27 March 2026

Part of Energy Queensland

Ms Kami Kaur
General Manager
Australian Energy Regulator
GPO Box 3131
Canberra, ACT, 2601
By email: AERInquiry@aer.gov.au

Dear Ms Kami Kaur

Quantonomics' Phase 2 Report and Supplementary Files

Ergon Energy Corporation Limited (Ergon Energy) and Energex Limited (Energex), operating as Distribution Network Service Providers in Queensland, welcome the opportunity to provide feedback to the Australian Energy Regulator (AER) on Quantonomics' phase 2 report and supplementary files evaluating the performance of the Translog opex econometric cost function models.

We appreciate the AER's ongoing commitment to examining options to improve the performance of the econometric opex cost function models used in its benchmarking reports. Detailed feedback on Quantonomics' phase 2 report and associated supplementary files, is provided in **Attachment 1** for the AER's consideration.

Should the AER require additional information in relation to our feedback, please contact me or [redacted]. This letter does not contain confidential information and may be published.

Yours sincerely

[redacted]

Guy Mutasa
Manager Economic Regulation
Telephone: [redacted]
Email: [redacted]

Attachment 1: Ergon Energy's and Energex's Feedback on Quantonomics' Phase 2 Report and Supplementary Files

Context for this consultation

Ergon Energy Corporation Limited (Ergon Energy), Energex Limited (Energex), and several other distribution network service providers (DNSPs) have expressed concern for some time that the econometric models used by the AER to benchmark the historical DNSP operating expenditure (opex) are mis-specified.

The AER and its adviser, Quantonomics, have observed that these models exhibit serious statistical problems, including severe monotonicity violations. In addition, the models suffer from instability in parameter estimates over time and some models produce implausibly low efficiency scores for some DNSPs. These problems have worsened over time.

In response to these concerns, the AER initiated a consultation on the specification of these econometric benchmarking models in 2024. In Phase 1 of that consultation, Quantonomics concluded that there was evidence that the models were mis-specified and attempted to address that mis-specification using different jurisdictional time trends. That analysis indicated that the cost time trends differed meaningfully between DNSPs in Australia, New Zealand and Ontario. However, those augmented models also exhibited evidence of mis-specification.

Quantonomics concluded that the source of the mis-specification was the existing models' underlying assumption that DNSPs' inefficiency remains constant over the benchmarking period. However, there is mounting evidence that many DNSPs have responded to the benchmarking regime introduced by the AER in 2015 by becoming more efficient over time. The constant inefficiency assumption of the existing models means that they are incapable of fitting the data well, resulting in mis-estimation of the efficiency of the Australian DNSPs and the cost function parameters used by the AER to estimate efficient base year opex.

This is highly problematic because:

- it may result in DNSPs' opex allowances being set higher or lower than the efficient level, and
- it may disincentivise some DNSPs from becoming more efficient over time if genuine efficiency improvements are not recognised properly by the AER's benchmarking analysis.

Neither of these outcomes would promote the National Electricity Objective.

Our response to the Phase 1 consultation supported Quantonomics' proposal to investigate time-varying inefficiency models.[1] Models that allow for changes in efficiency over time are more likely to fit the historical data better than the existing models and produce more reliable benchmarking results.

Phase 2 consultation and Quantonomics' findings

As part of the Phase 2 consultation, Quantonomics investigated several different types of time-varying inefficiency models, focussing on:

- Battese and Coelli (1995) (BC95) stochastic frontier analysis (SFA) models
- Kumbhakar (1990) (Kumb90) SFA models, and
- Least squares econometrics (LSE) fixed-effects panel models.

Quantonomics tested variants of these models that included:

[1] https://www.aer.gov.au/system/files/2025-05/Energy%20Queensland%20-%20Submission%20on%20Quantonomics%20Translog%20phase%201%20memo%20-%2027%20February%202025.pdf

- different jurisdictional efficiency time trends
- different cost time trends, and
- the assumption of a half normal (rather than truncated normal) distribution for the SFA models to make them computationally simpler, and to reduce convergence problems.

In total, Quantonomics evaluated 12 models against several selection criteria and identified four models that it concluded performed best on those criteria:

- one BC95 model (i.e., BC95-JTT-HN)
- one Kumb90 model (i.e., Kumb90-JTT-HN), and
- two LSE models (i.e., LSE-AJTT and LSE-AJTT-GTC).

However, Quantonomics stopped short of recommending that these four models should replace the AER's existing models, even though Quantonomics' analysis showed they clearly outperformed the existing models. Quantonomics regarded its findings as "preliminary", reiterating that its initial views required further analysis.[2]

Whilst Ergon Energy and Energex understands and appreciates Quantonomics' desire for caution, we submit that there is now overwhelming statistical evidence that the existing benchmarking models are no longer fit-for-purpose or reliable. In these circumstances, the AER should not continue to use the existing models to conduct benchmarking analysis. If models that are shown to perform more reliably than the current models are identified, the existing models should be discontinued and replaced by the better models, even if those new models are not 'perfect'.

Evaluation of Quantonomics' analysis

Given the complex nature of the subject matter central to this consultation, we engaged Frontier Economics to review Quantonomics' Phase 2 analysis and to advise on which time-varying inefficiency models, if any, should replace the AER's existing models.

Frontier Economics identified several issues with Quantonomics' analysis that needed to be addressed before the models investigated by Quantonomics could be evaluated properly:

- Quantonomics had adopted an inconsistent treatment when specifying the efficiency time trend term in the various BC95 models tested. Frontier Economics advised that there was no good reason to vary the specification of the efficiency time trend in the way Quantonomics had.
- In the BC95 model that Quantonomics identified as one of four best-performing models overall, Quantonomics had specified the efficiency time trend in a way that meant that expected DNSP inefficiency was effectively time-invariant over the benchmarking period.[3] Frontier Economics confirmed this by estimating a time-invariant version of that model and showed that the results from the two models were almost indistinguishable from one another. In other words, one of the top supposed time-varying inefficiency models identified by Quantonomics was in fact a time-*invariant* inefficiency model.
- The Kumb90 models tested by Quantonomics incorporated very deterministic efficiency adjustment factors that drive the efficiency scores of all DNSPs to converge rapidly to implausible levels. For example, in a number of Quantonomics' Kumb90 models, all DNSPs' efficiency scores converge quickly to 100% (clearly an

[2] Quantonomics, Electricity Distribution Benchmarking Opex Model Development, 26 November 2025, p. 143.
[3] This problem also affected some of the other BC95 models tested by Quantonomics.

unrealistic outcome), and are highly insensitive to changes in opex in individual years.

- The time-varying LSE models assume that efficiency catch-up occurs at a constant rate over the entire benchmarking period. However, there is compelling evidence that the rate of efficiency catch-up experienced by DNSPs varied over the benchmarking period. For example, for some DNSPs the rate of catch-up was slow before the AER introduced formal benchmarking in 2015, very rapid between 2015 and 2020, and more moderate post-2020 once the 'easy wins' had been realised.
- Quantonomics found that some of the SFA models it tested did not converge, and considered that lack of convergence indicated the need for caution because the estimates from these models "may be unreliable or unstable."[4] However, Frontier Economics found that convergence could be achieved for all of the SFA models investigated by Quantonomics if more appropriate starting values for the solving routine are employed.
- Quantonomics expressed concern that efficiency scores could not be calculated for some DNSPs under some models.[5] However, Frontier Economics found that efficiency scores could be obtained for all DNSPs in all the models investigated using a different post-estimation routine to the one employed by Quantonomics.

Frontier Economics evaluated all 12 of the BC95, Kumb90 and time-varying LSE models investigated by Quantonomics, addressing each of the issues above. In addition, Frontier Economics tested a further six models that were variants/extensions of the models considered by Quantonomics. These included:

- BC95 and Kumb90 models that allow the possibility of a step-change in the efficiency time trend every three years - in a similar way to Quantonomics' Generalised Technical Change for the cost time trend
- Kumb90 models that allow a jurisdiction-specific efficiency adjustment for New Zealand and Ontario, and
- A time-varying LSE model that allows the efficiency time trend to differ before and after 2015, the year in which the AER introduced the current benchmarking regime.

Frontier Economics evaluated these 18 time-varying inefficiency models, alongside translog versions of the SFA and LSE models currently used by the AER, using similar selection criteria to Quantonomics'.

Based on that analysis, Frontier Economics recommends the following:

1. The time-invariant inefficiency models currently used by the AER are fundamentally mis-specified and should be discontinued. Their assumption of constant efficiency is inconsistent with observed data and leads to unreliable outcomes.
2. Three time-varying SFA models satisfy all selection criteria and materially outperform all others tested:

- SFA-BC95-JTT-HN-GTC

  This is a time-varying BC95 model that:

  - allows for different efficiency time trends for Australia, New Zealand and Ontario,

[4] For example, Quantonomics, Electricity Distribution Benchmarking Opex Model Development, 26 November 2025, p. 51.
[5] For example, Quantonomics, Electricity Distribution Benchmarking Opex Model Development, 26 November 2025, p. 50.

  - assumes a half-normal efficiency distribution in the final year of the sample, and
  - permits different cost time trend estimates for each three-year year historical period.

- SFA-BC95-AGEC-HN-GTC

  This is a time-varying BC95 model that:

  - allows different efficiency time trend estimates for each three-year historical period, for the Australian DNSPs, while allowing simple, linear efficiency time trends for the New Zealand and Ontarian DNSPs
  - assumes a half-normal efficiency distribution in the final year of the sample, and
  - permits different cost time trend estimates for each three-year year historical period.

- SFA-Kumb-AGECJUR-HN-GTC

  This is a time-varying Kumb90 model that:

  - allows different efficiency time trend estimates for each three-year historical period, for the Australian DNSPs, while allowing simple, linear efficiency time trends for the New Zealand and Ontarian DNSPs
  - allows different efficiency levels to be estimated for Australia, New Zealand and Ontario
  - assumes a half-normal efficiency distribution, and
  - permits different cost time trend estimates for each three-year year historical period.

In addition, Frontier Economics concluded that:

3. The LSE specifications should be abandoned. These models are overly restrictive, and their statistical performance is unambiguously worse than that of the preferred SFA models.
4. The AER should give primacy to translog specifications, using the Cobb-Douglas models only as a fallback if the translog models cannot be used due to serious statistical problems. Formal statistical testing shows clearly that the Cobb-Douglas models fit the data more poorly than the translog specifications. Therefore, these models are unnecessary provided the recommended translog models can be estimated reliably.

Estimation of efficient base year opex using time-varying inefficiency models

Frontier Economics has advised that, if the AER adopts time-varying inefficiency models, it can continue to follow its existing approach of rolling forward an estimate of efficient opex from the middle of the benchmarking period to the base year. However, the estimate of average efficiency over the benchmarking period would need to be estimated by averaging the DNSP's annual efficiency scores over the period.

Quantonomics notes that time-varying inefficiency models can "enable the efficient base-year opex to be calculated directly if the base year is the same as the last year of the sample period,"[6] or the estimate of efficient opex could be rolled forward from the final year of the benchmarking period to the base year.

[6] Quantonomics, Electricity Distribution Benchmarking Opex Model Development, 26 November 2025, p. 143.

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Ergon Energy's and Energex's preference would be for the AER to retain its current approach of rolling forward the estimate of efficient opex from the middle of the benchmarking period, since this process is well understood by DNSPs and other stakeholders. The AER should consult with stakeholders carefully before changing its current approach, to ensure that all the implications of such a change are thought through, and that there are no unintended consequences.