24-28 Campbell St
Sydney NSW 2000
All mail to
GPO Box 4009
Sydney NSW 2001
T +61 2 131 525
ausgrid.com.au

28 February 2025

Networks Benchmarking Team
Australian Energy Regulator
GPO Box 3131
Canberra ACT 2601

Email: [redacted]

Dear Sasha

Thank you for the opportunity to provide feedback on the Australian Energy Regulator's (AER's) review to investigate the potential mis-specification of the opex benchmarking cost function models.

We commend the AER for prioritising development work on improving the reliability of the current econometric benchmarking models. We also commend Quantonomics' work on Phase 1 of the AER's consultation to investigate the concerns that Ausgrid and other DNSPs have expressed that the existing benchmarking models appear to be mis-specified. Quantonomics' findings validate those concerns.

Well-specified models are essential to undertake reliable assessments of efficiency

Ausgrid considers that it is critical for the AER's benchmarking models to be specified appropriately to explain the variation in DNSPs' historical opex because:

- The results from the econometric benchmarking models are used by the AER to set DNSPs' opex allowances for each regulatory control period. If, due to model mis-specification, the AER makes an incorrect assessment of the efficiency of DNSPs' historical opex, it could result in the AER adopting a forecast of opex over the regulatory control period that is either above or below the level required to satisfy the operating expenditure objectives in the National Electricity Rules (NER). Neither of these outcomes would promote the long term interests of consumers, as defined in the national electricity objective (NEO).
- As the AER has previously explained, the benchmarking analysis that the AER presents in its Annual Benchmarking Reports, including the results from its econometric benchmarking models, can create powerful reputational incentives that drive DNSPs to become more efficient over time. However, in order to realise these important benefits, it is necessary for the models to produce reliable assessments of the relative efficiency of individual DNSPs. If, due to model mis-specification, the results from the econometric models fail to recognise genuine efficiency improvements by DNSPs, that would weaken the reputational incentives to continue improving over time. Similarly, if the models suggest that certain DNSPs have remained efficient over time, when in fact they have become less efficient, that would weaken incentives for those

DNSPs to keep striving to remain at, or move closer towards, the efficient frontier for the industry.

As Ausgrid has previously submitted, we have concerns that the models no longer produce reliable assessments of the relative efficiency of DNSPs' historical opex, because (as explained below) they adopt an assumption that means the models are not reliably estimating the efficiency for some DNSPs and, therefore, may no longer be fit for purpose.

Quantonomics has confirmed the existence of a serious mis-specification problem that needs to be addressed

Quantonomics' analysis has demonstrated that the existing benchmarking models suffer from serious mis-specification problems.

The fundamental shortcoming of the current standard models is that they all assume that DNSPs' efficiency remains constant over time.

However, the results of the AER's opex MPFP benchmarking analysis indicates that some DNSPs—notably Ausgrid—have made significant efficiency improvements over time in response to the AER's introduction of regular benchmarking analysis (including for the purposes of supporting revenue determinations) since 2014.

This constant efficiency assumption means that the existing econometric benchmarking models cannot reflect in their estimates that some DNSPs have become materially more efficient since 2014. There is a material risk that the existing models penalise those DNSPs, such as Ausgrid, that have made material efficiency improvements over time. This may in turn result in the opex allowances for such DNSPs being set too low (everything else being equal).

Quantonomics' November 2024 report investigated this issue by relaxing the existing constraint of a common time trend for all DNSPs in Australia, New Zealand and Ontario. Specifically, Quantonomics tested two alternative sets of models with more flexible time trend specifications:

1. Jurisdictional Time Trend (JTT) models with separate time trends for DNSPs in Australia, New Zealand and Ontario; and
2. Australian Time Trend (ATT) models with a separate time trend for Australia and a common trend for DNSPs in New Zealand and Ontario.

Quantonomics' most important finding is that, under both of these alternative specifications, the hypothesis that the jurisdictional time trend variables are equal to each other (a constraint imposed in the standard model) is consistently rejected.[1]

Quantonomics concludes from this key finding that:

> *…variables capturing differing time trends across jurisdictions are likely omitted variables.*[2]

[1] Quantonomics memorandum, pp.24, 26.
[2] Quantonomics memorandum, p.39.

Quantonomics goes on to explain that:

> *Omitting relevant explanatory variables in cost functions is a form of mis-specification which can result in biased estimates of the relationship between output quantities and costs. When key variables are omitted, the remaining included variables may capture part of their influence, potentially leading to incorrect parameter estimates.* [3]

That is, Quantonomics' findings indicate that some important variables that explain the changes in opex for DNSPs have been omitted from the standard models, and that this indicates a mis-specification of the models.

Quantonomics also explains that the effect of some DNSPs becoming more efficient over time is likely captured by the time trend term in the standard models:

> *In theory, the time-trend element of the standard opex cost function specification represents technical change because the model assumes time-invariant inefficiency, and implicitly assumes there are no important omitted operating environment factors (OEFs). In actuality, the inefficiency of DNSPs has likely changed over time, given the length of the sample periods. Further, given the difficulties of including all relevant OEFs (because some are not measured or not consistently measured between jurisdictions or because the effects of OEFs are complex and may not be captured by a single metric) it is likely that changes in OEFs over time have an unmeasured influence on real opex. Hence, the time-trend component will, in practice, reflect the combined effects of technical change, changes in cost inefficiency over time and the effect of changes over time in omitted OEFs.* [4]

We agree with Quantonomics' conclusion that, owing to mis-specification of the econometric models, the time trend term likely captures the effect of 'frontier shift' (i.e., industry-wide productivity changes), changes in 'catch-up efficiency' (i.e., the effect of individual DNSPs moving closer to the efficient frontier over time) and changes over time related to other omitted variables.

This is likely why the estimated time trend for Australian DNSPs differs from the estimated time trend for DNSPs in the other two jurisdictions in the JTT and ATT models, especially in the short sample models. It's likely that at least some Australian DNSPs have become more efficient over time in response to the AER's economic benchmarking, while DNSPs in New Zealand and Ontario have not similarly improved their opex efficiency. The Australian time trend variable appears to be capturing this missing effect because the improvement in efficiency by Australian DNSPs occurred over time.

Ausgrid's positions on future improvements to the econometric benchmarking models

*Recommendation # 1: Ausgrid submits the JTT and ATT models **should not be adopted** as alternatives to the standard models.*

The JTT and ATT models presented by Quantonomics are very useful in demonstrating that the existing econometric models are mis-specified. However, this does not mean they should be viewed as replacements for the existing models. This is because the JTT and ATT models do not

[3] Quantonomics memorandum, p.39.
[4] Quantonomics memorandum, p.1.

address the incorrect assumption of constant efficiency when there is strong evidence that the efficiency of at least some Australian DNSPs has changed significantly over time.

The JTT and ATT models presented by Quantonomics should be viewed as useful tools to diagnose the existence of a more fundamental mis-specification that needs to be addressed through further investigation and consultation with stakeholders.

As Quantonomics explains, the existing models are incapable of separating the effects of time-varying catch-up efficiency from technical change (i.e., frontier shift). However, this problem is not apparent because the existing models impose the restriction of a common time trend for all jurisdictions.

The JTT and ATT models are also incapable of disentangling the effects of time-varying catch-up efficiency and technical change. However, this problem becomes more apparent because the JTT and ATT models allow the time trend for Australia to be estimated separately from the time trends for the other two jurisdictions, because some Australian DNSPs have achieved significant catch-up efficiency, particularly since 2014.

We see three reasons why the JTT and ATT models should not be considered as replacements to the existing econometric models:

- Overstated rate of technical change: The AER's approach to estimating an efficient level of base year opex involves rolling forward an estimate of the average level of efficient opex over the benchmarking period to the base year. The formula the AER uses to roll forward its estimate of efficient opex to the base year assumes that the time trend component reflects only the rate of technical change. However, because the JTT and ATT models conflate technical change with catch-up efficiency, the rate of technical change in the roll-forward will be overstated. For example, over the short benchmarking period (2012 to 2023), the estimated rate of technical change under the JTT specification ranges between 2.5% p.a. and 3.1%, and under the ATT specification the estimated rate of technical change ranges between 2.5% p.a. and 3.2% p.a.[5] These estimates reflect, in part, the historical catch-up efficiency achieved by some Australian DNSPs. It would be unrealistic to expect all non-reference DNSPs to sustain annual productivity improvements this large. Application of the JTT and ATT models would consequently result in implausibly low estimates of efficient base year opex.
- Mis-estimated efficiency: Because the JTT and ATT models also assume constant efficiency over the historical benchmarking period, it follows that these models will mis-estimate the efficiency of DNSPs whose efficiency has varied over time. As a result, the starting point for the roll-forward of opex to the base year—i.e., the estimate of average efficient opex over the period—will be incorrect.
- Mis-estimated coefficients for outputs: The mis-specification problem arising from the constant efficiency assumption—which also affects the JTT and ATT models—may result in mis-estimation of the coefficients for the output variables. These coefficient estimates act as

[5] Quantonomics memorandum, Tables A1.1 to A2.4.

weights for each of the outputs in the roll-forward formula. Mis-estimation of these output weights will also result in mis-estimation of the efficient level of base year opex.

For the avoidance of doubt, Ausgrid does not oppose the use of models that allow for jurisdiction-specific time trends. However, we consider that introducing jurisdiction-specific time trends alone (as the JTT and ATT models do) will not adequately address DNSPs' concerns about the mis-specification of the existing models.

Recommendation # 2: The AER should explore model specifications that allow for time-varying efficiency.

As noted above, and explained by Quantonomics, the fundamental source of the mis-specification problem affecting the existing models is the constant efficiency assumption. This feature of the existing models means they are unable to reliably estimate the efficiency of DNSPs that have achieved significant catch-up efficiency over time, and results in the time trend variable conflating the effects of technical change and catch-up efficiency.

For this reason, Quantonomics has advised that:

> *…there may be benefit in considering extensions of the models to include time varying inefficiency.*[6]

Ausgrid supports this recommendation and suggests that the mis-specification problem can only be addressed by allowing the econometric benchmarking models to account for time-varying efficiency.

The 2024 Annual Benchmarking notes that phase 2 of the AER's consultation on the specification of the econometric benchmarking models will focus primarily on whether and how to incorporate time varying inefficiency into the models. Ausgrid supports this approach.

One of the practical challenges that Quantonomics identifies is the need for statistical software packages that can implement more complex and flexible model specifications that accommodate time-varying efficiency. Ausgrid notes that Belotti et al (2013) have developed the *sfpanel* package for Stata, which allows implementation of a wide range of time-varying efficiency models.[7] The application of the *sfpanel* package was demonstrated in a recent working paper by the University of Queensland's Centre for Efficiency and Productivity Analysis (CEPA).[8] Ausgrid encourages the AER and Quantonomics to investigate the *sfpanel* package as part of its phase 2 consultation.

Recommendation # 3: Consultation on time-varying efficiency models should not be rushed.

The 2024 Annual Benchmarking Report indicates that the AER aims to complete phase 2 of its consultation on the specification of its econometric models during the first half of 2025, and that it

---

[6] Quantonomics memorandum, p.48.
[7] Belotti, F., Daidone, S., Ilardi, G., Atella, V. (2013), 'Stochastic frontier analysis using Stata', *The Stata Journal* 13(4), pp. 719-758.
[8] Nguyen, B. H., Sickles, R. C., Zelenyuk, V. (2021), 'Efficiency analysis with stochastic frontier models using popular statistical softwares', *Working paper*, June.

intends to use any improved models that result from that consultation process in the 2025 Annual Benchmarking Report.

Given the additional complexity in the development of econometric models that incorporate time varying efficiency and the importance of the econometric models in regulatory determinations, we encourage the AER not to rush the development work under Phase 2.

Changes to the standard models to incorporate time varying efficiency across jurisdictions would represent the most fundamental and significant change to the econometric models since the commencement of benchmarking. Given the direct impacts of the econometric benchmarking models for the setting of regulatory opex allowances, it is important to get the improvements right for the long-term benefit of all stakeholders, including ultimately the end customers.

Ausgrid therefore considers that it would be preferable to allow more time to ensure that any changes to the model specification are fit-for-purpose than aiming to complete this review before publication of the 2025 Annual Benchmarking Report.

Should you have any questions, please contact Philippe Laspeyres, Revenue Modelling Manager, at [redacted]

Regards,

[redacted]

Fiona McAnally
Head of Regulation