30 October 2020

Claire Preston
Director
Australian Energy Regulator
By email: AERInquiry@aer.gov.au

Dear Claire

Re: AER draft 2020 annual benchmarking report

CitiPower, Powercor and United Energy welcome the opportunity to provide feedback on the Australian Energy Regulator's (**AER**) draft 2020 annual benchmarking report.

We are concerned by the AER's continued reliance on the multilateral total factor productivity (**MTFP**) model as the primary benchmarking model in the annual benchmarking reports. Numerous independent consultant reports have shown through evidence the cost function used by Economic Insights (**EI**) to derive the output weights for the MTFP model is unprecedented, not statistically valid and provides illogical outcomes.

It is also disappointing the AER is satisfied with a significant shift in benchmarking results from a minor error correction to EI's modelling code, while not addressing the foundational concerns with its entire approach raised repeatedly by Frontier Economics and NERA Economic Consulting (**NERA**). The mere fact that EI's minor error correction results in a significant change in the output weights provides further evidence in support of the lack of statistical robustness in the EI approach. The resulting variation on the MTFP benchmarking outcomes also undermines confidence in benchmarking as a regulatory tool.

We are surprised the AER has not sought independent advice on the validity and robustness of the EI model used to develop the output weights for MTFP model. This is despite the quantum of evidence other experts have provided discrediting the MTFP approach. We recommend the AER obtain further views of other independent experts, given such varying conclusions from EI and Frontier/NERA. This is particularly important given the reliance placed on MTFP for the annual benchmarking report as well as assessing distributors operating expenditure efficiency and deriving the operating expenditure rate of change in regulatory determinations.

Following EI's model correction, we have again engaged NERA to review the EI approach to deriving output weights for the MTFP model. In summary, NERA find that:

- **the output weights are no more meaningful than a random variable**. The EI specification guarantees that at least one output coefficient will be statistically significant even if there is no relationship between any of the output variables and the input variables, or if there is insufficient data to estimate that relationship. NERA find that 95% of the time random variables receive higher weights than the real output variables (refer to figure 1). Further, spurious output drivers receive higher weight than real outputs. For example, the number of girls born in the Republic of Ireland each year named Zoe receives 19% weight
- **there is very little evidence that the true values of any or all coefficients are not zero** (meaning they should have zero output weights). NERA found that 80% of coefficients are not significant and EI's own calculations find 66% are not significant
- **output weights vary substantially and counterintuitively across the 52 regressions** used to derive the output weights. Figure 2 shows that most of the weights in the 52 regressions are either zero or 100%. This suggest that all companies have a single primary driver of operating expenditure, but it is effectively random what that driver is. That each company has a different driver of operating expenditure according to EI's analysis undermines the basis for estimating a single cost-function and common set of output weights. EI's evidence suggests that the companies have different drivers of costs and entirely different output weights

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- variants on the EI model specification result in different output weights, demonstrating the output weights from the EI model are not reliable because they are volatile and precarious to changes in model specification (refer figure 3)
- there is no precedent for the model specification used by EI and no evidence that the approach has been properly validated and subject to rigorous peer review. The model specification is non-standard and illogical.

NERA concludes (executive summary):

> *that the weights that actually come out of the Leontief specification are effectively random. EI could select four weights at random and not be further from the truth than it is under these output weights.*
>
> *the MPFP modelling is based on a set of arbitrary assumptions and methodological choices. The resulting efficiency scores and output weights are therefore not a reasonable reflection of DNSPs' relative outputs, inputs and efficiency levels. Therefore, the AER can place no reliance upon the MPFP modelling in its opex assessment process. Instead, the AER should place greater reliance upon the econometric cost functions, which do not suffer from the same deficiencies.*

Further, NERA demonstrates that the econometric cost functions can be used to derive the same insights as currently undertaken in the benchmarking report for the MTFP model, including annual trends in productivity and the decomposition of drivers in productivity, as shown in figures 4 and 5.

Given further evidence and remaining significant concerns with the EI model used to derive the MTFP weights, we encourage the AER:

- for the 2020 annual benchmarking report, to place less prominence on the MTFP model and instead focus on the outcomes across the group of models
- moving forward, to engage its own independent peer review of the EI cost model for deriving the output weights.

If you have any questions regarding this submission please contact [redacted]

Yours sincerely,

Renate Vogt
General Manager Regulation
CitiPower, Powercor and United Energy

Attachments: NERA

1 Summary of NERA's key findings

The following are extracts from the attached NERA report.

1.1 The output weights are no more meaningful than a random variable

NERA demonstrate that EI's method attributes positive weight to meaningless series through two approaches.

First by replacing the energy variable as a driver in the 52 regressions with a spurious variable including:

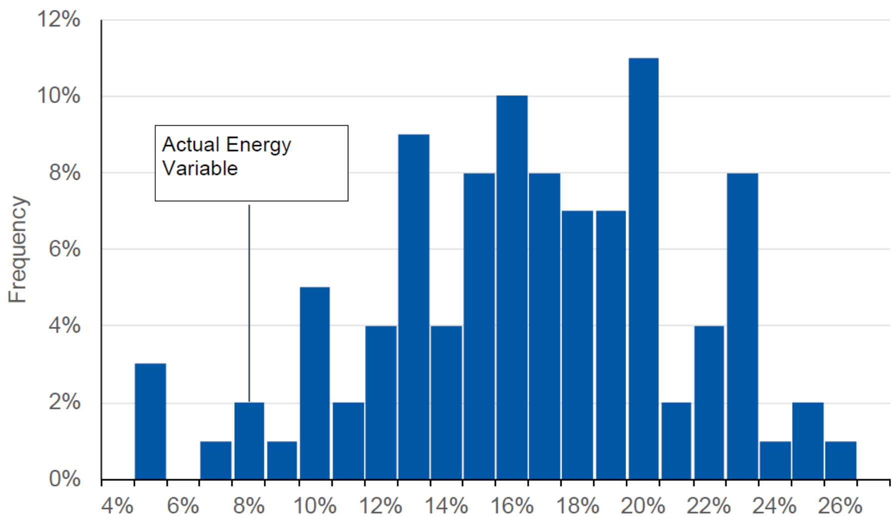
(i) annual flights to and from Melbourne Airport
(ii) the exchange rate between British Pounds Sterling and New Zealand Dollars (expressed as GBP per NZD)
(iii) the number of girls born in the Republic of Ireland each year named Zoe. This variable receives 19 per cent weight
(iv) energy delivered by a different distributor.

In (i)-(iii), the spurious variable receives higher weight than the company's actual energy variable.

In (iv), 58% of times the other company's energy variable receives higher weight than the same company's energy variable.

Secondly, NERA remove the energy variable as reported by a company and replaced it with a random number generated based on the mean and standard deviation of each company's actual energy value. In effect, this randomly generated variable resembles each company's energy variable in level and distribution but without any relation to cost in each year because random variations in it could not possibly explain variations in cost. NERA replicate this analysis 100 times and report weights resulting from each simulation in the figure below.

Figure 1: Weight assigned to random energy variable



As the figure shows, the output weight assigned to this random variable is larger than the weight assigned to the actual energy in 95% of cases, even though it clearly bears no relation to variations in cost. This suggests that energy is no stronger a driver of cost than a random number with a similar average level.

In fact, all of the spurious data series above (including the randomly-generated energy variables above) have one key feature in common: they all exhibit similar levels of variation relative to their mean levels. Due to the restrictions of the econometric specification (non-negative coefficients and no constant), most regressions only have one variable with only one non-zero output coefficients. Therefore, a variable with any negative values or with large variation relative to its mean, would be very unlikely to explain operating expenditure or the capital inputs, which exhibit relatively little variation relative to their means in each year.

1.2 Output weights vary substantially and counterintuitively across the 52 regressions

The EI process of combining coefficients into output weights involves aggregating the contribution of each output to the fitted level of each input variable across the 52 regressions. In figure 2, NERA present the contribution of each variable to the fitted value of each input, separated by input and company. The contribution of each output to the fitted level varies substantially and counterintuitively across the 52 regressions.

The operating expenditure regressions suggest that all companies have a single primary driver of operating expenditure, but it appears effectively random what that driver is. That each company has a different driver of operating expenditure according to EI's analysis, undermines the basis for estimating a single cost-function and common set of output weights in the first place: EI's evidence suggests that the companies have different drivers of costs and entirely different output weights.

Figure 2: Output variable contributions to operating expenditure

Input: Opex				
	Energy	RM Demand	Customers	Length
ACT	0%	8%	0%	93%
AGD	0%	100%	0%	0%
AND	0%	100%	0%	0%
CIT	100%	0%	0%	0%
END	90%	0%	0%	11%
ENX	0%	100%	0%	0%
ERG	0%	10%	0%	90%
ESS	0%	0%	100%	0%
JEN	0%	0%	100%	0%
PCR	0%	11%	0%	89%
SAP	0%	100%	0%	0%
TND	100%	0%	0%	0%
UED	94%	6%	0%	0%

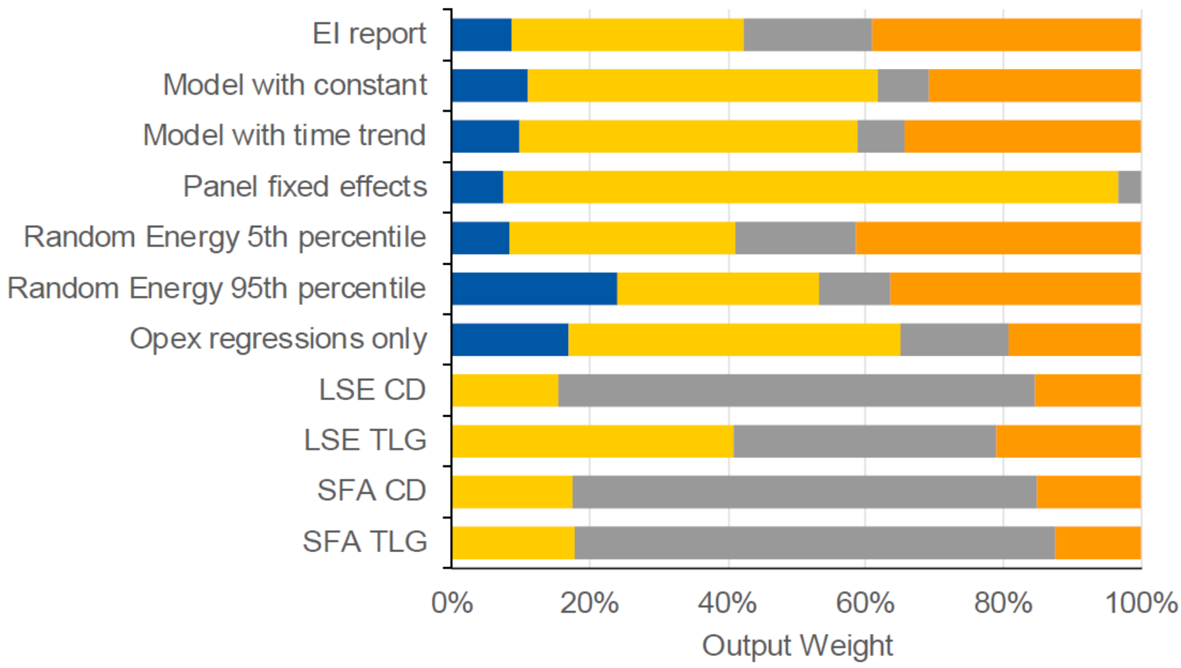
1.3 Different econometric specifications yield different output weights

The weights allocated to each of the four outputs depend on the regression specification used. In figure 3, NERA demonstrate the sensitivity of the ultimate weights to each of the alternative econometric specifications discussed above, as well as the 5th and 95th percentile iterations (in terms of weight on energy) from the random energy simulation above. NERA also show the weights from the cost functions for comparison.

The sensitivity of the output weights to the regression specification is clear. The output weight allocated to energy is halved when moving from the EI model to the panel fixed effects model. The weight allocated to customer numbers shrinks to less than a third of its previous value in all alternative specifications. In the EI model, circuit length is the greatest contributor to output costs; in all alternative specifications, demand is the greatest contributor.

Overall, this analysis illustrates that the output weights derived from the Leontief regressions are not reliable because they are volatile and precarious to changes in model specification. Alternative, more plausible specifications of the regressions yield very different weights.

Figure 3: Output weights vary with regression specifications



1.4 Benchmarking insights using econometric model

The AER annual benchmarking reports rely upon analysis of the MPFP model prepared by EI, including analysis of companies' year-on-year changes in efficiency as well assess the drivers of annual efficiency changes. Whilst EI has not set up the econometric cost function models to present the same analysis, it is simple to do. To demonstrate, NERA has prepared figures 4 and 5 efficiency scores from LSE-CD econometric model.

Figure 4 shows each company's efficiency relative to its peers on an annual basis, and also relative to itself in previous years, based on the LSE-CD model.

Figure 5 decomposes changes to United Energy's distribution LSE-CD efficiency score from 2018-19 due to changes in output drivers and actual operating expenditure.

NERA also show the equivalents for the other three cost models in their report.

Figure 4: Annual operating expenditure efficiency scores using SFA CD cost function

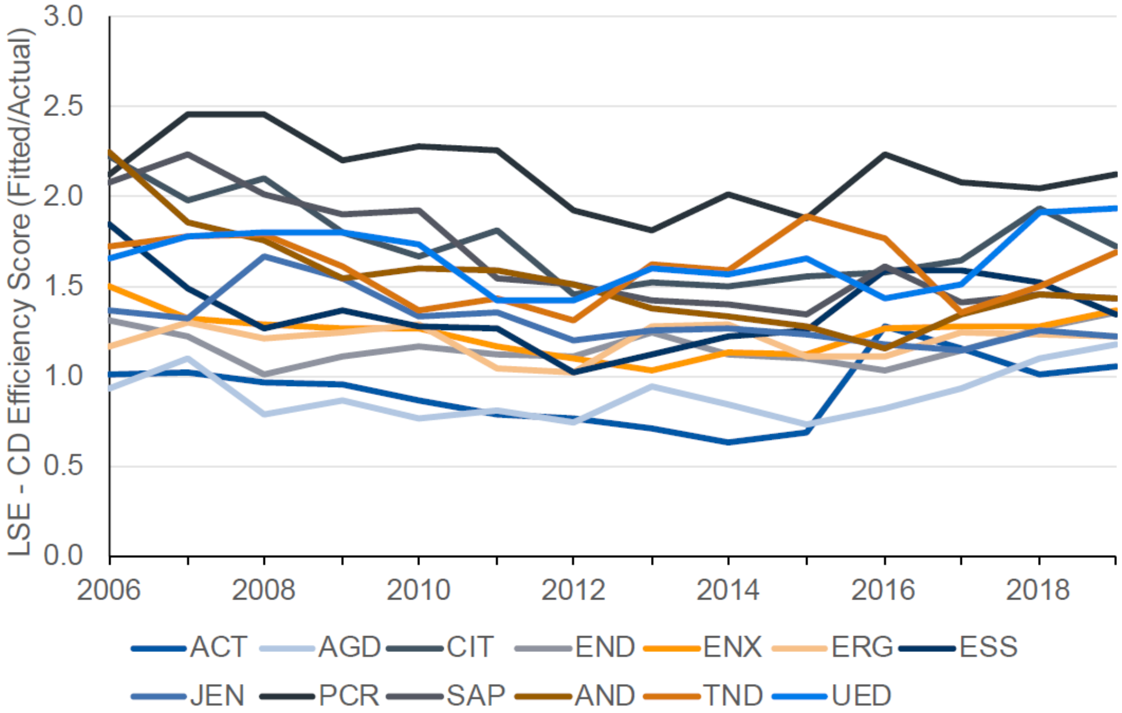


Figure 5: United Energy changes in operating expenditure efficiency, 2018-2019