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27 February 2025

Att: Networks Benchmarking Team
Australian Energy Regulator
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By email: AERInquiry@aer.gov.au

AER Consultation – Quantonomics' Memorandum on Electricity Distribution Opex Cost Function: Potential Misspecification Issues

Ergon Energy Corporation Limited (Ergon Energy) and Energex Limited (Energex), both distribution network service providers (DNSPs) operating in Queensland, welcome the opportunity to provide comment on Quantonomics' investigation of the potential misspecification of the econometric models currently used by the Australian Energy Regulator (AER) to benchmark the opex of DNSPs.

Ergon Energy and Energex commend the AER for initiating this review, given the concerns that we and other DNSPs have expressed to the AER about the reliability of the existing benchmarking models. We have been concerned that the existing econometric models are misspecified, and that this is likely to lead to unreliable estimates of opex efficiency and efficient base year opex for at least some DNSPs. Most recently, Energex and Ergon Energy submitted a report by Frontier Economics that set out these concerns in detail as part of Energex's and Ergon Energy's initial revenue proposals to the AER for the 2025-30 regulatory control period.[1] The Quantonomics memorandum[2] to the AER validates Frontier Economics' conclusions that the existing models are misspecified.

We recognise that the Quantonomics memorandum is Phase 1 of a two-part consultation process on the matter. Our key positions on Phase 1 of the consultation are as follows:

- The outcomes of the AER's econometric benchmarking models have real world consequences on DNSPs' ability to manage and operate their networks in a way that promotes the National Electricity Objective (NEO). Therefore, it is critical that the models are capable of producing reliable estimates of efficiency and efficient opex.

[1] Frontier Economics, *Benchmarking analysis of Energex's and Ergon Energy's opex*, 18 January 2024. (Attachment 6.04 to the Regulatory Proposal)
[2] Quantonomics, *Electricity Distribution Opex Cost Function: Potential Misspecification Issues*, 21 November 2024 (Quantonomics memorandum).

- Quantonomics' analysis has demonstrated that the existing models suffer from a serious misspecification problem. This misspecification means that the models are not capable of producing reliable estimates of efficiency and efficient opex.
- The Jurisdictional Time Trend (JTT) and Australian Time Trend (ATT) models help demonstrate the existence of a misspecification problem. However, they should not be viewed as the 'solution' to the problem.
- The source of the model misspecification is the very strong assumption that DNSPs' inefficiency is time-invariant. Hence, to address the misspecification problem properly, the AER must adopt specifications of the model that allow for time-varying inefficiency. Any such models should be shown to fit the data well and pass other standard model specification criteria.
- There are existing software packages that allow implementation of well-established time-varying inefficiency models. An example of this is the sfpanel package for Stata.
- The AER and Quantonomics should explore, as part of Phase 2, the implementation of models that allow for time-varying inefficiency and jurisdiction-specific time trends that are capable of producing more reliable estimates of efficiency and efficient opex.
- Given the importance of this issue, the AER should take the time required to consult properly on time-varying inefficiency models. We are concerned that seeking to finalise Phase 2 prior to the publication of the 2025 Annual Benchmarking Report will not allow sufficient time to consult adequately on time-varying inefficiency models.

These positions are further detailed in **Attachment 1** to this letter. Neither this letter nor **Attachment 1** contain confidential information.

Ergon Energy and Energex appreciate the AER's ongoing review and consultation on this matter. We look forward to continuing to work with the AER and Quantonomics to address the model misspecification in Phase 2 of this consultation process. Should the AER require any additional information or wish to discuss this submission, please contact Guy Mutasa, Acting Manager Economic Regulation on 0429 832 367.

Yours sincerely

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Attachment 1 – Ergon Energy's and Energex's Key Positions on Quantonomics' Memorandum and Potential Misspecification of Econometric Models

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Importance of the AER's econometric benchmarking models

The existing econometric benchmarking models have a direct impact on Distribution Network Service Providers' (DNSPs') ability to manage and operate their electricity networks in a way that promotes the National Electricity Objective (NEO). This is because the econometric benchmarking models are used by the AER to test the efficiency of a DNSP's revealed base-year opex. If the AER concludes, on the basis of these benchmarking models, that the DNSP's actual opex in that year is materially inefficient, the AER derives an estimate of efficient base year opex by making an adjustment to the revealed opex in that year. The size of any such adjustment is determined by the outputs of the econometric benchmarking models. If the AER's benchmarking models do not produce reliable estimates of efficiency or cost function coefficients (e.g., due to a misspecification problem), then the forecast of efficient opex for a particular DNSP adopted by the AER may be higher or lower than it actually requires to promote the NEO.

The results from the existing econometric models are also published in the Annual Benchmarking Models. In principle, the annual comparison of a DNSP's benchmarking results to the performance of its peers should incentivise DNSPs to improve their inefficiency. However, these incentives will only operate properly if the results from the benchmarking models are reliable. If relatively inefficient DNSPs are identified as strong performers, that would reduce the pressure on those DNSPs to continue improving over time. Likewise, if the models fail to recognise the improvements that some DNSPs have actually made, that too will weaken incentives to improve efficiency over time.

For these reasons, Ergon Energy and Energex consider that it is vitally important that the econometric benchmarking models used by the AER are as capable as possible of estimating the efficiency, and efficient opex, of individual DNSPs accurately. However, as discussed below, Quantonomics' findings confirm that the models are not well specified. This misspecification problem is likely to result in unreliable estimates of efficiency and efficient opex for individual DNSPs. Therefore, to achieve the desired outcomes of the benchmarking analysis conducted by the AER, the misspecification problem must be addressed at its source.

Quantonomics has demonstrated that the existing econometric models are misspecified

The existing benchmarking models make two important assumptions that are relevant to the misspecification issue that is the subject of this consultation:

1. The models assume that DNSPs' efficiency remains constant over time. However, there are strong reasons to believe that this is not a realistic assumption because some DNSPs have reduced their opex significantly in response to the AER's introduction of benchmarking analysis in 2014. Changes in the opex multilateral partial factor productivity (MPFP) indices published in the annual benchmarking models support this observation strongly.
2. A common time trend is assumed to apply to all DNSPs in the benchmarking sample. If the benchmarking models were specified properly, then the time trend variable should only reflect technical efficiency (also sometimes referred to as the rate of 'frontier shift'). However, if the models are not specified properly, then the time trend variable will capture other effects that are correlated with time -

such as changes in 'catch-up' efficiency and/or changes in the effect of operating environment factors (OEFs) that have not been accounted for in the models.

Quantonomics has relaxed the second of these two assumptions by allowing each jurisdiction to have its own time trend (the JTT models) and by allowing Australia to have a separate time trend from Ontario and New Zealand (the ATT model). Quantonomics finds that:

- There is no statistical evidence to support the hypothesis that the time for Australian DNSP's is equal to the time trend for the DNSPs in the other jurisdictions; and
- The opex efficiency of Australian DNSPs has improved significantly over time (consistent with the opex MPFP analysis published by the AER), particularly over the period 2012 to 2023—in contrast to DNSPs in Ontario and New Zealand. It is noteworthy that the AER began benchmarking DSNPs' opex in 2014. Hence, the period over which Australian DNSPs achieved the greatest opex efficiency improvements overlaps almost completely with the period over which the AER has been conducting benchmarking analysis.

Quantonomics concludes from this that:

> *…variables capturing differing time trends across jurisdictions are likely omitted variables.*[1]

Quantonomics goes on to explain that:

> *Omitting relevant explanatory variables in cost functions is a form of misspecification 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.*[2]

Based on this observation, Quantonomics concludes that the reliability of the econometric models may be improved by allowing different time trends for the different jurisdictions.

Models that allow for jurisdiction-specific time trends alone will not address the model misspecification problem completely

Quantonomics' recommendation of incorporating jurisdiction-specific time trends in the econometric models would address only one source of misspecification. The other source of misspecification, which is likely to be far more serious, is the invalid assumption (at least for Australia) that DNSPs' inefficiency is invariant over time.

As Quantonomics observes:

[1] Quantonomics memorandum, p. 39.
[2] Quantonomics memorandum, p. 39.

> *there is evidence that Australian DNSPs' inefficiency has varied over time, as indicated in the upward trend in the distribution TFP results since 2015, which is mainly due to opex productivity.*[3]

Given that at least some Australian DNSPs have achieved significant catch-up efficiency over time, but the models assume that this is impossible, the time trend variable will capture both the effect of frontier shift (common to all DNSPs) and catch-up efficiency (specific to individual DNSPs). That is, these two distinct effects will be conflated together, rather than disentangled, by the models within the estimated time trend term. The Quantonomics memorandum makes precisely this point:

> *The current models, and models in section 2 and 3 do not, however, enable us to separate the effects of time-varying inefficiency from technical change (or from changes over time in omitted OEFs), which are currently all conflated in λt. This may be a source of potential misspecification. This will be desirable if we want to ascertain the changes in efficiency scores over time.* [4]

Because the models cannot separate the effects of frontier shift and catch-up efficiency, they will mis-estimate:

- The level of inefficiency for individual DNSPs (and fail to recognise changes in efficiency over time);
- The rate of frontier shift for the industry; and
- The elasticities of the explanatory variables in the model.

As Quantonomics explains:

> *Models that incorporate time-varying efficiency of individual DNSPs often seek to separate the effects of time-varying inefficiency (or 'catch-up'), which are firm-specific, from the effects of technical change ('frontier shift), which are common to the DNSPs. As explained above, these two effects (as well changes in omitted OEFs over time) are currently conflated in the time trend term because the estimated inefficiency terms is time-invariant.*[5]

To see this, note that over the short benchmarking period (2012 to 2023), the estimated time trend for Australia under the JTT specification ranges between 2.5% p.a. and 3.1% p.a., and under the ATT specification the estimated time trend for Australia ranges between 2.5% p.a. and 3.2% p.a.6 It is implausible that these very large estimates reflect the effects of frontier shift and unaccounted for OEFs alone. The most likely explanation is that the estimated time trend in the JTT and ATT models also reflects the effect of catch-up efficiency, which is likely to be materially large for some DNSPs.

Two conclusions follow from this:

- Firstly, the JTT and ATT models are useful in exposing the fact that the models are misspecified due to the unrealistic assumption that DNSPs inefficiency is constant over time. This problem is masked by the common time-trend assumption. Once that assumption is removed, the evidence for misspecification due to the constant efficiency assumption becomes more apparent.

[3] Quantonomics memorandum, p. 42.
[4] Quantonomics memorandum, p. 42.
[5] Quantonomics memorandum, p. 44.
[6] Quantonomics memorandum, Tables A1.1 to A2.4.

- Secondly, and following on from the first point, adopting the JTT or ATT models (as they are specified in the Quantonomics memo) would not address the model misspecification problem arising from the constant inefficiency assumption. To address the issue properly, the AER would need to adopt alternatively-specified econometric models that allow explicitly for time-varying inefficiency. The practicalities of doing so are discussed in the next section.

Ergon Energy and Energex submit that the JTT and ATT models (as specified in the Quantonomics memorandum) should not even be considered as a 'stop gap' measure until such time as time-varying inefficiency models are identified and adopted. This is because average technical change implied by these models (i.e., 1.60% p.a. on average for the JTT models 1.5% p.a. on average for the ATT models) would be unrealistically large if applied by the AER when rolling forward an estimate of efficient opex to the base year. Since the models are unable to disentangle the effects of frontier shift and catch-up efficiency, the estimated rate of technical change (of 1.60% p.a. for the JTT models and 1.5% p.a. for the ATT models) cannot be interpreted as an estimate of pure frontier shift. Applying these very high estimates of technical change in the roll-forward model would result in unrealistically low estimates of efficient base year opex for most DNSPs.

Ergon Energy and Energex support Quantonomics' recommendation of investigating time-varying inefficiency models in Phase 2

The 2024 Annual Benchmarking Report states that Phase 2 of the AER's consultation will explore alternative time trend specifications, particularly those that incorporate inefficiency varying over time. Quantonomics has also recommended that:

> *there may be benefit in considering extensions of the [JTT and ATT] models to include time varying inefficiency.*[7]

Ergon Energy and Energex consider that this would be a worthwhile focus for Phase 2.

Quantonomics notes that one potential challenge that may arise in Phase 2 is identifying existing statistical packages that can implement more flexible and complex time-varying inefficiency models. Ergon Energy and Energex acknowledge that time-varying inefficiency models are more complex than the existing models used by the AER. However, we note that the sfpanel package developed by Belotti, Daidone, Ilardi and Atella (2013) can be readily used to estimate a wide range of well-known time-varying inefficiency models.8 There would be no need to develop a bespoke package or model code to investigate and implement different time-varying inefficiency models. The sfpanel package is available 'off the shelf' and has been used widely for more than a decade now. It can be readily accessed online and installed for use in the Stata program that the AER/Quantonomics uses to estimate the econometric models. Furthermore, there is detailed documentation from the original developers of the package, and other users, on how sfpanel can be used in practice. Therefore, the availability of appropriate software is not a real barrier to the exploration of time varying inefficiency models in Phase 2.

[7] Quantonomics memorandum, p. 48.

[8] Belotti, F., Daidone, S., Ilardi, G., Atella, V. (2013), "Stochastic frontier analysis using Stata", *The Stata Journal* 13(4), pp. 719-758.

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The AER should not rush Phase 2

As noted above, both Ergon Energy and Energex are very supportive of the AER's intention to explore time-varying inefficiency models in Phase 2 of this consultation process. However, we recommend the AER to take the time necessary to consult properly on alternative models that allow for time-varying inefficiency.

The 2024 Annual Benchmarking report indicates that Phase 2 will inform any changes to the econometric cost function models that are used in the 2025 Annual Benchmarking Report. Whilst Ergon Energy and Energex support the AER maintaining momentum in investigating this issue, the adoption of time-varying inefficiency models, in place of the existing models, would represent a very fundamental change that may have long-term implications for the opex allowances set by the AER for individual DNSPs. Furthermore, the alternative models themselves are likely to be more complex than the existing models. It is therefore important that stakeholders be provided with sufficient time to consider the strengths and weaknesses of alternative models, so that they can contribute meaningfully to the AER's Phase 2 consultation.

The issue that needs to be addressed - the correction of seriously misspecified models - is of such importance that it is strongly recommended the AER take the time necessary to consult properly with all interested stakeholders. This may mean that more time is required to consult thoroughly than is available before the 2025 Annual Benchmarking Report. In these circumstances, we suggest the AER seek to incorporate the findings from Phase 2 into the 2026 (rather than the 2025) Annual Benchmarking Report.