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Economic considerations for forecasting productivity in the DPP

Electricity Networks Association

31 January 2019

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1. Introduction and Summary

1. On 15 November 2018 the Commerce Commission released its issues paper on the 2020 reset of the default price-quality path (the **2020 DPP issues paper**[1]) for electricity distribution businesses (**EDBs**). In this paper, the Commission proposes to use an operating expenditure partial productivity factor (**opex PPF**) of 0%. The Commission further notes that it is "seeking any reasons and evidence for deviating from this assumption".
2. We have been asked by Electricity Networks Association (ENA) to prepare a short, high-level report that:
   a. Describes the role of the opex PPF in the DPP and the factors the Commission should take into account when setting the opex PPF;
   b. Reviews the Commission's logic for setting a 0% opex PPF assumption;
   c. Comments on the possible explanations and interpretations of negative measured historical productivity; and
   d. Comments on possible efficiency implications of setting a zero (or positive) opex PPF assumption when measured productivity is negative.
3. A high-level summary of our conclusions is as follows:
   a. Good measures of productivity do not pick up cyclicality, noise, catch-up and do not affect the incentives of EDBs to improve efficiency;
   b. The Commission's concerns about setting a negative opex PPF assumption are premised on the historical measure of productivity perfectly capturing the outputs and services provided by EDBs;
   c. If EBDs efficiently spend increasing amounts of money on *anything* that is not directly driven by changes in line-length, customer numbers, peak demand/system capacity or energy throughput, this will result in negative *measured* productivity, even if EDBs are becoming more efficient over time;[2]
   d. That is to say, negative measured productivity, rather than indicating that EDBs are becoming less productive over time, may instead demonstrate that the models used to measure productivity are wrong, or at least do not provide a complete measure of the outputs produced by EDBs.
   e. Electricity distribution networks are going through a transition. In general, this transition suggests the Commission should reassess the output specifications it uses to measure productivity (and by association, scale growth).
   f. Electricity consumption/throughput is not a key driver of EDB costs and should not be used in the output specifications. While this has always been the case, historically consumption was correlated with factors that do drive costs such as peak demand and the number of connections. However, in recent years consumption growth has slowed while peak demand and the number of connections has continued to grow. This decoupling makes its continued use problematic, as consumption is no longer proxying factors which do drive EDB costs.

[1] Commerce Commission, *Default price-quality paths for electricity distribution businesses from 1 April 2020: Issues paper*, 15 November 2018. Henceforth, the ***2020 DPP issues paper***

[2] Unless the efficiency gains achieved in delivering the assumed set of outputs are greater than the change in opex to deliver the other outputs.

g. If opex is forecast using the same outputs that demonstrate negative historical productivity, and forecasts of that measure are still negative, EDBs will be denied efficient cost recovery unless the opex PPF is negative.

h. In theory, this compensation could be provided by setting the PPF equal to zero and allowing for "step changes" in opex. However, the Commission's approach to step changes appears to be rigid and designed to account for some major/one-off changes to anticipated EDB costs. I.e. step changes will generally not account for a gradual transformation in the nature of outputs provided by EDBs, a misspecification that has persisted through time or a series of small one-off changes (the cumulative effect of which could be quite large).

i. Therefore, setting a negative opex PPF would be recognition that the output specifications, and the Commission's approach to step changes, are not perfect.

4. This report is set out as follows:

   a. Section 2 describes the role of the opex PPF and what a good productivity measure looks like; and

   b. Section 3 discusses the interpretation of negative measured partial productivity and the implications of setting a non-negative opex PPF factor if *measured* historical productivity is negative.

2. The role of the opex PPF in the DPP and implications for its measurement

5. In this section we:
   a. Give a brief overview of how the opex PPF fits within the Commission's price-quality path;
   b. Suggest some criteria the Commission could use when assessing different approaches to measuring (and forecasting) productivity; and
   c. Discuss the general preference for measuring productivity using long time series while also noting the current transition the energy sector is going through may be causing a "structural break".

2.1. The opex PPF is part of the trend in the "step and trend" approach to forecasting opex

6. When forecasting operating expenditure for EBDs subject to the DPP, the Commission uses the "step and trend" approach. Under this approach, a *base* level of historic opex[3] is adjusted for any *step changes*[4] and then *trended* forwards using the following formula:[5]

Box 1: Formula for calculating opex

$$\text{operating expenditure}_t = \text{operating expenditure}_{t-1} \times (1 + \Delta \text{ due to network scale effects}) \times (1 - \Delta \text{ partial productivity for operating expenditure}) \times (1 + \Delta \text{ input prices})$$

7. In this equation, the three trend factors are defined by the Commission as:[6]
   a. ***Network scale effects***: changes in the scale of the network affect operating expenditure due to changes in the level of service provided;
   b. ***Partial productivity for operating expenditure***: changes in productivity change the amount of operating expenditure needed to provide a given level of service; and
   c. ***Input prices***: changes in input prices affect the cost of providing a given level of service.

[3] This is the fourth year of preceding regulatory period. For DPP3 this will disclosed opex in 2019. For DPP2 it was the average of the 2013 and 2014 disclosure years.

[4] Step changes are changes in opex not included in the base year that are:

- significant;
- robustly verifiable;
- not captured by other components of the forecast;
- largely outside the control of the distributor; and
- applicable to most, if not all, distributors.

[5] For an overview of the Commission's approach, see NZ Commerce Commission, *Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020: Low cost forecasting approaches*, 28 November 2014.

[6] Commerce Commission, *Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020: Low cost forecasting approaches*, 28 November 2014, Box 3.1.

8. The partial productivity factor for operating expenditure (opex PPF) is the primary subject of this report. The Commission defines the opex PPF as follows:[7]

> *The operating expenditure partial productivity measures changes in the ratio of operational expenditure to associated outputs*

9. That is to say, productivity is measured by comparing changes in operating expenditure to changes in an *assumed set of outputs*. Therefore, it is not entirely accurate to say that measures of historic opex PPF measure the opex needed to provide a *given level of service*. These measures instead measure the changes in *total* opex relative to the amount of an *assumed* set of services/outputs.

10. As we discuss in section 3, one therefore needs to be confident the assumed outputs are an accurate reflection of what EDBs do (and therefore efficiently spend money on), before interpreting changes in the ratio as improvements (or otherwise) in "productivity".

2.2. Potential criteria for assessing productivity measures in light of the Part 4 purpose statement

11. The purpose statement in section 52A of the Commerce Act guides the Commission's decision making when setting the DPP and therefore the opex PPF assumption.[8] The Part 4 purpose is reproduced below:

> *The purpose of this Part is to promote the long-term benefit of consumers in markets referred to in section 52 by promoting outcomes that are consistent with outcomes produced in competitive markets such that suppliers of regulated goods or services—*
>
> > *(a) have incentives to innovate and to invest, including in replacement, upgraded, and new assets; and*
> >
> > *(b) have incentives to improve efficiency and provide services at a quality that reflects consumer demands; and*
> >
> > *(c) share with consumers the benefits of efficiency gains in the supply of the regulated goods or services, including through lower prices; and*
> >
> > *(d) are limited in their ability to extract excessive profits.*

12. 52A (b) and (c) are particularly relevant for how the Commission should approach the opex PPF. The opex PPF is a direct method of achieving the first limb of 52A (b) and 52A (c) as it is preemptively sharing efficiency gains with consumers by reducing forecast opex for an assumed productivity factor. The more general reference to promoting the "long-term benefit of consumers" and the inclusion in 52A (b) of providing services at a quality that consumers demand also suggests that the Commission should ensure that EDBs are able to recover their efficient costs under a DPP.[9] The statutory provisions and good regulatory practice should drive the criteria by which the Commission determines the opex PPF. To our knowledge, the Commission has not set out a comprehensive framework for how it should go about setting the opex PPF.

13. The "step and trend" approach is broadly similar to the "base-step-trend" approach the Australian Energy Regulator (AER) uses when preparing its alternative opex forecast, with the important

[7] Commerce Commission, *Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020: Low cost forecasting approaches*, 28 November 2014, footnote 14.

[8] E.g., the Commission notes that the DPP promotes the purpose of Part 4 at 2.9 of NZ Commerce Commission, *Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020: Main policy paper*, 28 November 2014.

[9] While EDBs obviously have the option to apply for customised price path (CPP), the DPP should presumably be designed in a way that industry wide drivers of efficient costs are compensated for, and the CPP is only used where individual circumstances differ from the assumptions used in the DPP.

distinction that the AER only uses that forecast if it doesn't accept a distributor's detailed opex proposal.[10] The Commission on the other hand does not have the same scope to depart from the step and trend forecast under the DPP. While there are other distinctions, the high-level approach to setting price-quality paths used by the Commerce Commission is broadly similar to that used by the AER when regulating electricity distributors. The AER also operates under a similar overriding statutory objective concerning the long term interest of consumers.[11] The AER is currently consulting on how it forecasts productivity for its price controls.[12] In an expert report we prepared as part of that process, we set out four criteria that should be used to asses any measure of productivity:[13]

a. **Approach captures underlying trends in productivity for DNSPs**: Any productivity assumption must reflect the productivity improvement that would be attainable by an efficient EDB. In other words, any measure of productivity should be electricity network specific and not pick up cyclicality/noise. One important factor likely to drive cyclicality is the age of the networks – with older networks likely requiring more intensive inspection and maintenance regimes.

b. **Approach separates productivity from catch-up**: Measured historical productivity may include inefficient firms "catching-up" to the frontier, rather than technological progress by efficient firms. Catch-up is unlikely to be replicable going forward, so the productivity adjustment should only reflect improvements in efficiency by efficient firms.

c. **Approach is objective and stable over time:** The approach adopted for measuring productivity should not be highly sensitive to start and end years and should demonstrate longer-term productivity trends. The approach should also be credible such that it can continue to use the approach in subsequent price control periods. Changing approaches frequently will risk perceptions of cherry-picking and could systematically deny cost recovery over time.

d. **Approach does not limit incentives to reduce costs:** The productivity adjustment should not introduce perverse incentives which would encourage EDBs to make business decisions with a view to influencing their current or future productivity targets. For example, if the opex PPF was set by reference to very recent, short term improvements in productivity, this would blunt the incentive to improve efficiency as this improvement would immediately be clawed back.[14]

14. While the statuary regimes are not identical, in our view adopting criteria like the above would promote the Part 4 purpose by giving EDBs the incentive to improve productivity while ensuring that EDBs are not denied efficient cost recovery, which is in the long term interests of consumers.

[10] For an overview of the AER's approach, see AER, *Expenditure Forecast Assessment Guideline: Explanatory Statement*, November 2013.

[11] The National Energy Objective (NEO), which has parallels to the 52A purpose statement, is as follows:

"to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

price, quality, safety and reliability and security of supply of electricity

the reliability, safety and security of the national electricity system."

[12] https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/review-of-our-approach-to-forecasting-opex-productivity-growth-for-electricity-distributors

[13] NERA, *Assessment of the AER's Proposed Productivity Assumptions*, 20 December 2018.

[14] Put another way, the productivity adjustment would begin to counteract the Incremental Rolling Incentive Scheme (IRIS) if it becomes too closely linked to recent efficiency gains.

15. While the criteria are fairly self-explanatory, it is worth briefly setting out the different ways in which one can control for catch-up, each of which varies in its complexity and stability, as set out in Table 1 below. Here "direct comparators" refers to using the firm/sector in question and making adjustments for catch up and "indirect comparators" refers to seeking other sectors that aren't affected by catch up, but whose productivity is otherwise driven by similar factors.

Table 1: Methods of controlling for catch-up/one-offs when measuring productivity

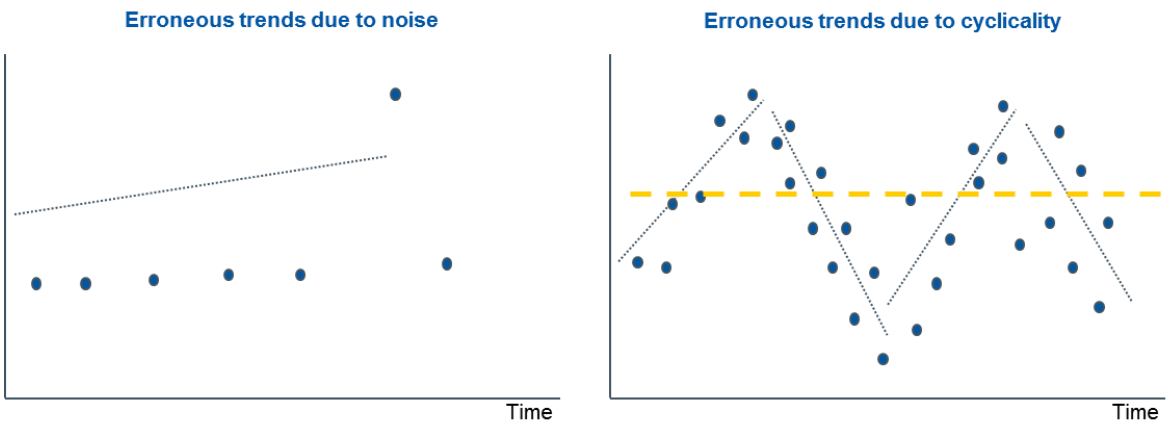
Option		Description of approach	Stability and simplicity
Direct comparators	Filtering	Remove inefficient firms and firms/time periods effected by structural change.	Requires either subjective judgements or a forensic assessment of each firm. The former is unlikely to be stable and the latter would be overly complex.
	Long term trends	By taking a long enough time series across firms, these issues "come out in the wash".	Simple and stable, but may not deal with industry wide changes (catch-up) if time period is too short.
	Econometrics	Try and achieve the same thing as filtering with econometrics.	Deals with subjective problems of filtering if the model is right.
Indirect comparators		Find other sectors expected to have similar gains and are unlikely to be experiencing catch-up.	More difficult as comparison needs to be appropriate and other sectors need to be tested for catch-up.

Source: NERA

2.3. Long-term series are generally preferable, but beware stale data and structural breaks

16. One commonality though is that whatever approach is used, a long enough time series is needed such that cyclicality and noise are reduced. I.e. if too short a time series is used, any measured trend in productivity may be simply picking up noise or measuring part of a productivity cycle, as demonstrated in Figure 1 below.

Figure 1: Measurement of erroneous trends when truncated data windows are used



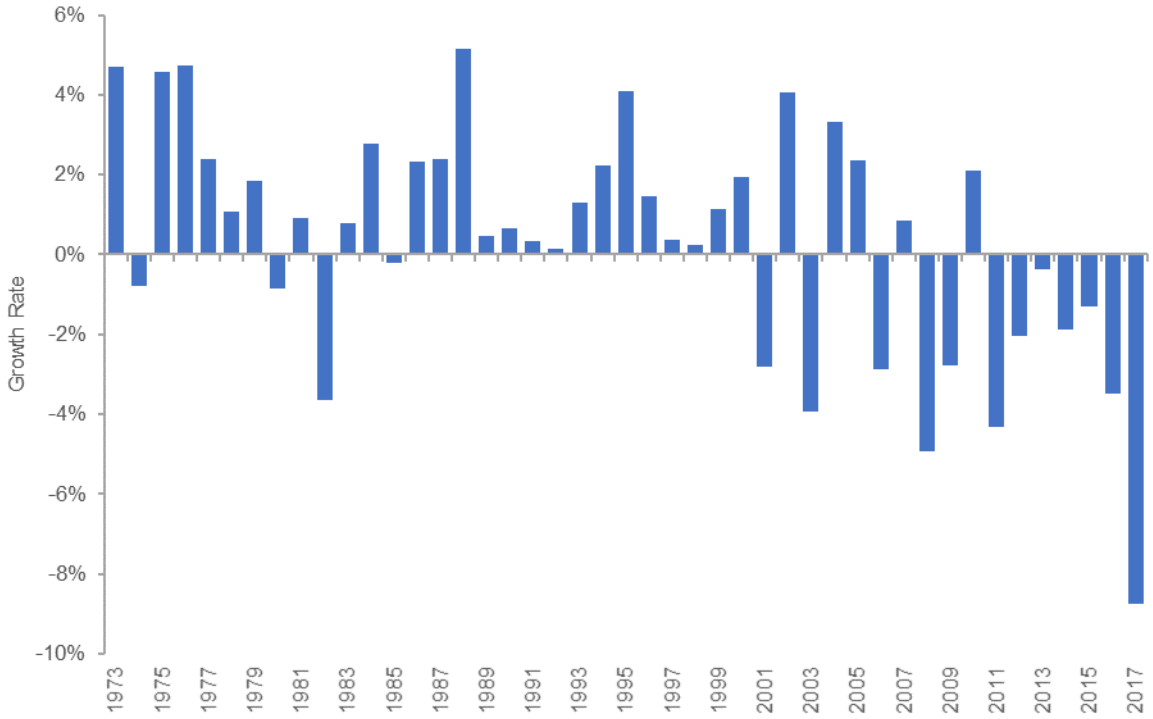
Source: NERA

17. However, there is a trade-off, going back too far can introduce data that is "stale" (i.e. does technological improvement by electricity networks in the 70s bear any relation to the forward looking gains achievable today?") and relatedly, one needs to be aware of "structural breaks".

18. The latter point is particularly important for EBDs given the current transition the energy sector and distribution networks in particular are going through. After long periods of growth in energy consumption, it has flattened in recent years, which is a reflection of the changing nature in the way distribution networks are being used.

19. A byproduct of this is that after long periods of historic measured productivity growth, in many jurisdictions productivity has now flipped to being negative. For example, in the US, measured total factor productivity (TFP) growth, having been positive since the 70s, has flipped to being negative since roughly the year 2000, as shown in Figure 2 below.

Figure 2: Average Growth in TFP, 65 US Electricity Distributors, 1973-2017



Source: NERA analysis on data from US Federal Energy Regulatory Commission[15]

20. A driver of this trend is that expenditures for activities related to electric vehicle charging, electrical storage, voltage optimisation, data management, and cybersecurity are now the norm in many US states. Recognising a growing mismatch between distributors' expenditure and traditional outputs like energy throughput, US regulators increasingly compensate distributors for alternative outputs linked to emerging policy and regulatory objectives.[16]

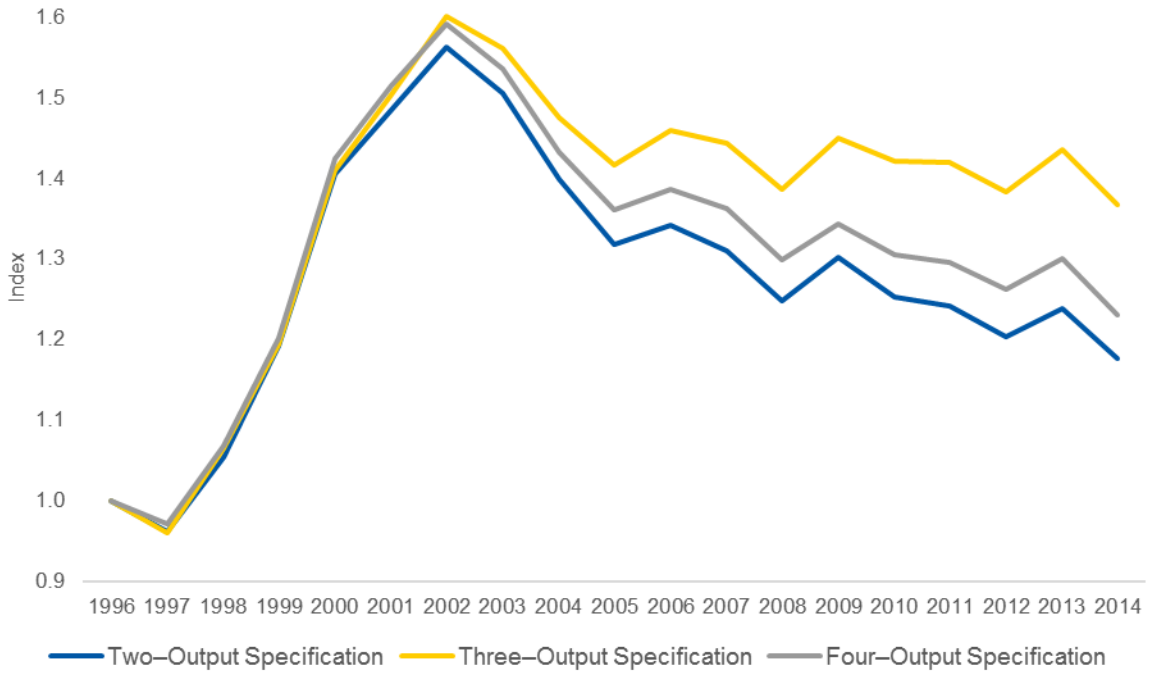
21. Similarly, in New Zealand recent measures of opex partial factor productivity are also negative. Figure 3 below shows historic opex PPF for New Zealand EDBs, as calculated by Economic

[15] Table US Federal Energy Regulatory Commission, Form 1. This figure originally appears in Makholm, J. D., The Rise and Decline of the X Factor in Performance-Based Electricity Regulation, *Electricity Journal* 31 (2018), p.38-41.

[16] E.g. in New York as part of the "Reforming the Energy Vision" (REV) initiative, the New York Public Service Commission authorised distributors to develop "Earnings Adjustment Mechanisms" (EAMs) that would reward distributors for contributing to peak reduction/system efficiency, energy efficiency, customer engagement, and improvements in the distributed generation interconnection process.

Insights (EI) for the Commerce Commission in 2014. Based on this measure, productivity fell between 2002 and 2014.

Figure 3: New Zealand opex partial factor productivity for EDBs declined between 2002 and 2014



Source: Economic Insights, Electricity Distribution Industry Productivity Analysis: 1996–2014, 30 October 2014.
Note: Two–Output specification: Customer nos (46%), Circuit length (54%)
Three–Output specification: Energy (22%), System capacity (kVA*kms) (49%), Customer nos (29%)
Four–Output specification: Energy (15%), Ratcheted maximum demand (15%), Customer nos (23%), Circuit length (47%)
Output cost shares in brackets

22. While the EI data for New Zealand is now four years old, and should be updated, this and the US data raises the question of whether there has been a "structural break" caused by a change in the nature of what electricity distribution networks do. The energy sector more generally is going through a large transition, driven by technological change, a desire to decarbonise and consumer preferences to have more localised control of energy supplies.

23. The Commission is cognisant of the changes that are occurring the energy sector. As part of the 2015 review of the Input Methodologies, the Commission consulted on the future impact of emerging technologies in the energy sector.[17] In its decision paper the Commission made the following observation about the changes afoot in the energy sector, including views of the joint MBIE and ENA Smart Grid Forum on changes in the way the grid will be used:

> *The prevailing consensus appears to be that the New Zealand electricity grid will continue to be needed and used by most consumers to satisfy their various energy requirements. However, the way those consumers use the grid, and in particular the distribution network, will evolve and change. At the outset of our IM review process, representatives from the Smart Grid Forum presented to a wide range of stakeholders at our IM forum on their work to date on emerging smart grid technology in the energy sector. Those representatives noted that the distribution network of the future will need:*

[17] Commerce Commission, *Input methodologies review decisions: Topic paper 3 – The future impact of emerging technologies in the energy sector*, 20 December 2016.

> *26.1 to be consumer centric – providing energy choices and options to consumers;*
>
> *26.2 to facilitate customer and third party transactions (open access), supplementing with locally generated electricity, and providing supply reliability and resilience; and*
>
> *26.3 the network operator to ensure:*
>
> *26.3.1 the safe and reliable operation of the network;*
>
> *26.3.2 systems stability, power quality and adequacy of supply; and*
>
> *26.3.3 the integrity of network assets.*

24. These changes in the way networks are/will be used are important in the context of the measuring and forecasting productivity of EDBs, given networks may be providing services that do not directly correspond to the outputs the Commission uses to measure productivity. For example, in 2018, regulatory expenditure (i.e. not solely opex) by EDBs included:[18]
    a. Network batteries;
    b. Smart grid assets (i.e. IT expenditure);
    c. Large distributed generation;
    d. EV chargers;
    e. Meters or home automation systems;
    f. Distributed batteries; and
    g. Distributed generation.
25. More generally, to the extent EBDs have and will continue to incur expenditure to meet growing customer service expectations, this will erroneously influence measured productivity if these services are not captured as outputs in any productivity calculation. For example, Attachment D of the *2020 DPP issues paper* discusses various quality of service (QoS) metrics that the Commission is considering implementing in DPP3, which flows on from work done on the same topic in 2014 for DPP2.[19]
26. Another issue, specific to measuring *partial* productivity for opex, is that it will be influenced by substitution between capital and opex. For example, if an EDB procures a non-network solution that counts as opex, this may show up as negative opex productivity, despite the EDB not becoming less efficient. A particular example of this is IT expenditure and the transition to software as a service (SaaS), which is recognised as opex.
27. One impact of this transition is that total energy consumption no longer tracks ratcheted maximum demand and system capacity. This is shown in Figure 4 below, demonstrating the decoupling of energy consumption from peak demand in roughly 2007. Changes in energy throughput do not drive changes in EDBs efficient costs, so throughput is not an appropriate

[18] https://comcom.govt.nz/__data/assets/pdf_file/0014/100661/Snapshot-of-EDBs-spend-on-e-tech-10-October-2018.pdf

[19] E.g. at D13 of the *2020 DPP issues paper*, the Commission notes the following dimensions of quality:

- providing high quality power supply;
- the time it takes to respond to a power cut;
- the time taken to answer the telephone;
- providing information on reasons for and the likely duration and extent of a power cut; and
- processing applications for new connections; and providing sufficient notice of shutdowns.

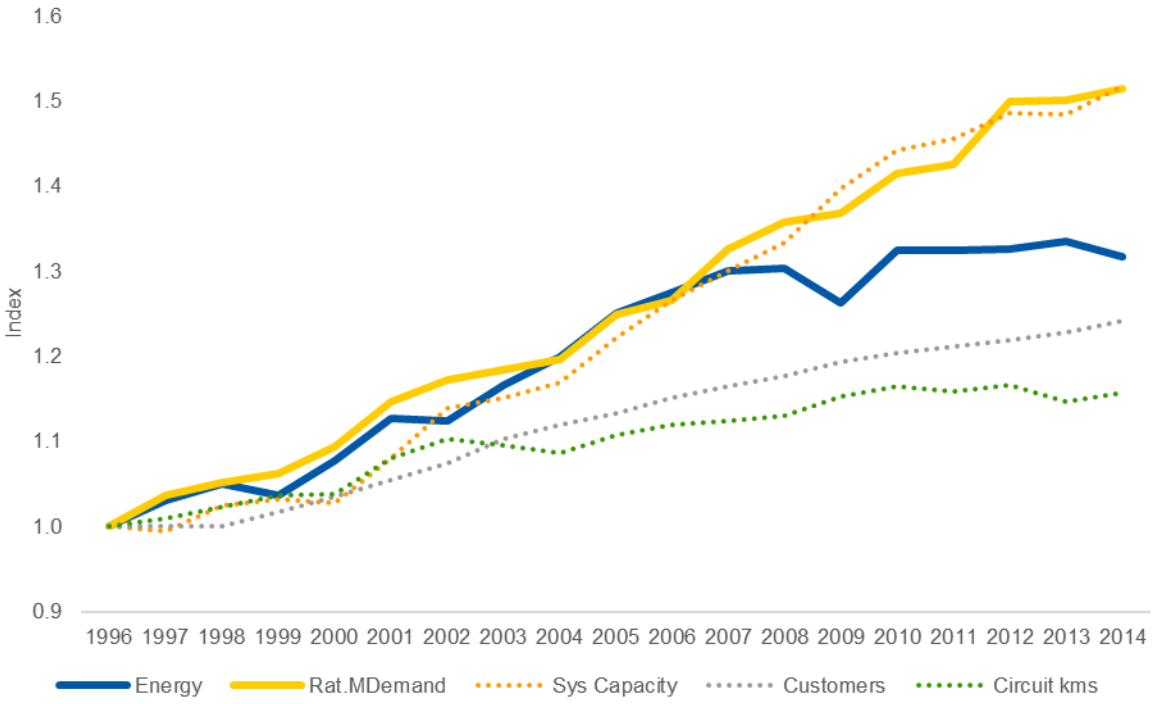
output in the productivity calculation. The AER noted this point in its 2018 Annual Benchmarking Report: [20]

> *Energy throughput is not considered a significant driver of costs (distribution networks are typically engineered to manage maximum demand rather than throughput…".*

28. Indeed, the link between energy throughput and costs could actually reverse - if the growth in distributed generation both reduces energy throughput while also imposing additional distribution costs that are not captured by customer numbers and ratcheted peak load. For example, DNSPs may need to expand network capacity (and incur any associated operating costs) to accommodate localised peaks in the export of embedded generation to other parts of the electricity distribution or transmission systems.

29. This data and discussion highlights that the Commission needs to think hard about whether historic relationships between outputs and inputs still hold and whether the outputs it uses are still a reasonably complete explanation of what drives costs, and therefore measured productivity, for EDBs.

Figure 4: New Zealand total electricity consumption decoupled from peak demand in ~2007



Source: EI 2014

[20] AER, *Annual Benchmarking Report – Electricity distribution network service providers*, November 2018, p.51.

3. How should negative productivity be interpreted when setting the DPP?

30. The Commerce Commission is currently grappling with how it should set the forward looking opex PPF assumption for DPP3, particularly if updated analysis continues to show negative measured productivity. Faced with negative measured productivity at DPP2, the Commission opted to set a negative opex PPF of -0.25% despite measured historic productivity appearing to be much lower. It did so on the basis that:[21]

    a. Partial productivity growth may be underestimated because of step changes in expenditure not associated with productivity;

    b. The potential adverse incentives created by adopting a negative growth rate which may entrench declines in partial productivity and weaken incentives to improve efficiency. Continuing productivity decline is not typically a feature of workably competitive markets; and

    c. There have been generally positive improvements in productivity in the electricity distribution industry overseas.

31. In its advice to the Commission at the time, Economic Insights attributes negative productivity to EBDs having overestimated output growth and expresses similar concerns about the adverse incentives created by adopting a negative opex PPF assumption, as well as the consistency of negative productivity with the workably competitive markets:[22]

> *Including a negative opex PFP growth rate in the opex rate of change formula also has potentially bad incentive properties. We have concerns with the incentive effects of including negative opex partial productivity growth rates in the rate of change formula – to some extent this would be akin to rewarding the EDBs for having previously overestimated future output growth and now entrenching productivity decline as the new norm. Such a situation is also arguably at odds with the workably competitive market assumptions in the Commerce Act. One would not expect to see ongoing productivity decline in a workably competitive market*

32. The AER is also currently grappling with the same issue and has made similar comments:[23]

> *However, we have not been satisfied that the past productivity growth that we have estimated occurred in 'business as usual' conditions. Consequently we have forecast zero productivity growth despite estimating negative historic productivity growth. We considered that a prudent and efficient distributor would not reduce its productivity over time unless it needed to increase its costs to meet a non-discretionary obligation. Given that we generally provide for the costs of new and material regulatory obligations through step changes, we have forecast zero productivity growth. We have previously stated that we did not consider the negative productivity growth we were seeing would continue. We expected distributors to make positive productivity growth in the medium to long term.*

33. The AER also agreed with submissions by the Consumer Challenge Panel (CCP) that it is reasonable to expect continuous improvement in productivity:[24]

> *It [the CCP] has argued that most businesses operating in competitive markets plan on continuous productivity gains. It also contended that meeting the national energy objective (NEO) means that network businesses need to be looking for positive productivity improvements each year. We agree*

[21] Commerce Commission, *Default price-quality paths for electricity distributors from 1 April 2015 to 31 March 2020: Low cost forecasting approaches*, 28 November 2014, par 3.32.

[22] Economic Insights, *Electricity Distribution Industry Productivity Analysis: 1996–2014*, 30 October 2014, pg iv.

[23] AER, *Forecasting productivity growth for electricity distributors: Draft decision paper*, November 2018, p. 22.

[24] AER, *Forecasting productivity growth for electricity distributors: Draft decision paper*, November 2018, p. 11.

with the CCP that it is reasonable to expect an efficient and prudent distributor to be continually looking for, and making, productivity gains.

34. We agree that it is reasonable to expect productivity improvements in workably competitive markets. However, to take that a step further and expect positive *measured* productivity, and therefore take a pejorative view of negative measured productivity, requires a belief that the chosen measure of productivity *perfectly captures the services and outputs provided by EDBs*.

35. Given the limited range of outputs included in EI's measure of productivity for EDBs, it should be of no surprise that productivity growth has been negative on average and neither should it be a surprise were that to continue in future. By definition, if EDBs spend additional money on *anything* besides the assumed outputs, then measured productivity will be declining. In other words, negative measured productivity may mean that the model being used to measure productivity is wrong, not that EDBs are getting less efficient.

36. Therefore, before being concerned that EDBs have been getting less efficient overtime, the Commission needs to be sure that the model that is being used to measure productivity accurately captures the services EDBs provide. In these circumstances, a negative opex PPF assumption would be recognition that opex needs to increase to take account of mismeasurement in the outputs provided by EDBs. Put another way, negative productivity growth assumptions in a price control may be consistent with (true) underlying productivity growth.

37. This misunderstanding of what *measured* productivity represents has led the AER, in its draft decision on forecasting productivity, to rule out any models of historic productivity that give a negative result and try to find alternative models (or time periods) that give a positive number. The Commission should not follow this path and instead:

    a. recognise that productivity measures are only as good as the outputs (and inputs[25]) used to compute them; and

    b. take into account the interaction of the opex PPF with the other aspects of the DPP.

38. Importantly, when there is negative measured productivity, if the same outputs are used for scale factors and step changes don't adequately compensate for any costs EDBs efficiently occur unrelated to the scale factors, EDBs will be denied efficient cost recovery unless a negative productivity factor is assumed. I.e. setting a negative factor would be an acknowledgment that the models are not perfect, rather than assuming inefficiency.

39. As we have already noted, increasing expectations around customer service and requiring EDBs to meet new quality of service targets/standards (that reflect consumer demands) will result in increased expenditure for services not picked up by the outputs used to measure productivity, and potentially not by the scale factors.

40. These changing expectations could in theory be dealt with through step changes to the base level of opex. However, it does not appear to be sufficient to rely on step changes, as alluded to by the Commerce Commission and the AER above. The threshold for step changes is high, in that they must be "significant" and "robustly verifiable"[26] and therefore is more likely to capture things like new regulatory or safety obligations imposed on EDBs. That is to say, step changes will generally not account for a gradual transformation in the nature of outputs provided by EDBs, a misspecification that has persisted through time, or a series of small one-off changes (which may a large cumulative effect).

[25] For opex PPF, the only input is opex. However, for total factor productivity (TFP) measures, other inputs (underground cables, overhead lines, transformers and capital) are used by EI in addition to opex.

[26] The Commission sets out these and other criteria at A17 of the *2020 DPP issues paper*.

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