Economic Insights have very divergent elasticities on outputs.** Elasticities show the percentage change in opex required to deliver a percentage change in the outputs. For example, Jemena's average customer number elasticity varies from 0.14 in one model (translog least squares) to 1.04 in another (translog stochastic frontier analysis (SFA)). This indicates that, in the first model, Jemena's opex increases by 0.14% for every 1% increase in customer numbers, while in the second model Jemena's opex increases by 1.04% for every 1% increase in customer numbers. These differences are inconsistent with economic and engineering theory.
3. **Economic Insights' multilateral productivity models are not statistically robust, and the output weights in these models should not be used to roll forward opex (the output weights generated by the models are based on total costs and not opex).** Economic Insights' claim that the models are simple and therefore do not need to meet a standard of statistical robustness. However, statistical robustness helps to identify if the models are mis-specified and/ or if there are errors in the modelling. Economic Insights' output weight models predominately have insignificant coefficients and low R^2 values (the latter being a measure of how well the model explains the variance in the data).

A more detailed summary of our findings is set out below, with full analysis in the remainder of the document. We have not reviewed other aspects of the AER's opex assessment such as its operating environment factor (OEF) for vegetation management.

1.1. THE IMPACT OF DNSPS' CAPITALISATION POLICIES

DNSPs have different policies for capitalisation of opex, and these policies have changed over time. The opex data that Economic Insights' use in its benchmarking is after deducting the capitalised amounts. Economic Insights has made no adjustment for different capitalisation policies adopted by each DNSP. This means that different capitalisation policies, e.g. one DNSP capitalisation 20% of overheads while another capitalises 30%, will affect the opex benchmarking efficiency scores.

[1] Economic Insights (2020a), Economic Benchmarking Results for the Australian Energy Regulator's 2020 DNSP Annual Benchmarking Report – Draft, August and Economic Insights (2020c), Economic Benchmarking Results for the Australian Energy Regulator's 2020 DNSP Annual Benchmarking Report, October.

[2] AER (2020a), Draft Decision – Jemena distribution determination 2021-26 – Attachment 6 – Operating expenditure, September.

AER's draft decision

In its September 2020 draft decision for Jemena, the AER set out its assessment of Jemena's capitalisation practices, and how this impacted on its assessment of Jemena's opex proposal.[3] However, the AER focused mainly on opex/ capital expenditure (capex) and opex/ capital services trade-offs.

We consider that it is important to separate out arguments around opex/ capex trade-offs and capitalisation issues. The former is about selecting an expenditure option to deliver the required outputs, the latter is about accounting choices. The amount of capex and opex will affect the dollar level of capitalisation, but capitalisation practices are related to accounting policies and the policies themselves should not be affected by the amount of opex/ capex.

The AER defined 'capitalisation practices' as a combination of capitalisation policies and opex capex trade-offs and it assessed the following ratios to determine if Jemena's relative opex performance was affected by DNSPs' capitalisation practices:

- opex to total cost ratios;
- opex to totex ratios; and
- opex to total inputs ratios.

While these ratios may give an imperfect indication of whether a DNSP might be adopting a greater level of opex solutions relative to capex solutions, we do not consider that these ratios provide insights into the specific question of whether the DNSPs' capitalisation policies impact on the opex benchmarking results. As the AER has previously noted: [4]

- Capitalisation policies affect the amount of opex recorded.
- Utilisation of capital will affect the amount of opex required.
- Differences in DNSPs' location in their asset replacement cycles will affect the amount of opex and capex.

In addition, differences in the level of capex related to reliability or growth will also affect the ratios, and whether the capex was efficient or not. These capex differences may be irrelevant to the assessment of opex efficiency but they may impact the ratios. Therefore, these ratios can mask the material differences in capitalisation policies without proper understanding of the capex differences.

The differences in capitalisation policies will not be identified by the ratios because of the aspects noted above. In addition, these factors mean that the opex/ totex ratios cannot be used to make quantitative adjustments for an OEF for a combined capitalisation and opex/ capex trade-off.

In addition, it is important to recognise that even small differences in the policies, e.g. capitalising 30% compared to 35%, have a material impact on the efficiency scores. For example, if two DNSPs' had opex of $100m, capex of $200m, and the same outputs, and one capitalised 30% and one capitalised 35%, the one that capitalised 5% less would appear materially more inefficient in the benchmarking. We have provided three generalised examples in Section 2.1 of why these ratios do not provide an accurate indication of the impact of the capitalisation policies on the opex benchmarking. These examples show that if the AER is only looking at the opex efficiency scores and the opex/ totex (or other total cost/ volume ratios) it will not be able to determine the impact of DNSP's capitalisation policies on the DNSPs' opex efficiency scores.

We agree with the AER that determining whether there is a capex/ opex trade-off occurring is an important aspect of assessing DNSPs' expenditure. However, we consider the opex efficiency scores and the simple ratios are insufficient for this purpose for the reasons listed above. We believe that the options that the AER has proposed to

[3] The capital services flows are based on estimates of the RAB, cost of capital, depreciation, and tax. AER (2020a), page 6-57.

[4] AER (2014), Draft decision – Ausgrid distribution determination 2014–19 – Attachment 7: Operating expenditure, November, page 7-123.

consider for dealing with the capitalisation and opex/ capex trade-off are appropriate ones to review.[5] However as these are only being considered over the next 12 months, we have been asked to focus on the current draft determinations and whether a capitalisation OEF is appropriate for Jemena.

The AER has collected new data that can assist it in gaining a better understanding of how DNSPs' capitalisation policies affect DNSPs' estimated efficiency scores. Three DNSPs have changed their CAMs – CitiPower, Powercor, and Ergon – and provided historical opex estimates based on these new CAMs to the AER. This data can also inform the AER on the size of an OEF adjustment for Jemena.[6] This is discussed below.

Our approach

Economic Insights has 'frozen' the CAMs, for determining opex used in its benchmarking, to the policies that DNSPs had in place in 2014. We have tested the impact of changing CAMs on DNSPs' efficiency scores using the following methods:

- Use opex based on the current CAMs (2019 CAMs).
- Use opex based on the CAM in effect in each year (varying CAMs).

We consider that the former, i.e. 'freezing' them at a point in time, is the most consistent with Economic Insights' current approach and therefore the results from this option are the most appropriate to use. Economic Insights has built a credible position by not changing its approach since 2014. Because of this position, there has been no incentive for DNSPs to game their CAMs.

Our analysis indicates that the DNSPs' CAMs have a material impact on the opex econometric benchmarking results. Jemena's opex econometric benchmarking scores are substantially improved when current CAMs from three **other DNSPs** are used rather than their historical (pre-2014) CAMs. As shown in the table below, adopting the current (2019) CAMs for the three DNSPs leads to Jemena's estimated efficiency scores increasing by between 8 and 11 points (i.e. 15% to 17% higher scores).

Table 1.1: Efficiency score estimates for Jemena – Three output specification models[7]

	Economic Insights	2019 CAMs
2006-2019		
Average all models	0.62	0.71
Average Cobb-Douglas models	0.63	0.74
2012-2019		
Average all models	0.55	0.64
Average Cobb-Douglas models	0.60	0.69

Source: Regulatory Information Notices (RINs), Economic Insights, CEPA analysis

Jemena's econometric average efficiency score based on the Cobb-Douglas models is 0.74 and 0.69, for the 2006-2019 and 2012-2019 periods respectively. This indicates that Jemena's historical estimated opex efficiency is only marginally below the AER's targeted 75% efficiency level.[8] We consider that the AER should only rely on the Cobb-Douglas modelling results due to issues identified with the translog models. This is discussed in more detail in the next sub-section.

[5] AER (2020b), Annual Benchmarking Report: Electricity distribution network service providers, November, page 89.

[6] We have used the AER terminology of 'OEF' for this capitalisation issue. However, it is not an operating environment issue, it is a data collection and accounting policy issue.

[7] Using Jemena's updated customer numbers.

[8] We have not considered any other OEFs that may affect the target.

Our analysis shows that differences in the DNSPs' capitalisation approaches meet the AER's requirements for an OEF adjustment for Jemena: [9]

1. Powercor's, CitiPower's, and Ergon's CAMs are outside of Jemena's control.
2. Changes in DNSPs' CAMs have a material impact on Jemena's efficiency score and therefore the AER's assessment of its base year efficiency.
3. This is not accounted for elsewhere. The AER's ratio analysis (opex/ total costs and opex/ totex) does not provide an accurate representation of the differences, and subsequent impacts, of DNSPs' capitalisation approaches, and the AER does not account for capitalisation differences in its capex assessment.

Our analysis means, at a minimum, that the AER needs to make an adjustment for the impact of DNSPs' CAMs on the modelling results when it assesses Jemena's proposed opex. A 15% OEF for Jemena is an appropriate starting point to consider when correcting for the impact of other DNSPs' capitalisation policies. We believe this is consistent with its previous approach to adjusting for OEFs when a material difference was identified. An increase of 15% in Jemena's efficiency scores is equivalent to a 13% reduction in the 75% efficiency target to 65.2%.[10, 11]

Note, we are not proposing at this stage that the AER switch to fixing the benchmarking data to 2019 CAMs going forward. As the AER notes, this may create future gaming issues.[12] However, as the AER has not yet determined its approach to the capitalisation issue, we believe that our approach can be used to help it estimate an OEF for Jemena.

1.2. Model reliability

After reviewing the AER's draft decisions, the accompanying memo prepared by Economic Insights, and Economic Insights (2020a), we consider that there are issues with using the results from:

- the translog three output specification models; and
- the multilateral partial factor productivity (MPFP) opex model.

Translog models

Economic Insights' three output translog models, using the whole sample mean, suffer from monotonicity violations. We are of the view that even if only some DNSPs' elasticities explicitly fail the monotonicity requirement, it indicates that there are issues with the model specification, and this raises the question as to whether the estimates that do not fail the monotonicity requirements can be relied upon.

Economic Insights advised the AER that the translog models should be retained as they produce additional useful information. However, Economic Insights were unable to conclude whether assessing elasticities at the full sample mean or the Australian (sub-) sample mean was the most appropriate. Economic Insights stated that it was 'indifferent' to the method.[13] However, the methods lead to significantly different output weights for the LSE translog

[9] AER (2019a), Annual Benchmarking Report – Electricity distribution network service providers, November.

[10] In the AER's opex roll forward model this is equivalent to having a positive margin allowance of 15%.

[11] We have done our analysis using Economic Insights' 2020 dataset, which includes 2019 RIN data. We have also tested the impact using the dataset the AER relied on for its draft decisions; we found a similar result using this dataset. These results are provided in Appendix C.

[12] AER (2020b), page 90.

[13] Economic Insights (2020b), Memorandum: Review of reports submitted by CitiPower, Powercor and United Energy on opex input price and output weights, 18 May, page 20.

model. We do not consider that being 'indifferent' to the method meets the requirements of the AER's better regulation expenditure forecast guidelines.

In addition, we have concerns with the differences in the elasticities at the sample mean and the company specific elasticities produced by Economic Insights. The elasticities, particularly for customer numbers, are significantly different between the SFA translog model and the LSE translog model. This is surprising given that the models have the same specifications. The table below shows the differences in the Economic Insights recommended output cost weights. As can be seen, the output weights for the LSETLG model are significantly different from the other models.

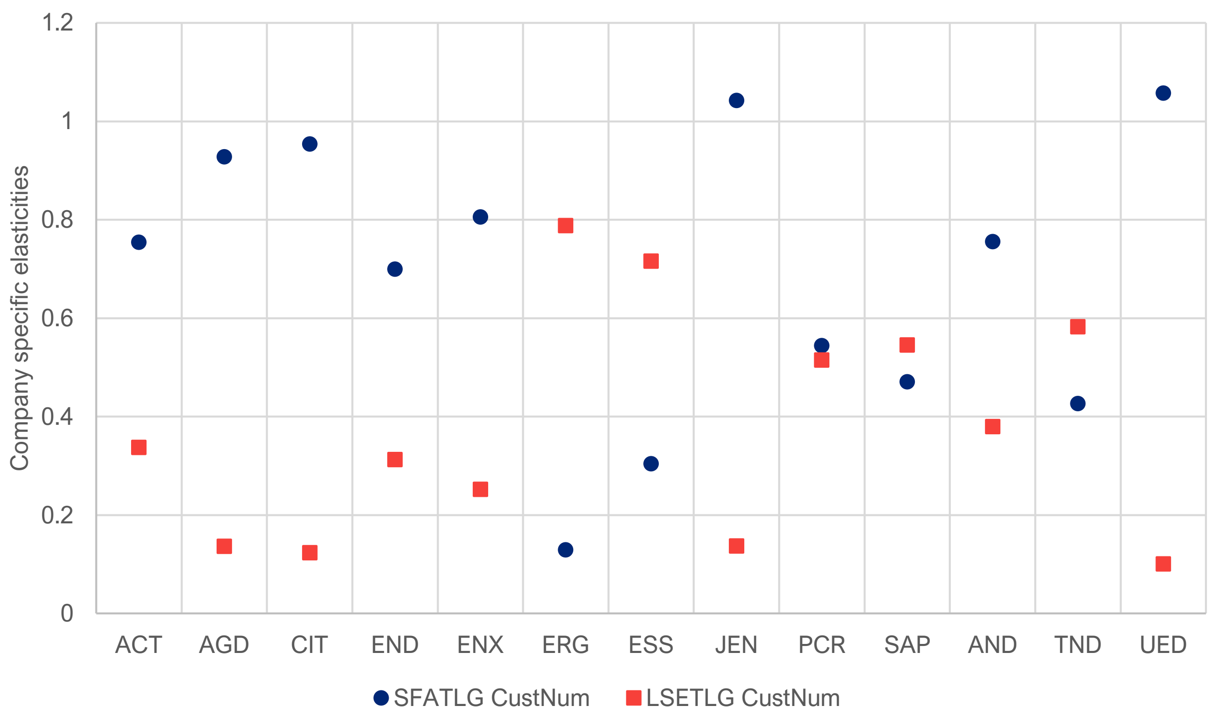
Table 1.2: Economic Insights' recommended output cost weights

	LSECD	LSETLG	SFACD	SFATLG
Customer numbers	68.95%	37.95%	67.43%	69.73%
Circuit length	15.56%	21.16%	15.08%	12.37%
Ratcheted maximum demand	15.48%	40.89%	17.50%	17.90%

Source: Economic Insights (2020b)

The figure below shows the company-specific elasticities for customer numbers for the translog LSE and SFA models (using the Australian sample mean). We can see that the majority of DNSPs' elasticities vary significantly across the two models. Economic Insights have not explained why the companies' elasticities are materially different across the two estimation techniques.

Figure 1.1: 2006-2019 DNSP's specific customer number elasticities



Source: Economic Insights, CEPA analysis

Given these issues, we are of the view that the AER should not put any weight on the results of the translog models in making its decision on Jemena's opex allowance.

We support Economic Insights' consideration of two output specification models. We consider that there is substantial merit in adding these models to the range that the AER considers given the presence of multicollinearity between the explanatory variables. We consider that the two output specification excluding ratcheted maximum demand is the most appropriate model to consider as the three output specification models' results clearly show that customer numbers are more important for explaining DNSPs' opex. Jemena's efficiency scores, shown in the table below, are slightly improved under this specification.

Table 1.3: Efficiency score estimates for Jemena – Two output specification models (customer numbers and circuit length) [14]

	Economic Insights	2019 CAMs
2006-2019		
Average all models	0.64	0.74
Average Cobb-Douglas models	0.63	0.74
2012-2019		
Average all models	0.62	0.70
Average Cobb-Douglas models	0.60	0.69

Source: RINs, Economic Insights, CEPA analysis

As with the three output specification models, Jemena's estimated efficiency under the 2019 CAMs approach is higher, supporting our findings that Jemena's efficiency score is materially affected by DNSPs' CAMs.

Broadly, we consider that the AER's three-output specification Cobb-Douglas or two-output (customer numbers and circuit length) specification models provide a starting point for assessing relative efficiency.

Multilateral productivity models

We do not consider that the weights used for the opex MPFP output index (which is also used for the MTFP analysis) are sufficiently robust to place, confidently, any reliance on the efficiency results.

Economic Insights' Leontief regressions for real opex only produce 10 statistically significant coefficients out of a possible 52. While we would not expect all coefficients to be statistically significant, the number of zero value coefficients on outputs that should have associated opex is concerning. The majority of r-squared values for these models are also very low (below 0.5). While Economic Insights claim that Leontief cost function regressions are simple, non-significant results are an issue regardless of whether the modelling is simple or complex.[15]

In addition, the new output weights do not align with the coefficients generated by the econometric models. This is shown in the table below. The econometric models indicate that customer numbers are a more important opex driver than ratcheted maximum demand.

Table 1.4: Comparison of the weights (elasticities) used/ produced by Economic Insights' modelling

Output weights	2019 MTFP/MPFP	Average of the econometric models 2006-19*	Average of the econometric models 2012-19*
Customer numbers	18.52%	55.95%	53.35%
Circuit length	39.14%	15.48%	21.30%
Ratcheted maximum demand	33.76%	28.58%	25.35%
Energy throughput	8.58%	n/a	n/a

Source: Economic Insights excluding the LSE TLG*

[14] Using Jemena's updated customer numbers.

[15] Economic Insights (2020a), page 122.

Economic Insights argue that the weights can be different as they represent the outputs' relationship with total costs.[16] However, the AER are using the output weights for opex, not total costs. Given Economic Insights' explanation, and the lack of statistical significance of the majority of the results of the Leontief models, the AER may want to revisit whether it is appropriate to use these weights to roll forward opex.

We also consider that the greater weight on customer numbers better aligns with evidence that changes in the DNSPs' operating environment, e.g. greater penetration of distributed energy resources (DER), decrease the importance of ratcheted maximum demand as an indicator of efficient opex. As Economic Insights state, "*the variation in customer numbers can explain considerable variation of opex costs*".[17]

It is worthwhile stepping back and considering what the change in weights means in practice; the new weights imply that ratcheted maximum demand is now almost twice as important for driving opex as it was in 2017 (when the 2014 weights were used). This does not seem plausible.

In summary, we have the following concerns with the opex MPFP (and by extension the MTFP):

- The Leontief cost function regression results are not robust.
- The resulting output weights do not align with the weights produced in the econometric modelling.
- The weights do not appear to align with current indicative evidence of what is driving DNSPs' opex.
- The change in weights indicate an implausible shift in what drives DNSPs' costs from 2017 to 2018.
- The output weights are based on total costs and therefore should not be used to roll forward opex.

We consider that the multilateral productivity approaches do not currently meet the AER's expenditure forecast assessment guidelines assessment principles.[18] In particular, we do not consider the methodology meets the 'validity', 'accuracy and reliability', and 'robustness' principles.

[16] Economic Insights (2020c), page 5.

[17] Economic Insights (2020c), page 5.

[18] AER (2013a), Expenditure Forecast Assessment Guidelines: Category analysis – Overheads and accounting issues, May, pages 17-18.

2. MEASURING THE IMPACT OF FIXING THE CAMS TO 2014

As in all prior annual benchmarking, Economic Insights (2020a) relies on fixing the DNSPs' CAMs to the ones that were in place in 2014:

> *"all Australian DNSPs' data for all years are based on the cost allocation methodologies (CAMs) that applied in 2014 rather than on more recently revised CAMs. The CAMs applying in 2014 (including ACT's revised CAM) led to opex/capex ratios being broadly consistent across DNSPs. 'Freezing' the CAMs at this point has minimised the scope for DNSPs to game the benchmarking results by reallocating costs between opex and capex and currently provides the best basis for like–with–like comparisons of overall network services opex in most cases."*[19]

We understand that Economics Insights' proposition is that if it did not fix the CAMs at the 2014 level then the DNSPs would attempt to capitalise more opex in order to improve their opex benchmarking score. To enable like-for-like comparisons, Economic Insights' approach relies on the capitalisation policies across the DNSPs being the same. This was noted by the AER in 2013, "*Things which detract from like-for-like comparisons … Capitalisation … CAMs and cost allocation".*[20] This was not the case; there was and is variation in DNSPs' capitalisation policies. The AER, however, chose to only make an adjustment to ActewAGL's[21] efficiency target for its capitalisation policy (see Appendix A). Aside from its attempt to avoid gaming, we understand that neither Economic Insights nor the AER have provided any reasons why he CAMs in place in 2014 provide more accurate opex efficiency scores than alternative CAMs.

The benchmarking approach has now had the CAMs fixed for six years and in 2019 the AER acknowledged that this approach needs to be reviewed:

> *"These changes in cost allocation methods suggest that it is the right time to review the impact that changes and differences in cost allocation and capitalisation methodologies are having or may have on the benchmarking analysis.*
>
> *While we will consult with stakeholders, our initial view is that a review would look holistically at the differences in cost allocation between DNSPs and over time, rather than focusing on a single category of expenditure. It would also consider how changes in cost allocation methodologies over time should be accounted for within the benchmarking analysis. It may also consider whether the consistency, reliability and comparability of benchmarking expenditure data could be potentially strengthened.*
>
> *Our examination of cost allocation approaches across DNSPs, and their effect on benchmarking, will involve consultation with the distribution industry and other relevant stakeholders."*[22]

In its 2020 benchmarking report, the AER has proposed that it will look at the following options over the next 12 months:

- *"Applying an OEF adjustment to the efficiency results under our current benchmarking approach to reflect material departures from benchmark comparators' capitalisation practices*
- *Modifying our approach by benchmarking on the basis of opex plus a fixed proportion of (corporate and/or network) overheads for all DNSPs*

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[19] Economic Insights (2020a), page 7.

[20] AER (2013a).

[21] ActewAGL is now EvoEnergy.

[22] AER (2019b), Annual Benchmarking Report: Electricity distribution network service providers, November, page 47.

- *Modifying our approach by benchmarking on the basis of DNSPs' current CAMs (incorporating their most recent capitalisation policy)*
- *Developing and introducing a common CAM for benchmarking purposes*
- *Moving to totex benchmarking as a complement or substitute to our current benchmarking approach."*[23]

Jemena has asked us to consider how the impact of the DNSPs' capitalisation practices can be assessed, and what OEF might apply to the AER's view of Jemena's opex if the 2014 CAMs are used for its benchmarking analysis. Jemena has not asked us to consider which approach(es) proposed by the AER may be appropriate over the longer term.

2.1. The AER's draft determination assessment of capitalisation

The AER, in Appendix C of Attachment 6 (opex) of its draft 2021-26 decision for Jemena, sets out its assessment of Jemena's capitalisation practices, and how this impacts on Jemena's opex benchmarking scores.

The AER appears to focus mainly on the opex/ capex trade-offs:

> *"Differences in capitalisation practices such as opex/capex trade-offs do exist among the distribution businesses."*[24]

We consider that it is important to separate out arguments around opex/ capex trade-offs and capitalisation issues. The former is about selecting particular options in order to deliver outputs, the latter is about accounting choices. The volume of capex and opex will affect the dollar level of capitalisation, but capitalisation practices are related to the accounting policies and the polices are not affected by the volume of opex and/ or capex. The AER recognised this in 2014:

> *"Capitalisation policies may affect the amount of opex recorded. Utilisation of capital will affect the amount of opex required. The relative efficiency of a service provider's opex and capex will also affect the opex to capex ratio, as will service providers' location in their asset replacement cycles."*[25]

Differences in the level of capex related to reliability or growth will also impact opex/ capex ratios.

The analysis the AER undertook for its September 2020 draft decisions focuses on:

- opex to total cost ratios;
- opex to totex ratios; and
- opex to total inputs ratios.

The AER recognised that each of these ratios has limitations in relation to assessing capitalisation. In relation to the opex to total cost ratio:

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[23] AER (2020b), page 89.

[24] AER (2020a), page 6-89.

[25] AER (2014), Draft decision – Ausgrid distribution determination 2014–19 – Attachment 7: Operating expenditure, November, page 7-123.

> *"[W]e consider this ratio also has weaknesses as a measure of the extent to which opex/capital mix may be affecting the benchmarking results. Primarily, this is because opex/capital input trade-offs are to a reasonable extent captured in the opex benchmarking models."*[26]

In relation to the opex to totex ratio:

> *"While a useful measure, we also consider the opex/totex ratio is not a perfect indicator of comparative opex/capital mix among the DNSPs and the extent to which this may be impacting the benchmarking results. As capital assets are long-lived, the use of capex in the opex/totex ratio, even over a long period, may not fully take account of different age asset age profiles and investment cycles among DNSPs."*[27]

In relation to the opex to total inputs ratio:

> *"[W]e also consider that there are quite significant issues with using it as a primary measure of the extent to which opex/capital mix may be affecting the benchmarking results. In addition to its volatility, the capital input quantity may also not adequately take into account important sources of capex as noted by the submissions, such as capitalisation of overheads.*[28]

We do not consider that the ratios the AER reviewed provide sufficiently accurate information on the impact of capitalisation policies on the econometric modelling or the opex MPFP results. Below, we set out three generalised examples of how different capitalisation policies across DNSPs could lead to the same (or similar) opex to totex ratios but completely different opex efficiency scores. We focus on the opex to totex ratio as we understand this is the ratio that the AER is most likely to consider if it were to make an OEF adjustment.

For simplicity, we have assumed that the outputs are the same across the DNSPs; this does not change the interpretation of our analysis. All three examples show that the opex to totex ratios could be similar across the DNSPs, but the capitalisation policies could be very different, and the efficiency scores are still materially impacted. We note, we have not linked the amount of opex to the amount of capex, as while the level of opex may increase with capex, it could also decrease if substitution is occurring (opex/ capex trade-off).

This simplification is intended to highlight the effect the capitalisation policy may be having on the opex benchmarking results. However, it also highlights the limitations of the opex/ totex ratios for determining whether the opex benchmarking is providing a true reflection of DNSPs' efficiency. We have highlighted in green in the table below the two measures that the AER indicates it reviews in its opex draft determination. Therefore, while we have shown the build up of information below to reach the opex/totex ratio and opex efficiency scores, the AER does not consider these factors.

Example 1 and **Example 2** in the tables below show that the opex efficiency scores can be substantially different pre- and post-capitalisation. In Example 1, the pre-capitalised opex indicates that the DNSPs have the same opex efficiency. However, after capitalisation is applied the DNSPs' opex efficiency scores diverge significantly. In Example 2, the pre-capitalised opex efficiency scores are different across the DNSPs. The pre- and post-capitalisation efficiency scores are also different.

[26] AER (2020b), pages 84 to 85.

[27] AER (2020b), page 83.

[28] AER (2020b), page 86.

Table 2.1: Example 1: Opex to totex ratios and efficiency scores (outputs assumed to be the same across DNSPs)

		DNSP1	DNSP2	DNSP3
Pre-capitalised opex	[1]	100	100	100
Capitalisation ratio	[2]	30%	50%	7%
Post-capitalised opex	[3]=[1]*(1-[2])	70	50	93
Capex (incl cap opex)	[4]	320	230	430
Totex	[5]=[3]+[4]	390	280	523
Opex to totex ratio	[6]=[3]/[5]	18%	18%	18%
Opex ‘efficiency’ post-capitalisation	[7]=1/([3]/min([3])	0.71	1.0	0.54
Opex ‘efficiency’ pre-capitalisation	[8]=1/([1]/min([1])	1.0	1.0	1.0

Table 2.2: Example 2: Opex to totex ratios and efficiency scores (outputs assumed to be the same across DNSPs)

		DNSP1	DNSP2	DNSP3
Pre-capitalised opex	[1]	160	100	225
Capitalisation ratio	[2]	30%	40%	25%
Post-capitalised opex	[3]=[1]*(1-[2])	112	60	169
Capex (incl cap opex)	[4]	450	240	480
Totex	[5]=[3]+[4]	562	300	649
Opex to totex ratio	[6]=[3]/[5]	20%	20%	26%
Opex ‘efficiency’ post-capitalisation	[7]=1/([3]/min([3])	0.54	1.0	0.36
Opex ‘efficiency’ pre-capitalisation	[8]=1/([1]/min([1])	0.63	1.0	0.44

The examples also show that the DNSPs’ opex/totex ratios could be broadly similar despite the significant difference in capitalisation policies. Therefore, despite DNSP1 and DNSP2 only appearing inefficient due to the difference in the capitalisation policies the AER would not make an OEF adjustment based on the opex to totex ratio.

While it could be argued that it is unlikely that the DNSPs’ outputs would be the same given the differences in capex, this is a plausible result. For example, DNSP1 and DNSP3 could be undertaking capex that is associated with (or causes) outputs in the future and/ or replacing a significant volume of assets that have reached the end of their useful life.[29] Therefore, while their capex may look high it is entirely plausible. As noted above, the AER’s draft determination on opex for Jemena did not appear to set out analysis of whether the capex/ totex levels were prudent and efficient.

Example 3 below shows that even if totex is the same level across the DNSPs, the opex efficiency scores can vary materially between pre-capitalisation and post-capitalisation of opex while the opex/totex ratios stay relatively similar with a spread of 6%. We are not aware of the AER making an OEF for a difference of 6% in the opex/totex ratio. It is important to note, in its draft determinations, the AER did not consider totex efficiency.

[29] We note that while Economic Insights refer to circuit length as an output, it is also clearly an input as DNSPs decide how much circuit to install in order to provide distribution services to consumers. Therefore, capex can result in an increase in circuit length.

Table 2.3: Example 3: Opex to totex ratios and efficiency scores (outputs assumed to be the same across DNSPs)

		DNSP1	DNSP2	DNSP3
Pre-capitalised opex	[1]	80	150	120
Capitalisation ratio	[2]	25%	45%	20%
Post-capitalised opex	[3]=[1]*(1-[2])	60	82.5	96
Capex (incl cap opex)	[4]	190	167.5	154
Totex	[5]=[3]+[4]	250	250	250
Opex to totex ratio	[6]=[3]/[5]	32%	33%	38%
Opex ‘efficiency’ post-capitalisation	[7]=1/([3]/min([3])	1.0	0.73	0.63
Opex ‘efficiency’ pre-capitalisation	[8]=1/([1]/min([1])	1.0	0.53	0.67
Totex ‘efficiency’	[9]=1/([6]/min([6])	1.0	1.0	1.0

The above examples show that even relatively small differences in capitalisation policies (e.g. 5%) can have large impacts on the measured efficiency scores, while the difference in opex/totex ratios may appear small. The ratios are affected by a range of factors beyond the DNSPs’ capitalisation policies. Therefore, even if the AER continues to use opex/ totex (and other) ratios, the AER would need to consider the difference in ratios in much greater detail rather than relying on the ‘in the range’ analysis that it has used in its draft decision.

We agree with the AER that DNSPs should not be disadvantaged in the opex benchmarking due to their opex/capex trade-off decisions, however we do not agree with the AER that the opex to totex ratio provides this information. Our examples are intended to show why the capitalisation policies are an issue. DNSPs could be spending more or less capex than other DNSPs without a noticeable change to their outputs. For example, a DNSP could have relatively high capex (over the period used for benchmarking) to increase capacity or to replace a higher proportion of assets.

The issue is not that ratios do not capture the capitalisation and opex/ capex trade-off or provide some information. The issues associated with only reviewing the ratios are that:

- The impact of capitalisation and opex/ capex trade-off cannot be assessed separately. The former is an accounting policy that should not affect the DNSPs’ measured opex efficiency, while the latter is a operational choice that can affect the DNSPs’ measured opex efficiency but needs to be considered against the DNSPs’ capex efficiency.
- The ratios do not provide information on the DNSP’s position in their asset replacement cycle, the DNSP’s efficiency/ inefficiency of capex, the DNSP’s overall totex relative to outputs, or the DNSP’s pre-capitalisation opex levels.

We believe that the AER has collected new data that can aid it in getting a better understanding of how DNSPs’ capitalisation policies affect DNSPs’ estimated efficiency scores. This is discussed below.

2.2. Our approach

Following a review of the available data, we consider that the following approaches are likely to be the best to determine the impact of fixing the CAMs on the DNSPs’ econometric efficiency scores:

- **Apply the current CAMs to the 2006-19 datasets.** This involves back casting opex using the DNSPs’ most recent CAMs. Three DNSPs (CitiPower, Powercor, and Ergon) have adopted new CAMs since 2014.
- **Allow the CAMs to vary over time.** This involves using DNSPs’ reported opex with no adjustment for changes in the CAMs.

We note that Jemena conducted and shared with us analysis it had previously conducted using similar methods. We have undertaken our own analysis; however, our results are a close match to Jemena's.

We have used Economic Insights 2020 dataset as the starting point. However, Jemena has informed us that its customer numbers as reported in the Economic Benchmarking RIN Response have been updated, and it has provided us revised estimates. We have included the updated values in our dataset.

We explain our reasons for using these two approaches below.

Apply the current CAMs to the 2006-19 datasets

As noted above, Economic Insights has used opex based on pre-2014 CAMs in its modelling since it began undertaking the AER's econometric benchmarking in 2014. In each subsequent year, it has continued to use the pre-2014 CAMs.

We consider that this has created a credible position that Economic Insights would be using the pre-2014 CAMs for the foreseeable future. This has created little scope for DNSPs to game the approach by submitting CAMs that improve their econometric benchmarking performance. We consider that this means that the current CAMs are an unbiased starting point for use in the benchmarking. Using them is akin to starting from the hypothetical of the AER undertaking benchmarking for the first time in 2020. Re-fixing the CAMs is likely only to work once, as DNSPs will assume that the AER/ Economic Insights will change its fixing point in future.

We note that two of the DNSPs that have changed their CAMs since 2014 are those which have traditionally been in the top five efficient companies based on the econometric benchmarking. Therefore, it is unlikely the change they made was to improve their benchmarking results.

We note that this approach is aligned with one of the options the AER is considering over the next 12 months to deal with the capitalisation issue.

The data and our approach to re-fixing the CAMs are set out in Appendix B.

Variable CAMs

An alternative to fixing the CAM at a particular point in time is to allow it to vary whenever a DNSP's CAM is changed. We have done this by using the reported network services opex in the annual economic benchmarking RINs.

This approach provides information on the impact on benchmarking from allowing CAMs to vary, however it is not like the approach adopted by Economic Insights in 2014.

2.3. Modelling results

In the figures below, we have provided the results, for the 2006-2019 and 2012-2019 periods, of:

- Economic insights' 2020 approach (as a reference point);
- using DNSPs' opex benchmarking data based on their current CAMs; and
- using DNSPs' opex based on their CAMs at the time.

The impact of the other DNSPs' changing their CAMs is material. Jemena's performance in the benchmarking improves noticeably in both the long period (2006-19) and the short period (2012-19).

Figure 2.1: Three output specification – Jemena's efficiency scores, 2006-2019

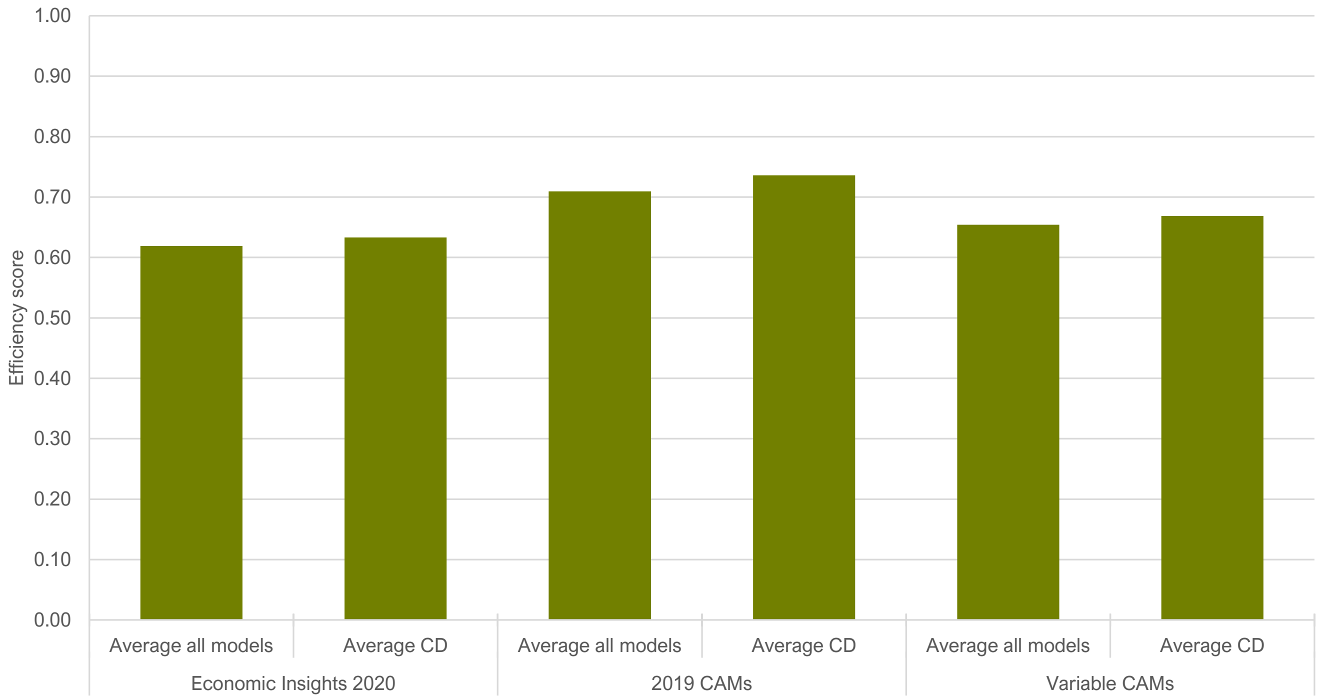
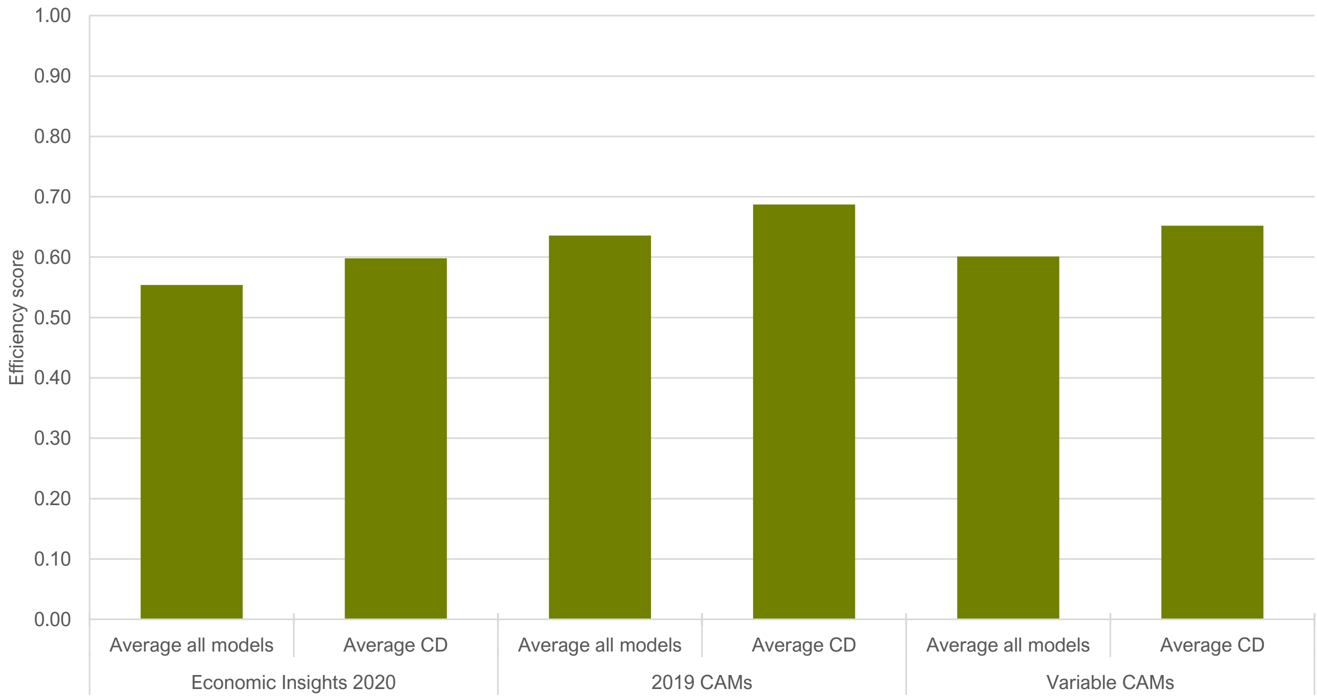


Figure 2.2: Three output specification – Jemena's efficiency scores, 2012-2019



In the table below, we have provided Jemena's efficiency scores under these two approaches compared to Economic Insights' 2020 results.

Table 2.4: Efficiency score estimates for Jemena (and percentage increases) – Three output specification models

	Economic Insights	2019 CAMs	Variable CAMs
2006-2019			
Average all models	0.62	0.71 (15%)	0.65 (6%)
Average Cobb-Douglas models	0.63	0.74 (17%)	0.67 (6%)
2012-2019			
Average all models	0.55	0.64 (15%)	0.60 (9%)
Average Cobb-Douglas models	0.60	0.69 (15%)	0.65 (9%)

Source: Regulatory Information Notices (RINs), Economic Insights, CEPA analysis

This means Jemena's opex benchmarking performance is materially improved by including the revised opex data from the three DNSPs that have updated their CAMs. We consider that the change in Jemena's opex efficiency scores are significant enough for the AER to make an OEF adjustment.

The AER has previously set out three criteria it would use for identifying relevant OEFs:

1. Is it outside of the service provider's control?
2. Is it material?
3. Is it accounted for elsewhere?[30]

Our analysis shows that DNSPs' capitalisation approaches are:

1. **Outside of Jemena's control.** The changes related to Powercor's, CitiPower's, and Ergon's CAMs.
2. **Material.** Changes in other DNSPs' capitalisation policies have a material impact on Jemena's opex efficiency score and therefore the AER's assessment of its base year efficiency. The materiality, in regards to Jemena's efficiency scores ranges from 6% to 17%, but we consider that the upper bound (15% to 17%) is appropriate as it better reflects the Economic Insights' 2014 approach of fixing the CAMs at a point in time. As Jemena's benchmarking opex in 2019 was approximately $85m the impact on Jemena's allowance could be into the double-digit millions
3. **Not accounted for elsewhere.** The AER's ratio analysis (opex/ total costs and opex/ totex) does not provide an accurate representation of the differences, and subsequent impacts, of DNSPs' capitalisation approaches and it is not captured in the AER's capex analysis.

While we have done our analysis using Economic Insights 2020 dataset which includes 2019 RIN data, we have also tested the impact using the dataset the AER relied on for its September 2020 draft decisions, which uses RIN data to 2018. The results of both datasets were similar.[31] Therefore, an OEF is justified using either dataset.

Jemena's improved scores are attributable to different capitalisation practices adopted by other DNSPs. If the DNSPs had these CAMs in place in 2014 then Jemena's benchmarking performance would have been higher in each opex benchmark since 2014.

[30] AER (2019b), Annual Benchmarking Report – Electricity distribution network service providers, November.

[31] The results using the revised 2018 dataset are provided in Appendix C.

3. RELIABILITY OF THE MODELS

After reviewing Economic Insights (2020a), its earlier reports, and the AER's draft decisions and Economic Insights' accompanying memo, we consider that there are issues with using the results of:

- The translog three output specification models.
- The MPFP opex model.

We detail our concerns with these models below.

3.1.1. Translog models

Monotonicity in the three output translog models

Economic Insights (2020c) noted the following:

> *"Monotonicity (the requirement that an output cannot be increased without an increase in cost) is imposed in the Cobb–Douglass specification but not in the more flexible translog specification.* ***Violations of the monotonicity requirement have, at times, been an issue for the SFATLG model in the full period sample and for both the SFATLG and LSETLG models in the shorter sample period from 2012 onwards.*** *These violations have become more prevalent with the inclusion of the additional year's data for 2019. Examination of this issue will cover both model specification and database issues."*[32] *[emphasis added]*

Economic Insights went on to note:

> *"[T]he SFATLG model still has monotonicity violations for three DNSPs for the full period. Its results are not included in the average efficiency scores for the two of these DNSPs which have violations for more than half their number of observations. No monotonicity violations are present for the LSETLG model for the full period. However, for the period from 2012 onwards, the SFATLG and LSETLG models each present monotonicity violations for five DNSPs for all their observations and their results are excluded for these DNSPs when forming an overall average efficiency score across models for the shorter period."*[33]

Jemena was one of the DNSPs whose coefficients Economic Insights referred to as having monotonicity violations.

We are of the view that even if only some DNSPs explicitly fail the monotonicity requirement, it indicates that there are issues with the model specification; this raises the question of whether the other estimates can be relied upon.

There are a number of concerns we have with the translog models. We set these out in turn below.

The use of the second order parameters

We note that despite the translog models being estimated to provide second order coefficients,[34] the AER does not use the second order parameters in rolling forward opex for DNSPs.[35] The AER correctly notes that the elasticities in the modelling reflect elasticities at the sample mean, and at the sample mean the second order coefficients are not relevant.[36] However, the efficiency scores for each of the DNSPs are not calculated at the sample mean. The

[32] Economic Insights (2020c), page 13.

[33] Economic Insights (2020c), page 34.

[34] Economic insights (2014), page 27.

[35] See for example, AER – Energex 2020-25 – Draft decision – Opex benchmarking RFM model_short – October 2019.xlsx'.

[36] AER (2019c), Draft decision: SA Power Networks Distribution Determination 2020 to 2025 – Attachment 6 – Operating expenditure, October, page 6-64.

second order coefficients are relevant to individual DNSPs. For example, if the models were used to predict the DNSPs' opex the second order coefficients would be used for that estimate.

Full sample or sub-sample mean

Economic Insights is now calculating the translog coefficients at the Australian sub-sample mean.[37] This creates another set of elasticity estimates that the AER could use for the output weights. However, Economic Insights states:

> *"We are relatively indifferent as to whether the translog opex cost function output weights are calculated at the overall sample mean or at the Australian sample mean. We have demonstrated that there is economic justification for using either basis and the statistical performance of the models using either basis is little different. There may be some presentational and communication advantages in normalising by the Australian sample mean and so we are prepared to adopt FE's (2019b) recommendations above. Going forward we also propose to normalise by the Australian sample mean in economic benchmarking reporting."*[38]

While Economic Insights may be "*indifferent*" to which sample mean is used to normalise the exogenous variables, its recommendations and the subsequent output weights have a direct impact on the AER's assessment of Jemena's opex. The LSE TL model's coefficients for customer numbers change from 52.95% to 37.95%. This is a material change. Economic Insights is now saying that weight on customer numbers is 28% lower. The table below shows Economic Insights' (2020b) recommended output cost weights. As can be seen, the output weights for the LSETLG model are significantly different from the other models.

Table 3.1: Economic Insights' recommended output cost weights

	LSECD	LSETLG	SFACD	SFATLG
Customer numbers	68.95%	37.95%	67.43%	69.73%
Circuit length	15.56%	21.16%	15.08%	12.37%
Ratcheted maximum demand	15.48%	40.89%	17.50%	17.90%

Source: Economic Insights (2020b)

We are of the view that "*indifferent*" falls short of 'accountability and reliability' nor 'robustness' principles set out in the AER's Better Regulation expenditure forecast assessment guideline for electricity distribution.[39] We understand that the AER may use the output weights from the full sample mean model, but Economic Insights has created further uncertainty as to the correct use of these models.

Company specific elasticity across the SFA and CD translog models

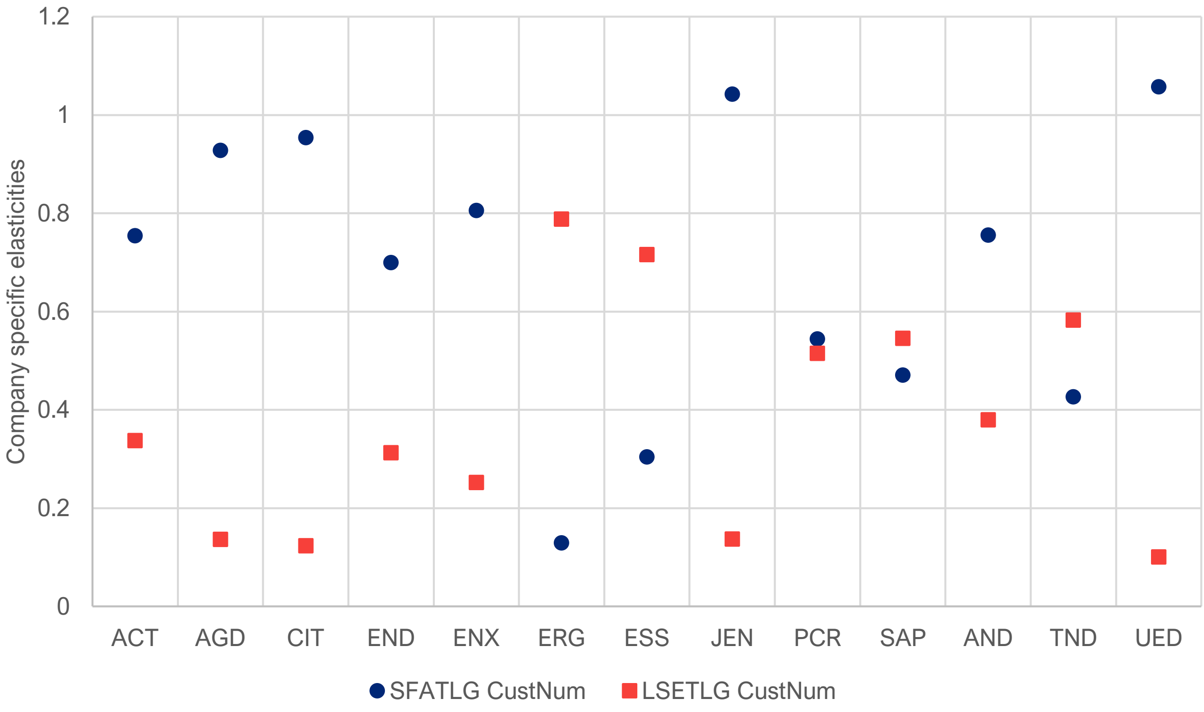
Examining the company specific elasticities that Economic Insights calculated (these were published alongside Jemena's draft decision) highlights our concerns with the translog models. In the figure below, we have plotted the average customer numbers' elasticity for each DNSP over 2006-2018 using the data in the tab '2006-18 Monotonicity Checks' in the spreadsheet 'Economic Insights AER DNSP Opex Eff Scores 2006-18 15Jul2019 Revised.xls'.

[37] Economic Insights (2020b), Memorandum: Review of reports submitted by CitiPower, Powercor and United Energy on opex input price and output weights, 18 May.

[38] Economic Insights (2020b), page 20.

[39] AER (2013b), Better Regulation: Expenditure Forecast Assessment Guideline for Electricity Distribution, November, pages 15-16.

Figure 3.1: DNSPs' 2006-2019 average customer number elasticities



Source: Economic Insights, CEPA analysis

Jemena's average customer number elasticity varies from 0.14, in the translog least squares model, to 1.04, in the translog SFA model. This indicates that, in the first model, Jemena's opex increases by 0.14% for every 1% increase in customer numbers, while in the second model Jemena's opex increases by 1.04% for every 1% increase in customer numbers.

It is concerning how different the elasticities are across the two models given that the model specifications are the same and the only difference is the estimator used (least squares versus maximum likelihood). We would expect the elasticities to be similar for the companies across the two models. These differences are inconsistent with economic and engineering theory.

Given the monotonicity violations, the fact that the translog models' elasticities are not used as intended, and Economic Insights' indifference as to which method for the translog models should be used, we are of the view that the AER should not, until it understands what is leading to the differences and has consulted on these issues, put any weight on the results of these models for the purposes of setting Jemena's allowance.

Two output specification models

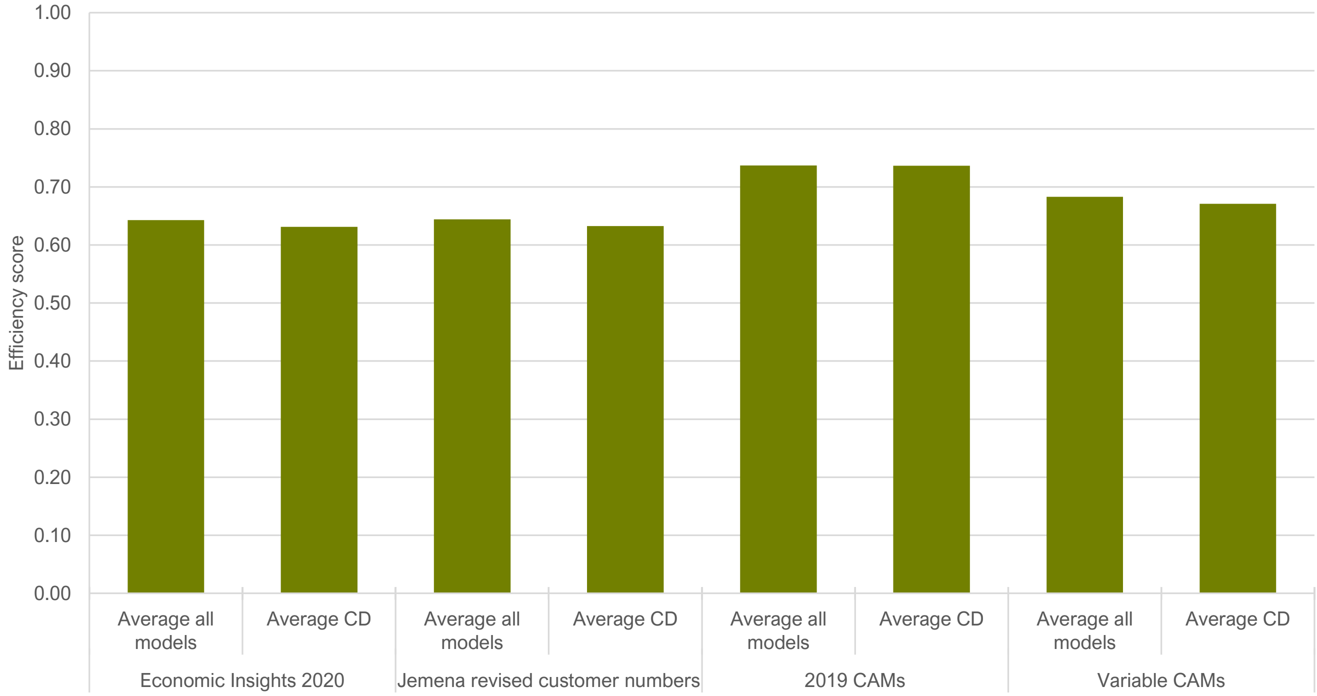
We support the investigation of the two output specification models. Indeed, we proposed the use of two output specification models in 2015 (see CEPA, 2015) and continue to consider that these models are worthwhile exploring due to multicollinearity in the explanatory variables.[40] As we set out in our report:

[40] We note that Economic Insights (2015) incorrectly referred to our models as only having a single output variable in the main body of its report. Economic Insights (2015), Response to Consultants' Reports on Economic Benchmarking of Electricity DNSPs, April, page 7.

"[we used] the transformation of customer numbers divided by length for circuit density. This provides a different interpretation of the coefficient, but in a log model the overall results are the same as if customer numbers alone was used as an explanatory variable."[41]

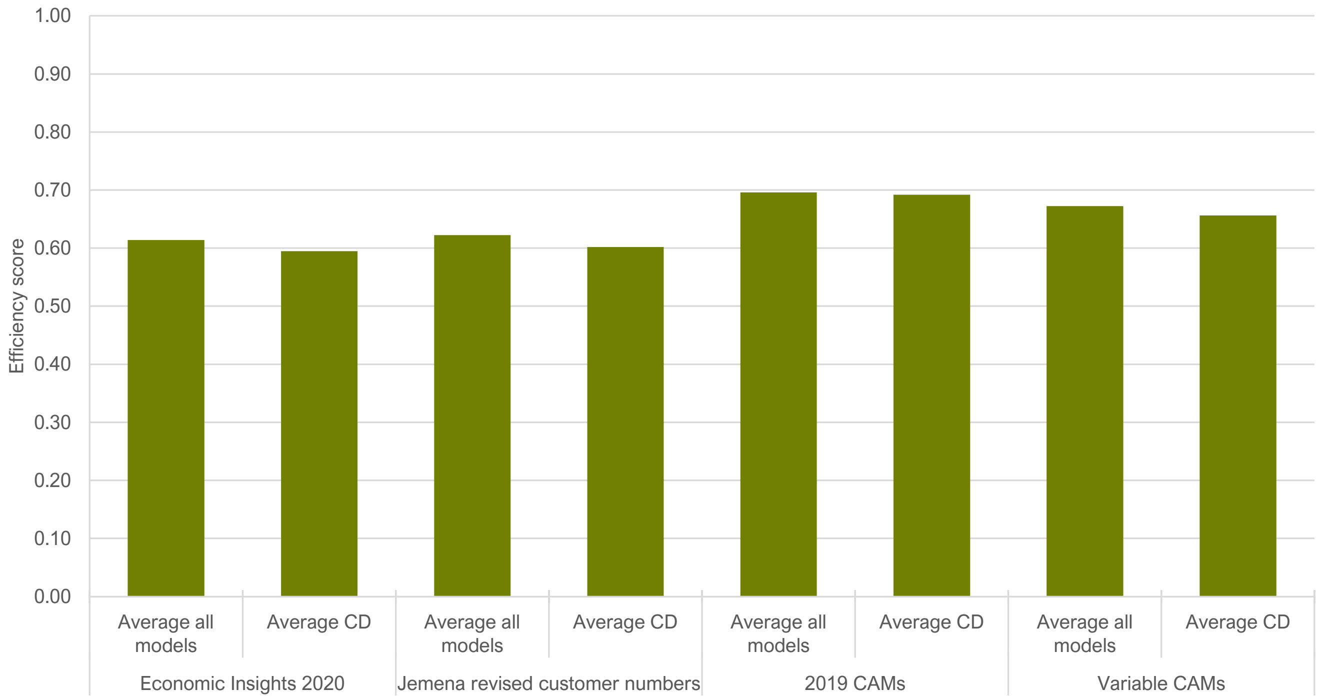
We have run models with a two output specification, excluding ratcheted maximum demand. Jemena's efficiency scores under a two output specification models, using Jemena's updated customer numbers and the post-2014 CAM and variable CAM options are shown in the figures below.

Figure 3.2: Two output model – Jemena's efficiency scores, 2006-2019



[41] CEPA (2015), Benchmarking and setting efficiency targets for the Australian DNSPs, a report prepared for ActewAGL Distribution, page 21. Although as we noted in CEPA (2015), multicollinearity by itself in not necessarily an issue as the results will still be unbiased.

Figure 3.3: Two output model – Jemena's efficiency scores, 2012-2019



Jemena's efficiency scores are much higher under the two output specification model compared to the three output specification models. The table below provides Jemena's estimated efficiency scores (using Jemena's updated customer numbers).

Table 3.2: Efficiency score estimates for Jemena – Two output specification models (customer numbers and circuit length)

	Economic Insights	2019 CAMs	Variable CAMs
2006-2019			
Average all models	0.64	0.74	0.68
Average Cobb-Douglas models	0.63	0.74	0.67
2012-2019			
Average all models	0.62	0.70	0.67
Average Cobb-Douglas models	0.60	0.69	0.66

Source: RINs, Economic Insights, CEPA analysis

We can see from the above that the impact of the CAM changes in the two output specification models are similar to the impact in the three output specification models.

We have not run two output specification models excluding customer numbers. We consider that the materially higher elasticity on customer numbers in the three output models compared to the elasticity on ratcheted maximum demand supports the use of customer numbers over ratcheted maximum demand. We also consider this is more aligned with the drivers of costs for DNSPs over recent years. As Economic Insights (2020c) also states:

> *"Therefore, short run opex costs can be more responsive to changes in customer numbers and less responsive to circuit length. The variation in customer numbers can explain considerable variation of opex costs, potentially relating to costs caused as a result of customer services including billing and collections, and inquiries, and connection-side repairs. However, capital inputs and their costs (which are considerably larger overall than opex) are more responsive to functional outputs relating to the*

> *employment of capital inputs, such as circuit line length and RMD, but relatively less responsive to functional outputs that more likely cause short run cost changes, such as customer numbers"*[42]

Prior to this statement, Economic Insights claim that customer numbers will be of secondary importance as customer-end assets will be a small proportion of total assets:

> *"The customer numbers output will be more closely aligned to the fixed and variable costs associated with having a customer connected such as service lines, local street access and responding to customer requests and complaints. While it provides information on the additional functions the DNSP has to perform, it can arguably be expected to be of secondary importance compared to the primary transport function as the customer–end assets will be a smaller proportion of total asset fixed costs and some of opex will be associated with line, cable and transformers as reflected in the circuit length and RMD outputs. Similarly, the capacity of the lines and transformers the DNSP has to provide can be expected to be primarily influenced by ratcheted maximum demand with energy throughput playing a secondary role."*[43]

The implication of Economic Insights' claims is that it considers that ratcheted maximum demand and circuit (MVA) length are better longer-term drivers of the DNSPs' total cost. However, of course the other assets (i.e. non 'end-customer') are put in place to deliver services to consumers, i.e. ratcheted maximum demand and energy throughput are based on customer demand and circuit (MVA) length is the DNSPs' investment in assets to deliver the services to consumers. Therefore, we consider a higher weight on customer numbers as a driver for opex is supported.

Regardless, as customer numbers are highly correlated with ratcheted maximum demand and circuit length, and the opex econometric modelling places more weight on customer numbers then statistically customer numbers are a more important driver than ratcheted maximum demand and circuit length. We discuss in the next section why we do not consider any weight can be placed on the current output weights resulting from Economic Insights' Leontief cost functions.

Dataset size

With regard to Economic Insights suggesting adding more overseas DNSPs to the sample, we are still of the view, set out in 2015,[44] that the use of overseas data does not necessarily increase the accuracy of the coefficients on the cost drivers.

The country dummy variable included in Economic Insights' model picks up any fixed difference between countries, i.e., higher/ lower average wages.[45] It does not account for environmental differences across the countries that drives costs in a non-fixed way. For example, Australia has significantly higher penetration of DER (specifically solar PV) than Ontario and New Zealand. This means that cost per customer is likely to be different over time as Australian DNSPs carry out different activities to manage DER on their networks. The AER has noted that opex is changing due to DER (see AER, 2019), however the econometric modelling does not currently take this into account.[46]

3.1.2. Opex MPFP

As Economic Insights set out in its 2020 report, a calculation error led to it miscalculating the weights for the output index used for the MPFP from when it was first introduced until its 2020 report:

[42] Economic Insights (2020c), page 5.

[43] Economic Insights (2020c), page 5.

[44] CEPA (2015).

[45] Although we note that Economic Insights do not have sufficient data from the overseas jurisdictions to determine this.

[46] AER (2019d), Assessing DER integration expenditure, November.

"A report submitted to one of the AER's distribution determinations has identified a coding error in the formation of the time trend variables included in the Leontief input demand regressions from which the four non–reliability output weights previously used in Economic Insights (2014, 2018) have been derived (Frontier Economics 2019, p.11).

…

In early applications of this method the time trend variable was formed outside the Shazam econometrics program code and was instead read in as part of the data file (eg Lawrence 2003). However, in Economic Insights (2014) (which used data covering the 8 years 2006 to 2013) and Economic Insights (2018) (which used data covering the 12 years 2006 to 2017) the time trend was formed by Shazam code. Instead of resetting the time trend to a common base for the observations applying to each DNSP, the time trend was mistakenly formed over the entire sample. Thus, taking Economic Insights (2018) as an example, instead of the time trend running from 1 to 12 for the annual observations for all DNSPs, the time trend ran from 1 to 12 for the first DNSP in the database, from 13 to 24 for the second DNSP and so on. Because the models are non–linear, this could have a distorting effect on the results obtained, particularly for the time trend coefficient."[47]

Economic Insights' corrected and updated estimates are significantly different from its 2014 and 2018 estimates. These estimates and the average for the econometric models are shown in the table below.

Table 3.3: Comparison of the weights (elasticities) used/ produced by Economic Insights' modelling

Output weights	2014 MTFP/MPFP (with error and used until 2017)	2018 MTFP/MPFP (before error correction)	2019 MTFP/MPFP (after error correction)	Average of 4 Econometric Models 2006-19*	Average of 4 Econometric Models 2012-19*
Customer numbers	45.8%	30.29%	18.52%	55.95%	53.35%
Circuit length	23.8%	28.99%	39.14%	15.48%	21.30%
Ratcheted maximum demand	17.6%	28.26%	33.76%	28.58%	25.35%
Energy throughput	12.8%	12.46%	8.58%	n/a	n/a

Source: Economic Insights

The primary impact of correcting for the error and updating the period estimated is a reduction in the weight on customer numbers. The weights on circuit length and ratcheted maximum demand increased.

The weights are based solely on Australian data and regressions for each DNSPs. Economic Insights has stated that it does not consider Australian data is sufficient for its econometric models to produce robust results.[48] **While Economic Insights claim that Leontief cost function regressions (used to form the output weights) are simple, non-robust results are an issue regardless of whether the modelling is simple or complex.**[49] Economic Insights notes that it does not expect to achieve impressive looking statistical results:

[47] Economic Insights (2020c), page 4.

[48] Economic Insights (2014a).

[49] Economic Insights (2020a), page 122, Economic Insights (2020c), Economic Benchmarking Results for the Australian Energy Regulator's 2020 DNSP Annual Benchmarking Report, October, page 3.

> *"As a result, the Leontief cost function will never produce impressive–looking statistical results. For a 4–output model we, as practitioners, would normally expect to get at least one significant output coefficient per regression equation, occasionally 2 significant and, on very rare occasions, 3 significant coefficients"*[50]

However, while 47 of 52 models produce some statistically significant coefficients – 28 of 52 models (54%) produce only a single significant output coefficient, 17 (33%) produce two significant coefficients and two (4%) produce three significant coefficients –[51] the majority of the coefficients are not statistically different from zero and when they are, they vary significantly across DNSPs. Take for example the coefficients generated for the real opex regressions. The coefficients are shown for each DNSP in the table below.[52] We have left out all zero coefficients and we have highlighted in red the ones that are not statistically significant (at the 5% level). The R^2 (a measure of the models' goodness-of-fit) is also provided and we have highlighted all R^2 below 0.5 in red (a value of 1.0 would mean that the model explains all the variation of opex from its mean). As can be seen, the majority of the regressions do not have a high R^2. Note, Economic Insights (2020c) does not provide the R^2 values, however these were provided in Economic Insights (2020a and 2020b). Economic Insights does not explain why these are removed from its most recent report, but we consider they provide useful information on the models' statistical performance.

Table 3.4: Economic Insights' real opex Leontief cost function regression results

	Energy	RMD	Customer Numbers	Circuit length	R^2
EVO		2.125*		2.728*	0.143
AGD		7.928			0.256
CIT	2.193				0.539
END	3.013			-0.719*	0.313
ENX		6.921			0.674
ERG		2.786*		1.225*	0.132
ESS			0.577		0.088
JEN			0.383		0.738
PCR		2.220*		-1.153*	0.408
SAP		-6.193			0.816
AND		7.378			0.797
TND	3.398				0.249
UED	3.080	1.564*			0.332

Source: Economic Insights (2020a)

To help explain what these results mean, we can pick out some specific results:

- EvoEnergy, Ergon, and Powercor – the results for these DNSPs indicate that none of the outputs (on a statistical basis) explain their levels of opex.

[50] Economic Insights (2020a), page 123. Although in 2018 when there was an error in Economic Insights it was willing to use the weights despite the majority its regressions not producing a single statistically significant coefficient on the output variables.

[51] Economic Insights (2020a), page 123.

[52] Economic Insights (2020a) tables B1 to B13.

- Essential Energy – customer numbers is statistically significant, however with an R^2 of 0.088, the model is only marginally better at estimating the variance in Essential Energy's opex than using Essential Energy's mean opex.

The statistical results are better than those Economic Insights previously accepted its 2018 modelling when it was not aware of the error in its calculations.[53] However, 'better' is a relative term and the statistical results are still poor. We consider that given the importance of these coefficients in setting the output weights and given how low the majority of the R^2 values are, no conclusion on the weights can be drawn from the results. We do not consider that requiring a regression model to be a able to reasonably explain the variations in the independent variable is "*judg[ing]… [the Leontief cost functions] by the same standards we would use for fitting smooth functions such as the Cobb-Douglas or translog*".[54] **We consider that modelling results should be robust, replicable and transparent. If a regression-based model cannot be judged on its statistical performance then, in our view, the model probably should not be used.**

The Leontief regression results for the other inputs are provided in Appendix C.

In addition, Economic Insights argue that the weights can be different from the opex benchmarking weights as they represent outputs relationship with total costs:

> *"In assessing the corrected output weights, it is important to remember that, unlike opex cost functions, output weights in partial productivity index number methods are based on shares in total cost. In this context, the reallocation of weight away from energy throughput and customer numbers towards circuit length and RMD in the corrected weights is consistent with what we would expect conceptually from both an engineering and an economic perspective. The main function of the distribution network is the transport of electricity from bulk supply points to end users. As such, we would expect circuit length to be the most important output in terms of total cost as it is closely aligned, as is the RMD output, to the fixed costs of lines, cable and transformer inputs which make up the bulk of a DNSP's total costs.*
>
> *…*
>
> *Therefore, short run opex costs can be more responsive to changes in customer numbers and less responsive to circuit length. The variation in customer numbers can explain considerable variation of opex costs, potentially relating to costs caused as a result of customer services including billing and collections, and inquiries, and connection-side repairs."*[55]

The AER are using the output weights to roll forward opex, not total costs; it is not clear why these weights are appropriate to roll forward opex when they reflect total costs.

Given the two reasons set out above – statistically insignificant results and weights based on total costs not opex – we consider that the AER should not use the output weights generated from the Leontief cost functions to roll forward opex.

In addition, we do not consider that the multilateral productivity approaches currently meet the AER's assessment principles that are set out in its expenditure forecast assessment guidelines,[56] given:

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[53] Frontier Economics (2019), Review of econometric models used by the AER to estimate output growth:, a report prepared for CitiPower, Powercor and United Energy, December, page 8, stated that "*Out of the 52 Leontief equations estimated by EI for the AER's 2018 Annual Benchmarking report, 27 equations (52%) have not a single estimated coefficient that is statistically significant at the most commonly used level of significance of 5%. If we use the less stringent 10% level of significance, there are still 24 equations (46%) that do not have a single statistically significant coefficient.*"

[54] Economic Insights (2020c), page 11.

[55] Economic Insights (2020c), page 5.

[56] AER (2013b), pages 17-18.

- The limited statistical significance of the weights – this does not meet the '**robustness**' principle.
- The materially different coefficients in the Leontief cost function regressions – this does not meet the '**accuracy and reliability**' or '**robustness**' principles.

In addition, we consider that the AER should conduct a wider consultation with DNSPs to determine what their current opex drivers are in order to better inform its modelling approach before relying on the MPFP results in setting DNSPs' opex allowances.

CEPA economics matters

Appendix A AER'S PREVIOUS APPROACH TO CAPITALISATION OEFS

As part of its 2015 decisions regarding DNSPs in NSW, Queensland and the ACT, the AER assessed potential OEFs using three criteria:

- **Exogeneity** – An OEF should be outside the control of the DNSP's management. The AER considered that when the effect of an OEF was within management's control, it would not generally provide an adjustment to avoid masking inefficient expenditure.
- **Materiality** – The AER treated as material any OEF that would increase opex relative to other DNSPs by at least 0.5%.
- **Duplication** – I.e. an OEF should not be accounted for elsewhere (e.g. the benchmarking model or another OEF).[57]

The AER only provided adjustments for exogenous and non-duplicative factors. For material exogenous and non-duplicative factors, the AER made an adjustment 'to the level of that materiality'. [58] For immaterial exogenous and non-duplicative factors, the AER considered whether each individually immaterial OEF provided the DNSP with a cost advantage/ disadvantage, translating each into a -0.5%/ +0.5% adjustment, i.e. the level of the materiality threshold. However, if the AER was able to quantify the effect of the immaterial factor, it would only adjust for the amount quantified.[59]

One of the OEFs considered as part of the 2015 determinations were capitalisation practices. In relation to exogeneity, the AER noted that:

> *"…choices on capital inputs and accounting policies are management decisions so would not satisfy the exogeneity OEF criterion. Nonetheless, because these differences may lead to differences in costs unrelated to efficiency, we have treated this OEF as if it satisfies the exogeneity OEF criterion."*[60]

and

> *"Cost allocation is not an efficiency consideration. It is not relevant to assessing whether the revealed expenditure in a base year is able to form the starting point of a total forecast that we are satisfied reasonably reflects the opex criteria."*[61]

In relation to duplication, the AER concluded that its SFA models did not account for capitalisation practices.[62] Therefore, the AER decided to allow an OEF for capitalisation practices. The AER clarified that capitalisation practices included both DNSPs' decision on the relative quantity of capital and operating costs and the policies DNSPs used to classify costs as assets or expenses, as both had the potential to affect efficiency scores.[63]

ActewAGL (now Evoenergy) was the only DNSP to have capitalisation practices recognised as a material factor, with an OEF of 8.5%. The AER noted that ActewAGL's capitalisation practices for vehicle and IT leasing costs

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[57] AER (2015a), *Final Decision: ActewAGL distribution determination 2015−16 to 2018−19 Attachment 7 – Operating expenditure*, April, p. 174.

[58] AER (2015a), p. 167-168.

[59] AER (2015a), p. 175.

[60] AER (2015a), p. 188.

[61] AER (2015d), *Final Decision: Ergon Energy determination 2015−16 to 2019−20 Attachment 7 – Operating expenditure*, October, p. 60.

[62] AER (2015a), p. 169.

[63] AER (2015a), p. 188.

provided it with a material cost disadvantage relative to the comparison firms (i.e. DNSPs in Victoria and South Australia) and not adjusting for these would penalise the company for actions unrelated to efficiency. The AER based the adjustment on the percentage of opex the costs identified rather than their absolute value, as it considered that the costs identified would contain the same inefficiencies identified in other parts of ActewAGL's opex. [64]

The AER noted that the relative efficiency of DNSPs' opex and capex programs and their position in their asset replacement cycle would affect DNSPs' opex capex ratio. As some of these factors are related to efficiency and some are not, the AER decided to provide material adjustments to a DNSP's benchmarking results only when its opex as a percentage of total expenditure was not broadly consistent with its peers'. The AER considered that this metric was appropriate as it accounted for opex capex trade-offs as well as differences in the capitalisation of indirect costs. On this basis, ActewAGL appeared as the only outlier.[65]

In its draft decision on ActewAGL, the AER also provided an OEF adjustment for a change in the company's CAM that had led to $9.9 million ($2013-14) of overheads being allocated to capex instead of opex. This meant including in the opex forecast overheads that would be capitalised. The AER changed its position in the final decision, considering that a forecast of opex that included capex would not reflect efficient opex and that since the change meant that ActewAGL was going to adopt a practice similar to its peers in the forecast period, it no longer required an OEF adjustment.[66]

For NSW DNSPs, the AER treated capitalisation practices as an individually immaterial OEF, noting that differences in capitalisation policies did not lead to material differences in total opex between the NSW DNSPs and the comparison firms.[67] The AER made a -0.5% adjustment for Ausgrid and Essential Energy, and a +0.5% adjustment for Endeavour. The decision to treat capitalisation practices as an immaterial factor and the sign of the adjustment were based on the AER's assessment of the NSW DNSPs' historical and forecast opex/ total expenditure ratios.[68]

Similar reasoning was applied to Queensland DNSP Energex and Ergon which received adjustments of +0.5% and -0.5% respectively with capitalisation practices being treated as an individually immaterial factor.[69] Energex and Ergon had considered that they would be disadvantaged in benchmarking because they expensed their IT costs but the AER decided not to adjust specifically for this because their opex, as a percentage of totex, was similar to those of the comparison firms – suggesting that their policy in relation to IT costs was offset by capitalising a higher percentage of costs in other areas.[70]

[64] AER (2015a), p. 169 and 188.

[65] AER (2015a), p. 188-190.

[66] AER (2015a), p. 191-192.

[67] AER (2015b), *Final Decision: Ausgrid distribution determination 2015−16 to 2018−19 Attachment 7 – Operating expenditure*, April, p. 182 and 193.

[68] AER (2015b), p. 196.

[69] AER (2015c), *Preliminary Decision: Ergon Energy determination 2015−16 to 2019−20 Attachment 7 – Operating expenditure*, April, p. 171.

[70] AER (2015c), p. 183.

Appendix B NEW CAM DATA

We used the following files to construct historical opex series for CitiPower, Powercor, and Ergon Energy:

- CitiPower - RIN003 - Workbook 3 - Recast CAT - 31 January 2020.
- CitiPower - RIN004 - Workbook 4 - Recast EB - 31 January 2020.
- Powercor - RIN003 - Workbook 3 - Recast CAT - 31 January 2020.
- Powercor - RIN004 - Workbook 4 - Recast EB - 31 January 2020.
- Ergon Energy - 17.055 - Recast Category Analysis RIN template 2020-25 - February 2019.
- Ergon Energy - 17.056 - Recast Economic Benchmarking RIN template 2020-25 - January 2019.

CitiPower and Powercor

The CitiPower and Powercor recast RINs provides the data for the DNSPs under their new CAMs. The change in CAM from 2016 onwards leads to higher network services opex as CitiPower and Powercor reduce the overheads that they have capitalised. The recast RINs contain data back to 2009.

We have used the ratio of standard control opex to standard control opex less the capitalised overheads, to estimate the network services opex for 2006 to 2008. The values we used are shown in the table below.

App_Table B.1: Alternative opex for CitiPower and Powercor

Year	CitiPower		Powercor	
	2019 CAMs	Varying CAMs	2019 CAMs	Varying CAMs
2006	36,461	26,413	139,753	116,861
2007	43,249	31,330	127,194	106,360
2008	42,960	31,121	135,751	113,515
2009	49,471	37,630	150,881	128,380
2010	53,205	42,280	153,300	127,280
2011	52,156	40,683	159,398	137,174
2012	64,745	52,809	195,044	167,746
2013	66,168	52,531	212,875	183,726
2014	71,509	55,151	186,264	171,080
2015	75,235	54,115	219,945	186,774
2016	76,712	76,712	199,545	199,545
2017	74,809	74,809	215,491	215,491
2018	71,835	71,835	224,219	224,219
2019	75,670	75,670	221,424	221,424

Source: RINs, CEPA analysis

Ergon

> *"The AER approved Ergon Energy's CAM in July 2014, effective from the 1 July 2015, introducing changes compared to the prior CAM primarily for the following:*
>
> - *Reclassification of services (AER FDD Attachment 13) from SCS to ACS, predominately for Real Estate Developments and Type 5 & 6 Metering; and*

- *Redundancies are recognised as Regulated Opex costs.*

The AER approved a subsequent change to Ergon Energy's CAM in November 2018, effective from the 1 December 2018, for a change in circumstance for corporate and organizational structure, and the accountability for the CAM. The methodologies for attributing and allocating costs remained unchanged."[71]

The values we used are shown in the table below.

App_Table B.1: Alternative opex for Ergon

Year	2019 CAM	Varying CAM
2006	272,381	259,958
2007	260,339	241,890
2008	292,037	269,457
2009	295,116	270,467
2010	303,431	270,621
2011	389,812	345,122
2012	439,132	363,976
2013	423,290	298,481
2014	477,687	308,046
2015	506,592	362,830
2016	529,305	529,305
2017	349,037	349,037
2018	382,621	382,621
2019	388,764	388,764

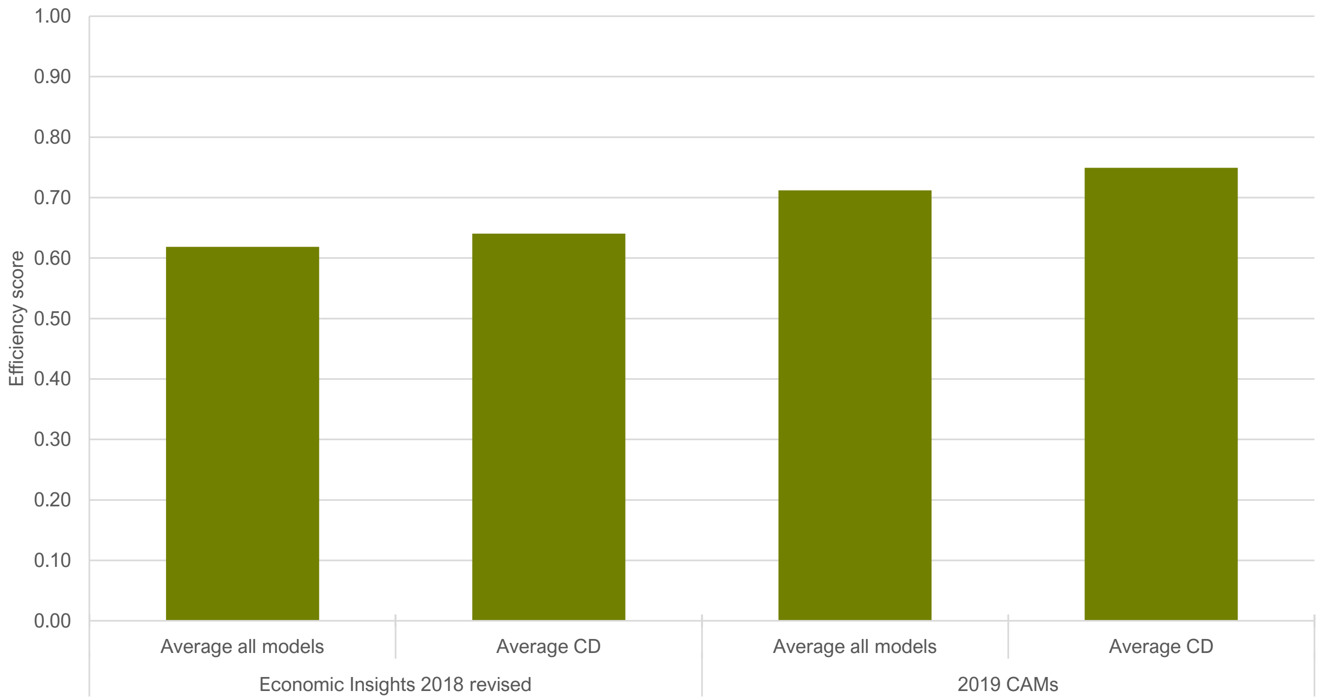
Source: RINs, CEPA analysis

[71] Ergon Energy (2019), Basis of Preparation Economic Benchmarking RIN, 31 October, page 19.

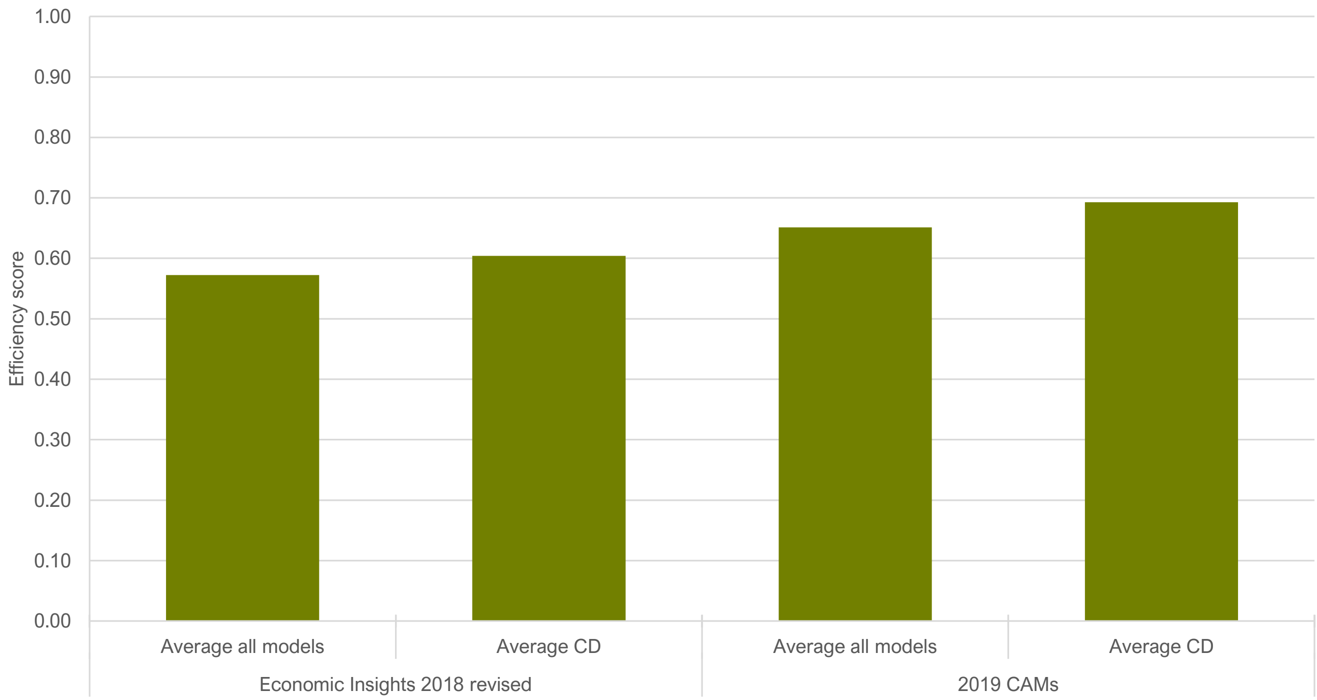
Appendix C RESULTS BASED ON THE REVISED 2018 DATASET

Below we have replicated our approach to fixing opex to the current CAMs as set out in Section 2.2 using the dataset published alongside the AER's draft decision for Jemena ('DNSPData AusNZOnt 15Jul2019x BM Revised').

App_Figure C.1: Three output specification – Jemena's efficiency scores, 2006-2018



App_Figure C.2: Three output specification – Jemena's efficiency scores, 2012-2018



App_Table C.1: Efficiency score estimates for Jemena (and percentage increases) – Three output specification models

	Economic Insights	2019 CAMs
2006-2019		
Average all models	0.62	0.71 (15%)
Average Cobb-Douglas models	0.64	0.75 (17%)
2012-2019		
Average all models	0.57	0.65 (14%)
Average Cobb-Douglas models	0.60	0.69 (15%)

Source: Regulatory Information Notices (RINs), Economic Insights, CEPA analysis

Appendix D LEONTIEF COST FUNCTION REGRESSION RESULTS

The tables below provide Leontief regression results for inputs other than real opex.

We have left out all zero coefficients and we have highlighted in red the ones that are not-statistically significant (at the 5% level). The R^2 (a measure of goodness-of-fit) is also provided, we have highlighted all R^2 below 0.5 in red.

The high R^2 values for the regressions are expected as there are very high correlations between the dependent variables – overhead lines (MVAKms), underground cables (MVAkms), and transformer capacity (MVA) – and the explanatory variables. For example, circuit length is highly correlated with overhead line MVAkms and underground cables MVAkms, and ratcheted maximum demand is very highly correlated with transformer capacity.

App_Table D.1: Economic overhead lines (MVAKms) Leontief cost function regression results

	Energy	RMD	Customer Numbers	Circuit length	R^2
EVO		9.356		1.630	0.925
AGD				-3.036	0.438
CIT			0.082*	1.355	0.461
END		5.275		2.842	0.090
ENX		1.556		2.351	0.958
ERG		6.503		1.624	0.460
ESS	3.171			1.423	0.962
JEN		-1.212*	0.209*	2.352*	0.711
PCR			0.622	1.561	0.682
SAP	1.457		0.207	1.298	0.713
AND		1.176		2.151	0.877
TND	-2.069			1.908	0.944
UED		2.353	0.355		0.871

Source: Economic Insights (2020a)

App_Table D.2: Economic underground cables (MVAKms) Leontief cost function regression results

	Energy	RMD	Customer Numbers	Circuit length	R^2
EVO		2.226		1.078	0.975
AGD				-2.026	0.891
CIT	-0.438*			-1.358	0.982
END				0.945	0.984
ENX		3.243			0.989
ERG		-1.913			0.980
ESS		1.578*		0.150*	0.865
JEN				-1.140	0.989
PCR		1.841	0.040*		0.949
SAP		1.495		0.439	0.990
AND			0.152		0.996
TND			0.109*	-0.558	0.976

	Energy	RMD	Customer Numbers	Circuit length	R^2
UED		0.877	0.077	-0.581	0.993

Source: Economic Insights (2020a)

App_Table D.3: Economic transformers (MVA) Leontief cost function regression results

	Energy	RMD	Customer Numbers	Circuit length	R^2
EVO	0.475			0.722	0.990
AGD		2.028			0.928
CIT	-0.721	0.393*			0.980
END		0.606*		-0.810	0.978
ENX		1.283		0.642	0.995
ERG			0.130	0.520	0.976
ESS			0.141		0.985
JEN		-0.844		0.680	0.976
PCR		-0.518		0.321	0.997
SAP	-0.535*	-0.602*		0.281	0.975
AND		1.526	0.059*	0.138*	0.986
TND			0.115		0.974
UED		0.965	0.086		0.986

Source: Economic Insights (2020a)

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