9 DECEMBER 2019

ASSESSMENT OF THE AER'S BENCHMARKING ANALYSIS

A REPORT PREPARED FOR ERGON ENERGY AND ENERGEX

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1 INTRODUCTION

On 8 October 2019 the Australian Energy Regulator (AER) published Draft Decisions on the regulatory proposals submitted by Energex and Ergon Energy for the 2020-25 regulatory control period (the Draft Decisions). A key component of the total revenue allowance proposed by the AER in the Draft Decisions is the allowance for operating expenditure (opex). The AER assessed the opex forecasts submitted by Energex and Ergon Energy using a base-step-trend approach. This involved establishing a level of efficient opex in a base year (taken to be 2018-19 in the Draft Decisions) and trending that base level of opex forward over the regulatory control period, taking account of required step changes in opex over that period.[1]

The AER used benchmarking analysis in the Draft Decisions to assess the efficiency of base year opex proposed by Energex and Ergon Energy. The AER concluded that whilst there was evidence that Energex's and Ergon Energy's opex had been "relatively inefficient in the past," the opex efficiency of both Distribution Network Service Providers (DNSPs) had improved over the first three years of the current regulatory control period such that their estimated base year opex is "not materially inefficient."[2]

However, the AER noted that this assessment in Ergon Energy's case was "finely balanced", and that it would "review this position after updating our benchmarking analysis, taking into account the actual base year opex included in Ergon Energy's revised proposal and the results of our 2019 Annual Benchmarking Report, which will be published in late November 2019."[3]

1.1 Our terms of reference

We have been asked by Energex and Ergon Energy to:

- Provide an expert opinion on the robustness and reliability of the benchmarking analysis relied on by the AER in the Draft Decisions; and
- Using relevant information supplied to us by Energex and Ergon Energy, including the data underlying the AER's 2019 Annual Benchmarking Report, provide an expert opinion on whether there is evidence to suggest that the 2018-19 base year opex proposed by Energex and Ergon Energy, respectively, in their revised proposals is materially inefficient.

1.2 Key findings

Our key findings are the following.

There is no evidence that either Energex's or Ergon Energy's proposed base year opex is materially inefficient

- We have assessed the efficiency of the 2018-19 base year opex amounts proposed by Energex and Ergon Energy in their revised regulatory proposals. We have done so:

[1] The AER noted in its Draft Decisions that whilst it took a different view on specific components of Energex's and Ergon Energy's proposal, the AER's alternative estimate of total opex (assessed using its base-step-trend approach) was higher than Energex's and Ergon Energy's proposals. The AER therefore accepted Energex's and Ergon Energy's total opex proposals.

[2] Energex, Draft Decision, October 2019, Attachment 6, p. 9; Ergon Energy Draft Decision, October 2019, Attachment 6, p. 25.

[3] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 43.

  - Using Energex’s and Ergon Energy’s revised proposal for base year opex. We note that Ergon Energy’s proposed base year opex is normalised for unusually high storm costs. However, we also consider Ergon Energy’s actual base year opex, without this normalisation for storm costs. We find no evidence of material inefficiency in either of these scenarios;
  - Using the 2019 Annual Benchmarking Report dataset;
  - Using the benchmarking approach adopted by the AER in the Draft Decisions, having updated the AER’s OEF estimates;
  - Having implemented several methodological improvements to the benchmarking approach used by the AER in the Draft Decisions; and
  - Taking account of statistical uncertainty around estimates of target base year opex, by constructing confidence intervals around point estimates of target base year opex.

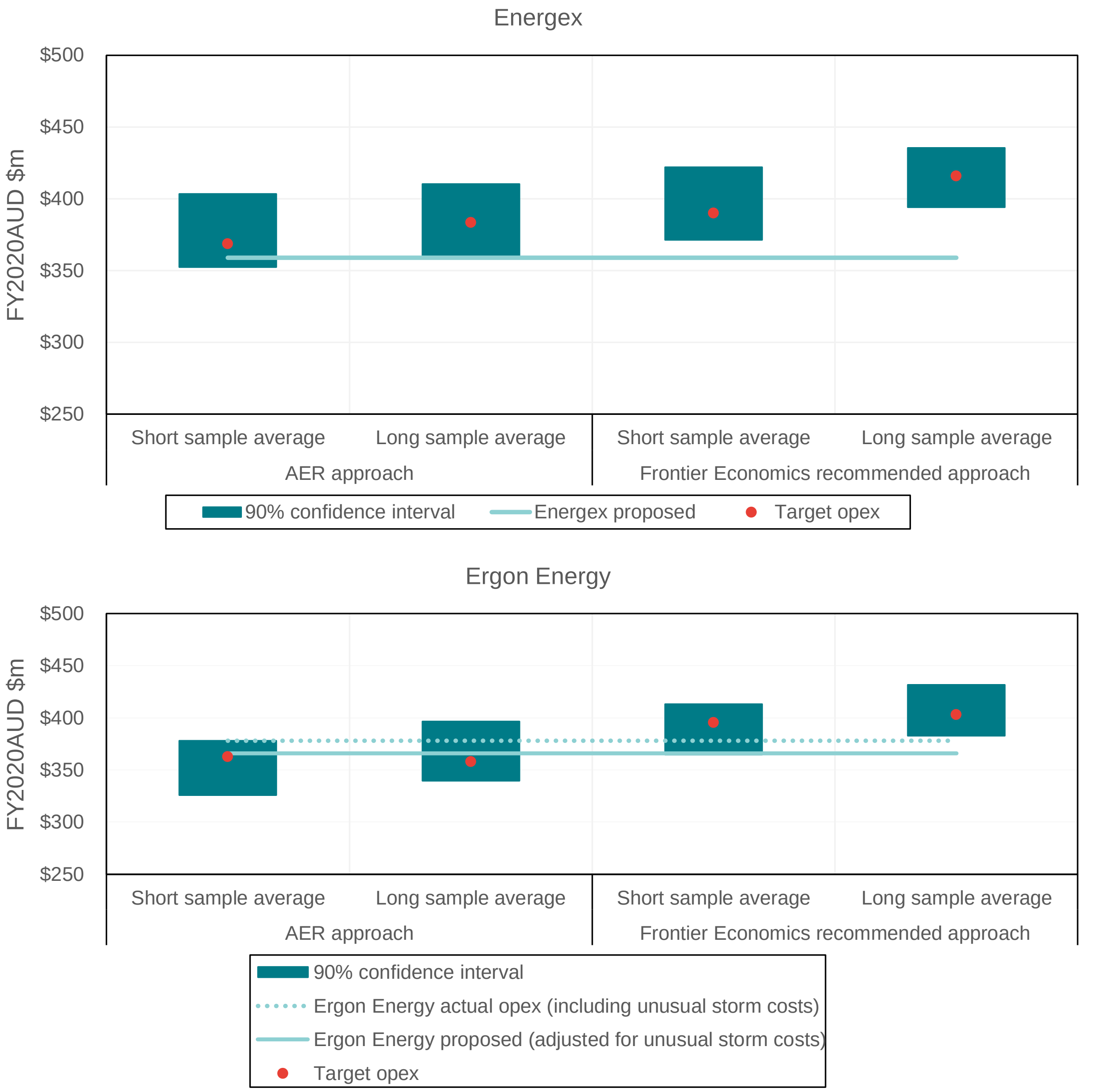
- **Figure 1** below plots Energex’s and Ergon Energy’s proposed opex (solid blue lines) against the average estimate of target base year opex (red dots) across the econometric benchmarking models, for both the short benchmarking period (2012 to 2018) and the long benchmarking period (2006 to 2018). The Figure also presents Ergon Energy’s actual opex, which is inclusive of unusual storm costs (dashed blue line). The estimates of target base year opex, for both DNSPs, are derived using:
  - the AER’s approach (and updating the OEF estimates using the latest RIN data, as the AER indicated it would do in the Draft Decisions); and
  - our recommended approach (which incorporates the various methodological improvements we propose in this report).

  The Figure also plots 90% confidence intervals (derived using a bootstrapping technique) around the average estimates of target base year opex (teal coloured bars)—to account for the statistical uncertainty that surrounds those estimates.

- The Figure shows that:
  - Energex’s proposed base year opex lies towards the lower bound of the 90% confidence interval surrounding the average target base year opex (for both the short and long samples) estimated using the AER’s approach;
  - Ergon Energy’s proposed opex and actual opex (inclusive of unusual storm costs) lies comfortably within the 90% confidence interval surrounding the average target base year opex (for both the short and long samples) estimated using the AER’s approach; and
  - Both Energex’s and Ergon Energy’s proposed opex lie well below the 90% confidence interval surrounding the average target base year opex (for both the short and long samples) estimated using our proposed approach.

- We conclude from this analysis that there is no evidence that either Energex’s or Ergon Energy’s proposed base year opex is materially inefficient.

Figure 1: Assessment of the efficiency of Energex's and Ergon Energy's proposed base year opex



Source: Frontier Economics

Notes: Under the 'AER approach' scenario, the averages across models are taken across all 4 econometric models for the short sample average, but for the long sample average the SFA TL model has been excluded. This is consistent with the approach used by the AER in the Draft Decisions. Under the 'Frontier Economics recommended approach' scenario, the averages across models are taken across all 4 models for the short sample and the long sample average.

The AER's benchmarking analysis suffers from major methodological shortcomings that mean the AER should interpret its benchmarking results very cautiously

- The Australian Competition Tribunal (the Tribunal) identified several serious flaws in the AER's benchmarking analysis in February 2016. Nearly four years on, many of those problems have not been addressed properly by the AER, including in the benchmarking analysis the AER has relied on in its Draft Decisions.
- Hence, the AER's conclusion in the Draft Decisions that it can now take a less "cautious and conservative" approach to benchmarking is misplaced.

- The AER ought to exercise much more caution when interpreting the results of its benchmarking analysis than it has done in the Draft Decisions. This is partly because, as explained above, many of the problems identified by the Tribunal remain unresolved. The AER should also exercise caution because there is scope for misspecification of its benchmarking models, its benchmarking results are sensitive to the selection of the international sample, and because there can be considerable statistical uncertainty around the AER's estimates of target base year opex.

The latest Economic Benchmarking RIN data suggest that a model previously excluded by the AER should now be included in its analysis

- The AER has concluded in recent determinations that it should only make use of Economic Benchmarking RIN data from 2012 onwards (the short benchmarking sample) rather than all of the data from 2006 onwards (the long benchmarking sample). This is because it may take some time before the average efficiency scores reflect efficiency improvements over time—in particular for the full benchmarking period. Consequently, efficiency estimates over shorter, more recent periods are likely to be better representations of current relative efficiencies. We agree with that reasoning.
- However, in the Draft Decisions the AER has considered efficiency estimates derived using both the short and long samples.
- In past decisions, the AER has excluded the Stochastic Frontier Analysis Translog model (SFA TL) from the suite of models used to estimate efficiency over the long sample on the grounds that the SFA TL suffers from monotonicity violations. We disagree with AER's reasons for excluding the SFA TL. However, once the AER's benchmarking dataset is extended to include 2018, the SFA TL meets all the conditions that the AER's adviser on benchmarking, Economic Insights (EI), has previously set for inclusion of the model. Therefore, the AER should use the SFA TL if it decides to give some weight to the long sample.
- We note that in EI's latest advice to the AER—in relation to the 2019 Annual Benchmarking Report—EI has recommended the inclusion of the results of the SFA-TL model estimated over the long period, since this model now has far fewer monotonicity violations using the most recent dataset. EI's latest advice to the AER is consistent with our findings.

The AER has relied on flawed reasoning to support its estimate of the bushfire obligations OEF

- The AER recognises that the Australian DNSPs in its sample operate in very heterogenous environments. These differences in operating environments can affect the costs that DNSPs must incur when delivering regulated services. Several of these operating environment factors (OEFs) are not captured in the AER's benchmarking models. Hence, to avoid estimates of efficiency being distorted by differences in operating environments, the AER has sought to make post-modelling adjustments in its Draft Decisions to account for certain 'material' OEFs.
- The AER has applied a large negative OEF adjustment related to bushfire obligations to Ergon Energy in its benchmarking analysis because it considers that Ergon Energy faces a cost advantage over the Victorian reference DNSPs, on the grounds that Victorian DNSPs face more stringent bushfire management regulations than does Ergon Energy.
- However, the AER has claimed incorrectly that the difference in annual vegetation management opex of Victorian DNSPs relative to Ergon Energy has remained broadly consistent since 2012. This comparison is irrelevant to the assessment of OEFs since it is the difference in costs between the reference firms (not all Victorian DNSPs) and Ergon Energy that matters for the purposes of assessing OEFs. The difference in annual vegetation management costs between the reference firms and Ergon Energy has generally declined since 2012.
- The AER has also understated the bushfire risk that Ergon Energy must manage. Whilst Victorian DNSPs may face more stringent bushfire risk management obligations than Queensland DNSPs, the evidence shows that Queensland DNSPs face considerably larger bushfire risks than DNSPs in Victoria. The AER's bushfire OEF is too narrow in the sense that it focusses only on the cost disadvantage faced by Victorian DNSPs in complying with tougher bushfire obligations. The

quantification of that OEF ignores the fact that the bushfire related costs incurred by DNSPs is affected by a wider range of factors than just obligations—including the probability of a bushfire occurring and the consequence of such a bushfire. We show in this report that there is a greater risk of bushfires in Queensland than in Victoria, and that the consequence (i.e., scale) of bushfire damage in Queensland is significantly greater than in Victoria.

The AER's quantification of bushfire obligation OEFs is flawed

- The AER has no information on the reference firms' actual opex associated with complying with more stringent bushfire management regulations in Victoria. Instead, the AER has relied on cost allowances for these costs that it has previously provided to the reference DNSPs. If the reference DNSPs underspent those allowances—a possibility that the AER cannot rule out—then the bushfire obligations OEFs would have been overstated.
- The AER has relied on average allowances to the reference firms over the period 2011 to 2015 to quantify the bushfire obligations OEF adjustment, even though the AER forecast that all of those reference firms would reduce their bushfire obligation compliance costs (in Powercor's case, very materially) from 2013 onwards. It is possible that the reference firms' actual costs between 2016 to 2018 were similar to the levels forecast for 2015. If that were so, then the AER would have overestimated the bushfire obligation OEF adjustment.
- Given that the AER has no reliable data with which to quantify the bushfire obligations OEF—a fact recognised by the AER's own adviser Sapere-Merz—in our view the AER should make no OEF adjustment for bushfire obligations in the Final Decision.

The AER has failed to consider a relevant and material OEF for Ergon Energy related to network accessibility

- The AER only applied in the Draft Decisions those OEFs that its adviser Sapere-Merz identified as material OEFs.
- However, Sapere-Merz appears to have overlooked an OEF that the AER treated as a material OEF for Ergon Energy in its 2015 Final Decision—the network accessibility OEF, which recognised that Ergon Energy incurs greater costs than the reference DNSPs in order to maintain physical access to its network. As such, an OEF adjustment that was treated as material in 2015 has not been applied (or even mentioned) in the Draft Decision.
- As the AER has considered no new information in relation to this OEF since 2015, there appear to be no grounds for its exclusion in 2019. In our view, the AER should apply an OEF adjustment of +1.1% to Ergon Energy for network accessibility.

The AER has relied on flawed reasoning to exclude an OEF adjustment related to more stringent occupational health and safety (OH&S) laws and regulations in Queensland compared to Victoria

- In its 2015 Final Decision for Ergon Energy, the AER applied a material OH&S OEF adjustment. In 2017-18, Sapere-Merz advised the AER that it should treat this OEF as an immaterial factor. Consequently, no OH&S OEF adjustment was applied to Ergon Energy in the Draft Decision.
- It appears that Sapere-Merz's advice to the AER that the OH&S OEF should be viewed as an immaterial factor was due to a misunderstanding on Sapere-Merz's part of the AER's 2015 approach to quantifying that OEF. Therefore, there appear to be no grounds for treating the OH&S OEF as an immaterial factor in the Draft Decision.
- In our view, the AER should apply an OH&S OEF of at least +1.2% to both Energex and Ergon Energy.

Changes to the composition of the group of reference DNSPs may mean that previously immaterial OEFs are now material

- Some OEFs applied by the AER to Ergon Energy in 2015 (e.g., in relation to environmental variability within a service area and in relation to topography) were judged to be immaterial because several of the reference firms at the time—AusNet Services, Powercor and SA Power Networks—were, like Ergon Energy—rural service providers. AusNet Services is no longer identified by the AER as a reference firm.

- Hence, some previously immaterial OEFs would now have become more material. However, the AER has no data to assess the impact of these OEFs. This provides a further reason for the AER to exercise caution in its interpretation of its latest benchmarking results.

The AER's reasons for excluding immaterial OEFs in the Draft Decision are unconvincing

- The AER argues that it should only account for material OEFs because economic benchmarking need not normalise every cost difference between DNSPs. However, the AER has previously acknowledged that the cumulative effect of individually-immaterial OEFs could be material. If that is the case (and the AER has adduced no evidence in the Draft Decisions to suggest otherwise), then by the AER's own past reasoning, the benchmarking analysis used in the Draft Decisions may have ignored material differences in costs between DNSPs that are unrelated to efficiency.
- It is clear from the reasons provided in the AER's 2015 Final Decision that the AER had very little information at that time to quantify (or even assess reliably) the materiality of many of the factors that it treated in that decision as immaterial. The obvious solution to that problem would have been to collect the information on immaterial OEFs that it lacked in 2015. However, the AER has performed no work since 2015 to close these information gaps. The AER's suggestion that the Sapere-Merz's 2017-18 study on OEFs has provided the AER with more information that supports the exclusion of the immaterial OEFs is incorrect. The Sapere-Merz study provided no such information, because the terms of reference for that study expressly instructed Sapere-Merz to only focus on material OEFs.
- In 2015, the AER took two steps to moderate its benchmarking results. First, it applied what it refers to as a "conservative" benchmark comparison point. Second, it made an allowance for immaterial OEFs. In the present Draft Decisions, it has only applied the first of those approaches. The AER has gained no new information since 2015 that would support the exclusion of the immaterial OEFs. Therefore, it is unclear why the AER now regards only one of these measures, the application of a "conservative" benchmark comparison point, sufficient to address the significant uncertainty associated with estimating accurately the true relative efficiencies of DNSPs in Australia.
- In our view, the AER should include in the benchmarking analysis used for the Final Decisions all OEFs that it identified in its 2015 decisions as being immaterial OEFs.

The AER's approach of making post-modelling adjustments for OEFs casts doubt over the reliability of the AER's benchmarking analysis

- The AER has undertaken no work since 2015 to address the well-recognised shortcomings of its *ex-post* approach to adjusting OEFs—notwithstanding that the Australian Competition Tribunal identified major flaws in that approach. The lack of action by the AER to address this problem is troubling.
- To the extent that the problems persist, the AER should reflect that in its interpretation of its benchmarking results.

1.3 Structure of this report

The remainder of this report is organised as follows:

- Section 2 provides an assessment of the AER's benchmarking modelling;
- Section 3 assesses the AER's treatment of OEFs; and
- Section 4 provides an empirical assessment of Energex's and Ergon Energy's proposed base year opex.

2 ASSESSMENT OF AER'S BENCHMARKING MODELLING

This section provides an assessment of the benchmarking modelling the AER relies on in its Draft Decisions.

2.1 Previous criticisms of the AER's benchmarking approach that remain unaddressed in the Draft Decisions

In February 2016, the Australian Competition Tribunal (the Tribunal) handed down a judgment in relation to merits reviews sought by several DNSPs of regulatory decisions made by the AER in 2015. In that judgment, the Tribunal held that the AER had erred in its application of opex benchmarking, and directed the AER to remake its opex decisions:[4]

> *…using a broader range of modelling, and benchmarking against Australian businesses, and including a "bottom up" review of [the DNSPs'] forecast operating expenditure*

The Full Federal Court subsequently dismissed the AER's appeal against the Tribunal's decision in relation to opex matters, including opex benchmarking.[5]

The Tribunal identified several errors in the AER's benchmarking analysis, including the following:

- The AER placed undue reliance on a single, flawed statistical model to make its opex decisions;[6]
- The AER had cast aside its previous practice of conducting bottom-up reviews of opex forecasts in favour of the emphasis it placed in benchmarking analysis.[7] As noted above, the Tribunal instructed the AER to undertake a "bottom up" review of forecast opex when remaking its decisions;
- There were legitimate concerns about the reliability of the Economic Benchmarking RIN data used in the AER's benchmarking analysis. The AER had relied too much on the RIN data to: (a) determine the benchmark opex that would be incurred by an efficient DNSP; and (b) corroborate its preferred model;[8]
- The sheer volume of overseas data represented in the AER's benchmarking analysis meant that the AER's benchmarking analysis reflected cost relationships between opex and opex drivers that exist in the overseas DNSPs, rather than the relationships that exist in Australia.[9] The AER's use of country dummy variables was an inadequate way of controlling for differences in the relationship between cost drivers and opex in the three jurisdictions (Australia, New Zealand and Ontario)

[4] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [1a].

[5] Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79.

[6] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [467], [471], [472] and [496a].

[7] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [389] and [408].

[8] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [253], [254], [259] and [260].

[9] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [299].

represented in the AER's benchmarking sample.[10] As noted above, the Tribunal directed the AER to remake its opex decisions by "benchmarking against Australian businesses";

- The AER should have made OEF adjustments to the data used in its benchmarking analysis before it undertook any modelling, rather than making post-modelling OEF adjustments;[11] and
- When determining opex allowances, the AER gave "discordant weight" to those parts of the National Electricity Rules (NER) that required it to have regard to benchmarking analysis, and insufficient weight to other opex factors enumerated in the rules (such as, for instance, the actual and expected operating expenditure of the DNSP during any preceding regulatory control periods).

Nearly four years has passed since the Tribunal handed down its judgement. Yet, the benchmarking approach applied by the AER in its Draft Decisions fails to address many of the fundamental failings identified by the Tribunal.[12] Many of those criticisms made by the Tribunal have received only cursory consideration by the AER or have been ignored altogether.

As a result, the benchmarking analysis that the AER has relied on in its Draft Decisions, and the way in which that analysis has been used to set opex allowances, continue to suffer from several of the shortcomings identified by the Tribunal. Despite this, the AER suggests in some parts of its Draft Decisions that it no longer needs to be as "cautious and conservative" in its benchmarking approach as it was in those earlier decisions that were set aside by the Tribunal. The Tribunal concluded that the many serious problems associated with the AER's benchmarking analysis in its 2015 decisions warranted a more cautious and conservative treatment than had been adopted by the AER. Given that many of those serious problems have not been addressed (or addressed adequately), in our view the AER's suggestion that it should now follow a less cautious and conservative approach is unreasonable.

We summarise briefly below the key problems that remain unresolved in the benchmarking approach adopted in the Draft Decisions, including some problems identified by the Tribunal.

2.1.1 Reliance on too narrow a set of models and benchmarking approaches

The AER relies on at most just four econometric models to estimate the efficient base year level of opex for DNSPs.[13] As we have demonstrated, there are a wide range of additional models and techniques that could be used to complement the AER's efficiency analysis.[14] Furthermore, we have shown that the benchmarking results are highly sensitive to model specification.[15]

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[10] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [296] and [301a].

[11] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [333] and [335].

[12] The AER updated slightly its estimates of material OEFs to recognise that AusNet Services is, in its latest benchmarking analysis, no longer one of the reference firms, and also to correct one minor error.

[13] These models are the Stochastic Frontier Analysis Cobb-Douglas model (SFA-CD), SFA Translog model (SFA-TL), Least Squares Estimation Cobb-Douglas model (LSE-CD) and the LSE Translog model (LSE-TL). As discussed in section 2.2, the AER excludes consideration of the SFA-TL when estimating relative efficiency over the full benchmarking period (i.e., 2006 to 2017, in the Draft Decisions).

[14] Frontier Economics, Review of the AER's econometric benchmarking models and their application in the draft determinations for Networks NSW, January 2015, section 3.2; Frontier Economics, AER benchmarking, 15 January 2019, section 3.4.

[15] Frontier Economics, AER benchmarking, 15 January 2019, section 4.1.3.

We recognise that the AER has broadened the set of models it uses in its benchmarking analysis—apparently in response to the Tribunal's criticisms of the AER for placing undue reliance on a single model that suffered from limitations.[16, 17]

However, all of the models used by the AER are closely-related, in the sense that they all use similar explanatory variables. The main differences in the models used by the AER relate to the form of the cost function adopted (e.g., Cobb-Douglas or Translog) and estimation technique (Stochastic Frontier Analysis or Least Squares Estimation). We note that during the merits review process in which the Tribunal set aside the AER's benchmarking analysis, the AER argued that it had checked the results of its preferred benchmarking model against two other econometric models and the Multilateral Partial Factor Productivity model (which did not use overseas data, and which adopted a different output specification).

In review-related materials that we had prepared, we argued that:[18]

> *… the AER appears to have put undue faith in the ability of it, and its advisers, to develop a single benchmarking model (or suite of very closely related models, all derived from the same data and missing the same wider review of factors and sense checks) that can capture very well relative inefficiency.*

The Tribunal noted in its judgment that following this "acute observation", the AER's submission (amongst others) that it had the use of closely-related models as cross-checks or corroborating evidence was "tenuous."[19]

We note that the Tribunal directed the AER explicitly to remake its 2015 opex decisions (for those DNSPs that sought merits reviews) by undertaking a bottom-up review of forecast opex. The AER has not undertaken any bottom-up assessment of base year opex in the Draft Decisions, even as a cross-check of its top-down benchmarking analysis.

We remain of the view that the challenges associated with benchmarking DNSPs in Australia, who operate in vastly heterogeneous environments, are so great that it would be prudent for the AER to consider evidence from a much wider range of models than the AER has used in the Draft Decisions. To the extent that the AER cannot develop and consider a broader suite of models in the time available, it should recognise this as a limitation of its benchmarking approach and take a more cautious approach to interpreting the results from its benchmarking analysis.

2.1.2 Use of data on overseas DNSPs

The AER continues to use data on DNSPs in Ontario and New Zealand. We have previously:

[16] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [496a].

[17] The AER has explained in some recent decisions that it has now adopted a multi-model approach to help address concerns expressed by the Tribunal over the AER's reliance on a single model. See, for example: Ausgrid Draft Decision, November 2018, Attachment 6, p. 39.

[18] Frontier Economics, Review of the AER's econometric benchmarking models and their application in the draft determinations for Networks NSW, January 2015, p. 105.

[19] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [461].

- explained that Ontarian DNSPs are disproportionately represented in the AER's benchmarking sample (because they are more numerous than the Australian DNSPs). As explained above, this was a concern that was expressed by the Tribunal as well;
- presented evidence that the Ontarian DNSPs face very different operating environments to the Australian DNSPs, and the AER's benchmarking analysis has no way of controlling appropriately for those differences. Once again, this was a major weakness of the AER's methodology identified by the Tribunal;[20] and
- shown on a number of occasions, including in our January 2019 benchmarking report, that statistical testing demonstrates that data on Ontarian DNSPs should not be pooled with data on Australian and New Zealand DNSPs.[21]

In short, the AER's benchmarking results are unlikely to be reliable (in part) due to the use of data on overseas DNSPs. In our view, in order to overcome this problem, the AER should (over the longer term) work towards a benchmarking approach that relies only on Australian data. However, in the near term, the AER could make modifications to its existing models to allow for differences between Ontarian and non-Ontarian DNSPs. Our January 2019 benchmarking report explained that one method for doing this would be to interact the Ontario dummy variable in the AER's models with each of the key explanatory variables in the models.[22] We present the impact of implementing this approach in section 4.3 of this report.

2.1.3 Benchmarking rural DNSPs against urban DNSPs

The AER continues to pool together in its benchmarking sample DNSPs operating rural networks (such as Ergon Energy) and DNSPs operating urban networks. We demonstrated in our January 2019 benchmarking report that statistical testing suggests that rural and urban samples should not be pooled together. This result is intuitively and economically compelling since rural and urban DNSPs typically operate in quite different environments, often have differently-engineered networks and face different cost challenges.

Indeed, as we discuss in section 3 of this report, a number of the OEF adjustments that the AER has applied in the past recognise that rural and urban DNSPs face different operating circumstances. However, the AER has previously had difficulty in quantifying the cost impact of those differences reliably. The AER could modify its existing models to allow for differences between rural and urban DNSPs. Our January 2019 benchmarking report explained that one method for doing this is to include either a rural or urban DNSP dummy variable in the AER's models, and then interact that dummy variable with each of the key explanatory variables in the models.[23] We present the impact of implementing this approach in section 4.3 of this report.

2.1.4 Inadequate caution in using benchmarking results to set allowances

Our January 2019 benchmarking report explained that the AER's approach to using economic benchmarking in order to assess the opex proposals of DNSPs, and to set opex allowances, is still in its infancy. Many of the problems identified by the Australian Competition Tribunal about the AER's application of economic benchmarking in its 2015 decisions for NSW and ACT DNSPs have not been

[20] The Australian Competition Tribunal held that the way in which the AER attempts address this problem does not in fact correct properly for differences between DNSPs operating in different countries. See Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [296] and [301a].

[21] Frontier Economics, AER benchmarking, 15 January 2019, Appendix B.

[22] Frontier Economics, AER benchmarking, 15 January 2019, Appendix B.

[23] Frontier Economics, AER benchmarking, 15 January 2019, Appendix C.

addressed properly, or at all, by the AER. We explained in our January 2019 benchmarking report that economic benchmarking, even in the most favourable circumstances, is a very challenging endeavour. As such, regulators overseas—including, those who have had many more years of experience in applying economic benchmarking than the AER, and who must deal with much less heterogeneity between DNSPs than is confronted by the AER—treat the results of their benchmarking analysis more cautiously when determining opex allowances.[24]

We recognise that the AER does make some allowance for uncertainty—for instance, by comparing the efficiency of individual networks to an efficiency frontier of 75% (before adjustments for OEFs), rather than assuming that the most efficient DNSPs define the frontier. However, given the prodigious heterogeneity between DNSPs in Australia and the unresolved limitations of the AER's benchmarking methodology, we consider that the AER should exercise much more caution when interpreting the results from its benchmarking analysis than it has done in the Draft Decisions.

When evaluating actual base year opex against estimates of efficient base year opex determined on the basis of econometric models, it is important to keep in mind that these estimates are subject to a variety of uncertainties and potential errors. Here we focus on three reasons why caution is needed when interpreting these estimates of efficient base year opex:

- Model misspecification;
- Sensitivity to the selection of the international sample; and
- Uncertainty around the estimated base year target opex.

Model misspecification

An econometric model can only ever be an approximation to the relationship between opex and the factors that drive opex. While we recognise that the AER has broadened the set of models it uses in its benchmarking analysis, there is little evidence that any of the models have been subjected to the kinds of validity tests commonly used in econometrics to evaluate the adequacy of a model. It is common practice in the estimation of econometric models to undertake a series of diagnostic tests and investigations to confirm that the estimated models are well-specified. This would include an analysis of extreme observations and extreme outliers to ensure that they don't have undue influence on the estimation of the model's parameters. For the validity of the SFA models, it is also a requirement that the residual term is normally distributed.

As an example of such a diagnostic investigation, in **Figure 2** we plot the residuals of the LSE-TL model estimated over the 2006-2018 period. The residuals, which can be interpreted as percent prediction errors, are plotted against a normal distribution. If the residuals were normally distributed, the points would lie on a straight line.

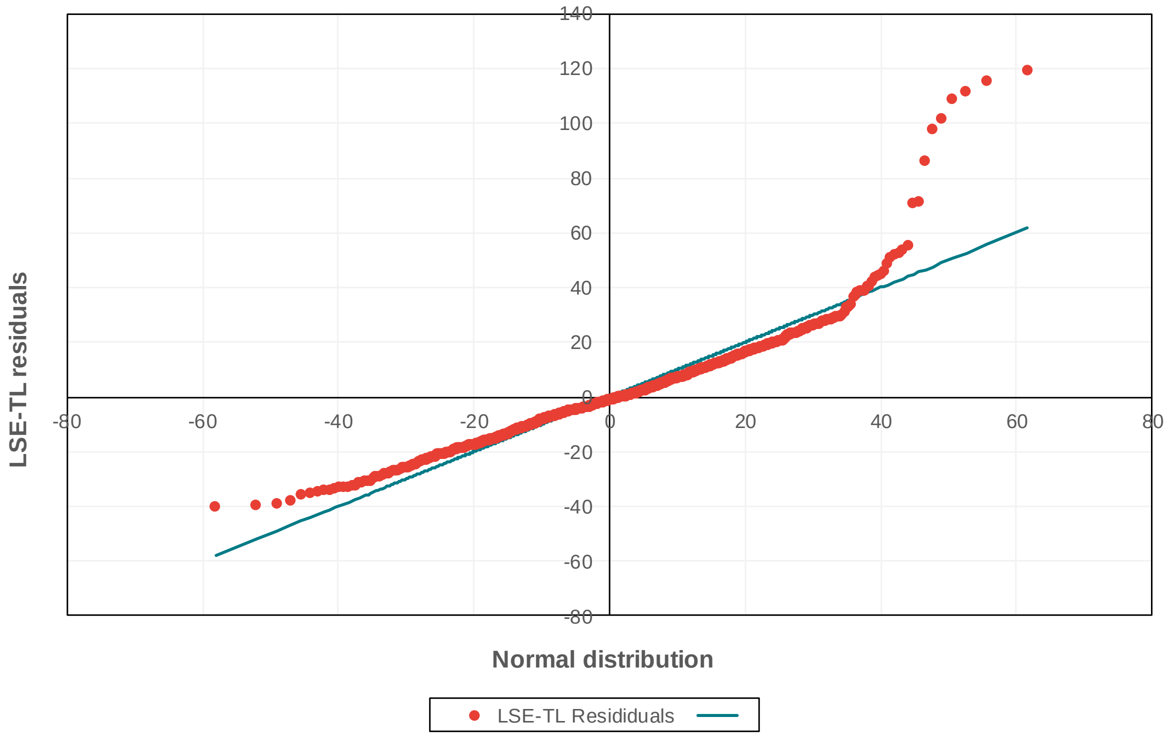
We make two key observations on this chart. Firstly, some of the prediction errors are very large with actual opex being between 40% below the fitted opex cost function to 120% above the fitted opex cost function. The second point is that the residuals are clearly not normally distributed; the distribution of the residuals is shorter-tailed than the normal distribution when actual opex lies below the line, and much longer tailed when actual opex lies above the fitted line. This could indicate that LSE-TL model is mis-specified.

The AER has not presented any evidence to indicate that it has undertaken any diagnostic analysis to confirm that the estimated models have satisfactory statistical properties. In the absence of such an

[24] The approaches used by some regulators overseas to moderate the results of their benchmarking analysis were discussed in section 4.3 of our January 2019 benchmarking report.

analysis, which is standard practice in applied econometrics, doubt must remain about the robustness and reliability of the estimated models and the results derived from them.

Figure 2: Residuals (i.e., % prediction errors) of the LSE-TL model plotted against a normal distribution



Source: Frontier Economics analysis of the AER's 2019 Benchmarking Report data. The dataset used is for the period 2006-2018.

It is also possible to undertake statistical tests to evaluate the comparative fit of the models to the data. One such test is a test of the fit of the TL model versus the CD model, which is a special case of the TL model. We have carried out this test, and the results show that, in all four cases—LSE long sample, SFA long sample, LSE short sample and SFA short sample—the test rejects the hypothesis that the CD model is an acceptable simplification of the TL model.[25]

We do not wish to imply that there is no value in estimating the CD model. However, the above arguments strongly suggest that, for sound statistical reasons, the results of the econometric estimations need to be treated with appropriate caution.

Sensitivity to the selection of the international sample

The international sample used by EI in its benchmarking analysis for the AER is largely a sample of convenience. For example, there are other jurisdictions where the electricity distribution businesses operate in an environment that would be just as similar, if not more similar, than the businesses in Ontario. In our discussion of model misspecification above, we pointed to some potential outliers in the dataset used by EI to estimate the benchmarking models. It is likely that the estimates of model

[25] The probability values (p-values) for the two tests for the 2006-2018 sample were 0.000 (for testing LSE-TL vs LSE-CD) and 0.019 (SFA-TL vs SFA-CD). For the 2012-2018 sample the p-values were 0.000 (LSE-TL vs LSE-CD) and 0.001 (SFA-TL vs SFA-CD). The hypothesis that the TL model does not improve significantly on the CD model is rejected at the 5% level if the p-value is less than 0.05. This hypothesis is rejected in all four cases.

parameters, and hence of target opex, would be sensitive to the exclusion or inclusion of particular DNSPs.

One way to investigate the sensitivity of target opex to the set of businesses included in the estimation sample is to undertake an exercise similar to the bootstrapping analysis discussed later in section 4. Analogous to the procedure described in section 4, we could construct a bootstrap sample of international businesses by sampling with replacement from the set of international businesses in the sample. We could then produce confidence intervals around the target opex values produced by the AER's models to capture the uncertainty inherent in the selection of the sample of international businesses. The two resampling processes—resampling the businesses and resampling the estimation residuals—can also be combined, although this would increase the computational effort considerably.

We have not undertaken this exercise due to time limitations, but it is clear that such an exercise could provide evidence of an additional source of uncertainty that has not been accounted for in the AER's benchmarking approach. Moreover, if data on the distribution businesses in other jurisdictions were to be included in the estimation sample, this would likely lead to different estimates again, and most likely wider confidence intervals around the estimates.

Uncertainty around the estimated base year target opex

When undertaking benchmarking analysis, the AER seeks to estimate as closely as possible the true level of efficiency of the DNSPs it regulates. The AER cannot *observe* the true level of efficiency of individual DNSPs directly. Therefore, it must *estimate* efficiency using benchmarking models and the data available.

The AER relies primarily on econometric benchmarking models. The residuals from the econometric models measure the differences between actual opex and the fitted value produced by the model linking opex to the factors that influence opex. They are a combination of misspecification issues, such as those discussed above, and statistical noise due to random factors. Due to these factors, estimates of the coefficients of the model, and other estimates derived from the estimated model, are subject to statistical uncertainty. The AER uses estimates from its econometric models to derive estimates of efficiency and base year target opex. Hence, to the extent that there is statistical uncertainty around the estimated model coefficients, there will also be statistical uncertainty around estimated base year target opex.

To date, the AER has dealt with this statistical uncertainty in a very qualitative way. Specifically, the AER's approach since it began using benchmarking analysis in its regulatory decisions is to adjust DNSPs' actual, revealed opex only if there is evidence of "material inefficiency." This was the approach the AER adopted in the Draft Decisions. The AER explains in the Draft Decisions that:[26]

> *Material inefficiency is a concept we introduce in our Guideline. We consider a service provider is materially inefficient when it is not at or close to its peers on the efficiency frontier.*

That is, the AER does not require a DNSP to match or surpass the position of peers on the efficiency frontier in order to avoid a base year adjustment. The DNSP simply needs to be sufficiently "close" to its peers on the frontier. This means that the AER may accept a DNSP's revealed base year opex, even if its benchmarking models indicate that the DNSP may be somewhat inefficient—provided that estimated inefficiency is not 'material.'

[26] Ergon Draft Decision, October 2019, Attachment 6, p. 15

It seems to us that by allowing for some margin for error in this way in its benchmarking analysis, the AER recognises at least conceptually that there is statistical uncertainty around estimated base year target opex.[27] However, because the AER has always applied its "material inefficiency" test in a purely qualitative way, through the exercise of judgment, there is no way for stakeholders to assess:

- how wide the margin for error assumed by the AER is; and
- whether the AER is applying its judgements about the appropriate margin for error consistently from one decision to the next.

Moreover, because the margin for error used by the AER to apply the material inefficiency test is *assumed* (through the exercise of its own judgment) rather than *derived* from the benchmarking analysis, it is quite possible that the AER may misjudge (e.g., understate or overstate) the true level of statistical uncertainty surrounding estimates of base year target opex. Under these circumstances, the AER may conclude that it has found evidence that a particular DNSP is materially inefficient, when in fact that DNSP's actual opex is well within the *true* margin of statistical error surrounding estimates of base year target opex.

In our view, the AER requires a process for quantifying the statistical uncertainty that surrounds its estimates of base year target opex—to reduce the likelihood that it draws erroneous conclusions about the efficiency or inefficiency of individual DNSPs due to random statistical noise. In section 4 we present a method for doing precisely that, and apply that approach to construct statistical confidence intervals around estimates of base year target opex. This provides a way of formalising and quantifying the AER's material inefficiency test, and also provides the AER with a means to exercise due caution over its benchmarking results, taking account the scope for estimation uncertainty.

2.2 New issues arising in the Draft Decisions

In this section we discuss two further concerns we have about the benchmarking analysis in the AER's Draft Decisions.

2.2.1 Exclusion of SFA-TL model

Economic Insights (EI) has previously presented compelling reasons why the translog functional form should be preferred over the Cobb-Douglas functional form when modelling cost functions.

> *It is tempting to choose the Cobb–Douglas functional form because it involves the estimation of fewer parameters. However, given that it only provides a first–order approximation to the true unknown functional form, it has a number of limitations. For example, it assumes that output elasticities remain constant over all data points, and hence that scale economies must also be constant across firms. Furthermore, in multi–output settings it cannot accommodate*

[27] The AER also seeks to account for estimation uncertainty be adopting what it considers to be a "conservative" benchmark comparison point of 0.75, rather than targeting the most efficient DNSP as the relevant benchmark, or full efficiency.

> *a production possibility curve that is concave to the origin (i.e. one which incorporates the property of diminishing returns).*[28]

The flexibility of the translog function compared to the Cobb-Douglas function with respect to economies of scale and output elasticities is particularly important in the Australian context, since the Australian DNSPs vary considerably in terms scale and operating characteristics. In view of these conceptual advantages of the translog functional form over the Cobb-Douglas functional form, one would need convincing reasons for not using a translog model to estimate the cost function of Australian DNSPs.[29]

In previous decisions, the AER has relied on advice from EI on whether or not to include a particular model within the suite of econometric models used to estimate the efficient base year level of opex for DNSPs. The criteria used by EI to assess whether or not to include a translog model seem to be based primarily on the frequency and nature of any violations of the so-called monotonicity condition.[30] For example, in its 2018 benchmarking report EI justified the inclusion of the LSE-TL and SFA-TL models for the short period (2012 to 2017) by considering the monotonicity violations for these models:

> *When we move to estimating the translog models on the sample from 2012 onwards, the LSETLG model still performs well with no Australian observations violating monotonicity. And, the SFATLG model now performs much better with only one Australian DNSP's observations for one output not satisfying monotonicity – those of CIT [(CitiPower)]. Only 8 per cent of the Australian sample now has monotonicity issues and, for the sample as a whole, the proportion of observations with monotonicity issues is halved to 20 per cent and no observations have monotonicity violations for two outputs. Given this improvement in the SFATLG's model's properties with the more recent sample, we are of the view that it is now worth presenting its results for the shorter period and it should be considered for inclusion in any averaging of model results for base year assessment purposes.* [31]

We note that EI does not require a total absence of monotonicity violations before it considers a translog model to be acceptable. According to the above criteria, EI finds a modest proportion of violations acceptable. However, for the SFA-TL model estimated over the long period (2006-2017) EI considered that the violations were too severe for the model to be included for benchmarking:

[28] Economic Insights (Nov 2014), *Economic Benchmarking of NSW and ACT DNSP Opex*, p. 27.

[29] One such reason would be if a statistical test indicated that the translog model did not fit the data significantly better than the Cobb-Douglas model.

[30] Unlike the Cobb-Douglas model, the output elasticities for translog models are not constant; they vary with the levels of the outputs. Monotonicity is violated for a particular output at an observation if the output elasticity at that observation is negative. This is inconsistent with the principle that an increase in any output is associated with an increase in opex. In practice it is not uncommon for violations of monotonicity to occur, largely due to the fact that the outputs tend to be highly correlated. Since the elasticities for the translog model depend on the values of the outputs, in practice it is common to evaluate the elasticities at some average or representative level of the outputs.

[31] Economic Insights (Nov 2018), *Economic Benchmarking Results for the Australian Energy Regulator's 2018 DNSP Annual Benchmarking Report*, p. 19.

> *Energy Queensland Group (2018, p.11) noted in their submission on the draft report that they had advice that the monotonicity violations for the SFATLG model over the period 2006–2017 were 'minor' and they requested its consideration for inclusion in the economic benchmarking results. When such a large proportion of the sample suffers from these violations and a number of DNSPs have violations for two outputs at the same time, we retain our view that this model is not suitable for inclusion for the whole 12 year period but it is worth considering for the more recent period where its performance is much improved. Our view is reinforced by the increased variability in efficiency scores the inclusion of the 12–year SFATLG results would produce.* [32]

We have previously put forward arguments why minor monotonicity violations should not disqualify a translog model from being used to assess the efficient base year level of opex for DNSPs. These violations need to be considered in the context of the uses that the AER makes of the econometric models, the main uses being:

- to obtain estimates of the DNSPs' relative efficiencies; and
- to obtain output weights to enable the calculation of the combined output growth across the three main output variables for use in its roll-forward methodology.

Neither of these applications of the econometric models involve calculating elasticities for specific observations.

With respect to estimating efficiencies, the aim should be to obtain the best estimates of the efficiency scores of the DNSPs. For the estimation of efficiencies, the model's fit to the data is more important than whether or not there are monotonicity violations.[33] Since monotonicity violations are most likely due to multicollinearity between the output variables, they do not invalidate the estimates of the efficiencies. When the AER uses the estimated elasticities of a translog model to obtain the weighted average of outputs for use in its roll-forward methodology, it makes the translog elasticities constant by calculating the elasticities of a hypothetical DNSP whose outputs are equal to the average outputs across all DNSPs in the sample, including New Zealand and Ontarian DNSPs. The AER never uses the elasticities evaluated at individual observations. These 'average output' elasticities are always well above zero for all the translog models that have been discussed. Hence, there is no risk that the roll-forward methodology will produce counter-intuitive outcomes for the change in opex when outputs change.

In our view, the validity of these arguments is not diminished by the points raised by EI. However, even if the AER does not accept these arguments, the monotonicity properties of the SFA-TL model over the long period improve dramatically when the model is estimated on the updated dataset covering the period (2006 to 2018).

Table 1 summarises the monotonicity properties of the four translog models under consideration when estimated over different time periods. With respect to the SFA-TL model, the table shows that, whereas for the previous (2006 to 2017) dataset there were monotonicity violations for 48 out of 156 observations for Australian DNSPs, for the updated (2006 to 2018) dataset only 5 out of 169 observations (3%) have violations, and never for more than one output. Moreover, the size of the violations is considerably

[32] Economic Insights, *Economic Benchmarking Results for the Australian Energy Regulator's 2018 DNSP Annual Benchmarking Report*, 9 November 2018, p. 21.

[33] A statistical test of the fit of the SFA translog model versus the SFA Cobb-Douglas model estimated over the (2006-2017) period indicates that the SFA translog model fits the data significantly better.

smaller; the largest violation is now -0.013 compared to -0.091 previously. Hence, the extra year of data vastly improves the performance of the long period SFA-TL with respect to monotonicity violations. We note that in its 2018 benchmarking report, EI considered the short period SFA -L model to be acceptable because only 8% of observations for the Australian DNSPs had monotonicity issues. By comparison, the SFA-TL model for the long period, estimated on the updated dataset, has only 3% of observations for the Australian DNSPs that have monotonicity issues. Moreover, the sizes of the monotonicity violations of the updated long period SFA-TL model are considerably smaller than for the model previously considered acceptable by EI, with the largest violation being -0.013 compared to -0.046 for the short period model previously considered acceptable by EI. Hence, a consistent application of the criteria previously used by EI to determine whether a translog model is acceptable, would indicate that the AER should now include the updated long sample SFA-TL model in the suite of models used to determine the efficient base year level of opex for DNSPs.

Table 1 also presents the updated results for the translog models that the AER *has* relied upon in its Draft Decisions – namely the short period SFA-TL model and the short and long period LSE-TL models – when data for 2018 is added to the estimation sample. The results for the short period SFA-TL model and the long period LSE-TL model are virtually unchanged when the extra year of data is added. However, the short period LSE-TL model now has violations for 23 out of 91 violations. Nevertheless, given our arguments above, in our view this does not disqualify the LSE-TL model from being included in the suite of econometric models used to estimate the efficient base year level of opex for DNSPs. Rather, it highlights how sensitive the monotonicity requirement is to minor changes in the dataset, and strengthens our view that minor violations of this requirement should not disqualify a translog model from being used to estimate efficient base year opex.

We note that in EI's latest advice to the AER—in relation to the 2019 Annual Benchmarking Report—EI has recommended the inclusion of the results of the SFA-TL model estimated over the long period:[34]

> *In earlier modelling the SFATLG model has not performed well on this property for the period from 2006 onwards but did perform well for the period from 2012 onwards in Economic Insights (2018). With the current data updates and revisions, the SFATLG model now also performs relatively well for the full period and is also included in the full period results.*

EI's conclusions are consistent with the analysis we present above.

In the same report, EI went on to note that with the latest dataset available, the LSE TL presents monotonicity violations for one output for three DNSPs (i.e., Ausgrid, Jemena and United Energy) for all of their observations.[35] On this basis, EI recommended the LSE-TL be excluded for these three DNSPs when forming an overall average efficiency score across models for the short period.[36] EI found no monotonicity violations for the LSE-TL for either Energex or Ergon Energy.

[34] Economic Insights, Economic Benchmarking Results for the Australian Energy Regulator's 2019 DNSP Annual Benchmarking Report, 5 September 2019, p. 20.

[35] EI found no monotonicity violations using the latest dataset for the LSE TL for the full period.

[36] Economic Insights, Economic Benchmarking Results for the Australian Energy Regulator's 2019 DNSP Annual Benchmarking Report, 5 September 2019, p. 20.

Table 1: Monotonicity violations of translog models for Australian DNSPs

MODEL	PERIOD	NUMBER OF VIOLATIONS			AVERAGE SIZE OF VIOLATIONS			LARGEST VIOLATION			TOTAL OBS	OBS WITH 2 VIOLATIONS	DNSPS WITH VIOLATIONS
		No. Custs	Circuit Length	Ratch'd MD	No. Custs	Circuit Length	Ratch'd MD	No. Custs	Circuit Length	Ratch'd MD			
SFA TLG	2006-2017	0	48	12		-0.044	-0.078		-0.073	-0.091	156	12	4
SFA TLG	2006-2018	0	1	4		0.000	-0.008		0.000	-0.013	169	0	2
SFA TLG	2012-2017	0	6	0		-0.043			-0.046		78	0	1
SFA TLG	2012-2018	0	3	0		-0.004			-0.005		91	0	1
LSE TLG	2006-2017	0	0	0							156	0	0
LSE TLG	2006-2018	0	0	0							169	0	0
LSE TLG	2012-2017	0	0	0							78	0	0
LSE TLG	2012-2018	23	0	0	-0.069			-0.123			91	0	4

Source: Frontier Economics analysis

Note: While the models have all been estimated using the international sample, in this table we only report the results for the subsample of Australian DNSPs

2.2.2 Consideration of long estimation period

In the Draft Decisions, the AER assessed the relative efficiencies of DNSPs over two benchmarking periods:

- A long period, encompassing the years 2006 to 2017 (inclusive). This represented the full period over which the AER had data gathered from the Economic Benchmarking RINs with which to conduct its benchmarking analysis; and
- A short period, encompassing the years 2012 to 2017 (inclusive). Economic Insights recommended 2012 as the first year of the short estimation period because:[37]
  - It still allows six years to be included for each DNSP and does not lead to loss of statistical robustness; and
  - The period from 2012 onwards represents for Australian DNSPs "a period of more settled performance following earlier reform initiatives and unusual events such as the aftermath of the 2009 Victorian bushfires."

The Draft Decisions did not express a view on whether the results relating to one of these periods should be given greater weight than the other. This contrasts with the approach the AER has followed in recent decisions for other DNSPs.

In the recent decisions for the NSW and ACT DNSPs, the AER focussed on the shorter, more recent benchmarking period rather than the full benchmarking period. For instance, in its Draft Decision for Essential Energy the AER stated that:[38]

> *We have used the 2011–17 period because the data across this six year period provides for statistically robust benchmarking results and also provides a relatively current estimate of opex efficiency. We note it may take some time for improvements in efficiency by previously poor performing distributors to be reflected in the efficiency scores. For more detail, please see our 2018 annual benchmarking report for distribution service providers that we will publish by the end of November 2018.*

The key reason the AER gave in the decisions for the NSW and ACT DNSPs for using the short benchmarking period, rather than the long benchmarking period, is that it may take some time for improvements in efficiency by DNSPs that have previously performed poorly in the AER's benchmarking analysis to be reflected in the AER's estimated efficiency scores. The AER reiterated this point in its 2018 annual benchmarking report:[39]

> *The econometric models produce average opex efficiency scores for the period over which the models are estimated. The results we are using in this section reflect average efficiency scores over the 2012–17 period and the 2006–17 period. Where there are rapid increases*

[37] Economic Insights, Economic Benchmarking Results for the Australian Energy Regulator's 2018 DNSP Annual Benchmarking Report, 9 November 2018, p. 19.

[38] AER, Essential Energy Distribution determination 2019–24, Draft Decision, Attachment 6, November 2018, p. 24, footnote 56.

[39] AER, Annual Benchmarking Report, Electricity distribution network service providers, November 2018, p. 33.

or decreases in opex, it may take some time before the average efficiency scores reflect these changes, in particular for the longer period average results. This means that in some circumstances the efficiency scores will not reflect a DNSP's relative efficiency in the most recent year.

We agree with the AER that there can be a considerable lag between improvements in the efficiency of individual DNSPs over time and those improvements being reflected in the AER's estimated efficiency scores for those DNSPs. This is because the AER's econometric benchmarking models estimate the average efficiency of a DNSP over a given historical benchmarking period. The longer the averaging period, the more muted will be the response of the estimated efficiency scores to changes in efficiency (improvements or deterioration) over time. This will tend to disadvantage networks that were historically inefficient, but that have made substantial efficiency improvements in recent years. Such outcomes would be inappropriate because they would be punitive and may disincentivise historically inefficient networks from pursuing efficiency improvements.

In our view, the best way to address that problem would be to estimate time-varying efficiencies. However, to the extent that the AER wishes to retain an approach that estimates average efficient opex over a period, which is then rolled forward to a base year, we recommend that the AER give greater weight to later years, as it did in its most recent decisions for NSW and ACT DNSPs.

2.3 Conclusions

In summary, we find that:

- The AER's benchmarking models, and the way in which the AER interprets results from those models, suffers from many shortcomings. Many of the most serious of these problems were identified by the Australian Competition Tribunal in its February 2016 judgment that set aside the benchmarking analysis relied on by the AER in a number of decisions in 2015, and which directed the AER to remake those decisions. The AER has not addressed properly many of those problems in the Draft Decisions. Therefore, the AER's conclusion in the Draft Decisions that it can now take a less "cautious and conservative" approach to benchmarking is misplaced.
- Our opinion is that the models that the AER has relied on continue to have significant weaknesses that mean the AER should not rely on the results from its benchmarking analysis in the way that it has in the Draft Decisions.
- The AER should exercise due caution when interpreting the results of its benchmarking analysis, recognising that there is scope for misspecification of its benchmarking models, its benchmarking results are sensitive to the selection of the international sample, and because there can be considerable statistical uncertainty around the AER's estimates of target base year opex.
- EI has argued in the past that the translog functional form should be preferred over the Cobb-Douglas functional form when modelling cost functions. However, EI has advised the AER (as recently as 2018) that the SFA TL model should not be used for the long (i.e., 2006 to 2017) benchmarking period because the estimated model suffers from monotonicity violations. We disagree with EI's reasons for that advice. However, once the AER's benchmarking dataset is extended to include 2018, the SFA TL passes all the conditions that EI considers should be met for use of the model. Therefore, if one were to accept EI's criteria for inclusion/exclusion of the SFA TL model, then there would seem to be no sound reason to reject the SFA TL model with the latest economic benchmarking dataset.
- The AER has previously stated that its preference is to use results from the short benchmarking period in its analysis on the grounds that it may take some time before the average efficiency scores

reflect efficiency improvements over time—in particular for the full benchmarking period. This means that efficiency estimates over shorter, more recent periods are likely to be better representations of current relative efficiencies. We agree with that reasoning.

3 OPERATING ENVIRONMENT FACTORS

This section provides an assessment of the AER's treatment of OEFs in the benchmarking analysis it relies on in the Draft Decisions.

3.1 Bushfire obligations

3.1.1 The Draft Decision

In its Draft Decision for Ergon Energy, the AER concluded that Ergon Energy enjoys a cost advantage in managing bushfire risk compared to Victorian DNSPs, many of whom are included in the reference group of DNSPs identified by the AER's benchmarking analysis. The AER therefore applied a negative 'bushfire obligations' OEF adjustment to Ergon Energy, which had the effect of raising Ergon Energy's opex comparison point. Specifically, the AER applied the following OEF adjustments for Ergon Energy in its Draft Decision:

- -3.36% for the 2006 to 2017 benchmarking period; and
- -5.75% for the 2012 to 2017 benchmarking period.

The methodology the AER used to quantify these OEFs was based largely on its 2015 Final Decision for Ergon Energy, in which the AER also concluded that Ergon Energy faced a cost advantage over Victorian DNSPs in managing bushfire risk.

In its Draft Decision, the AER had regard to the following considerations when establishing that Ergon Energy retains a cost advantage in managing bushfire risk compared to the Victorian DNSPs:[40]

- Changes in Ergon Energy's vegetation management opex over time compared to changes in vegetation management opex incurred by Victorian DNSPs;
- The reasons and evidence the AER relied on when considering relative bushfire risks in its 2015 Final Decision for Ergon Energy; and
- The AER's 2015 assessment of the differences in bushfire regulations and duty of care in Queensland and in Victoria.

The AER's 2015 Final Decision for Ergon Energy relied on the following reasoning and evidence when quantifying an OEF adjustment to reflect relative bushfire risk obligations:[41]

- Lower bushfire risk – the AER concluded that Ergon Energy's service area faces a lower risk of bushfires compared to the reference group of DNSPs, including several Victorian DNSPs (i.e., Powercor, AusNet Services and United Energy) that the AER considered operate in high bushfire risk areas. These conclusions were based on historical information on the probability and severity of bushfires in the relevant service areas.
- Lower vegetation density – the AER examined vegetation density maps from the Bureau of Meteorology and concluded that Ergon Energy had low vegetation density in its service region compared to the vegetation density in high bushfire risk regions in Victoria.

[40] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 79.

[41] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 78.

- Lower bushfire obligations – the AER concluded that vegetation management obligations imposed on Queensland DNSPs were less stringent over the regulatory period than analogous regulations imposed on Victorian DNSPs over the benchmarking period. The AER cited a significant increase in obligations on Victorian DNSPs following the 2010 Black Saturday bushfires.

3.1.2 Assessment of the reasoning in the Draft Decisions

Changes in vegetation management opex over time

The AER acknowledged in the Draft Decisions that it currently has no information regarding the opex DNSPs actually incurred when managing bushfire risk and complying with bushfire obligations over the historical benchmarking period:[42]

> *…we do not currently have information on the actual costs incurred by the Victorian distribution businesses in relation to complying with the regulatory changes introduced in 2010. This is because these businesses only report aggregated vegetation management opex and to date have not been able to provide us with the incremental costs associated with changes in regulatory obligations.*

Given the lack of relevant data, the AER examined how Ergon Energy's vegetation management opex had changed over time, compared to the vegetation management opex incurred by Victorian DNSPs. The AER presented in the Ergon Energy Draft Decision the chart reproduced in **Figure 3** below. The AER inferred from this chart that:

- Ergon Energy's vegetation management opex has decreased since 2010 (when more stringent bushfire obligations and regulations were introduced in Victoria); and
- The difference in the vegetation management opex of Victorian DNSPs relative to Ergon Energy's vegetation management opex had been broadly consistent since 2012.

In our view, this analysis is misleading in three ways:

- Firstly, the AER's chart combines the vegetation management opex of all Victorian DNSPs. However, only three Victorian DNSPs—CitiPower, Powercor and United Energy—are currently regarded by the AER as reference firms.[43] The OEF adjustments should quantify the difference in costs between individual DNSPs and a reference group. Therefore, the difference in costs between Ergon Energy and Victorian DNSPs that are not reference firms is irrelevant for the purposes of evidencing the need for an OEF adjustment.[44] **Figure 4** adds to **Figure 3** the vegetation management opex of each of the Victorian DNSPs (i.e., the grey curves). This shows that the profiles of vegetation management opex incurred by the individual Victorian DNSPs are not consistent with one another over time. For example, the vegetation management opex curve belonging to Powercor (one of the three reference firms at the present time) follows quite a different pattern to the vegetation management curve belonging to AusNet Services (which is not one of the references firms). This suggests that the yellow

[42] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 81.

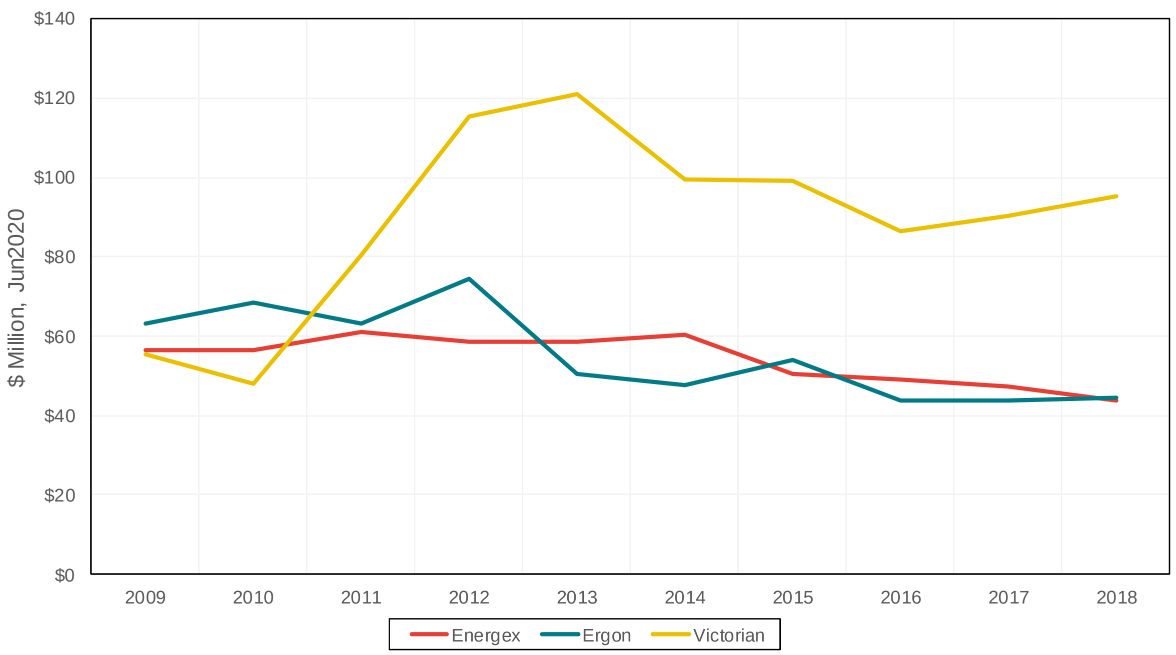
[43] At the time of the AER's 2015 Final Decision for Ergon Energy, the AER considered AusNet Services to also be a reference firm. However, AusNet Services is no longer a reference firm, according the AER's latest benchmarking analysis. Further, Jemena was not one of the reference firms in 2015, and is not a reference firm currently, in the AER's benchmarking analysis.

[44] For the avoidance of doubt, we acknowledge that when quantifying the bushfire obligation OEF adjustment, the AER focussed only on the current reference firms, and disregarded information on AusNet Services and Jemena.

curve in **Figure 3** is not representative of the vegetation management costs of the three reference DSNPs.

- Secondly, the difference in the vegetation management opex of the reference group of Victorian DNSPs relative to Ergon Energy's vegetation management opex has not been broadly consistent since 2012. **Figure 5** plots this difference over time[45] and shows that the gap between the reference group of Victorian DNSPs and Ergon Energy fell sharply between 2013 and 2015, and then remained steady between 2015 and 2017 before rising somewhat again in 2018. **Figure 6** presents the difference in vegetation management opex/km of overhead circuit length between the reference group of Victorian DNSPs and Ergon Energy. That Figure also shows that the general trend since 2012 has been a narrowing of the gap between the reference firms and Ergon Energy.
- Thirdly, the vegetation management costs represented in **Figure 3** do not reflect just the costs associated with complying with bushfire regulations. DNSPs undertake vegetation management to minimise the risk of vegetation interacting with powerlines causing faults that can result in power outages, cause damage to network assets, create electrical safety hazards or start bushfires.[46] Whilst most vegetation management activities involve trimming back vegetation, the purpose of vegetation management work is not solely to comply with bushfire regulations. This is obvious from the fact that DNSPs that serve urban areas (in which bushfire risk is generally low) undertake significant amounts of vegetation management. As discussed in section 3.1.3, the AER has very poor information on the actual vegetation management costs incurred by DNSPs in order to comply with bushfire regulations.

Figure 3: Annual vegetation management opex between 2009 and 2018 – Ergon Energy, Energex and the combined Victorian DNSPs



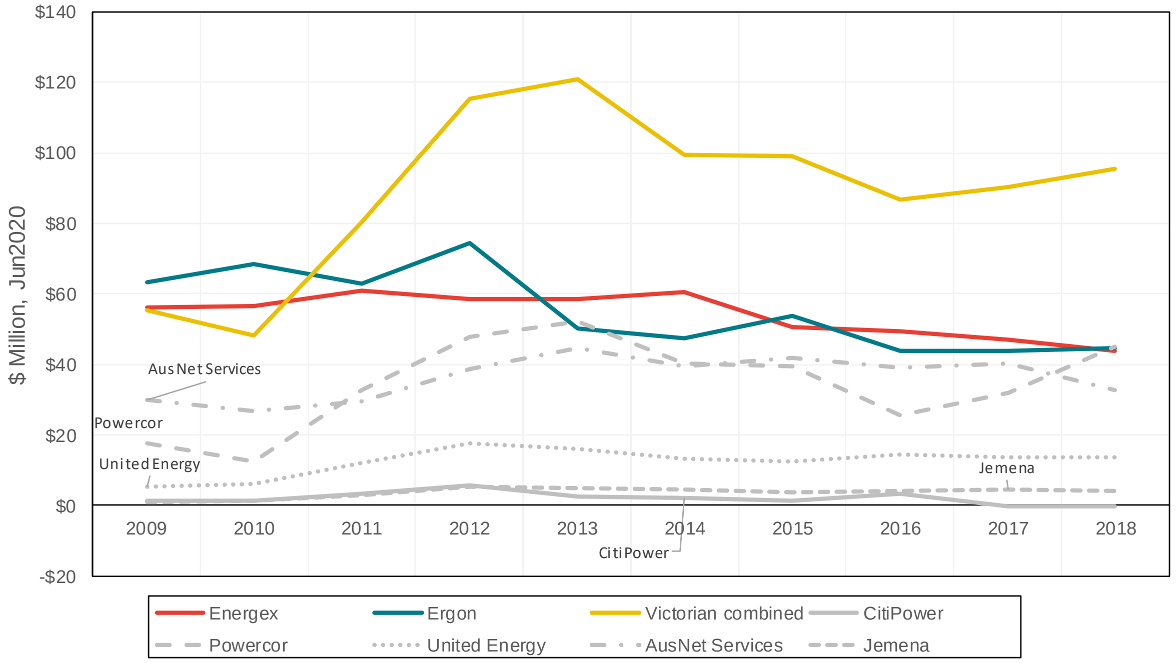
Source: Category Analysis RINs and Ergon Energy Draft Decision, October 2019, Attachment 6, Figure A6.1

Notes: The Victorian DNSPs are AusNet Services, CitiPower, Jemena, Powercor and United Energy. The original AER chart did not present 2018 data for the Victorian DNSPs. These data have been included in this Figure.

[45] The vertical axis represents the sum of reference Victorian DNSPs' vegetation management opex minus that of Ergon Energy.

[46] See, for instance: ENA, Electricity network service provider vegetation management variability report, March 2016.

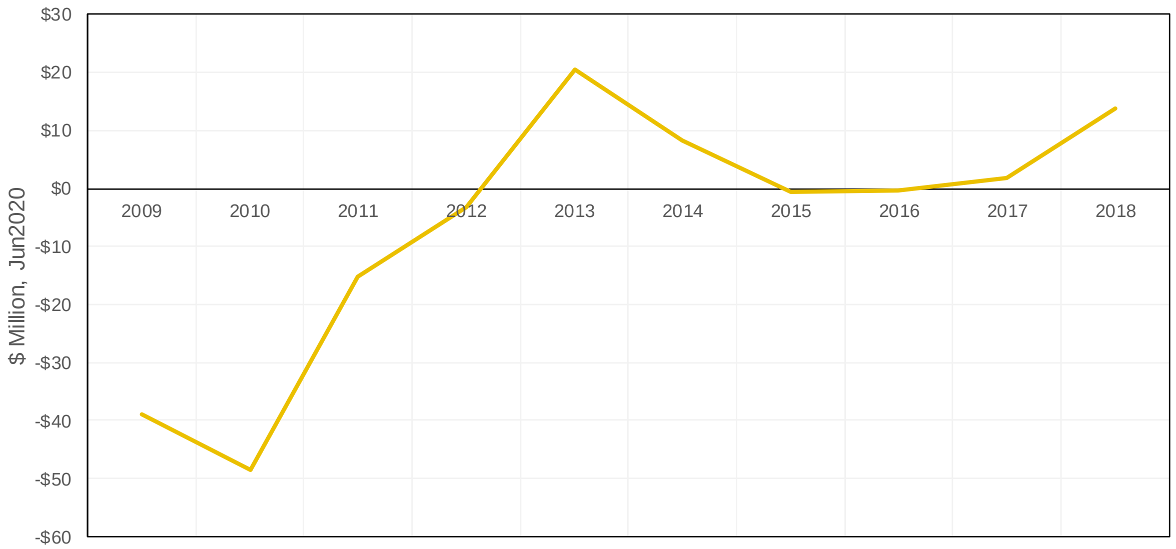
Figure 4: Annual vegetation management opex between 2009 and 2018 – Ergon Energy, Energex and each of the Victorian DNSPs



Source: Source: Category Analysis RINs and Ergon Energy Draft Decision, October 2019, Attachment 6, Figure A6.1

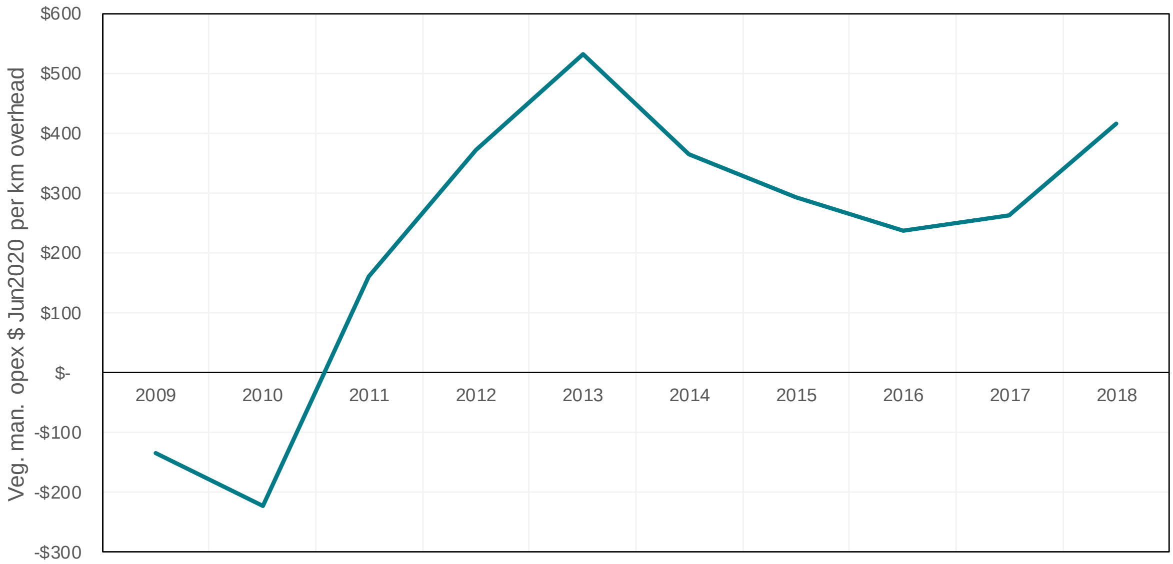
Notes: The Victorian DNSPs are AusNet Services, CitiPower, Jemena, Powercor and United Energy. The original AER chart did not present 2018 data for the Victorian DNSPs. These data have been included in this Figure.

Figure 5: Annual vegetation management opex between 2009 and 2018 – reference DNSPs vs Ergon Energy



Source: Category Analysis RINs; Frontier Economics analysis

Figure 6: Annual vegetation management opex/km of overhead circuit length between 2009 and 2018 – benchmark DNSPs vs Ergon Energy



Source: Category Analysis RINs; Frontier Economics analysis

Claim that Ergon Energy faces lower bushfire risk compared to Victorian DNSPs

In the Draft Decision, the AER referred to its conclusions in its 2015 Final Decision for Ergon Energy that Ergon Energy's service area does not face the same level of bushfire risk as the benchmark comparison distribution businesses in Victoria (in particular Powercor, AusNet Services and United Energy that operate in high bushfire risk areas). The AER also claimed in its 2015 Final Decision for Ergon Energy that:[47]

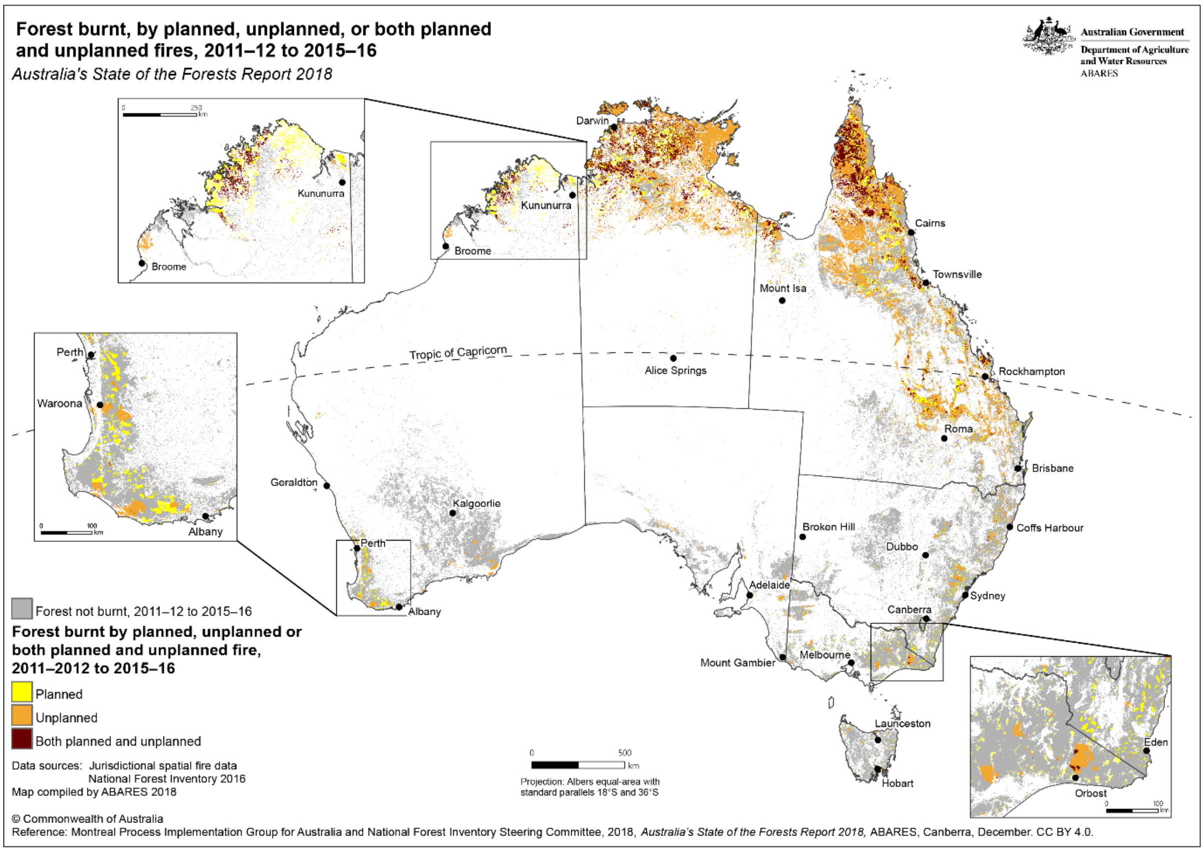
> *Victoria has the highest risk of bushfire of any State or Territory in Australia. It is one of the most bushfire prone areas in the world.*

These claims are not borne out by recent evidence compiled by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) for the National Forest Inventory (NFI). *The Fires in Australia's Forests 2011–16 (2018)*, published in 2018, is a continental spatial dataset of the extent and frequency of planned and unplanned fires occurring in Australia's forests in the five financial years between July 2011 and June 2016, assembled for *Australia's State of the Forests Report 2018*. It was developed from multiple fire area datasets contributed by state and territory government agencies, after consultation with Australia's Forest Fire Management Group. The fire dataset is then combined with forest cover information sourced from the *Forests of Australia (2018)* dataset, and forest tenure information sourced from the *Tenure of Australia's Forests (2018)* dataset. As such, *The Fires in Australia's Forests 2011–16 (2018)* dataset is one of the most comprehensive datasets of Australian planned and unplanned forest fires developed to date in Australia.

[47] Ergon Energy Final Decision, October 2015, Attachment 7, p. 65.

Figure 7 overlays the maps of Australia's States and Territories with data on planned and unplanned forest fires between 2011-12 and 2015-16. The Figure shows that, over the period covered (which represents most of the AER's short benchmarking period), Queensland was far more prone to planned and unplanned forest fires than was Victoria.

Figure 7: Forest fires in Australia between 2011-12 and 2015-16



Source: Fires in Australia's Forests 2011-16, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) for the National Forest Inventory (NFI)

This can be seen more clearly from the statistics in **Table 2** (which presents the number of planned, unplanned forest fires in Queensland and Victoria between 2011-12 and 2015-16) and **Table 3** (which presents the area of planned, unplanned forest fires in Queensland and Victoria between 2011-12 and 2015-16). The Tables show that, between 2011-12 and 2015-16:

- There were 34 times more unplanned forest fires (21 times more forest fires in total) in Queensland than there were in Victoria; and
- The total area of forest affected by unplanned forest fires was 74 times greater (49 times greater for all fires) in Queensland than in Victoria.

Table 2: Number of forest fires by State between 2011-12 and 2015-16

STATE	PLANNED	UNPLANNED	TOTAL NUMBER OF FIRES
QLD	2,158	2,197	4,355
VIC	148	64	212

Source: Frontier Economics analysis; Fires in Australia's Forests 2011-16, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) for the National Forest Inventory (NFI)

Table 3: Area (hectares) of forest fires by State between 2011-12 and 2015-16

STATE	PLANNED	UNPLANNED	TOTAL AREA OF FIRES
QLD	13,158,722	36,743,270	49,901,992
VIC	526,465	498,324	1,024,789

Source: Frontier Economics analysis; Fires in Australia's Forests 2011-16, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) for the National Forest Inventory (NFI)

Consistent with the data presented in **Figure 7**, *Australia's State of the Forests Report 2018* notes that:[48]

> *The largest cumulative areas of fire in forest were Queensland (50 million hectares, 47% of the national total) and the Northern Territory (46 million hectares, 43% of the national total).*

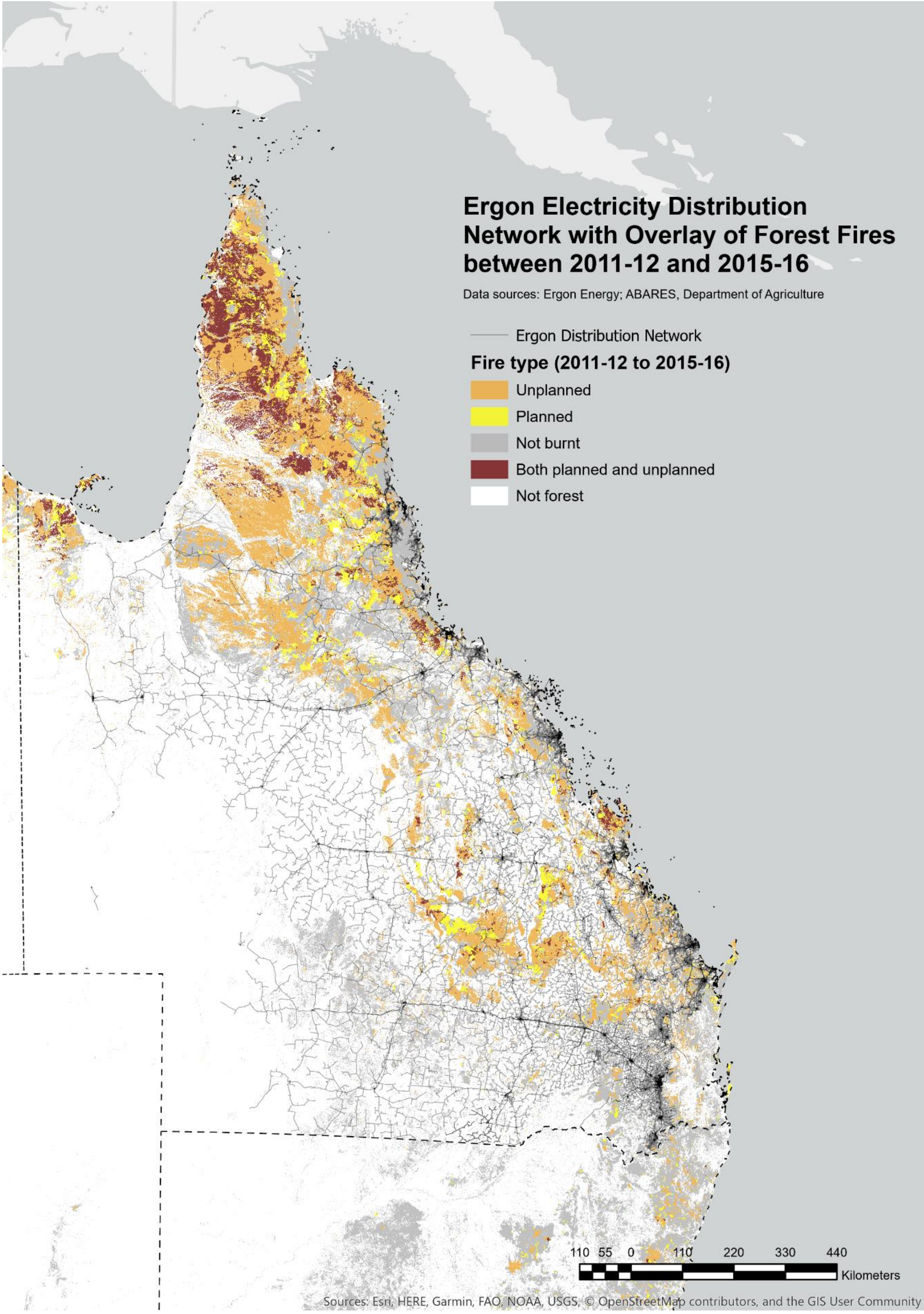
Australia's State of the Forests Report 2018 also indicates that over the period studied, approximately 50% of the total forested area (roughly 72,880 ha) in which unplanned fires occurred was in Queensland.[49]

Figure 7 also shows that the most densely-forested area in Victoria, which is also the area in which most forest fires occurred over the 2011-12 to 2015-16 period, is the region served by AusNet Services in the Eastern part of Victoria. As noted above, AusNet Services is no longer one of the reference firms in the AER's benchmarking analysis. **Figure 8** overlays the map of Queensland with Ergon Energy's distribution network with data on the areas that are forested, and the areas in which planned and unplanned fires occurred between 2011-12 and 2015-16. The Figure demonstrates that Ergon Energy's network overlaps with significant areas of vegetation (which is subject to fire risk if not managed properly) as well as significant areas where fires have actually occurred.

[48] ABARES, Australia's State of the Forests Report 2018, p. 264.

[49] ABARES, Australia's State of the Forests Report 2018, Table 3.8, p. 264.

Figure 8: Location of Ergon Energy's network and regions of forest fires in Queensland



Source: Fires in Australia's Forests 2011-16, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) for the National Forest Inventory (NFI); Frontier Economics analysis

In order to investigate this further, we focussed on the area within a 10-metre distance either side of the Ergon Energy's low voltage, high-voltage sub-transmission lines represented in **Figure 8**. Within this 10-metre zone, we found using data from *The Fires in Australia's Forests 2011–16 (2018)* dataset that:

- approximately 35,578 hectares is forested; and
- of that forested land, approximately 8,813 hectares had experienced a forest fire within the sample period.

That is, of the forested land within very close proximity to Ergon Energy's network, nearly 25% experienced a forest fire between 2011-12 and 2015-16. This suggests that, contrary to the AER's assessment, the bushfire risk that Ergon Energy must manage is material.

Finally, we note that the scale and severity of the bushfires in a number of non-Victorian States in 2019—most notably the major bushfires in Queensland and NSW during November and December—demonstrates vividly the bushfire risks that non-Victorian DNSPs must contend with. It is estimated that, as at 7 December 2019, at least 2.2 million hectares of forest had been burned in NSW and Queensland since the start of the 2019 fire season.[50] To put this into context, 2.2 million hectares is:

- more than double the area of unplanned forest fires in Victoria between the whole of the period 2011-12 to 2015-16 (see **Table 3**);
- greater than the land area of Israel (2,164,000 hectares) and approximately the land area of Belize (2,281,000 hectares).[51]

In our view, the evidence above suggests that the AER has understated significantly the bushfire risk that Ergon Energy must manage and has had to manage during the 2006 to 2018 period that the benchmarking data covers.

The AER's bushfire OEF is focussed too narrowly

Whilst Victorian DNSPs may face more stringent bushfire risk management obligations than Queensland DNSPs, the evidence presented above shows that Queensland DNSPs face considerably larger bushfire risks than DNSPs in Victoria. The AER's bushfire OEF is too narrow in the sense that it focusses only on the cost disadvantage faced by Victorian DNSPs in complying with tougher bushfire obligations. The quantification of that OEF ignores the fact that the bushfire related costs incurred by DNSPs is affected by a wider range of factors than just obligations—including the probability of a bushfire occurring and the consequence of such a bushfire. The evidence presented above shows that there is a greater risk of bushfires in Queensland than in Victoria, and that the scale of bushfire damage in Queensland is significantly greater than in Victoria. The AER's OEF analysis fails to take this into account.

Claim that Ergon Energy has low vegetation density in its region

The AER asserts in the Draft Decision that vegetation density in Ergon Energy's service area is low, and comparable to the lower bushfire risk areas in North West Victoria. The AER's only evidence for this claim appears to be Bureau of Meteorology maps of vegetation density.

[50] Nick Evershed and Andy Ball, How big are the fires burning on the east coast of Australia? Interactive map, The Guardian, 7 December 2019.

[51] World Bank, World Development Indicators as at December 2019.

In a recent report, the AER's adviser on OEFs, Sapere-Merz, cautioned the AER that vegetation density maps cannot be used to draw conclusions about differences in growth rates within DNSPs' service regions:[52]

> *The AER has previously made reference to vegetation density maps such as those in Figure 7 in recognition that the vegetation management burden varies geographically.*
>
> *While useful, on their own, these maps do not allow conclusions to be drawn regarding differences in growth rates relative to the geographical distribution of network assets within a DNSP's total footprint.*

Sapere-Merz went on to explain that the seasonal and inter-annual variation in vegetation growth can be substantial (e.g., due to changes in rainfall), so DNSPs' vegetation management opex may also need to vary substantially over time: [53]

> *In addition, the two periods [the six months to November 2016 and November 2017] mapped in Figure 7 [showing vegetation density around Australia], as well as the temporal rainfall anomaly series in Figure 8, highlight that both the seasonal and inter-annual variation of vegetative growth can be substantial. This suggests that associated vegetation management OPEX may also vary substantially over time and careful consideration is required in annualisation of observed OPEX in any one year (see Section 2.3.4).*

We agree with Sapere-Merz that mere visual inspection of vegetation density maps produced by the Bureau of Meteorology—particularly if these maps are examined at snapshot points in time—is not a reliable method for drawing conclusions about the extent of bushfire risk vegetation management that DNSPs must undertake. However, the AER appears to not have heeded its own adviser's warnings in its Draft Decision for Ergon Energy.

Finally, we note that relying on comparisons of vegetation density in Victoria and in Queensland, without accounting for the fact that DNSPs in Victoria are responsible for a much smaller proportion of vegetation management than DNSPs in Queensland, is an unreliable way of assessing the extent of bushfire risk that DNSPs in the two jurisdictions must manage. For example, in the Draft Decision, the AER assumes that DNSPs are responsible for 82% of vegetation management in Victoria, and acknowledges that DNSPs in Queensland are responsible for vegetation clearance from all network assets.[54] This means that a significant share of the vegetation surrounding network assets in Victoria in the density maps examined by the AER is in fact the responsibility of councils rather than DNSPs. That is, the vegetation

[52] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, pp. 58-59.

[53] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 59.

[54] Ergon Energy, Draft Decision, October 2019, Attachment 6, p. 83.

density maps examined by the AER overstate the area of vegetation that the Victorian DNSPs are responsible for managing.

3.1.3 Quantification of bushfire obligations OEF

In the Draft Decision for Ergon Energy, the AER has followed the same approach to quantifying the bushfire obligations OEF adjustment that it adopted in its 2015 Final Decision for Ergon Energy.

The AER did not have access to the actual costs that Victorian DNSPs incur in order to comply with more stringent bushfire obligations than Queensland DNSPs. Therefore, in order to quantify the relevant OEF adjustment, the AER collected data from past regulatory decisions on certain cost allowances that it had approved for Victorian DNSPs. Those allowances reflected forecasts of incremental costs that Victorian DNSPs were expected to incur in order to comply with new bushfire-related obligations. Specifically, those forecasts of incremental costs were:

- Step changes that the AER allowed for Victorian DNSPs for the 2011-15 regulatory control period, as well as certain later variations by the Australian Competition Tribunal for specific cost items; and
- The 2012 opex pass-throughs for AusNet Services and Powercor for implementing the recommendations from the Victorian Bushfire Royal Commission.

These data were available for each of the years 2011 to 2015. The AER reasoned that since Ergon Energy and Energex did not face the new obligations imposed on Victorian DNSPs, the incremental costs of the Queensland DNSPs complying with those obligations was nil. Therefore, the AER concluded that the entirety of the bushfire obligation opex allowances provided to the Victorian DNSPs over the 2011-15 period represented the cost disadvantage faced by the Victorian DNSPs, relative to the Queensland DNSPs.

In order to convert these cost data into an OEF adjustment that could be applied to Ergon Energy, the AER:

- Expressed the allowed bushfire obligation costs in each year as a proportion of total opex allowed in that year;
- Averaged the resulting ratio over the five years, 2011 to 2015;
- Weighted the resulting average ratios for each DNSP in the reference group by the total number of customers for each of those DNSPs to obtain a weighted average ratio for the reference group as a whole; and
- Multiplied this weighted average ratio by the proportion of the historical benchmarking period over which those obligations applied.[55]

In our view, the AER's quantification of the bushfire obligation OEF applied to Ergon Energy in the Draft Decision was flawed in several respects, which we discuss in turn below.

In addition, we note that there appears to some errors in the data relied on by the AER to quantify the bushfire obligation OEF applied to Ergon Energy. These are described in Appendix A. Whilst the effect of these apparent errors on the overall OEF estimate is minor, they do indicate some concerns about the reliability of the AER's analysis.

[55] For instance, suppose the weighted average ratio of bushfire obligation costs to total opex was 10%, and that the new obligations applied over 7 years out of a 12-year historical benchmarking period. Then, the relevant OEF adjustment would be computed by the AER as 10% x 7/12 = 5.83%.

Lack of data on the actual costs incurred by reference firms in order to comply with more stringent bushfire obligations

The AER acknowledges in the Draft Decisions that it had to rely on previous forecasts of costs related to complying with bushfire obligations in Victoria because it does not have actual data on these costs:[56]

> *We have continued to rely on these forecasts costs to quantify the cost of the OEF for bushfire risks. We note that we have also used this information in our recent opex productivity review final decision for distribution businesses. We have relied on this previous forecast information because we do not currently have information on the actual costs incurred by the Victorian distribution businesses in relation to complying with the regulatory changes introduced in 2010. This is because these businesses only report aggregated vegetation management opex and to date have not been able to provide us with the incremental costs associated with changes in regulatory obligations.*

Indeed, the AER's adviser Sapere-Merz considered that it was unable to quantify reliably, using the data presently available, an OEF adjustment for bushfire obligations:[57]

> *No quantification of a vegetation management OEF candidate (or set of OEF candidates) has been able to be estimated at this time. The summary results for this OEF candidate (or set) have therefore been reported as nil…*
>
> *…*
>
> *In the absence of such data, and within the scope of the present project, we have so far been unable to identify sufficient evidence on which to distinguish between the effect of exogenous and endogenous variables on variations in observed vegetation OPEX. The methods that have been applied to quantifying unit costs and volumetric variables to support the quantification of other candidate OEFs have so far not been able to be applied to vegetation OPEX.*

At the time Sapere-Merz made this assessment, it had access to the same information available to the AER at the time it made the Draft Decisions. That is, Sapere-Merz considered that the information that the AER relied on in the Draft Decisions was insufficient to quantify the OEF adjustments for bushfire obligations reliably.

Sapere-Merz went on to caution that, owing to the lack of reliable relevant data, the margin for error in the quantification of a bushfire obligation OEF adjustment is likely to be significantly higher than for other

[56] Ergon Energy Preliminary Decision, October 2015, Attachment 7, p. 81.

[57] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, pp. 65-66.

OEF categories, and that the resulting OEFs could be materially over-estimated for some DNSPs and materially under-estimated for others:[58]

> *As a result, the error margins for any quantification of this OEF category (or set) across all DNSPs using a common methodology are considered to be significantly higher than for the quantification of other OEF categories. The likely result would be a material over estimation of the efficient OEF for some DNSPs alongside a material under-estimation for others. Because of the likely scale of the errors, and in particular the impact on the comparison point, these errors would in turn be likely to result in significant errors being introduced into the aggregate OEF adjustments and OEF adjusted efficient OPEX estimates.*

In our view, it is problematic that the AER has relied on data on *ex-ante* cost allowances for complying with new bushfire obligations rather than on actual, revealed costs. This is because it is possible that the reference DNSPs underspent the cost allowances set by the AER. This would not be remarkable, given the reference firms operate under a system of incentive regulation and, by the AER’s own assessment, are the most efficient firms amongst all DNSPs. If the actual costs incurred by the reference DNSPs had turned out lower than the forecasts relied on by the AER, then the negative OEF adjustment for bushfire obligations applied to Ergon Energy in the Draft Decision would have been overstated.

The AER’s Draft Decision fails to acknowledge the risk (which Sapere-Merz identifies) that its bushfire obligations OEF may be subject to significant misestimation. Instead, the AER suggests that Sapere-Merz had advised that this OEF adjustment “could be estimated by the AER on a case by case basis until such time as a systematic quantification is implemented.” This suggestion by the AER presents Sapere-Merz’s actual advice to the AER out of context.

Sapere-Merz did state that the fact that its inability to quantify a vegetation management OEF:[59]

> *…does not indicate that this OEF cannot be estimated by the AER on a case by case basis until such time as a systematic quantification is implemented.*

However, Sapere-Merz went on to clarify that:

> *It does not follow from the preliminary conclusion that a vegetation candidate OEF (or set) could not be quantified in the context of a future regulatory determination by the AER, in response to proposals submitted by DNSPs on a case by case basis. With adequate supporting data and information, including improved evidence and data on exposure to the*

[58] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 66.

[59] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 66.

> *exogenous variables identified, and the efficiency of related OPEX (including any significant inter-annual factors), this OEF candidate (or set) should be capable of being quantified by individual DNSPs and the AER.*

That is, Saper-Merz considered that the bushfire obligations OEF could be quantified on a case-by-case basis, provided that the AER had access to "adequate supporting data and information, including improved evidence and data." The AER has collected no new information of this type that we are aware of.

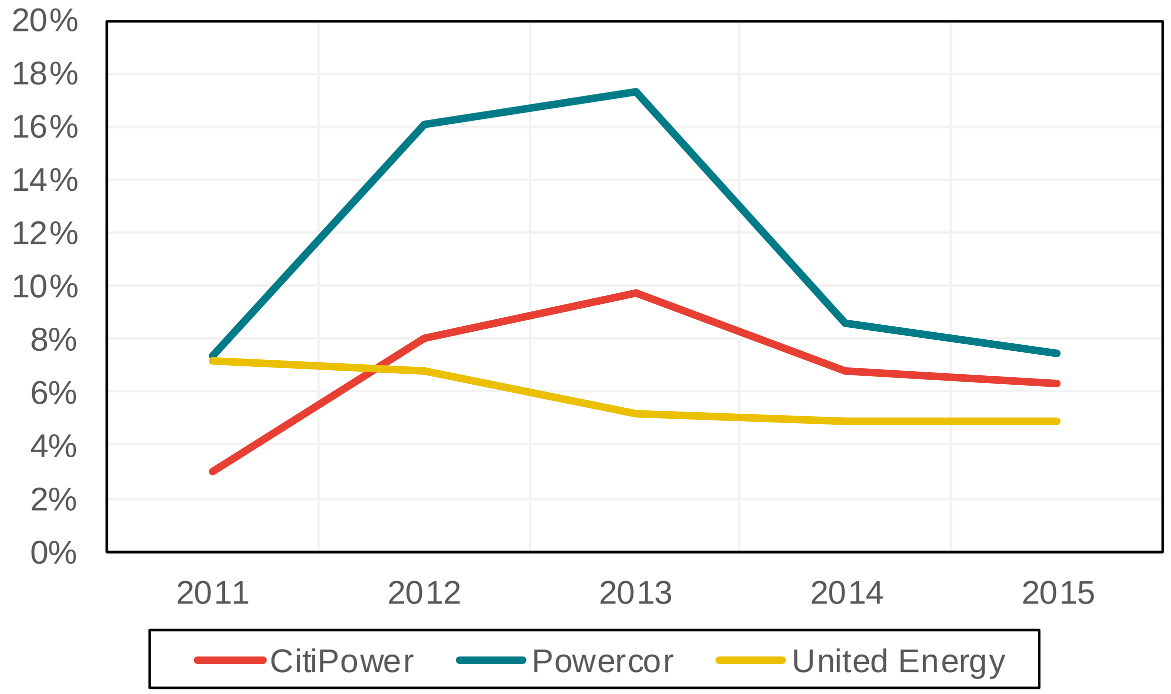
Sapere-Merz did not advise that it would be appropriate for the AER, having collected no new information, to simply revert back to using its 2015 methodology, as the AER has done in the Draft Decision. Indeed, as part of the 2017-18 review of OEFs, Sapere-Merz considered the AER's 2015 methodology for quantifying bushfire obligations OEFs and recommended a different quantification method. Hence, in our view, Sapere-Merz's suggestion that bushfire obligation OEFs could be estimated by the AER on a case-by-case basis until such time as a systematic quantification is possible should in no way be read as an endorsement of the AER's 2015 approach (with no new information gathered)—even as an interim measure.

The AER relies on average forecast costs over the period 2011 to 2015 rather than the latest information available

Another problem with the AER's methodology for quantifying the bushfire obligations OEF is that it relies on the average forecast costs associated with complying with new bushfire obligations (expressed as a proportion of total allowed opex) over the period 2011 to 2015. However, the forecast costs varied considerably over this period.

For example, as **Figure 9** below shows, Powercor's forecast compliance costs (as a proportion of total allowed opex) rose sharply between 2011 and 2013, and then fell by 2015 to levels that are very close to those in 2011.

Figure 9: Allowed bushfire risk management opex as a proportion of total allowed opex



Source: AER – Ergon Energy 2020-25 – Draft Decision – OEF – Veg management update – October 2019.xls

This pattern is entirely consistent with Powercor undertaking some initial catch-up work to become compliant with significant changes in vegetation management standards, and then settling into a steady maintenance of the new standards, once compliance had been achieved. Given this set of information, the best evidence on Powercor's costs associated with complying with new, more stringent standards in the years 2016 to 2018 (i.e., the latter three years in the benchmarking period) is not the average costs that it incurred over the period 2011 to 2015 (which included a transition period of catch-up work) but, rather, the cost forecasts towards the very end of that period. There is no evidence that the best estimate of the relative difference in costs between the reference group of firms and Ergon Energy, in relation to bushfire obligations, is one derived by averaging the forecasts of the 2011-15 period.

We note that the pattern of forecasts attributable to Powercor is significant because, as described above, the overall OEF adjustment is derived by weighting the costs of the reference DNSPs by customer numbers. Powercor has the largest number of customers of any of the Victorian DNSPs, so its costs are weighted the most when estimating the bushfire obligation OEF.

In summary, the AER appears to have ignored the fact that bushfire obligation costs were forecast to decline significantly over time for all three reference firms. Given this, it seems probable that the bushfire obligation costs incurred by the reference firms in 2016, 2017 and 2018 were lower than the average costs faced by those firms over the period 2011 to 2015. Therefore, by relying on average (forecast) costs over the period 2011 to 2015 in order to quantify the bushfire obligations OEF, the AER is likely to have overstated the bushfire obligation OEF.

3.2 Network accessibility

3.2.1 The 2015 Final Decision

In Ergon Energy's 2015 Final Decision the AER applied a material OEF adjustment of +1.1% to Ergon Energy to account the higher cost of access route maintenance (e.g., due to adverse climate and heavy rainfall) that Ergon Energy incurs compared to the reference DNSPs at that time. The AER explained that:[60]

> *The most cost effective route for a line may not always be in areas that are easily accessible. The opex of access route maintenance for Ergon Energy is a material part of Ergon Energy's network services opex. There is no variable in Economic Insights SFA model for differences in network access.*

And that:

> *…economic benchmarking RIN data indicates that Ergon Energy has a greater percentage of its network that does not have standard vehicle access than the comparison firms. In 2013/14, 36 per cent of Ergon Energy's network did not have standard vehicle access. In comparison, the weighted average for the comparison firms was only 5 per cent. As a result we consider that Ergon Energy is likely to have a cost disadvantage relative to the comparison firms on access track maintenance.*

The Economic Benchmarking RIN data for the period 2006 to 2018 suggests that a large proportion (roughly 32%) of Ergon Energy's network does not have standard vehicle access compared to the four current reference DNSPs (4.5%, weighted by customer numbers).

3.2.2 The Draft Decision

The Draft Decision does not apply any network accessibility OEF to Ergon Energy. As explained above, the AER simply adopted in the Draft Decision the material OEFs recommended by Sapere-Merz. However, it does not appear that Sapere-Merz considered a network accessibility OEF at all as part of its analysis. The costs associated with maintaining track access does not appear to be captured by any of the material OEFs that Sapere-Merz recommended to the AER, or by any of the candidate OEFs considered (but ultimately not recommended) by Sapere-Merz.

Given that network accessibility appears to be a factor that did not receive any attention by the AER or its adviser during the 2017-18 OEF review, and the circumstances faced by Ergon Energy in relation to network accessibility have remained largely the same since the 2015 Final Decision, there appears to be no good reason to exclude a material network accessibility OEF for Ergon Energy now.

[60] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 247.

3.3 Occupational Health & Safety

3.3.1 The Draft Decision

In Ergon Energy's 2015 Final Decision, the AER applied a material OEF adjustment of +1.2% to Ergon Energy to account for the fact that Queensland DNSPs operate under more stringent occupational health and safety (OH&S) regulations than do the reference Victorian DNSPs.[61] However, the present Draft Decision has provided no analogous OH&S OEF adjustment.

3.3.2 Basis of the OH&S OEF applied in the 2015 Final Decision

In 2011, Safe Work Australia developed a single set of Work Health and Safety (WHS) laws to be implemented nationally. These are known as 'model' laws. In order for these laws to become legally binding on employers, each jurisdiction must implement the model laws in its own legislation. To date, all States and Territories in Australia, except Victoria, have adopted the model laws.

In the 2015 Final Decision, the AER recognised that Queensland DNSPs face a cost disadvantage, relative to Victorian DNSPs, in complying with the model laws, and that these additional costs faced by Queensland DNSPs were beyond their control.[62]

The AER quantified the OH&S OEF adjustment that it applied to Ergon Energy in 2015 using the best information available at that time—a 2012 study by PWC for the Victorian Government, which estimated the costs to Victoria of achieving and maintaining full compliance with the WHS model laws, in the event that those laws were adopted in Victoria.[63] In quantifying the OH&S OEF, the AER:

- Adopted PWC's 2012 estimate that the ongoing cost of complying with WHS model laws in Victoria would be $796 million ($2011-12) annually;[64]
- Estimated Victoria's Gross State Product (GSP) to be $328 billion ($2011-12);[65]
- Assumed, on that basis, that the impact of complying with the WHS model laws was approximately 0.24% of GSP for all jurisdictions;[66]
- Referred to estimates in the 2012 PWC study which suggested that it would cost Victorian power generators roughly 2.5 times more than most other businesses in Victoria to comply with the WHS model laws.[67] The AER considered that, of the types of firms that PWC had surveyed, power generators were the most similar to DNSPs;[68] and
- Assumed, on that basis, that Queensland DNSPs require 0.6% more opex than Victorian DNSPs to comply with the WHS model laws;[69]

[61] Ergon Energy, Final Decision, October 2015, Attachment 7, p. 56.

[62] Ergon Energy, Final Decision, October 2015, Attachment 7, pp. 56-57.

[63] PWC, Impact of the proposed national Model Work Health and Safety Laws in Victoria, 4 April 2012.

[64] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 229.

[65] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 229.

[66] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 229.

[67] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 230.

[68] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 231.

[69] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 230.

- Calculated that, when this figure of 0.6% was weighted to reflect the total number of Victorian customers belonging to Victorian DNSPs amongst the reference firms (which, at that time, included SA Power Networks), this resulted in a raw OEF adjustment of 0.5%;[70] and
- The AER recognised that DNSPs may incur more incremental costs associated with the introduction of the WHS model laws than power generators. Therefore, the AER applied a 'risk factor' of approximately 2.6, which increased the raw OEF adjustment of 0.5% to a final adjustment of 1.2%.[71]

3.3.3 Sapere-Merz's assessment of OH&S OEFs

Sapere-Merz considered the need for an OEF adjustment as part of the AER's 2017-18 OEF review. Sapere-Merz concluded that the impact of differences in the WHS model laws between jurisdictions did not meet the materiality threshold because the AER's quantification of the OH&S OEF had been "substantially over-stated."

The basis for Sapere-Merz's conclusion was a Table in PWC's 2012 report, which suggested that:

- the total annualised, ongoing cost of power generators complying with WHS model laws would be less than $0.5 million; and
- the average cost per power generator (on an annualised, ongoing basis) of complying with WHS model laws would be $5,210.

Sapere-Merz concluded that:[72]

> *If the PWC report is taken at its face value, and the cost per DNSP is around $5,210, then the impact of WHS is clearly well below the materiality threshold. This suggests that, on the basis of the 2012 PWC report, the WHS candidate OEF does not meet the AER's materiality criterion.*

On this basis, Sapere-Merz advised that the OH&S OEF should be treated as an immaterial factor. As the AER has made no allowances for OEFs in the present Draft Decision, no OH&S OEF has been applied to either Ergon Energy or Energex.

Assessment of Sapere-Merz's conclusion on OH&S OEFs

In our view, Sapere-Merz misunderstood the AER's approach to quantifying OH&S OEFs. It appears that Sapere-Merz interpreted the AER's approach as using the estimated compliance costs for power generators as a measure of the compliance costs that would be faced by DNSPs. That was not the AER's approach.

The AER first estimated the cost of compliance with WHS model laws by the average Victorian firm, expressed as a proportion of Victorian GSP. The AER then scaled these average costs up to reflect the business type that was most similar to DNSPs—namely, power generators. The AER then applied a further risk factor adjustment to recognise the likelihood that the compliance costs faced by DNSPs would be greater than the compliance costs faced by power generators.

[70] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 230.

[71] Ergon Energy, Final Decision, October 2015, Attachment 7, p. 57.

[72] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 82.

The AER never suggested that estimates of Victorian power generators' compliance costs was a close proxy or direct estimate of the likely compliance costs faced by Victorian DNSPs. In fact, the AER explained explicitly that it had not used the average annualised cost per power generator (i.e., $5,210), implying that that estimate was too low to be a reasonable estimate of DNSPs' costs. Specifically, the AER explained the following:[73]

> *The challenges in safely operating high voltage assets that network service providers must take into account will be similar to those that power generators face. Although PwC's report's findings show that the costs of adopting the laws are not uniformly distributed across Victorian businesses we have taken steps to account for this. We adjusted the average impact across the Victorian economy to reflect the observed differences between most firms surveyed and the business type that most resembled the network service providers: power generators. We note that network service providers are likely to incur higher costs for OH&S obligations than power generators due to their scale. This is why we adopted a percentage adjustment, calculated using the average cost to the Victorian economy, rather than the average annualised cost per power generator, which was only $5,210 ($2011−12).*

In our view, the approach the AER followed in its 2015 Final Decision for Ergon Energy (using the information available at that time) was reasonable. Sapere-Merz's suggestion that the AER had overstated the OH&S OEF for Ergon Energy was based on a misunderstanding of the AER's approach, and was therefore not a reasonable conclusion to reach.

Since the AER's 2015 Final Decision for Ergon Energy, further evidence has become available that suggests that the AER's 2015 estimate of the required OH&S OEF adjustment may have been conservatively low. The 2012 PWC study for the Victorian Government estimated that the annualised cost of full compliance with WHS model laws would be $796 million ($2011-12). In 2016, Deloitte Access Economics (DAE) completed a Regulatory Impact Statement (RIS), which estimated that the annualised cost to Victorian businesses of achieving increased consistency with the WHS model laws would be over $1,015 million ($2014-15), or $949 million ($2011-12), a 19% increase.[74]

In view of this additional information, we consider that an OH&S OEF adjustment of *at least* +1.2% for Ergon Energy (consistent with the AER's 2015 estimate) would be reasonable to apply in the 2019 Final Decision. This OEF adjustment should also be applied to Energex because it is subject to the same OH&S laws and regulations as Ergon Energy.

[73] Ergon Energy, Preliminary Decision, April 2015, Attachment 7, p. 231.

[74] DAE, Regulatory Impact Statement for proposed Occupational Health and Safety Regulations 2017 and Equipment (Public Safety) Regulations 2017, June 2016, Table 4.6, pp. 59-60. In the RIS developed by DAE, the option that most closely resembled full compliance with the WHS model laws was Option 3, where existing OH&S laws and regulations in Victoria would be remade but with amendments in select areas to increase consistency with the WHS model laws.

3.4 Immaterial OEFs excluded by the AER

3.4.1 The Draft Decision

In Ergon Energy's 2015 Final Decision, the AER applied 19 immaterial OEFs totalling +5.0% for Energex and +6.1% for Ergon Energy, as summarised in **Table 4** below.[75] By contrast, the AER has applied no immaterial OEFs in the present Draft Decisions.

Table 4: Summary of immaterial OEFs adopted by the AER for the 2015-20 regulatory control period

Factor	Energex	Ergon
Asset lives	-0.5%	0.5%
Building regulations	0.5%	0.5%
Capitalisation practices	0.5%	-0.5%
Cultural heritage	0.5%	0.5%
Corrosive environments	0.5%	0.5%
Environmental regulations	0.5%	0.5%
Environmental variability	-0.5%	0.5%
Fire ants	0.1%	0.0%
Grounding conditions	0.5%	0.5%
Mining boom cost imposts	0.0%	0.5%
Planning regulations	0.5%	0.5%
Private Power poles	-0.5%	-0.5%
Proportion of 11kV and 22kV lines	0.5%	0.5%
Rainfall and humidity	0.5%	0.5%
Skills required by different service providers	0.5%	0.5%
Solar uptake	0.5%	0.5%
Traffic management	0.5%	0.5%
Transformer capacity owned by customers	-0.1%	-0.4%
Topography	0.5%	0.5%
Total	5.0%	6.1%

Source: AER Draft Decision 2015-20, April 2015, Table A.9, Attachment 7, p. 171.

[75] The AER's reasons for allowing these OEFs in the 2015 Final Decision for Ergon Energy are summarised in Appendix B.

In the Draft Decision for Ergon Energy, the AER provides three reasons for its move away from the application of immaterial OEFs:

- Benchmarking is a top-down approach to assessing the relative efficiencies of DNSPs, which lends itself to taking into account material differences between DNSPs rather than all differences;
- The AER has now completed an industry-wide consultation process on OEFs; and
- The AER has retained the benchmark comparison point of 75% adopted in previous decisions, which the AER considers remains relatively conservative.

The following section assesses the validity of each of these reasons in turn.

3.4.2 Assessment of the AER's reasons for excluding immaterial OEFs

Benchmarking is a top-down approach that need only account for material differences between DNSPs

The AER defends its approach in the Draft Decisions of making no allowance for immaterial OEFs on the grounds that top-down economic benchmarking does not require normalisation of all cost differences between DNSPs:[76]

> *Benchmarking is a top–down approach to assessing the relative efficiency of distribution businesses in the NEM. In our regulatory decisions, we have used benchmarking to identify distribution businesses that are materially inefficient. This approach of benchmarking lends itself to taking into account material differences between distribution businesses rather than all differences.*

In this regard, we make two observations:

- Firstly, this argument would be reasonable if the AER were simply using benchmarking analysis to provide a "high level" check of the relative efficiency of DNSPs. However, the AER is not doing that. The AER is using economic benchmarking directly to *set* cost allowances for DNSPs (i.e., by determining the base year efficient level of opex used to forecast allowances over a regulatory control period). Under those circumstances, it is incumbent on the AER to take greater care to account for differences between DNSPs' operating environments than the AER suggests in the excerpt above—especially given the general uncertainty that already applies to the AER's economic benchmarking results.
- Secondly, as the AER has acknowledged (correctly) in the past, whilst the impact of certain individual OEFs may be immaterial, their combined impact may be material:[77]

[76] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 69.

[77] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 66.

> *For the 2015 decisions we included OEFs that individually may have had an immaterial impact on opex, but their combined effect may have been material.*

This statement (which is similar to statements made by the AER in previous decisions) recognises that failure to account for the cumulative effect of individual OEFs that it has judged to be immaterial could result in distorted comparisons of efficiency between DNSPs. We consider that reliance on estimates of efficiency that suffer from this problem to set DNSPs' opex allowances is unreasonable as such an approach could result in some DNSPs under-recovering their efficient costs.

The AER can take a less cautious approach to OEFs since it has now consulted on OEFs

The AER argues that its decision to account for immaterial OEFs in past determinations "was part of a deliberate decision to adopt a cautious approach in the context of our first use of benchmarking and a more limited information set."[78]

However, the AER goes on to suggest in the Draft Decision for Ergon Energy that it now has better information than it did in 2015, which suggests its use of immaterial OEFs now would be overly conservative:[79]

> *The change in approach, and the use of material OEFs for this draft decision, is based on our assessment that, based on the best available information, the continued application of the immaterial OEFs now represents an overly conservative estimate of the impact of OEFs on differences in businesses' costs. The use of immaterial OEFs likely overestimates the magnitude of the differences between Ergon Energy and Energex and the comparison point firms when used in the context of identifying material inefficiency.*

It appears that the improvement in information available relates to the OEF review that the AER undertook in 2017-18. For instance, the AER explains in the Draft Decision that:[80]

> *We now have better information to support the identification and quantification of the key material differences in operating environments in the NEM. The OEF review we undertook over 2017 and 2018, which included the development of the Sapere–Merz report in relation to material OEFs, represents an improvement in our information set.*

However, we note that advice on immaterial OEFs was outside the scope of Sapere-Merz's terms of reference (as discussed further, below). This meant that the 2017-18 OEF review did not collect or add any new information on those OEFs that the AER had previously classified as being immaterial factors.

[78] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 69.

[79] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 69.

[80] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 71.

No new data was gathered or presented that would assist in verifying whether those factors were in fact immaterial. Furthermore, no new data was collected that would allow those OEFs to be quantified. It appears that the AER had decided from the outset of the review that it would focus its attention on the most material OEFs. This is a reasonable thing to have done in order to make incremental improvements to the overall understanding of OEFs.

However, this has meant that many crucial questions about the OEFs previously treated as immaterial have simply been neglected since 2015. The most pressing of those questions is whether in fact each of those factors do lead to only immaterial cost differences between DNSPs? In our view, the only reliable way to answer that question is to attempt to quantify each of those OEFs systematically (as the AER has done in relation to the material OEFs). However, that requires the collection of relevant information, and further engagement with the industry to understand how best to quantify those OEFs. Neither of these things, with the specific objective of investigating the so-called immaterial OEFs, has been pursued by the AER. In essence, the AER has done nothing since 2015 to advance the understanding of what it has previously assumed to be immaterial factors.

Since the AER appears to have no new information on the materiality or otherwise of those OEFs, it is unreasonable for the AER to simply disregard those OEFs in the Draft Decisions, and then claim that advancement of knowledge and information is a basis for doing so. It is manifestly not.

The AER suggests in the Draft Decisions that Sapere-Merz had considered the full range of OEFs previously examined by the AER:[81]

> *We note that while the Sapere–Merz report only quantifies five OEFs for Ergon Energy and Energex, in the process of its review it considered the full range of OEFs previously examined by the considered by the AER.*

The AER's suggestion that Sapere-Merz's review did somehow investigate the immaterial OEFs to nearly the same extent as the handful of material OEFs that it did quantify is worth examining closely.

Firstly, it is incontrovertible that the AER's instructions to Sapere-Merz's work was to focus only on material OEFs. Specifically, the terms of reference provided to Sapere-Merz required it to:[82]

> *… provide a written report that:*
>
> • *identifies **the most material factors** driving apparent differences in estimated productivity and operating efficiency between the distribution networks in the NEM, and*
>
> • *quantifies the likely effect of each factor on operating costs in the prevailing conditions.*
>
> *The consultant is expected to **only** focus on those operating environment factors that*

[81] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 71.

[82] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 38.

> *contribute to a material difference in relative costs between businesses. As noted in the Appendix below, the AER has previously defined material as a 0.5 per cent difference in relative costs. The consultant may wish to consider the level and appropriateness of this materiality threshold. [Emphasis added.]*

Given these instructions, Sapere-Merz would have acted beyond its brief had it investigated the immaterial OEFs in the same way it investigated the material OEFs.

Secondly, any consideration given by Sapere-Merz to the immaterial OEFs was very cursory in nature. Sapere-Merz provided the DNSPs it consulted with during the review the full list of OEFs that the AER had previously considered. This list was dominated by the immaterial OEFs. The purpose of providing this list was to ask DNSPs which of those factors they considered to be material, with a view to whittling the full list down to a handful of the most material OEFs. Sapere-Merz did not gather any new data that could be used to quantify those immaterial OEFs, or to fill any of the numerous information gaps that the AER identified in relation to the immaterial OEFs. This observation is not a criticism of Sapere-Merz's work. Sapere-Merz was simply acting according to the terms of reference it had been given. We simply note that the only role that the immaterial OEFs played in the 2017-18 OEF review was to provide a mere starting point for Sapere-Merz's analysis. Hence, the AER's attempt to construe Sapere-Merz's consideration of immaterial OEFs as having in any way added substantively to an understanding of those factors is quite misleading.

The AER suggests that its decision to make no allowances for immaterial OEFs reflects a recent realisation that its 2015 treatment of OEFs would now be overly conservative:[83]

> *…particularly given that Sapere-Merz's advice expanded on, and refined, our previous analysis of OEFs in our 2015 opex decisions, including its advice on which OEFs were material.*

As explained above, Sapere-Merz's advice in no way added substantively to the previous understanding of the immaterial OEFs. It is puzzling why the AER considers that Sapere-Merz's advice on which OEFs are material is relevant to the question of whether immaterial OEFs should be allowed or not. **Table 5** compares the material OEFs that the AER applied to Ergon Energy in the 2015 Final Decision against the OEFs that Sapere-Merz advised the AER in 2018 are material factors (and which were used in the Draft Decision). Of the material OEFs applied to Ergon Energy in 2015, Sapere-Merz:

- concluded that three were either immaterial or duplicated other OEFs (i.e., extreme weather, licence conditions and OH&S regulations); and
- apparently failed to consider one in its analysis (i.e., network accessibility).

It is entirely unclear how Sapere-Merz's treatment of these four OEFs provides the AER with any new relevant information on whether any of the 19 immaterial OEFs applied by the AER to Ergon Energy in 2015 (**Table 4**) ought to be applied now or disregarded. The link between Sapere-Merz's work and the AER's decision to exclude immaterial OEFs in the Draft Decisions seems an entirely tenuous one.

[83] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 40.

Table 5: Material OEF adjustments applied to Ergon Energy in 2015 and 2019

2015 FINAL DECISION		2019 DRAFT DECISION	
Cyclones	5.40%	Cyclones	5.24%
Taxes and levies	1.7%	Taxes and levies	0.91%
Termite exposure	0.5%	Termite exposure	1.10%
Sub-transmission	4.6%	Sub-transmission	5.91%
Vegetation management	4.1%	Vegetation management (Division of responsibility)	2.79%
		Vegetation management (Bushfire obligations)	-3.36%
Extreme weather	3.0%		
Licence conditions	0.7%		
Network accessibility	1.1%		
OH&S regulations	1.2%		

Source: Ergon Energy Preliminary Decision, April 2015, Attachment 7, Table A.8; Ergon Energy Final Decision, October 2015, Attachment 7, pp. 55-56; Ergon Energy Draft Decision, October 2019, Attachment 6, Table A6.1.

The AER has retained a conservative benchmark comparison point

The AER explains in the Draft Decision for Ergon Energy that it continues to adopt a relatively conservative comparison point score of 0.75 (which is similar to the comparison point it has adopted in previous decisions). The AER goes on to say that:[84]

> *We consider this relatively conservative benchmark comparison point provides an appropriate margin to account for any residual data issues.*

As explained above, the AER has taken a less conservative approach in the Draft Decisions, compared to its 2015 Final Decisions, by not accounting for any immaterial factors. This decision appears to be based on no new information that has come to light since 2015, and no resolution of "data issues." It seems that the only change that has occurred is the passage of time.

Therefore, if the AER considered that it had struck an appropriate balance in 2015 by applying a benchmark comparison point similar to the one used in the present Draft Decision, while applying allowances for immaterial OEFs, it is unclear why the AER now considers that only one of those actions (the application of a "conservative" benchmark comparison point) "provides an appropriate margin to account for any residual data issues."

[84] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 73.

Conclusion on AER's reasons for excluding immaterial OEFs

In our view, the reasons that the AER has given to explain the exclusion of so-called immaterial OEFs in its Draft Decisions for Energex and Ergon Energy are not convincing:

- Whilst it is reasonable to argue that economic benchmarking need not normalise every cost difference between DNSPs, no matter how small, the AER has not addressed the fact that it has previously acknowledged that the cumulative effect of individually-immaterial OEFs could be material. If that is the case (and the AER has adduced no evidence to suggest otherwise), then by the AER's own analysis, the benchmarking analysis used in the Draft Decision may have ignored material differences in costs between DNSPs that are unrelated to efficiency.
- It is clear from the reasons provided in the AER's 2015 Final Decision that the AER had very little information at that time to quantify (or even assess reliably) the materiality of many of the factors that it treated in that decision as immaterial (see Appendix B). The obvious solution to that problem would have been to collect the information on immaterial OEFs that it lacked in 2015. However, the AER has performed no work since 2015 to close those information gaps. The AER's suggestion that the Sapere-Merz's 2017-18 study on OEFs has provided the AER with more information that supports the exclusion of the immaterial OEFs is incorrect. The Sapere-Merz study provided no such information, because the terms of reference for that study expressly instructed Sapere-Merz to only focus on material OEFs. That is precisely what Sapere-Merz did.
- In 2015, the AER took two steps to moderate its benchmarking results. First, it applied what it refers to as a "conservative" benchmark comparison point. Second, it made an allowance for immaterial OEFs. In the present Draft Decisions, it has only applied the first of those approaches. The AER has gained no new information since 2015 that would support the exclusion of the immaterial OEFs. Therefore, it is unclear why the AER now regards only one of these measures, the application of a conservative benchmark comparison point, sufficient to address the significant uncertainty associated with estimating accurately the true relative efficiencies of DNSPs in Australia.

3.4.3 Changes in circumstances since 2015 ignored by the AER

The AER argued in 2015 that some OEFs in Ergon Energy's case were likely to be immaterial because several of the reference DNSPs at that time were, like Ergon Energy, also rural service providers. For example:

- **Environmental variability.** The AER argued in 2015 that AusNet Services, Powercor and SA Power Networks (who were all judged to be reference firms) are "predominantly rural service providers that must operate in environmentally diverse circumstances."[85]
- **Topography.** The AER explained in 2015 that "[o]perating in mountainous regions may lead to higher costs in some operating areas such as maintenance, emergency response, and vegetation management due to access issues…" The AER then noted that "…most of the comparison service providers operate in a relatively flat area compared to Queensland service providers. Therefore, the Queensland service providers may have a cost disadvantage relative to the comparison service providers due to topography." However, the AER also noted that "AusNet Services, the comparison service provider at the benchmark comparison point, has a more mountainous operating environment than the Queensland service providers."[86]

We note that AusNet Services is no longer considered to be a reference firm by the AER. This would mean that the materiality of the two OEFs identified above would have increased since 2015, all else remaining equal. It is unclear whether this change would be sufficient to push these OEFs above the AER's materiality threshold for OEFs. However, the AER's decision to simply exclude from the Draft

[85] Ergon Energy Preliminary Decision, April 2015, Attachment 7, p. 210.

[86] Ergon Energy Preliminary Decision, April 2015, Attachment 7, p. 222.

Decisions all OEFs previously treated as immaterial—regardless of whether circumstances may have changed since 2015—meant that this question was never investigated by the AER.

3.5 Other problems with the AER's OEF adjustments that remain unaddressed

3.5.1 Data availability, quality and consistency

In our January 2019 OEFs report, we noted that there remain many gaps in the data required to quantify OEF adjustments reliably.[87] Sapere-Merz itself expressed reservations over the availability, reliability and consistency of some of the data required to quantify the OEFs it investigated. For example, when attempting to quantify the sub-transmission OEF, Sapere-Merz examined the Category Analysis RIN data available and concluded the following:[88]

> *There is a material difference between the highest and lowest cost DNSP, for example by a factor exceeding ten for line lengths. This cost difference is beyond what the authors would expect because of situational or operating environment factors between the firms. This suggests that each firm may be using a different method to establish these costs in the Category Analysis RINs. This situation could be improved over time with increased guidance on how to calculate these costs and/or a process of audit on the calculation of these costs.*

That is, Sapere-Merz suspected that some of the RIN data had not been reported consistently across DNSPs. In order to address this problem, Sapere-Merz had to apply an *ad hoc* rule that filtered out any reported costs that were below 30% or above 300% of the average of the all the DNSPs. Sapere-Merz admitted that this filtering rule was "based on the judgment of the authors" of the Sapere-Merz report, rather than any concrete evidence.[89] Sapere-Merz went on to note that: [90]

> *If, in the future, cost changes were to move a reference firm outside our defined outlier boundaries, the outcome to the efficient unit cost calculation, and in turn OEF estimate, could be material. This potential volatility is not ideal in an ongoing methodology…*

[87] Frontier Economics, AER operating environment factors (OEFs), 15 January 2019, section 5.3.3.

[88] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 57.

[89] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 57.

[90] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 57.

Sapere-Merz explained that one way to address the address this problem would be to ensure "improved consistency in the RIN data reporting."[91]

By way of a second example, as explained above, Sapere-Merz was unable to quantify the vegetation management OEFs, due to lack of suitable data. Sapere-Merz noted that:[92]

> *No quantification of a vegetation management OEF candidate (or set of OEF candidates) has been able to be estimated at this time…*
>
> *…EBRIN data on vegetation density is considered less mature than other EBRIN data, upon which the EI model and some other OEF estimates have been developed or otherwise considered. Further refinement and consultation with DNSPs to ensure consistency of EBRIN data is required before it can be relied upon to the extent necessary to quantify this OEF candidate (or set) within an acceptable margin for error.*

Given the apparent deficiencies in the data used to estimate the OEFs, the AER should not assume that it has achieved a reliable quantification of OEFs. The AER ought to continue a process to improve its OEF quantification incrementally. It is encouraging that the AER has signalled in the Draft Decisions an intention to do so.[93] Nevertheless, uncertainty over the reliability of the data underpinning its current estimates of OEFs should be reflected in a suitably cautious interpretation of its benchmarking analysis.

3.5.2 Use of *ex-post* OEF adjustments

In our January 2019 OEFs report, we recommended that the AER consider:[94]

- investigating the inclusion of additional cost driver variables in its model, which should become more feasible over time as the benchmarking sample size increases; and
- making *ex-ante* adjustments for any costs associated with OEFs that are unexplained, or poorly explained, by the cost driver variables that are included in the model—as Ofgem does.

The AER has not adopted either of these approaches in the Draft Decisions. Rather, the AER simply dismisses these two approaches by arguing that they:

> *…would likely be difficult and time consuming to develop and require relatively significant further engagement with industry and additional data collection, including extensive recasting of data and model testing. In the meantime, we maintain that our post–modelling*

[91] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, pp. 65-66.

[92] Sapere-Merz, Independent review of Operating Environment Factors used to adjust efficient operating expenditure for economic benchmarking, August 2018, p. 58.

[93] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 66.

[94] Frontier Economics, AER operating environment factors (OEFs), 15 January 2019, section 5.3.4.

> *approach to accounting for OEFs is a reasonable and practical approach in the context of a top–down approach to benchmarking and opex assessment more broadly.*

We agree that such improvements would be time-consuming and require proper engagement with stakeholders.[95] But, they would be improvements, nevertheless. It is worth pointing out that the AER has not undertaken any work on any of these issues in the nearly five years since the AER first applied economic benchmarking to set regulatory allowances in November 2014.

This is particularly striking since the AER's approach of applying only post-modelling adjustments was criticised by the Australian Competition Tribunal in a judgment nearly four years ago:[96]

> *…the difficulty with the AER's approach is that despite making post modelling OEF adjustments, the efficiency scores of the EI model have been affected by the inclusion of non-comparable data. Post modelling adjustments do not address the fact that the costs relationships within the model, including those DNSPs for which no OEF adjustments have been made, have been affected by the non-comparable data. Thus, those cost relationships are skewed by heterogeneous differences between the DNSPs. The output of the model is therefore skewed by flawed data. That skewed cost relationship cannot be corrected by post modelling OEF adjustments made to some only of the DNSPs…*

The AER has undertaken no development work to address this valid criticism made by the Australian Competition Tribunal.

In our view, the fact that the AER has not resolved these problems identified above means that the AER should take a much more cautious interpretation of the benchmarking results than it has done in the Draft Decisions.

3.6 Conclusions

In summary, we conclude that:

- The AER has relied on flawed reasoning to support its estimate of the bushfire obligations OEF. In particular, the AER has:
  - Claimed incorrectly that the difference in annual vegetation management opex of Victorian DNSPs relative to Ergon Energy has remained broadly consistent since 2012. The comparison the AER made was irrelevant to the assessment of OEFs since it is the difference in costs between the reference firms (not all Victorian DNSPs) and Ergon Energy that matters for the purposes of assessing OEFs. The difference in annual vegetation management costs between the reference firms and Ergon Energy has generally declined since 2012; and
  - Understated the bushfire risk that Ergon Energy must manage.
- The AER's quantification of bushfire obligation OEFs is flawed:

[95] As we pointed out in our January 2019 benchmarking report (p. 36), the task of normalising the cost data for OEFs, would be made much simpler if the AER relied on Australian data alone in its benchmarking modelling.

[96] Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1, [335].

  - The AER has no information on the reference firms' actual opex associated with complying with more stringent bushfire management regulations in Victoria. Instead, the AER has relied on cost allowances for these costs that it has previously provided to the reference DNSPs. If the reference DNSPs underspent those allowances—a possibility that the AER cannot rule out—then the bushfire obligations OEFs would have been overstated; and
  - The AER has relied on average allowances to the reference firms over the period 2011 to 2015 to quantify the OEFs, even though all of those reference firms were forecast by the AER to reduce their bushfire obligation compliance costs (in Powercor's case, very materially) since 2013. It is possible that the reference firms' actual costs between 2016 to 2018 were similar to the levels forecast for 2015. If that were so, then the AER would have overestimated the bushfire obligation OEF adjustment.
- The AER only applied in the Draft Decisions those OEFs that Sapere-Merz identified as material OEFs. However, Sapere-Merz appears to have overlooked an OEF that the AER treated as a material OEF for Ergon Energy in its 2015 Final Decision—the network accessibility OEF. As such, an OEF adjustment that was treated as material in 2015 has not been applied (or even mentioned) in the Draft Decision. As the AER has considered no new information in relation to this OEF since 2015, there appear to be no grounds for its exclusion in 2019.
- In its 2015 Final Decision for Ergon Energy, the AER applied a material OH&S OEF adjustment. In 2017-18, Sapere-Merz advised the AER that it should treat this OEF as an immaterial factor. Consequently, no OH&S OEF adjustment was applied to Ergon Energy in the Draft Decision. It appears that Sapere-Merz's advice to the AER that the OH&S OEF should be viewed as an immaterial factor was due to a misunderstanding on Sapere-Merz's part of the AER's 2015 approach to quantifying that OEF. Therefore, there appear to be no grounds for treating the OH&S OEF as an immaterial factor in the Draft Decision.
- The AER's reasons for excluding immaterial OEFs in the Draft Decision are unconvincing:
  - Whilst it is reasonable to argue that economic benchmarking need not normalise every cost difference between DNSPs, no matter how small, the AER has not addressed the fact that it has previously acknowledged that the cumulative effect of individually-immaterial OEFs could be material. If that is the case (and the AER has adduced no evidence to suggest otherwise), then by the AER's own analysis, the benchmarking analysis used in the Draft Decisions may have ignored material differences in costs between DNSPs that are unrelated to efficiency.
  - It is clear from the reasons provided in the AER's 2015 Final Decision that the AER had very little information at that time to quantify (or even assess reliably) the materiality of many of the factors that it treated in that decision as immaterial. The obvious solution to that problem would have been to collect the information on immaterial OEFs that it lacked in 2015. However, the AER has performed no work since 2015 to close these information gaps. The AER's suggestion that the Sapere-Merz's 2017-18 study on OEFs has provided the AER with more information that supports the exclusion of the immaterial OEFs is incorrect. The Sapere-Merz study provided no such information, because the terms of reference for that study expressly instructed Sapere-Merz to only focus on material OEFs.
  - In 2015, the AER took two steps to moderate its benchmarking results. First, it applied what it refers to as a "conservative" benchmark comparison point. Second, it made an allowance for immaterial OEFs. In the present Draft Decisions, it has only applied the first of those approaches. The AER has gained no new information since 2015 that would support the exclusion of the immaterial OEFs. Therefore, it is unclear why the AER now regards only one of these measures, the application of a conservative benchmark comparison point, sufficient to address the significant uncertainty associated with estimating accurately the true relative efficiencies of DNSPs in Australia.
- Some OEFs considered by the AER for Ergon Energy in 2015 were judged to be immaterial because several of the reference firms at the time—AusNet Services, Powercor and SA Power Networks—

were, like Ergon Energy—rural service providers. AusNet Services is no longer identified by the AER as a reference firm. Hence, some previously immaterial OEFs would now have become more material. However, the AER has no data to assess the impact of these OEFs. This provides a further reason for the AER to exercise caution in its interpretation of its latest benchmarking results.

- The AER has undertaken no work since 2015 to address the well-recognised shortcomings of its *ex-post* approach to adjusting OEFs—notwithstanding that the Australian Competition Tribunal identified major flaws in that approach. The lack of action by the AER to address this problem is troubling. To the extent that the problems persist, the AER should reflect that in its interpretation of its benchmarking results.

4 ASSESSMENT OF QUEENSLAND DNSPS' BASE YEAR OPEX

This section assesses the efficiency of base year (2018-19) opex amounts proposed by Energex and Ergon Energy.

4.1 Assessment using the AER's Draft Decision approach

We begin by assessing Energex's and Ergon Energy's base year opex using the latest information available, including new information that has become available since the AER conducted the benchmarking analysis that informed its Draft Decisions. To do this, we:

- Apply the AER's latest benchmarking approach, as described in the Draft Decisions;
- Employ the economic benchmarking dataset that was used by the AER in the 2019 Annual Benchmarking Report;
- Updated AER's estimates of material OEFs for Ergon Energy and Energex used in the Draft Decisions. The AER states in its Draft Decision that "We will update our OEF calculations summary spreadsheet for the final decision to reflect the results from the 2019 Annual Benchmarking Report and in particular to use the period average opex over the benchmarking periods (instead of the 2015 historical opex used by Sapere-Merz)."[97]

  Two of the inputs to the AER's OEF calculations are:

  - estimates of efficiency scores from its benchmarking models for each of the DNSPs; and
  - estimates of target average efficient opex over the benchmarking period for each of the DNSPs.

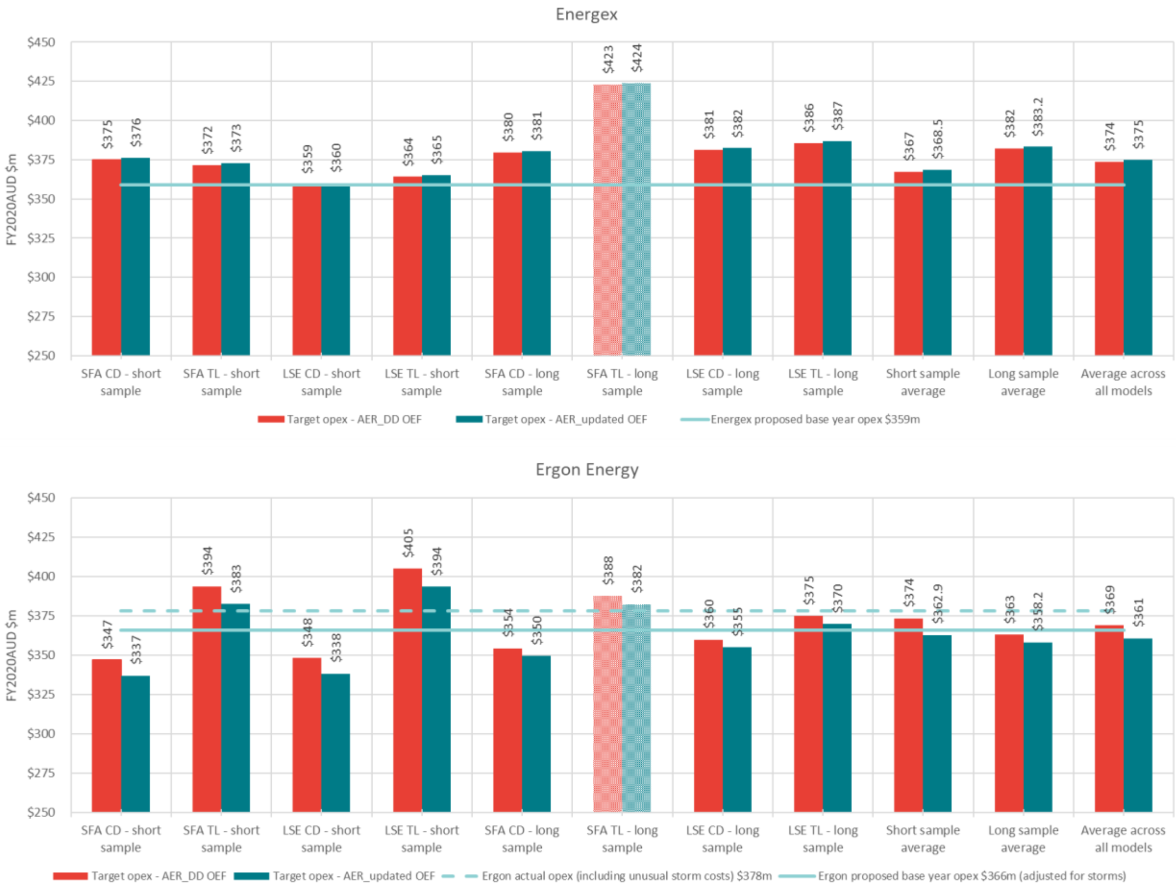
  The AER has not updated these inputs since 2014. However, the AER has signalled in the Draft Decisions that it intends to update those two inputs, for the purposes of determining material OEFs for the Final Decisions. The AER has not explained exactly how it intends to update those inputs. Therefore, in our analysis we have made an informed assessment about how the AER may implement those updates;
- Used the opex roll-forward models for Energex and Ergon Energy published as part of the Draft Decisions;
- Used Energex's and Ergon Energy's actual data on key output variables for 2018-19. These data were supplied to us by the two DNSPs.[98]
- Used Energex's proposed base year opex, which reflects Energex's actual opex for 2018-19: $358.89 million ($2019-20). These data were supplied to us by Energex.
- Used Ergon Energy's proposed base year opex, which reflects Ergon Energy's actual opex for 2018-19, normalised for unusually high storm costs: $366.04 million ($2019-20). These data were supplied to us by Ergon Energy.

The resulting estimates of target (i.e., efficient) base year opex are presented below in **Figure 10**.

[97] Ergon Energy Draft Decision, October 2019 Attachment 6, p. 74, footnote 211.

[98] These variables are: customer numbers, circuit length, maximum demand, ratcheted maximum demand, underground circuit length and share of underground assets.

Figure 10: Comparison of estimated target and proposed base year opex ($FY2020) for Energex and Ergon Energy using the AER's benchmarking methodology



Source: Frontier Economics

This Figure shows that:

- Energex's proposed base year opex is *below* the estimated target base year opex, averaged across models, for the short benchmarking period and the long benchmarking period; and
- Ergon Energy's proposed base year opex is *in line with* the estimated target base year opex, averaged across models, for the short benchmarking period and the long benchmarking period.

This suggests that—consistent with the Draft Decisions—there is no evidence using the AER's benchmarking methodology and the latest data available that the base year opex proposed by Energex or Ergon Energy is materially inefficient.

4.2 Accounting for estimation uncertainty around target base year opex

We explained in section 2.1.4 that the AER's assessment of DNSPs' proposed base year opex should account for the statistical uncertainty involved in estimating target base year opex. Thus far, the AER's benchmarking analysis has either largely assumed this uncertainty away, or accounted for it in a very imprecise and qualitative way—for instance by investigating if there is evidence that a DNSP's revealed opex is "materially inefficient."

In this report, we have sought to quantify the statistical uncertainty around estimates of target base year opex generated using the AER's preferred econometric benchmarking models, by deriving confidence intervals around the estimates from individual models, as well average estimates across models.

The residuals from the econometric models measure the differences between actual opex and the fitted value produced by the model linking opex to the factors that influence opex. They are a combination of misspecification issues, such as those discussed in section 2.1.4, and statistical noise due to random factors. Due to these factors, estimates of the coefficients of the model, and other estimates derived from the estimated model, are subject to statistical uncertainty. The degree of this uncertainty is commonly represented by the standard error of the estimate or a confidence interval around the estimated value.

The standard errors for the coefficients are produced by the econometric package used to estimate the model, and confidence intervals for the estimated coefficients can be constructed using these standard errors. However, there are no ready formulas for the calculation of standard errors and confidence intervals for the estimates of base year target opex because the process undertaken by the AER/EI to derive these estimates from the estimated parameters of the econometric models involves a number of complex combinations of these parameters. No mathematical formulas exist for calculating the standard errors and confidence intervals for these combinations of the estimated parameters. We suspect that this is one of the reasons why, to date, neither the AER nor expert advisers on benchmarking (including EI and others) have attempted to quantify the estimation uncertainty surrounding estimates of base year target opex.

There is, however, a widely-used statistical technique called bootstrapping, that can be employed in this situation to derive confidence intervals for the estimates of base year target opex calculated from the econometric models used by the AER. Bootstrapping is a general approach to deriving the statistical properties of an estimator by repeatedly resampling from the data at hand.[99] Bootstrapping has been considered by the ACCC/AER in the context of efficiency analysis for DNSPs using data envelopment (DEA). In a personal communication to the ACCC, Professor Coelli wrote:[100]

> *I would suggest that the construction of bootstrap confidence intervals for DEA efficiency scores could provide some useful information regarding the degree to which these DEA results obtained from small samples can be relied upon.*

Whilst Professor Coelli refers in the quote above to the usefulness of confidence intervals to assess the reliability of DEA benchmarking results, exactly the same could be said for benchmarking results obtained using econometric models. Both DEA and econometric techniques involve estimating efficiency with some degree of uncertainty. Confidence intervals are a standard way of quantifying uncertainty. Bootstrapping is a recognised method for constructing confidence intervals.

In the case of a regression model for opex, at each iteration of the bootstrap, a random sample is taken from the residuals of the estimated regression model (with replacement), and these randomised residuals are then added to the fitted values corresponding the observed opex values to produce a new,

[99] For an introduction to bootstrapping see: Orloff, J. and J. Bloom, *Bootstrap confidence intervals*, MIT coursework readings, class 24, 18.05, Spring 2014.
[100] ACCC (May 2012), *Benchmarking Opex and Capex in Energy Networks*, ACCC/AER Working Paper Series, Working Paper No. 6., p. 113. For a discussion of bootstrapping in the context of regulating Norwegian DNSPs see Edvardsen, D. et al (2006), "Productivity and regulatory reform of Norwegian electricity distribution utilities", in Coelli, T. & D. Lawrence (eds) (2006), *Performance Measurement and Regulation of Network Utilities*.

artificial set of observed opex values.[101] The model is then re-estimated using this new 'bootstrapped' set of opex values. All the additional calculations (including the roll-forward of opex to the base year) can then be carried out to produce a new 'bootstrapped' estimate of base year target opex. This process is repeated many times, resulting in a distribution of values for base year target opex. Standard errors and confidence intervals for the estimate of base year target opex can be determined from this distribution.

We have used the bootstrapping technique to produce confidence intervals for base year target opex for Energex and Ergon Energy for all the econometric models considered by the AER, as well as for the averages across models. The confidence intervals related to the target base year opex estimates presented in **Figure 11** are presented in **Figure 12** below. These confidence intervals are based on 1,000 bootstrap iterations.[102]

The Figure shows the base year target opex estimates derived from each of the econometric models under discussion, as well as the 90% confidence intervals for base year target opex obtained from the eight models under discussion.[103] The Figure also shows the averages across models.[104] The horizontal lines show the level of opex proposed by Energex and Ergon Energy respectively. The Figure presents results for target opex after applying the updated AER OEFs, and excluding the results of the SFA TL model long sample estimates from the averages.

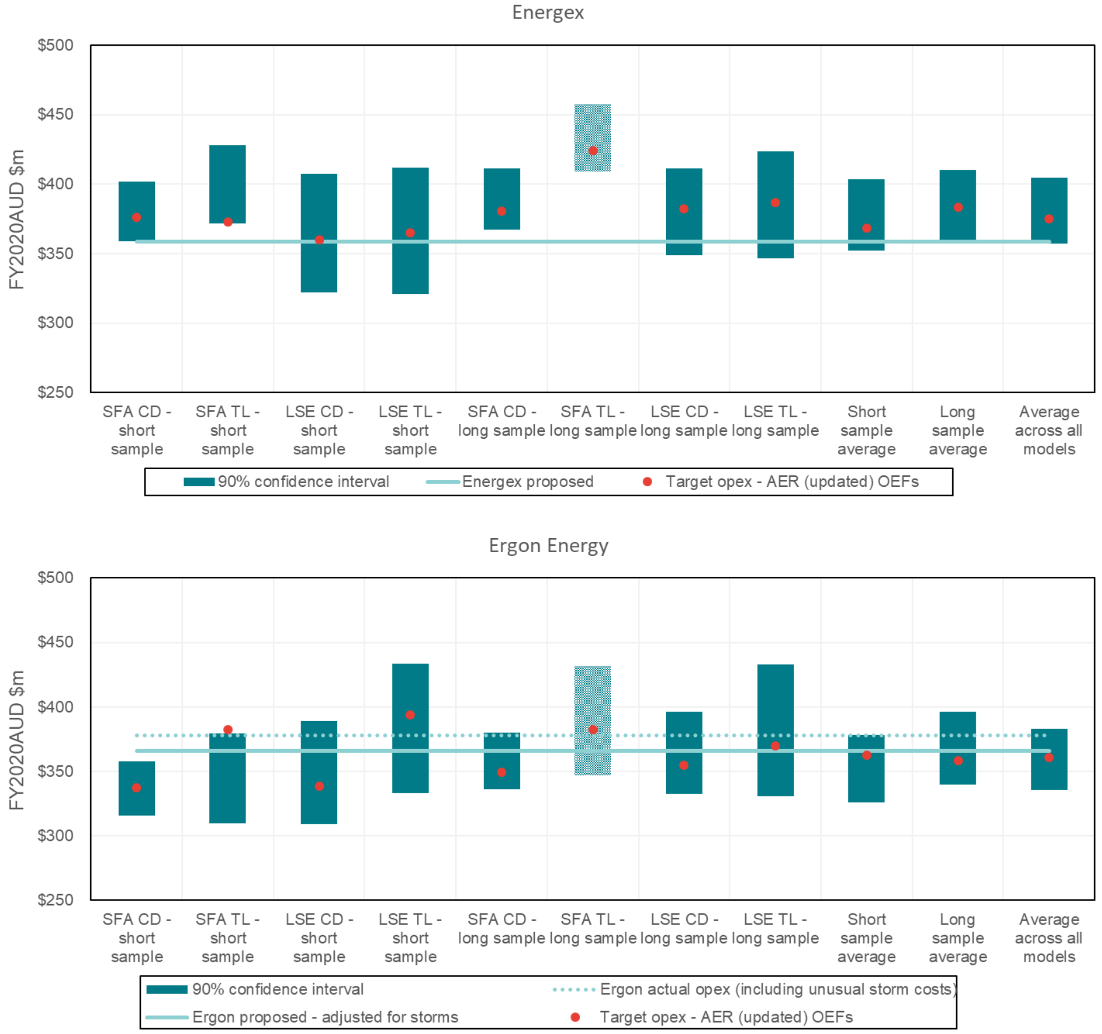
[101] The bootstrapping approach assumes that the residuals can be treated as independent, identically distributed random variables. For a well-specified regression model without autocorrelation and heteroscedasticity, this assumption holds in large samples. Intuitively, the rationale behind bootstrapping is that, if the residual terms are random draws for the same distribution, then any residual could, with equal probability, be associated with any of the observations.

[102] Since the residuals across different models for the same observation are likely to be correlated, these residuals were sampled as an ensemble, treating like a draw from the multivariate empirical distribution of residuals. Further, in order to maintain the relationship between the residuals for models estimated using the long sample and residuals for models using the short sample for the years 2012-2018, we stratified the residuals into a pre-2012 stratum, and a 2012-2018 stratum. The bootstrap samples were drawn separately within each stratum.

[103] In statistics there are two commonly used standards for constructing confidence intervals: the 95% confidence interval and the 90% confidence interval. The 90% confidence interval is narrower, and is hence considered to be more conservative, than the 95% confidence interval.

[104] All the averages across models were obtained using equal weighting.

Figure 11: Confidence intervals for target opex using the AER's benchmarking methodology and updated AER OEFs, excluding SFA TL Long



Source: Frontier Economics analysis

Notes: In this chart the averages across models are taken across all 4 models for the short sample average, but for the long sample average and the overall average the SFA TL model has been excluded. This is consistent with the approach used by the AER in the Draft Decisions.

In **Figure 11**, the opex proposed by Energex falls in the lower half of the confidence interval, and in some cases it falls below the lower limit of the confidence interval. In our view, this suggests that there is no evidence that the proposed level of opex is materially inefficient—taking account of the statistical uncertainty involved in estimating target base year opex.

In the case of Ergon Energy, the proposed base year opex also falls well within the confidence intervals, except for the SFA CD short sample model, where the proposed opex is slightly above the upper limit of the confidence interval. Note, however, that the proposed opex is well within the confidence intervals for the averages of target opex across models. The AER's recent practice has been to consider the averages of target opex across models rather than to focus exclusively on estimates from the SFA CD model. Moreover, the confidence intervals shown in **Figure 11** are fairly conservative. The mostly commonly used confidence level for confidence intervals is the 95% level. The 95% confidence intervals would be approximately 20% wider than the intervals shown on the charts. Hence, for Ergon Energy as well, the evidence does not provide convincing support for concluding the proposed level of opex is materially inefficient.

Finally, we also note that Ergon Energy's actual opex (which includes unusual storm costs removed in order to arrive at Ergon Energy's proposed opex) sits at the upper limit of the confidence interval for the short sample average and lies within the confidence interval for the long sample average.

4.3 Assessment using an improved benchmarking methodology

In sections 2 and 3 of this report we have recommended a number of improvements to the AER's benchmarking methodology, for the purposes of making Final Decisions for Energex and Ergon Energy. Briefly, our key recommendations are the following:

1. The AER should give most weight to results from the short benchmarking period (section 2.2.2). If the AER gives any weight to the long benchmarking period, it should include the results of the SFA TL model (section 2.2.1);
2. If the AER continues to use data on overseas DNSPs, it should modify its models to allow Ontarian DNSPs to have a different relationship between opex and opex drivers than the Australian and New Zealand DNSPs (section 2.1.2);
3. The AER should modify its models to allow rural DNSPs to have a different relationship between opex and opex drivers than urban DNSPs (section 2.1.3);
4. The AER should exclude any OEF adjustments for bushfire obligations as it has no reliable information with which to quantify any such adjustment (section 3.1);
5. The AER should apply an OEF adjustment of +1.1% for network accessibility to Ergon Energy as it did in its 2015 Final Decision (section 3.2);
6. The AER should apply an OEF adjustment of at least +1.2% for OH&S regulations to Ergon Energy as it did in its 2015 Final Decision. This adjustment should also be applied to Energex (section 3.3);
7. The AER should apply the immaterial OEFs it applied to Ergon Energy and Energex in the 2015 Final Decisions (section 3.4).

Table 6 compares the base year opex proposed by Energex and Ergon Energy, respectively, to estimates of base year target opex, averaged across models for the short and long samples:

- Derived using the benchmarking approach used by the AER in the Draft Decision and applying the updated AER OEFs;
- Applying individually each of the methodological improvements (scenarios 1 to 7) enumerated above;
- Applying all of the FE OEF adjustments described above (scenario 8); and
- Applying all of the FE OEF adjustments described above and including the SFA TL estimates for the long sample (scenario 9).

Table 6: Estimated target opex (with methodological improvements implemented) and proposed base year opex – Energex and Ergon Energy ($2019-20 million)

Scenario	ENERGEX Short sample average	ENERGEX Long sample average	ERGON ENERGY Short sample average	ERGON ENERGY Long sample average
AER approach (AER updated OEFs)	$368.5	$383.2	$362.9	$358.2
1. Include SFA TL for long sample	$368.5	$393.4	$362.9	$364.2
2. Allow for differences between Ontarian and non-Ontarian DNSPs	$359.2	$386.5	$350.6	$367.1
3. Allow for differences between urban and rural DNSPs	$420.4	$389.7	$452.0	$408.5
4. Exclude bushfire obligations OEFs	$368.5	$383.2	$382.5	$369.6
5. Include network accessibility OEFs	$368.5	$383.2	$366.7	$361.7
6. Include OH&S obligations OEFs	$372.7	$387.6	$367.0	$362.1
7. Include immaterial OEFs	$385.9	$401.3	$383.6	$377.9
8. All FE OEF adjustments	$390.1	$405.6	$411.0	$396.7
9. All FE OEF adjustments and include SFA TL for long sample	$390.1	$416.4	$411.0	$403.4
Proposed base year opex	$358.9	$358.9	$366.0	$366.0
Actual opex (including unusual storms)	-	-	$378.2	$378.2

Source: Frontier Economics.

Notes: For scenario 1 above, the estimates of base year target opex are averaged over four models (SFA CD, SFA TL, LSE CD and LSE TL) for each of the short and long samples. For scenarios 2 to 7 above, the estimate of base year target opex derived using the SFA TL model is excluded from the average of models for the long sample.

The Table shows that across all of the scenarios modelled:[105]

- Energex's proposed base year opex is less than the estimated target base year opex; and
- Ergon Energy's proposed base year opex is in line with, or less than, the estimated target base year opex.

On this basis, we conclude that there is no evidence that either Energex's or Ergon Energy's proposed base year opex is materially inefficient.

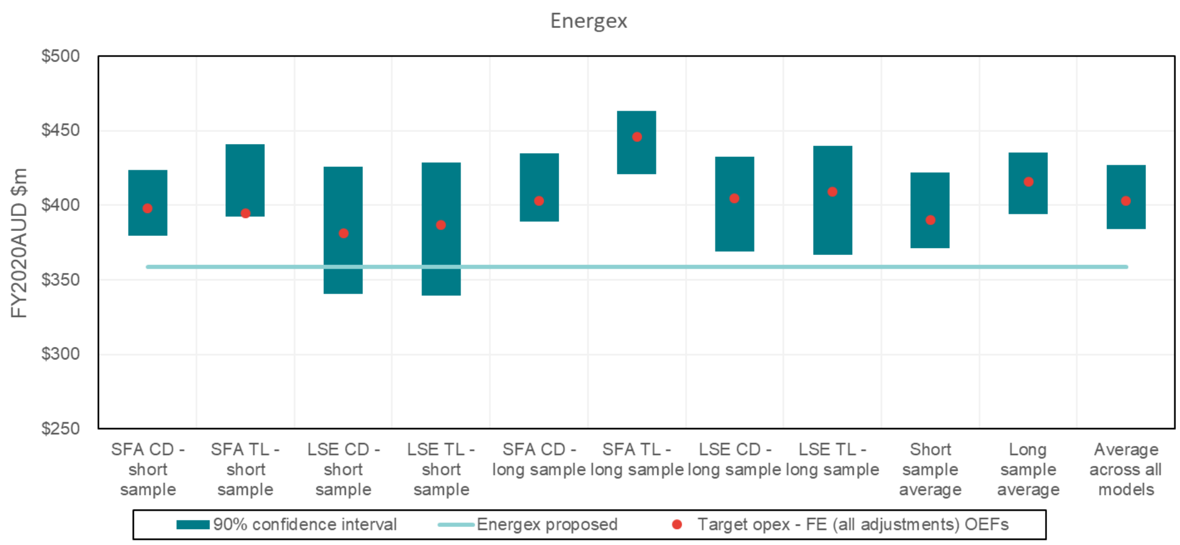
This conclusion is supported further by **Figure 12**, which presents 90% confidence intervals around the estimates of target base year opex—for all individual models and averaging across all models—assuming all of our recommended OEF adjustments are implemented (i.e., scenario 9). These

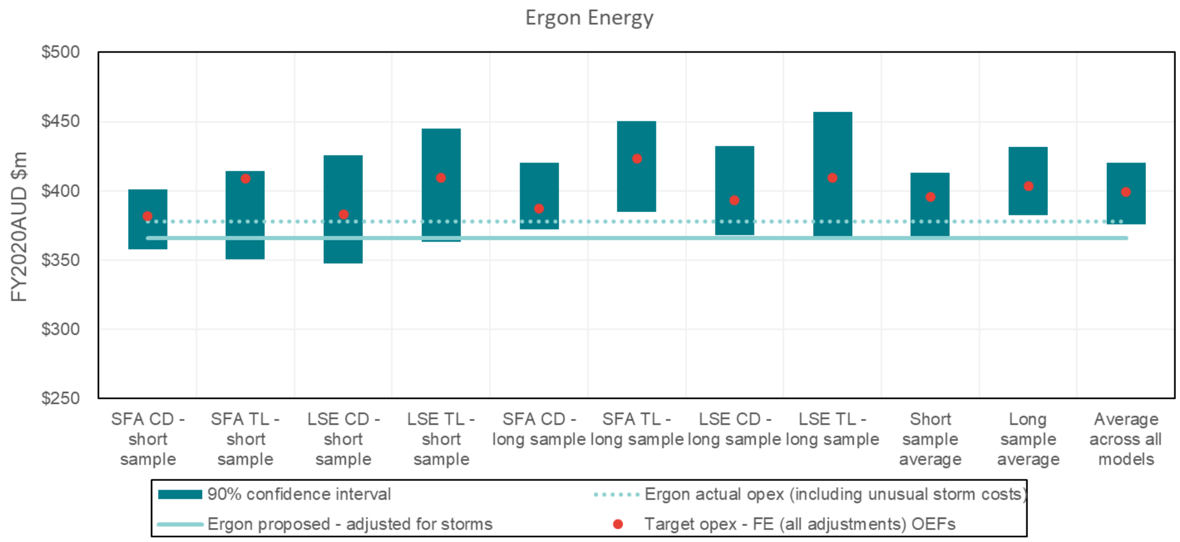
[105] The estimated target opex for the individual models, for all scenarios in Table 7, are provided in Appendix B.

confidence intervals were constructed using the same bootstrapping approach described above in section 4.2.

The Figure shows that Energex's proposed base year opex sits below the confidence intervals relating to the average target opex across models (both for the short and long samples). Ergon Energy's base year opex (whether adjusted for unusual storm costs or not) sits either in the lower half, or below, the confidence intervals that relate to the average estimates across models (both for the short and long samples). That is, even once statistical uncertainty around the estimates of target base year opex is accounted for, there is no evidence that either Energex's or Ergon Energy's proposed base year opex is materially inefficient.

Figure 12 Confidence intervals for target opex with all proposed OEF adjustments included and averages taken across all models





Source: Frontier Economics analysis

Notes: In this chart the averages across models are taken across all 4 models for the short sample and the long sample average, and across all 8 models for the overall average.

Note that it was not possible to derive meaningful estimates of target base year opex when specifying the cost functions to simultaneously allow for differences between Ontarian and non-Ontarian DNSPs (scenario 2) *and* differences between rural and urban DNSPs (scenario 3). This is likely due to the fact that a large proportion of the Ontarian DNSPs are rural networks. Hence, seeking to allow for both rurality and the fact that a DNSP is in Ontario in the cost function introduces a multicollinearity problem that affects the estimated model coefficients. This, in turn, affects the rolled-forward target opex. However, each of these improvements, individually, can be implemented reliably. As **Table 6** shows, specifying cost functions that allow for differences between Ontarian and non-Ontarian DNSPs produces base year target opex estimates that are economically meaningfully different to the estimates derived using the AER's approach. Likewise, specifying cost functions that allow for differences between rural and urban DNSPs produces base year target opex estimates that are economically meaningfully different to the estimates derived using the AER's approach. This indicates that the AER's standard models fail to capture some aspect of the relationship between costs and cost-drivers for the DNSPs in the sample. This is another reason why the AER should be more cautious than it has been to date in its use of its benchmarking results to set opex allowances for individual DNSPs.

4.4 Conclusion

In this section we have assessed the efficiency of the base year opex amounts proposed by Energex and Ergon Energy. We have done so:

- Using the 2019 Annual Benchmarking Report dataset;
- Using the benchmarking approach adopted by the AER in the Draft Decisions, having updated the AER's OEF estimates;
- Having implemented several methodological improvements to the benchmarking approach used by the AER in the Draft Decisions; and
- Taking account of statistical uncertainty around estimates of target base year opex, by constructing confidence intervals around point estimates of target base year opex.

We conclude that there is no evidence that either Energex's or Ergon Energy's proposed base year opex is materially inefficient.

A AMBIGUITY OVER SOME DATA RELIED ON BY THE AER TO QUANTIFY THE BUSHFIRE OBLIGATION OEFS

As part of its Draft Decisions, the AER published an Excel file that presented its calculations of the vegetation management OEF adjustments applied to Energex and Ergon Energy.[106] We were unable to locate (using the information contained in that file) the underlying data used by the AER in that file to calculate the bushfire obligation OEF adjustments applied to Ergon Energy. Therefore, the AER subsequently provided (on 31 October 2019) an amended version of the file that contained clear references to the underlying data.[107]

Using the information provided in those files, we were able to verify nearly all of the data used by the AER in its bushfire obligations OEF calculations, with two exceptions.

Firstly, we were unable to verify the bushfire obligations opex attributed to Powercor. The AER explains in its Draft Decisions that the quantification of bushfire obligation OEFs was based on forecast costs of step changes and opex pass throughs for the Victorian distribution businesses that "we approved for the 2011–15 period."[108] However, it appears that figures used by the AER to quantify Powercor's bushfire obligations-related costs related to the pass-through costs arising from the Victorian Bushfire Royal Commission (VBRC) that Powercor had *proposed* to the AER, rather than the costs the AER actually approved.

As **Table 7** shows, the VBRC costs actually approved by the AER were lower than the amounts proposed by Powercor. The Table also shows that the Powercor bushfire obligations costs used by the AER in its OEF calculations match very closely the VBRC costs proposed by Powercor. The apparent error of using Powercor's proposed costs, rather than the costs actually allowed by the AER, has the effect of overstating somewhat the bushfire obligations OEF applied to Ergon Energy.

Table 7: VBRC costs proposed by Powercor and approved by the AER compared to VBRC costs used by the AER in its OEF calculations for the Ergon Energy Draft Decision ('000s, $2010 Dec)

	2011	2012	2013	2014	2015	TOTAL
Powercor proposed opex	$ -	$4,978	$3,933	$3,297	$2,660	$14,868
AER approved opex	$ -	$4,083	$3,484	$2,963	$2,442	$12,971
AER OEF model	$ -	$4,982	$3,931	$3,296	$2,662	$14,872

Source: AER, Powercor cost pass through application of 13 December 2011 for Costs arising from the Victorian Bushfire Royal Commission – Final Decision, 7 March 2012, p. 94.

[106] For example: AER - Ergon Energy 2020-25 - Draft decision - OEF - Veg management update - October 2019.xls.

[107] AER - EQ 2020-25 - Draft decision - OEF - Veg management update (Source files for bushfire step changes).xls.

[108] Ergon Energy Draft Decision, October 2019, Attachment 6, p. 81.

Note: The VBRC costs in the AER's 2012 Final Decision for Powercor were expressed in $2012, whereas the costs used in the AER's OEF calculations were expressed in $2010. In order to aid comparability, we deflated the costs in the AER's 2012 Final Decision for Powercor to $2010.

Secondly, we were unable to verify a component of the bushfire obligation costs attributed to United Energy—namely step change costs related to line clearance. Specifically, the AER's OEF calculations assume that the approved cumulative step change costs over the period 2011 to 2015 related to line clearance activity by United Energy was $31.114 million ($2010). However, the regulatory decision that the AER cited as the source for these approved costs indicates that the approved amount over this period was somewhat lower, $29.914 million ($2010). This apparent error also has the effect of overstating slightly the bushfire obligations OEF applied to Ergon Energy.

If the two cases identified above are genuine errors, then correcting both mistakes would result in the bushfire obligations OEF applied to Ergon Energy being revised from:

- -3.36% for the 2006 to 2017 benchmarking period to -3.29%; and
- -5.75% for the 2012 to 2017 benchmarking period to -5.63%.

B AER'S REASONS FOR ALLOWING IMMATERIAL OEFS IN 2015 DECISIONS

Table 8: Immaterial OEFs applied by the AER to Ergon and Energex

OEF	REASONS GIVEN BY THE AER FOR APPLYING OEF ADJUSTMENT
Asset lives (pp. 240-243)	As assets age, they, in general, will become more likely to fail. Therefore a service provider with older assets would be more likely to incur emergency response costs for asset failure. …it is likely that Energex has a cost advantage relative to the comparison firms due to asset age while it is unclear for Ergon Energy. Although it will not lead to material differences in opex, asset age is likely to lead to some difference in opex between the comparison firms and the Queensland service providers. An OEF adjustment for asset age would also meet the exogeneity and duplication OEF adjustment criteria. The date a network was established is beyond service providers' control and there are no variables in Economic Insights' SFA model that account for it.
Building regulations (pp. 222-223)	We are not satisfied that an OEF adjustment for differences in building regulations is necessary because there will not be material differences in opex between service providers in different jurisdictions due to consistent building regulations. However as there may be some slight differences in the application and enforcement of the regulations across jurisdictions. Building regulations are not determined by service providers and there are no variables in Economic Insights' SFA model that account for differences in them.
Cultural heritage (pp. 224-225)	In response to questions from the AER on the OEFs that materially affect its costs, Ergon Energy submitted that cultural heritage obligations impose additional management and operational costs on it. Specifically Ergon Energy identified staff training and awareness, special alert and management processes and additional operational precautions for native title cultural heritage. Ergon Energy provided a map showing areas where native title has been found to exist and where claims have been made. Ergon Energy did not quantify the costs it incurs for its native title or other cultural heritage programs. … there is likely to be some differences in obligations that will lead to immaterial differences in opex. An adjustment for differences in cultural heritage obligations would also satisfy the exogeneity and duplication OEF adjustment criteria. Cultural heritage obligations are not determined by service providers and there are no variables in Economic Insights' SFA model that account for differences in them. As the direction of cost advantage is unclear, we have included an adjustment of positive 0.5 per cent for differences in cultural heritage obligations in our adjustment for immaterial factors.

OEF	REASONS GIVEN BY THE AER FOR APPLYING OEF ADJUSTMENT
Corrosive environments (pp. 209-210)	While salts affect assets in coastal areas, dusts affect assets in inland areas. While all service providers will be affected to some extent, the differences in the corrosive elements in each area will lead to differences in design and operational considerations that may affect opex. Although an OEF adjustment for differences in exposure to corrosive elements is not likely to lead to material differences in opex, the differences they do cause would meet the exogeneity and duplication OEF criteria. The prevalence of corrosive compounds in a network area is beyond service providers' control and Economic Insights' SFA model does not have a variable to account for it. We have provided a positive 0.5 per cent adjustment because it is unclear if differences in exposure to corrosive elements will lead to a cost advantage or disadvantage for the Queensland service providers relative to the comparison firms.
Environmental regulations (pp. 228-229)	Ergon Energy and Energex submitted that differences in environmental regulations would lead to material differences in opex. The way various jurisdictions administer environmental regulation varies considerably. We consider it is likely that differences in environmental regulations faced by service providers will lead to differences in costs, but we do not have any evidence to suggest that these differences are material. An OEF adjustment for environmental obligations would satisfy the exogeneity and duplication OEF criteria. Environmental obligations are not determined by service providers and Economic Insights' SFA model does not include any variables that account for differences in them.
Environmental variability (pp. 210-211)	In its regulatory proposal Ergon Energy raised intra-network environmental variability as an issue that would lead to material differences in opex between it and the comparison firms. Ergon Energy submitted metrics on the variability of temperature, rainfall, and humidity to support this claim. These metrics showed that Ergon has the highest level of intra-network variability in humidity, rainfall, and temperature. Ergon considers this variability of environment within its network presents Ergon Energy with a significant challenge in the development of optimal maintenance schedules and resource allocation. As the majority of comparison firms are rural service providers, the customer weighted average comparison firm is likely to operate in a service area with a more variable climate than Energex. However, as the comparison firms include CitiPower and United Energy, Energex is likely to have a cost disadvantage. An OEF adjustment for environmental variability is also likely to satisfy the exogeneity and materiality OEF adjustment criteria. Differences in environment within a network's service are beyond service providers' control and Economic Insights' SFA model does not capture differences in environmental variability.
Grounding conditions (p. 212)	Electricity distribution requires the use of earthing or grounding connection to aid in the protection and monitoring of the network. In rural areas, service providers use the earth as the return path for some forms of electricity distribution. These systems require service providers to create an electrical earth, usually from embedding conductors or rods in the ground. The effectiveness of these earths varies depending on the soil type and the amount of moisture in the soil. The installation and maintenance of earth grids are a very small part of service provider's costs. Further, all service providers will have areas of their networks that provide challenging grounding conditions. Although there may be differences in grounding costs between networks, there is not sufficient evidence to conclude that these differences are material. An adjustment for grounding conditions would satisfy the exogeneity and duplication OEF criteria. Soil conditions are beyond service providers' control and Economic Insights' SFA model does not have a variable that accounts for them.

OEF	REASONS GIVEN BY THE AER FOR APPLYING OEF ADJUSTMENT
Mining boom cost imposts (pp. 233-234)	Ergon Energy stated that it considers that the mining boom has increased its labour costs and accommodation costs in remote areas near mines. Ergon Energy did not quantify the effect of the mining boom on its labour or accommodation costs. We have considered differences in work conditions in the endogenous factors section above. … Ergon Energy is likely to have some cost disadvantage due to the impact of the mining boom on remote communities. An adjustment for the effects of the mining boom would satisfy the exogeneity and duplication OEF adjustment criteria. The mining boom was caused by global economic forces beyond the control of service providers' control and there is no variable in Economic Insights' SFA model that accounts for differences in the effects of the mining boom.
Planning regulations (pp. 234-235)	Ergon Energy stated that Queensland legislation imposed special requirements when working on mining leases. Ergon Energy provided no quantification of what impact these requirements would have on opex. It is likely that there will be some difference between service providers due to differences in planning regulations, and there is uncertainty of the direction of the cost advantage. Also, an OEF adjustment for difference in planning regulations would meet the exogeneity and duplication OEF adjustment criteria. Planning regulations are not determined by service providers and Economic Insights' SFA model does not include variables to account for differences in planning regulations.
Proportion of 11kV and 22kV lines (pp. 250-252)	Each of the Queensland service providers operates a high-voltage distribution network that is predominantly 11kV although 22kV forms a significant proportion of Ergon's network. The comparison firms operate both 11kV and 22kV high voltage distribution networks. The Victorian service providers have mostly changed their high-voltage networks to a 22kV model with the notable exception of CitiPower. CitiPower maintains a predominantly 11kV high-voltage distribution network. Simplistically, a doubling of the voltage will provide a doubling of the capacity of the line. In the case of high-voltage lines, a 22kV line will potentially have twice the capacity of an 11kV line. The 22kV line can also cover a greater distance than an 11kV line serving the same electrical load. In practice, this will result in an 11kV network design that has more 11kV feeders to service the same customer loads and a larger number of lower capacity zone substations to service these feeders. On the other hand, a 22kV network design will have fewer feeders and a smaller number of higher capacity zone substations. The Queensland service providers operate 11kV high voltage distribution networks. The comparison firms mostly operate 22kV high voltage distribution networks. In theory operating a 22kV network would provide a small reduction in opex costs. Although it does not satisfy the materiality criterion, an adjustment for the proportions of 22kV and 11kV lines would satisfy the exogeneity and duplication criteria. The technology that was available at the time a network was established is beyond service providers' control. Economic Insights' SFA model does not include any variables that account for the proportion of 11kV and 22kV lines.

OEF	REASONS GIVEN BY THE AER FOR APPLYING OEF ADJUSTMENT
Rainfall and humidity (pp. 213-215)	In response to questions from the AER about the effect of rainfall and humidity on poles, cross arms, transformers and assets using SF6 as an insulator, Ergon Energy submitted that high rainfall and humidity increases the degradation of timber assets. It also submitted that asset failures in high rainfall areas make up 40 per cent of asset failures although they only make up five per cent of the area of Queensland. Ergon Energy also stated that it has a special inspection program for pole top structures in areas that have rainfall of above 1500mm per annum. This leads to inspection costs being higher for poles in its higher rainfall areas. When we asked Ergon Energy about the impact rainfall and humidity on poles, cross arms, transformers and assets using SF6 as an insulator, Ergon Energy only provided evidence to suggest that costs were higher for cross arm maintenance. Ergon Energy provided a comparison of the number of asset failures in high rainfall areas and low rainfall areas. However Ergon Energy did not indicate what percentage of its assets were in high rainfall areas. The only evidence that higher rainfall and humidity lead to increased opex that Ergon Energy provided relates to cross arm maintenance. Ergon Energy stated that it carries out more expensive cross arm inspections in high rainfall areas. However, Ergon Energy provided no evidence to indicate that the benefit of these inspections outweighs the additional costs relative to the aerial inspections used by other service providers to inspect cross arm health. Further only small parts of Energex and Ergon Energy's service areas are subject to average rainfalls in excess of 1500mm a year. On balance, we are not satisfied that differences in rainfall and humidity are likely to lead to material increases in opex between the Queensland service providers and the comparison firms. However, we consider that the increased susceptibility of timber to fungal rot in Queensland may indicate that the Queensland service providers have a marginal cost disadvantage relative to the comparison firms. An adjustment for humidity and rainfall would satisfy the exogeneity and duplication criteria. The weather and climate are beyond the control of service providers and there is no variable in Economic Insights' SFA model that accounts for differences in humidity between the NEM service providers.
Skills required by different service providers (p. 216)	As service providers operate in different environments, they may require different skills. For example, rural networks may hire pilots to carry out asset inspections and transport staff and equipment. We have included this factor as part of the allowance for immaterial OEFs. This is because although differences in the skills required by service providers are unlikely to lead to material differences in opex, it is logical that there will be some differences. An adjustment for differences in skills required would satisfy the exogeneity OEF adjustment criterion. Different environmental conditions may require specialised expertise not required by other NEM service providers. Also differences in the skills required are not accounted for in Economic Insights' SFA model.
Solar uptake (pp. 255-256)	We would expect…that Energex and Ergon Energy's PV connection administration costs would be higher, than those of the Victorian comparison firms due to the higher PV uptake in Queensland. However, there is not sufficient evidence to conclude that the high rate of PV installations in Queensland will lead to a material difference in opex due to higher PV connection administration costs. An adjustment for differences in PV penetration would meet the exogeneity and materiality OEF adjustment criteria. The decision to install PV is a customer's choice and there are no variables to account for differences in PV penetration rates in Economic Insights' SFA model.

OEF	REASONS GIVEN BY THE AER FOR APPLYING OEF ADJUSTMENT
Traffic management (pp. 237-238)	Traffic management is the direction of motorist and pedestrian movements around worksites using temporary traffic signage and traffic controllers. Traffic management costs generally correlate with the volume of traffic near the worksite. We consider that traffic management will have a greater overall impact on expenditure in higher density areas than in lower density areas. We have included jurisdictional differences in traffic management in our adjustment for immaterial factors. Although the density related differences in traffic management are captured in Economic Insights' SFA model, the jurisdictional differences in requirements are not. That is differences in cost due to traffic volumes are related to customer density, while differences stemming from differences in council requirements are not. These jurisdictional differences are likely to lead to some difference in cost and are not determined by service providers. As a result an OEF adjustment for traffic management would satisfy the exogeneity OEF adjustment criterion. Also, because Economic Insight's SFA model does not account for differences in traffic management regulations it would satisfy the duplication OEF adjustment criterion.
Topography (pp. 221-222)	Adverse topographical conditions may affect some NEM service providers. For example, the Great Dividing Range runs through some distribution network areas. Operating in mountainous regions may lead to higher costs in some operating areas such as maintenance, emergency response, and vegetation management due to access issues, even if this is not likely to be a material cost. We note that AusNet Services, the comparison service provider at the benchmark comparison point, has a more mountainous operating environment than the Queensland service providers. However, most of the comparison service providers operate in a relatively flat area compared to Queensland service providers. Therefore, the Queensland service providers may have a cost disadvantage relative to the comparison service providers due to topography. An adjustment for topography would satisfy the exogeneity and duplication OEF criteria. The landforms in service providers' network areas are beyond their control and there is no variable in Economic Insights' SFA model to account for differences in topography.

Source: AER Draft Decision 2015-20, April 2015, Table A.9, Attachment 7

C TARGET OPEX FOR INDIVIDUAL MODELS AND SCENARIOS

The following tables provide the target opex resulting from the eight models, including the short sample and long sample averages, for different methodological improvement scenarios as summarised in **Table 6**.

Table 9: Energex target opex

Scenario	SHORT SAMPLE				LONG SAMPLE					
	SFA CD	SFA TL	LSE CD	LSE TL	SFA CD	SFA TL	LSE CD	LSE TL	Short sample average	Long sample average
AER approach (AER updated OEFs)	$376.2	$372.6	$360.2	$365.2	$380.7	$423.9	$382.4	$386.7	$368.5	$383.2
1. Include SFA TL for long sample	$376.2	$372.6	$360.2	$365.2	$380.7	$423.9	$382.4	$386.7	$368.5	$393.4
2. Allow for differences between Ontarian and non-Ontarian DNSPs	$379.7	$338.5	$340.9	$377.5	$369.2	$408.9	$391.6	$398.6	$359.2	$386.5
3. Allow for differences between urban and rural DNSPs	$431.3	$524.6	$367.2	$358.7	$421.5	$446.4	$363.8	$383.7	$420.4	$389.7
4. Exclude bushfire obligations OEFs	$376.2	$372.6	$360.2	$365.2	$380.7	$423.9	$382.4	$386.7	$368.5	$383.2
5. Include network accessibility OEFs	$376.2	$372.6	$360.2	$365.2	$380.7	$423.9	$382.4	$386.7	$368.5	$383.2
6. Include OH&S obligations OEFs	$380.4	$376.8	$364.3	$369.3	$385.0	$428.7	$386.7	$391.1	$372.7	$387.6
7. Include immaterial OEFs	$393.9	$390.2	$377.2	$382.4	$398.6	$443.9	$400.4	$404.9	$385.9	$401.3
8. All FE OEF adjustments	$398.2	$394.4	$381.2	$386.5	$402.9	$448.7	$404.7	$409.3	$390.1	$405.6
9. All FE OEF adjustments and include SFA TL for long sample	$398.2	$394.4	$381.2	$386.5	$402.9	$448.7	$404.7	$409.3	$390.1	$416.4

Source: Frontier Economics

Notes: For scenario 1 above, the estimates of base year target opex are averaged over four models (SFA CD, SFA TL, LSE CD and LSE TL) for each of the short and long samples. For scenarios 2 to 7 above, the estimate of base year target opex derived using the SFA TL model is excluded from the average of models for the long sample.

Table 10: Ergon Energy target opex

	SHORT SAMPLE				LONG SAMPLE					
Scenario	**SFA CD**	**SFA TL**	**LSE CD**	**LSE TL**	**SFA CD**	**SFA TL**	**LSE CD**	**LSE TL**	**Short sample average**	**Long sample average**
AER approach (AER updated OEFs)	$337.2	$382.6	$338.4	$393.6	$349.5	$382.4	$355.1	$370.0	$362.9	$358.2
1. Include SFA TL for long sample	$337.2	$382.6	$338.4	$393.6	$349.5	$382.4	$355.1	$370.0	$362.9	$364.2
2. Allow for differences between Ontarian and non-Ontarian DNSPs	$356.9	$313.8	$361.7	$369.9	$382.1	$388.9	$373.0	$346.3	$350.6	$367.1
3. Allow for differences between urban and rural DNSPs	$422.2	$486.8	$443.0	$456.2	$382.3	$436.1	$426.7	$416.4	$452.0	$408.5
4. Exclude bushfire obligations OEFs	$355.3	$403.2	$356.6	$414.8	$360.7	$394.6	$366.4	$381.8	$382.5	$369.6
5. Include network accessibility OEFs	$340.6	$386.5	$341.9	$397.6	$353.0	$386.1	$358.6	$373.6	$366.7	$361.7
6. Include OH&S obligations OEFs	$341.0	$386.9	$342.2	$398.0	$353.3	$386.5	$358.9	$374.0	$367.0	$362.1
7. Include immaterial OEFs	$356.4	$404.4	$357.7	$416.1	$368.7	$403.4	$374.6	$390.3	$383.6	$377.9
8. All FE OEF adjustments	$381.8	$433.3	$383.2	$445.7	$387.1	$423.5	$393.2	$409.7	$411.0	$396.7
9. All FE OEF adjustments and include SFA TL for long sample	$381.8	$433.3	$383.2	$445.7	$387.1	$423.5	$393.2	$409.7	$411.0	$403.4

Source: Frontier Economics

Notes: For scenario 1 above, the estimates of base year target opex are averaged over four models (SFA CD, SFA TL, LSE CD and LSE TL) for each of the short and long samples. For scenarios 2 to 7 above, the estimate of base year target opex derived using the SFA TL model is excluded from the average of models for the long sample.

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