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Comments on the AER's Draft Annual Benchmarking Report

A Report prepared for Grid Australia

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1. Summary

This report comments on the Electricity Transmission Network Service Providers draft Annual Benchmarking Report (draft Benchmarking Report) prepared by the Australian Energy Regulator (the AER).

The AER is required by the National Electricity Rules (NER) to undertake a comparison across TNSPs for the purposes of the Annual Benchmarking Report. In particular, the NER requires the AER to produce a network service provider performance report that describes the relative efficiency of each TNSP.

In its draft Benchmarking Report, the AER comments that the benchmarking techniques used in the report will assist it 'in forming a view on the productive efficiency of transmission networks [..]' and that 'measuring productive efficiency will help us determine the efficient revenues for services to be used in setting prices.'¹

Our comments set out in this report are primarily concerned with noting the limitations of applying the performance measures in the AER's draft Benchmarking Report to the task of assessing efficient capex and opex expenditure as part of a regulatory determination. The AER itself notes the limitations in its draft Report and includes a number of caveats. It is important that sufficient regard is given to these caveats if the AER does adopt the measures included in its draft Report in order to determine efficient expenditure.

The AER has previously recognised two key limitations in applying benchmarking techniques to the TNSPs in the National Electricity Market (NEM), namely:

- the small number of TNSPs in the NEM, from which benchmarking data can be drawn; and
- the differences in the environmental factors that each of the TNSP's face, which can be expected to affect their productivity.

The AER continues to note these limitations in its draft Benchmarking Report. Essentially, both these factors affect the ability to interpret the benchmarking results as indications of relative efficiency, rather than being due to external factors that have not been captured in the models. As such, they severely limit the applicability of cross-sectional benchmarking across TNSPs.

We have also examined the memorandum prepared by Economic Insights, which describes the findings of its MTFP analysis. The memorandum does not recognise the limitations inherent to the MTFP analysis, in particular the inability to measure the performance of different output specifications against some objective benchmark. Given that different specifications lead to markedly different MTFP results and affect the relative rankings of TNSPs, we caution against drawing conclusions as to the relative efficiency of TNSPs from this analysis.

¹ AER, Electricity transmission network service providers, Draft annual benchmarking report, August 2014.

2. Limitations in benchmarking TNSPs

The AER has previously recognised two key limitations in applying benchmarking techniques to the TNSPs in the National Electricity Market (NEM), and the implications of these limitations for both the conclusions that can be drawn from the benchmarking results and the uses to which they may be applied. These limitations are:

- the small number of TNSPs in the NEM from which benchmarking data can be collected; and
- the different environmental factors faced by each of the TNSPs, which can be expected to affect their productivity.

In its draft Benchmarking Report, the AER continues to note these limitations.

2.1 Small sample size

The AER is required under the National Electricity Rules (NER) to undertake a comparison across TNSPs for the purposes of the Annual Benchmarking Report. In particular, the NER requires the AER to produce a network service provider performance report that describes the *relative efficiency* of each TNSP.²

The AER has previously noted the likely limitation of conducting comparative benchmarking analysis across TNSPs, due to the limited sample size. In its draft Benchmarking Report, the AER continues to recognise this limitation:

It should be noted that the ability to draw conclusions from the benchmarking of transmission networks within Australia may be limited by the number of networks and their diversity. (AER, p. 21)

There are only five TNSPs in the NEM. Aside from this low number, there is also substantial variation between these TNSPs in terms of both the scale of their operations, and the operating environments they face. As a consequence, the factors that can be expected to affect expenditure are likely to vary for each TNSP. However, the small sample size acts as a limiting factor on the number of environmental factors that can be incorporated within the benchmarking analysis for TNSPs. As the number of variables incorporated into the analysis increases, so does the necessary sample size in order to ensure that the results of the analysis are reliable. To the extent that explanatory variables which drive differences between TNSPs are omitted from the analysis due to the small sample size, then differences in results between TNSPs are likely to be a function of omitted variables, rather than being able to be interpreted as 'inefficiency'.

In its draft Benchmarking Report, the AER also notes the limitations on comparing its benchmarking outcomes for AusNet Services with those for the other TNSPs, given the difference in the scope of the activities carried out by AusNet Services, and the fact that it does not own all of the transmission assets in Victoria.

A sample size of just five, compounded by the heterogeneity between TNSPs, significantly limits the ability of quantitative benchmarking techniques to offer any meaningful insights into the relative efficiency across the TNSPs.

² NER, Ch 6A clause 31(a).

Previously, the AER has commented that the difficulties of making cross-sectional comparisons means that benchmarking analysis for TNSPs is likely to focus more on the time-series assessment of changes in productivity for each TNSP.

[..] despite the difficulties of cross sectional comparisons of economic benchmarking results for TNSPs, the measurement of their productivity over time will be relevant.³

However, the AER makes no similar comments in the context of the benchmarking measures reported in its draft Annual Benchmarking report. In contrast, the draft Benchmarking Report notes only that:

the benchmarking techniques in this report primarily assist us in forming a view on the productive efficiency of transmission networks [..] Measuring productive efficiency will help us determine the efficient revenues for services to be used in setting prices. (AER, p. 11).

We continue to be of the view expressed earlier that:

the small sample size available for the benchmarking of TNSPs within the NEM will severely limit the explanatory power and significance of any benchmarking model applied for comparative analysis across TNSPs. [..] At a minimum, extreme care will be required in interpreting the results of any such analysis, while differences between the benchmark analysis and observed outcomes will not be able to be presumed to reflect 'inefficiency.'⁴

We recognise that the AER is required under the NER to conduct a comparative analysis across TNSPs for the purposes of the Annual Benchmarking Report. However, the AER has considerable discretion under the NER as to whether and how it applies the results of its comparative analysis. In our opinion, any application of this comparative analysis by the AER to derive allowed revenues for a specific TNSP would need to be undertaken with extreme care, particularly given the issues raised by the small sample size and heterogeneity between the TNSPs in the NEM.

2.2 Importance of environmental factors

The AER recognises in its draft Benchmarking Report that:

To measure the efficiency of transmission networks it is necessary to consider the environment within which they operate (AER, p. 19).

The backcasting data requested from the TNSPs for the purposes of the development of the benchmarking models identified 19 potential operating environment factors, grouped into weather factors, terrain factors, climate difficulty index and network characteristics.

We noted above, and in an earlier report prepared for Grid Australia,⁵ that the small sample size makes it difficult to adequately incorporate all of the relevant environmental factors in the benchmarking analysis. If explanatory variables that drive differences between TNSPs are omitted from the analysis due to the small sample size, then differences in results between TNSPs are likely to reflect omitted variables, rather than being capable of being interpreted as 'inefficiency'.

³ AER, Explanatory Statement, Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution, August 2013, p. 92.

⁴ NERA Economic Consulting, Holistic Economic Benchmarking, Report of Gregory Houston, 20 September 2013, p. 12.

⁵ NERA Economic Consulting, Holistic Economic Benchmarking, Report of Gregory Houston, 20 September 2013, p. 9.

Consistent with its earlier statements,⁶ the AER comments on the importance of recognising the impact of these environmental factors in interpreting the results of the benchmarking measures in its draft Benchmarking Report.

it may not be possible to account for every environmental factor when conducting benchmarking analysis quantitatively. As such, qualitative consideration of the effect of operating environment conditions is required when interpreting benchmarking results. (AER, p. 19)

These sentiments are also consistent with commentary the AER provides in its draft Benchmarking Report in relation to the Partial Productivity Indicators (PPIs) it has derived. In discussing the variation in the PPIs between the TNSPs, the AER highlights the differences in the operating environments faced by the different TNSPs are being the possible drivers of the reported variations.⁷

However, the AER makes two comments in its draft Benchmarking Report that potentially run counter to the above approach, namely:

It may be that the net impact of some environmental factors will be immaterial to the consideration of efficiency. (AER, p. 19)

Further, the gap in relative efficiency may prove to be so great that environmental factors alone could not account for the difference in relative efficiency. (AER, p. 19)

It is not clear how it would be possible to determine *a priori* that the net impact of some environmental factors will be 'immaterial', without empirically testing whether and, if so, how much effect those factors have on a TNSP's expenditure.

Similarly, it is not clear how the AER would determine that the difference in the benchmark results between businesses was 'too great' to be explained by environmental factors alone. Without being able to measure the effect of environmental factors, a decision to label a 'gap' in the results as being 'too large' to be explained by these factors would remain essentially subjective.

Moreover, even if the AER were to decide that part of the 'gap' between the benchmarking results for the TNSPs was such that some of it must reflect differences in efficiency (rather than environmental factors), the difficulty of distinguishing between the environmental factors and efficiency would continue to limit the application of the benchmarking results. For example, if the AER were to seek to apply the results in the context of determining efficient operating and capital expenditure allowances, the inability to distinguish the extent of the impact of environmental factors is likely to limit the specificity of the conclusions that can be drawn from the analysis.

In interpreting the results of the benchmarking analysis, and in applying the resulting measures in the context of determining efficient expenditure allowances, it therefore remains important to recognise that the differences between TNSPs will reflect environmental factors that have not been incorporated in the analysis, as well as potential efficiency differences. It is not currently clear from the MTFP analysis exactly how environmental factors have been reflected in the analysis, outside of the way that inputs and outputs have been specified, and this issue is not discussed in the memorandum from Economic Insights.

⁶ AER, Explanatory Statement, Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution, August 2013, p. 116.

⁷ AER draft Annual Benchmarking Report, p. 29-32. Also discussed further in section 4.1 of this report.

3. Comments on the MTFP Analysis

In the time available to analyse the draft Benchmarking Report, we have had only a limited opportunity to interrogate the analysis undertaken by Economic Insights. Nevertheless, we have identified two principal shortcomings with the MTFP analysis put forward in the Economic Insights memorandum. In particular, the material set out in the memorandum does not:

- recognise the limitations inherent to the MTFP analysis; and
- identify that alternative, equally valid formulations of outputs and inputs lead to different results.

3.1 Inherent limitations of the MTFP analysis

An MTFP index is a ratio of business outputs to inputs over time. The selection of outputs and inputs included in the specification is a non-trivial process. Different choices will lead to different results, and may well affect the conclusions drawn from the analysis. Indeed, as discussed in section 3.2 below, this is the case with the MTFP model developed by Economic Insights, as it currently stands.

In many industries, there may be obvious input and output specifications. For example, a coffee vendor might measure output simply in terms of the number of coffees sold – a logical choice given that the single ostensible output of the business is servings of coffee (albeit, perhaps of different sizes). Such an output specification would be consistent with our intuitive understanding of the output of a coffee business, and so could be adopted to measure a business' productivity over time.

In contrast to the coffee vendor, an electricity transmission business is significantly more complicated. The value and cost of energy carried across the network is highly dependent on the time, location, and reliability of supply. Any specification of outputs and inputs for a TNSP must therefore consider outputs beyond the simple volume of delivered energy, eg, maximum demand and value of unserved energy.

The specification of outputs is therefore a non-trivial process, because our ability to describe and, more importantly, to understand the interaction of different outputs with one another is limited. Put another way, there is no obvious formula for the 'output' of a TNSP.

Given that we cannot derive an explicit formula for a TNSP's output, an MTFP analysis of electricity transmission businesses relies on assumptions as to:

- which outputs/inputs are to be included; and
- the interactions between each output – ie, the degree to which production of one dimension of output is dependent on or correlated with the production of other dimensions of output.

Having made these assumptions, it is then possible to examine whether the resulting MTFP indices exhibit properties consistent with our expectations. However, there is no objective means of determining that one specification is superior to another. Examination of the resulting indices can only demonstrate that a specification is *not inconsistent* with some intuitive understanding of network businesses. Indeed, it may well be that there is more than one specification that would not be inconsistent with such understanding.

In our opinion, Economic Insights' report does not adequately describe this limitation on the MTFP analysis. Further, the report contains several statements that appear to ignore this limitation, namely:

- '... output specification #2 appears to perform relatively well';
- '... the results obtained using output specification #3 did not appear to favour any particular type of TNSP'; and
- 'A potential disadvantage of the specification in this context is the multiplicative nature of the system capacity variable, which introduces a degree of non-linearity thereby potentially advantaging large NSPs'.

These statements are all predicated on an assumption that it is possible to measure the performance of a given output specification against some external benchmark. It is not.

Of particular concern is the statement that:

'... the results from [output specification #4] were considerably more dispersed than for specifications #2 and #3 with smaller TNSPs being relatively disadvantaged. We consequently believe this specification is less preferred than output specification #3.'

Economic Insights' report neither explicitly states the basis for its use of dispersion as a measure of an MTFP specification's performance, nor does it explain why dispersion is an undesirable trait of an MTFP index. Regardless, this statement implies that Economic Insights has adopted its own subjective system to rank for input/output specifications.

In summary, the Economic Insights memorandum does not acknowledge the inherent limitations of the MTFP analysis. Its analysis neither supports the chosen specification, nor detracts from any alternative.

We note that in its draft Benchmarking Report, the AER comments that:

Economic Insights considers that the model specification presented here is currently the most appropriate and we agree. (AER, p. 34)

Again, in terms of the criteria that have been applied in forming the conclusion that the proposed specification is 'the most appropriate', in our opinion there is no robust basis for the proposed model specification.

3.2 Alternative specifications lead to different results

We have explained that there is no objective means of assessing the appropriateness of any different input/output specification, and so alternative specifications are equally valid. Importantly, the adoption of several alternative specifications would significantly affect the results.

Given time constraints, we have not been able to replicate Economic Insights' methodology, and so have not been able to examine output/input specifications other than those considered by Economic Insights.

In the time that has been available, we have examined the results of the four different output specifications considered by Economic Insights. [Figure 1](#) sets out the MTFP indices resulting from each of these different output specifications.

Figure 1 – Comparison of MTFP index results (Output specifications 1 to 4)

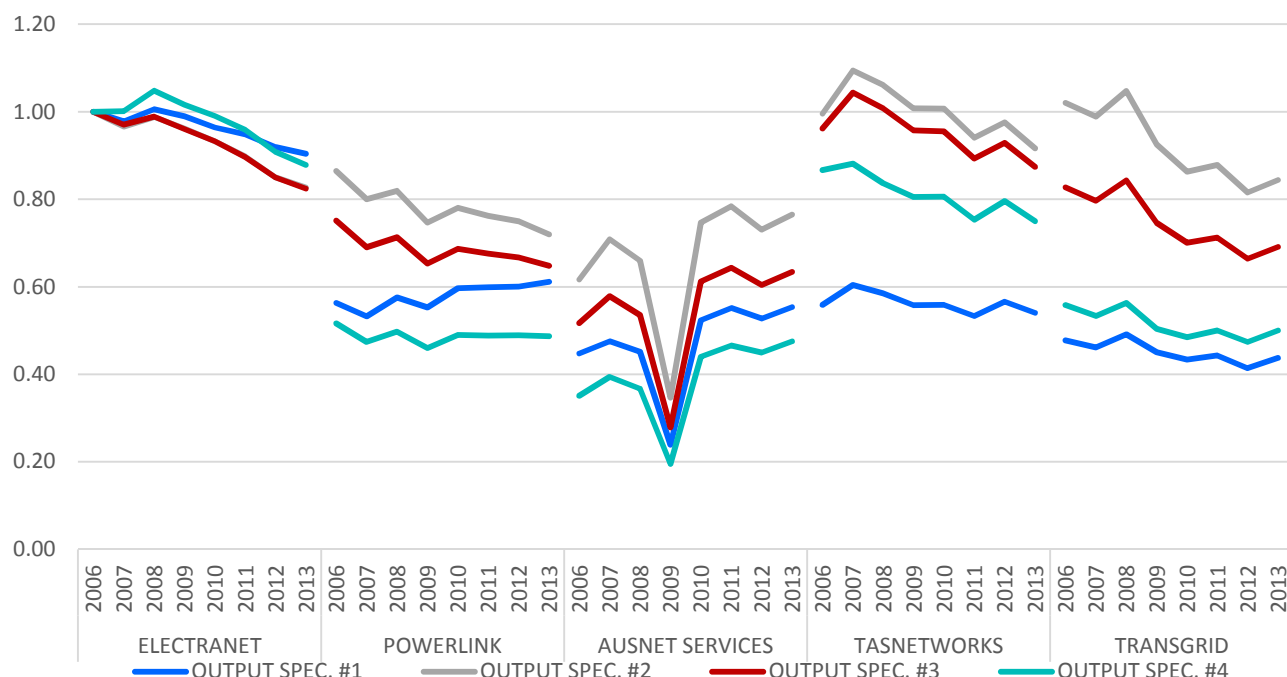


Figure 1 illustrates that, even using the four relatively similar specifications examined by Economic Insights, different specifications lead to significant variations in MTFP.⁸ For example, specification 1 suggests that ElectraNet has twice the MTFP of TransGrid and TasNetworks, whereas specification 2 suggests all three businesses have similar levels of productivity.

The variation in outcomes emphasises that the results of the analysis are heavily influenced by the decision to adopt one specification over another – a decision that we have already explained is inherently subjective.

Given that the AER has indicated a desire to use these results to compare performance across different businesses, it is also relevant that the ranking of TNSPs is highly conditional on the specification adopted. Table 1 compares the rankings of each TNSP (from most productive to least productive) for each output specification. The difference in outcomes across specifications is striking – only output specifications 2 and 3 produce the same set of rankings.

Table 1 – Comparison of TNSP rankings (Output specifications 1 to 4)

	ElectraNet	Powerlink	AusNet Services	TasNetworks	TransGrid
Output spec. 1	1	2	4	3	5
Output spec. 2	2	4	5	1	3
Output spec. 3	2	4	5	1	3
Output spec. 4	1	4	5	2	3

⁸ For ElectraNet the results under output specifications 2 and 3 are very close, and so do not show up separately in the figure.

The differing results suggest that the relative performance of TNSPs as measured by the MTFP index is highly conditional on the specification adopted. For this reason alone, we caution against drawing conclusions as to the relative productivity of any particular TNSP from this analysis.

3.3 Process for testing and refining MTFP model

We recognise that the AER is following a process of developing and refining the MTFP model, and that the results presented in the draft Annual Benchmarking report reflect the current model results. We also anticipate that further testing and refining of the model will be an on-going process. This is consistent with the iterative nature of such model development, with different model specifications being subject to assessment and modification in the light of actual data.

We have previously commented on the 'best practice' approach to the development of benchmarking models.⁹ We note that the AER is broadly following a model development process consistent with a best practice approach.

Specifically, the AER has made the underlying data on which its benchmarking models are based publicly available. It has also published the SHAZAM scripts that have been used to implement the MTFP models tested by Economic Insights. Together the data and information on the model specifications should allow interested parties to replicate the MTFP results, and to conduct their own independent analysis of the robustness of the results to changes in the assumptions.

We recognise that the data and model specification has been made available for this purpose. However, we note that direct replication is not a straightforward exercise, particularly given that SHAZAM is a proprietary piece of software.

We also note that the information that has been provided on the model specification has been provided separately from any particular revenue determination process. This is appropriate, because it allows the robustness of the model to be assessed prior to the model being applied. The robustness of the MTFP model is a key factor that will determine its credibility, and therefore the manner in which the results of the model could be applied as part of a revenue determination.

In our opinion, it is important that further testing and development of the MTFP model take place, prior to its being applied as part of a revenue determination process.

In addition to determining the robustness of the model, it is important to ensure that the data being used is subject to an adequate 'data cleaning' process, to ensure that, as far as possible, information is being reported on a consistent basis across businesses, and it therefore comparable. It is unlikely that all TNSPs currently collect and define data on the same basis, and historical data need not have been collected on a consistent basis. We noted previously that the data collection and model development process can be expected to be highly interactive, with the initial testing of the models being used to identify potential issues with the data used. From our preliminary examination of the MTFP data, the values for 'voltage of entry and exit points' appear somewhat surprising, with the values for ElectraNet being comparable to those of Powerlink and TransGrid. This may indicate differences in terms of the basis on which the data has been reported across the TNSPs (ie, whether the voltage has been measured at the 'high' or 'low' sides of the entry and exit points).

⁹ NERA Economic Consulting, Holistic Economic Benchmarking, Report of Gregory Houston, 20 September 2013. See section 3.2.

4. Application of comparative performance measures

The AER's draft Benchmarking Report has been produced in the context of the requirement in the NER for the AER to publish an annual benchmarking report for the transmission businesses.

In particular, under NER Ch 6A31 (a):

- (a) The AER must prepare and publish a network service provider performance report (an annual benchmarking report) the purpose of which is to describe, in reasonably plain language, *the relative efficiency* of each Transmission Network Service Provider in providing prescribed transmission services over a 12 month period. (emphasis added)

We note that this purpose is distinct from any application by the AER of benchmarking techniques as part of a specific revenue determination, and the related need to determine efficient expenditure allowances.

However, in the draft Benchmarking Report, the AER makes the following comments:

the benchmarking techniques in this report primarily assist us in forming a view on the productive efficiency of transmission networks [..]

Measuring productive efficiency will help us determine the efficient revenues for services to be used in setting prices [...] (p. 11)

The AER has earlier issued an Explanatory Statement in relation to its approach to expenditure assessment, in which it notes its intention to adopt benchmarking techniques as part of the revenue determination process.¹⁰ An earlier report for Grid Australia commented on the care that needs to be taken in applying the results from benchmarking analysis in determining the opex and capex expenditure allowances as part of a revenue determination.¹¹

The measures reported in the AER's draft Benchmarking Report comply with the requirement under the Rules to report on the TNSPs' relative performance. However, it is important to recognise the limitations of the measures reported in terms of providing a measure of relative efficiency that may be able to inform the determination of efficient expenditure allowances in the regulatory determination process.

In discussing the specific PPI results and the MTFP analysis, the AER is careful not to conclude that its analysis indicates differences in efficiency, and recognises a number of caveats that need to be applied in interpreting the results. It is important that these caveats and the inherent limitations of interpreting the measures as indicating relative efficiency, continue to be borne in mind in considering any application of these results as part of the revenue determination process.

4.1 PPI results driven by environmental factors

The AER's discussion in relation to the PPIs describes the differences in the measures (ie, the relative difference in costs between TNSPs), but, appropriately, does not equate these differences with

¹⁰ AER, Explanatory Statement, Expenditure Forecast Assessment Guideline, November 2013

¹¹ NERA Economic Consulting, Holistic Economic Benchmarking, Report of Gregory Houston, 20 September 2013

reflecting differences in efficiency. Rather, the AER notes that it is differences in the nature of the different networks and the external environment that are likely to be behind the differences in the indicators. For example:¹²

- Total cost per km of transmission route line length: 'TransGrid has the longest line length [...] and hence a lowest total cost per km of line length. Conversely, Transend has the shortest line length and as such performs worse under this measure than against the PPI of KV of entry/exit points.'
- Total cost per MW of maximum demand served: 'TransGrid performs well under this measure as it has the highest maximum demand of all the networks. Transend has the lowest maximum demand which may explain its high cost per MW of maximum demand.'
- Total cost per MVA of connection point capacity: 'Powerlink performs poorly under this measure [...] This may be because Powerlink has a significant number of connections to DNSP networks that are not through step-down transformers.'

The AER goes on to note that:

'[...] caution should be exercised in interpreting the results of the partial productivity indicators. The relative performance of the transmission networks differs depending upon the measure used. This could be attributable to differences in the nature of the transmission networks which mean that the relative quantum of their outputs differs depending on the measure selected.' (AER, p. 28)

The AER concludes that 'It is difficult to form conclusions about efficiency from observing the PPI benchmarks as the PPIs only consider the delivery of individual outputs'.¹³

In our opinion, it is actually *not possible* to form conclusions about efficiency from the PPI benchmarks reported by the AER. This is because those benchmarks do take not account of the environmental factors that affect the measures for each of the TNSPs. The fact that the different measures result in different rankings across the TNSPs is *prima facie* evidence that the measures are not reflective of underlying differences in the efficiency of the businesses.

This is not a criticism of the performance measures reported by the AER. As noted above, the AER is required to report on comparative performance under the NER, and itself recognises the importance of environmental factors in discussing its results in terms of each of the PPIs, and concludes that the partial nature of the indices means that no conclusions can be drawn in relation to overall performance. However it does mean that these measures will be of limited assistance to the AER in coming to a view on productive efficiency that will assist it in making its determination on efficient capex and opex expenditure as part of a regulatory determination.

4.2 MTFP results reflect productivity changes, distinct from efficiency

In its discussion of the MTFP results, the AER includes a substantial caveat that recognises the concerns discussed in section 2.1 above in relation to the ability to draw robust conclusions given the small sample size of TNSPs in the NEM:

Given the relatively low number of observations caution should be exercised when interpreting the finding of MTFP benchmarking. (AER, p. 35).

¹² See AER draft Annual Benchmarking Report, p. 29-32.

¹³ AER draft Annual Benchmarking Report, p.33.

It is important that this caveat continues to be borne in mind in considering the appropriateness of applying the results from the MTFP analysis to form a view on efficient capex and opex expenditure, as part of the regulatory determination process.

It is also important to recognise that the MTFP results reflect 'productivity', which is the rate at which a TNSP converts inputs to outputs. Productivity can be affected by factors external to the business, as well as the business' own efforts. As a result, measuring productivity is not equivalent to measuring the business' 'efficiency'. The difference again comes back to the importance of adequately accounting for the environmental factors that can affect the costs required by different TNSPs to produce the same output, as discussed in section 2.2. Differences between the MTFP measures for the TNSPs reflect both the impact of these environmental factors, where these have not been able to be incorporated in the models, as well as differences in efficiency.

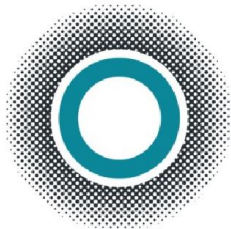
In discussing the MTFP results in its draft Benchmarking Report, the AER does refer to differences in productivity, rather than efficiency:

The analysis indicates that industry wide productivity has been declining. This is due to inputs increasing at a faster rate than outputs. (AER, p. 34)

However statements elsewhere in the draft Benchmarking Report are not always careful to recognise this distinction. For example:

Benchmarking measures the efficiency of [a] business in using inputs to produce outputs. (AER, p. 10)

Again, it will be important to remember the limitations in interpreting the MTFP results presented in the Annual Benchmarking Report as representing differences in efficiency between the businesses, (rather than simply differences that the model has not explained) in the event that the AER seeks to use these measures as part of its separate revenue determination process.



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