Review of Submissions on Electricity Distribution Productivity

Report prepared for
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EXECUTIVE SUMMARY

The Commerce Commission has engaged Economic Insights to provide information to inform the Commission's decisions regarding the 2014 default price–quality path reset for the 17 non–exempt electricity distribution businesses (EDBs). The reset will involve either resetting EDB starting prices taking account of current and future profitability or, alternatively, rolling over the prices applying in the last year of the preceding regulatory period. If prices are reset, this will be done by the application of the building blocks methodology. Our recommendations on productivity growth rates and related parameters are presented in Economic Insights (2014a).

The Commission has also engaged Economic Insights to review material in submissions that relates to EDB productivity and that task is the subject of this report. We have reviewed the productivity study undertaken by Pacific Economics Group (PEG 2014a) and submitted by the Electricity Networks Association (ENA). And we reviewed the PEG (2014b) critique of our draft report, also submitted by the ENA. Most productivity–related material in other submissions draws on the ENA material.

Review of ENA/PEG productivity study

In undertaking our review of the PEG (2014a) productivity study of New Zealand EDBs we have identified a number of issues. These include:

- data period used is unnecessarily short and out of date
- output cost shares do not use New Zealand information
- opex series used does not adjust for differences in coverage before and after 2008
- capex series used before 2008 cannot be verified
- annual user cost (AUC) used appears to be too low and does not provide a good approximation to that used in building blocks regulation
- 'monetary' method used to proxy the capital input quantity appears to distort capital input and, hence, total factor productivity (TFP) growth rates
- inclusion of Orion will distort productivity growth rates due to the effects of the Christchurch earthquake
- there appears to be confusion over the way building blocks regulation works compared to productivity–based regulation, and
- benign acceptance of long–run negative productivity growth rates is questionable.

There are a number of factors which will lead the PEG (2014a) opex partial factor productivity (PFP) and TFP growth rates to underestimate EDB industry productivity growth. These range from the inclusion of Orion without adjusting for the effects of the Christchurch earthquake combined with the use of endpoint–to–endpoint growth rates to the use of depreciated asset value proxies for capital input quantity which overstate the increase in the annual capital input quantity.

Review of PEG critique for the ENA

Based on our review of the PEG (2014b) critique of our draft report, we have some areas of agreement and quite a few areas of disagreement. We agree it is desirable to have consistency in output and input specifications across the various components of the opex rate of change formula used to forecast opex under building blocks. Consequently, we include the Commission's two–output specification covering customer numbers and circuit length in Economic Insights (2014b) and use the All industries Labour cost index (as used by the Commission) to deflate the labour component of opex. We note there is no requirement for consistency between the specification used in the opex rate of change and the X factor under building blocks but adopt a similar specification in our discussion to avoid confusion.

The major areas of disagreement relate to:

- output specifications
- functional versus billed outputs
- capital input quantity proxies
- apparent confusion in PEG (2014a,b) over the way building blocks regulation works compared to productivity–based regulation, and
- implications of negative productivity growth estimates for regulatory parameters.

PEG (2014b) questions whether it is appropriate to include measures of system capacity as output measures in productivity calculations. We find this somewhat puzzling given that the PEG (2013) productivity benchmarking study for the Ontario Energy Board includes two functional outputs – one a measure of system capacity and the other of line length. The PEG (2013) four–output specification covers similar dimensions of system capacity to the system capacity output used in Economic Insights (2009a, 2014a) but improves upon our measure by including the components separately rather than in a multiplicative form and it also introduces an element of the demand–side to the system capacity measure. We also report this measure.

More broadly, it is certainly appropriate to include measures of system capacity as outputs in EDB productivity measures. EDBs are required to provide sufficient capacity to meet consumers' demand and throughput requirements at the places where consumers are located. The input requirements allowance in building blocks regulation is predicated on EDBs providing that capacity so it is appropriate – and only reasonable – to measure their performance by counting that capacity as part of the EDB's output.

The PEG (2014b) contention that measures of system capacity measures should not be included as outputs in EDB productivity studies thus has no merit in our view and runs counter to recent practice in PEG (2013).

PEG (2014b, p.16) contends that 'it is conceptually problematic to include unbilled, "functional" outputs in a productivity study used to set utility rates'. However, the discussion and example presented assumes a pure productivity–based regulation framework and is not relevant to how rates are set under a building blocks regulation framework. And, even under productivity–based regulation, it is not correct. This issue has been addressed in detail in appendix B3 of Economic Insights (2009a) and in our detailed technical report for the Commission (Economic Insights 2009b).

The PEG analysis is based on the inappropriate assumption of competitive conditions in the energy distribution industry. It does not take account of the increasing returns and sunk cost characteristics actually observed in the industry. For the purposes of productivity–based regulation of natural monopoly industries, it is desirable to include all economic or functional outputs (of which billable outputs will be a subset). As was demonstrated in Economic Insights (2009a,b), limiting coverage to only billed outputs and using revenue weights can actually introduce significant distortions, particularly if one X factor is to be applied across a diverse range of firms.

PEG (2014b, p.26) argues that 'physical capital metrics … do not reflect the costs of capital replacement spending'. The PEG proposition does not appear to recognise the important role that price resets play in all forms of building blocks regulation and in many forms of productivity–based regulation. An accurate representation of the case of increasing replacement capex is that the quantity of annual capital input only increases to the extent that system capacity is augmented by increases in line length or to the extent that old assets are replaced with new assets of higher capacity.

However, the value of the capital stock – and the annual user cost of capital – increases because the new assets now have many years of service left whereas the assets they replace only had a few years of service left. Hence, when a building blocks review takes place the higher cost of the replaced assets leads to a higher forecast revenue requirement, even though the EDB's productivity may not have been affected by the substitution of new assets for old assets. Under building blocks regulation, there will be a P_0 reset to equate forecast revenue with the higher forecast revenue requirement resulting from the replacement of some old capital with new capital. The reset will be done in such a way that ensures ex–ante financial capital maintenance is achieved whereas there is no guarantee of this in the mechanism proposed by PEG (2014b).

Furthermore, the use of so–called monetary proxies for the quantity of capital input can introduce significant distortions to productivity measures given the production characteristics of EDBs. This is particularly the case at times of increasing replacement capex.

PEG (2014b, pp.27–32) restates the contention that, because PEG (2014a) opex PFP and TFP growth rates have been negative for most of the decade to 2012, then opex PFP and TFP growth rates going forward will also be negative. In section 2 we present a number of factors which will lead the PEG (2014a) opex PFP and TFP growth rates to underestimate productivity growth.

Many of the EDB submissions the Commission has received highlight increasing responsibilities due to regulatory and legislative changes as a key reason for the steady increase in EDB opex over the past decade. Such increases in regulatory and legislative responsibilities are often described as step changes in building blocks regulation. They reflect the fact that opex is being applied to an expanding range of functions over time and so simply measuring opex PFP using an unchanged definition of outputs will lead to measured opex PFP understating underlying opex PFP growth because like is not being compared with like.

Failure to explicitly allow for these increases in EDB functions and responsibilities in the application of building blocks regulation by simply accepting both the increase in base year opex and the resulting lower measured productivity growth rates will lead to the EDBs being over–remunerated and ex–ante FCM not being satisfied. This is because like is not being

compared with like when productivity is being measured and output from the increased functions and responsibilities is not being recognised. The EDBs are then effectively compensated twice for the increased functions they have to perform – once through the additional costs being included in base year opex and, secondly, through a lower productivity growth rate being used in the opex rate of change formula. To maintain ex–ante FCM, it is necessary to either include the costs of the added functions in base year opex and use the higher opex PFP growth rate for like–with–like activities in the opex rate of change formula or to use the measured opex PFP growth rate in the rate of change formula but exclude the costs of new functions from base year opex.

Since it would be difficult to accurately identify the extent of costs associated with new functions and responsibilities given current reporting requirements, we believe the preferred option in this case is to use a higher opex PFP growth rate in the opex rate of change formula than that measured from reported data. Consequently, Economic Insights (2014b) recommends use of a zero per cent opex PFP growth rate.

The PEG (2014a,b) reports make no allowance for changing regulatory and legislative responsibilities of EDBs over time. We do, however, note that in the excerpt from PEG's work for the Ontario Energy Board quoted in PEG (2014b, pp.31–2), PEG expressed concern that inclusion of a negative productivity growth rate could 'double–count costs that are being recovered elsewhere'. This is similar to the point we make above regarding the effects of ignoring the effects of changing regulatory and legislative responsibilities on measured opex productivity growth and base year opex. PEG also quoted a potential move to 'decoupling' and the availability of multiple ratemaking options for EDBs as other reasons it recommended use of a zero productivity rate in Ontario even though measured productivity to 2012 was negative. We note that the effects of building block regulation are broadly similar to decoupling and New Zealand EDBs with unusual characteristics or facing special circumstances also have the option of applying for a Customised Price Path if the default price path proves to be too onerous. The reasons PEG gives for recommending a zero productivity growth rate in Ontario therefore appear to be broadly similar to the situation in New Zealand.

Based on our consideration of submissions on productivity matters received by the Commission and updating our EDB database to include 2014 data, in Economic Insights (2014b) we recommend:

- –1 per cent as the X factor in building blocks analyses where the Commission opts to reset EDB prices
- zero opex PFP growth rate to be used in the opex rate of change formula in building blocks analyses, and
- a productivity–based regulation X factor of –1.5 per cent where the Commission opts to roll over current EDB prices.

1 INTRODUCTION

Seventeen New Zealand electricity distribution businesses (EDBs) are currently subject to a default price–quality path under Part 4 of the Commerce Act 1986 (the Act). Four months before the end of the regulatory period the Commerce Commission is required to reset the default price–quality paths applying to each EDB. Amongst other things, the Commission must reset starting prices, rates of change and quality standards. These paths will take effect from 1 April 2015.

Section 53P(3) of the Act states that the starting prices must either be:

- the prices that applied at the end of the preceding regulatory period; or
- prices, determined by the Commission, that are based on the current and projected profitability of each EDB.

The rate of change is the annual rate at which EDBs' maximum allowed prices can increase. This is expressed in the form 'CPI–X', meaning prices are restricted from increasing by more than the rate of inflation, less a certain number of percentage points, termed an 'X–factor'.

Sections 53P(6) and 53P(10) of the Act set out the constraints for the Commission's work, including:

- the rate of change must be based on the long–run average productivity improvement rate achieved by either or both of EDBs in New Zealand, and suppliers in other comparable countries, using appropriate productivity measures, and
- the Commission may not use comparative benchmarking on efficiency to set starting prices, rates of change, quality standards, or incentives to improve quality of supply.

The Commission has engaged Economic Insights to provide an estimate of the productivity improvement rate to inform the 2014 default price–quality path reset. Economic Insights (2014a,b) provide our draft and final recommendations, respectively, to the Commission on:

- our estimate of the long–run productivity improvement rate in the electricity distribution industry
- our estimates of the operating expenditure (opex) and capital partial productivity improvement rates for the electricity distribution industry
- our recommendations on the X factor and opex partial productivity growth rates to be used in building blocks regulation (where the Commission decides to reset prices for EDBs) and on the X factor to be used in productivity–based regulation (where the Commission decides to roll–over existing EDB prices).

The Commission has also engaged Economic Insights to:

- provide material that responds to points made in submissions as identified by Economic Insights and/or requested by the Commission.

The latter task is the subject of this report. In section 2 we review the productivity study undertaken by Pacific Economics Group (PEG 2014a) and submitted by the Electricity Networks Association (ENA). In section 3 we respond to the PEG (2014b) review of our draft report submitted by the ENA and in section 4 we review productivity–related material in other submissions.

2 REVIEW OF PEG PRODUCTIVITY STUDY FOR THE ENA

PEG (2014a) reports the results of productivity analysis of the New Zealand electricity distribution industry undertaken for the ENA. The study reports results for the period 2001–2012 and covers all New Zealand EDBs.

As part of this review, the Commission requested additional information from the ENA in September 2014. This review takes account of the responses to those questions.

In undertaking our review of PEG (2014a) we have identified a number of issues with the study. These include:

- data period used is unnecessarily short and out of date
- output cost shares do not use New Zealand information
- opex series used does not adjust for differences in coverage before and after 2008
- capex series used before 2008 cannot be verified
- annual user cost (AUC) used appears to be too low and does not provide a good approximation to that used in building blocks regulation
- 'monetary' method used to proxy the capital input quantity appears to distort capital input and, hence, total factor productivity (TFP) growth rates
- inclusion of Orion will distort productivity growth rates due to the effects of the Christchurch earthquake
- there appears to be confusion over the way building blocks regulation works compared to productivity–based regulation, and
- benign acceptance of long–run negative productivity growth rates is questionable.

In this section we address each of these issues in turn.

Data period used

It is not clear why PEG (2014a) only presents results to 2012 when 2013 Information Disclosure Data (IDD) were available well before the PEG study was undertaken. IDD are filed in August each year. In response to the Commission's information request, PEG stated:

> 'The sample period for the data available to us in April and May 2014 only went through 2012. Therefore, to the best of our knowledge, 2013 data were not available at the time the study was undertaken.'

However, work for Economic Insights (2014a) was undertaken at the same time and 2013 IDD had then already been available for several months and were incorporated in our draft report. We note that Economic Insights (2014b) uses data up to and including 2014 and is therefore two years more current than PEG (2014a).

PEG (2014a, pp.7–8) also notes that although it had access to data from earlier periods – variously described as being from 1998 or 1999 – it decided to use data from 2001 onwards only as there were 'one–time, unusual events' affecting the EDBs over the period 1998–2000.

While the earlier PEG (2009) study failed to adjust opex for the very significant effects of the February 1998 Auckland CBD outage – and this distorted both the opex partial productivity and TFP results in PEG (2009) – Economic Insights staff have adjusted for the effects of this anomalous event in all their previous studies. Similarly, all productivity studies undertaken by Economic Insights staff have adjusted for the effects of reporting changes in 1999 resulting from the legal separation of EDB and retail activities.

All data used in the Economic Insights (2009a) report were made available to PEG on 16 May 2014 and the basis of adjustments for these 'one–time, unusual events' was fully explained. There thus appears to be no reason for PEG (2014a) to have not used data from 1996 onwards. Not doing so risks providing an unbalanced view of New Zealand EDB productivity growth being presented as the period from 2001 onwards largely excludes the period of rapid opex partial productivity growth and strong TFP growth which preceded the period of negative growth commencing in 2003. PEG (2014a) does not provide a justification for the representativeness or otherwise of its chosen sample period of 2001–2012

We conclude that PEG (2014a) uses data from a period which is unnecessarily short and out of date.

Basis of estimating output cost shares

PEG (2014a) uses output cost shares derived from PEG (2013) econometric results for the Ontario electricity distribution industry. We find this somewhat puzzling since at the Commission's productivity workshop held in May 2014 in response to a question from the Commission's John McLaren, Larry Kaufmann from PEG expressed the view that it is preferable to use output cost shares based on local jurisdictional data where possible. We agree with this view.

In response to a question on this issue in the Commission's information request, PEG attempt to justify the use of Ontario data by stating that more observations are available for Ontario to support estimation of a more complicated cost function. However, Economic Insights (2014a,b) estimate a simpler – and arguably more robust and reliable – cost function for New Zealand using 432 and 456 observations, respectively, covering 24 cross sections. These are relatively large numbers of observations for this type of study. We believe the latter is a preferable approach.

We have further concerns with the PEG (2014a) approach of estimating three–output and two–output model cost shares from econometric results for a four–output model. That is, PEG (2014a, p.8) estimates output cost shares from relative cost elasticity estimates from a subset of cost elasticities within the Ontario model. We believe it is preferable to estimate a cost function model which has the same number and type of outputs included as are being included in the productivity analysis.

PEG states in its response to the Commission's information request on this issue that 'Dr. Lawrence expressed some support for the quality of PEG's econometric work at the May 2014 workshop'. To be clear, Denis Lawrence expressed support for the specification of outputs in PEG (2013) including ratcheted maximum demand and line length – which he believes has considerable merit and which forms the basis of the four–output model in

Economic Insights (2014a,b). He did not make any comment on the quality of PEG's econometric work.

No adjustment of opex series

The opex series used in Economic Insights (2009a) used information on the direct costs per kilometre and indirect costs per customer from the IDD in place up to and including 2008. These series were found to provide the most accurate measure of actual input use by the EDBs. Other measures of opex included significant extraneous items such as line rental rebates for many EDBs. Unfortunately the collection of the direct costs per kilometre and indirect costs per customer series were discontinued with the introduction of the new IDD from 2008 onwards. For many EDBs there are significant gaps between 2008 opex using the direct costs per kilometre and indirect costs per customer from the previous IDD and 2008 opex reported using the current IDD – 2008 data were available on both bases. For 10 of the 28 EDBs, the difference between the series is more than 5 per cent with the maximum difference being over 60 per cent.

Economic Insights (2014a,b) addressed this problem by splicing the new IDD opex data onto the former direct costs per kilometre and indirect costs per customer series from the previous IDD. That is, 2008 opex for each EDB using the direct costs per kilometre and indirect costs per customer from the previous IDD is rolled forward by the percentage change in annual opex reported in the new IDD.

This inconsistency in the opex series pre and post 2008 was drawn to PEG's attention in our email of 16 May 2014. However, PEG's response to the Commission's information request indicates that it has simply joined the reported IDD opex for 2009–2012 onto the Economic Insights opex series for years up to and including 2008 without making any adjustment for the different reporting bases. While the distortion created by not adjusting opex to allow for the different reporting bases will be generally less at the aggregate level than at the individual EDB level (since EDB differences are not all of the same sign), an adjustment should have been made in PEG (2014a) to allow for the different reporting bases.

Capex series used

Capital expenditure data for New Zealand EDBs has a number of issues. The previous IDD reported capital expenditure using optimised deprival value unit rates rather than the actual value spent. This makes the previous IDD capex series unsuitable for use in perpetual inventory type calculations which roll depreciated asset values backwards and forwards from a given reference year. As a result, Economic Insights (2009a, 2014a,b) derive an imputed capex series for the industry as a whole for years prior to 2005. For 2005–2008 we sourced capex data from a special information request the Commission sent to EDBs in 2009 and from 2009 onwards we use the current IDD capex data.

The problem with the previous IDD's capex series was drawn to PEG's attention in our email of 16 May 2014. The Commission's information request asked PEG to 'document the sourcing of the capital expenditure variable used in forming the capital input variable and explain why you think this series accurately reflects actual spending by the businesses'. In its reply PEG simply stated 'Capital expenditures were calculated as the sum of the "Total

Capital Expenditure on System Assets" and "Capital Expenditure on Non-System Fixed Assets"'.

The capex data used in PEG (2014a) do not reconcile with the previous IDD capex data and no information has been provided on where they were sourced from or how they were calculated. Consequently, we have been unable to verify the capex data used in PEG (2014a). As a result, we recommend caution be exercised in any reliance on information from PEG (2014a) which uses capital data derived from the capex series used. This includes TFP estimates.

Annual user cost

PEG (2014a) uses the simple Jorgenson (1963) method to calculate capital annual user costs whereby the user cost is formed simply by multiplying the written down asset value by the sum of a depreciation rate and a real rate of return. This approach involves the assumption that depreciation is geometric in nature rather than straight–line in nature as commonly used in building blocks calculation of the regulated asset base (RAB). Geometric depreciation takes a constant proportion of the asset value each year as depreciation. This means an asset depreciates rapidly in its initial years and slowly in its later years whereas straight–line depreciation allocates the asset's initial cost in equal amounts over its lifetime. The Jorgenson geometric approach will provide only a very rough approximation, at best, to the principle of ex–ante financial capital maintenance which forms a cornerstone of building blocks regulation and the calculation of the return on and return of capital as key building block elements. The Jorgenson user cost does not take account of the increasing returns and sunk cost characteristics actually observed in the industry. The amortisation approach used in Economic Insights (2014a,b), on the other hand, provides a very close approximation to the annual user cost method used in building blocks.

We are also of the view that the parameters used in the PEG (2014a) user cost formula underestimate the true cost of capital. The depreciation rate used in PEG (2014a) is only a little over 3 per cent compared to the depreciation rate of 3.75 per cent using the average of the regulatory depreciation rates between 2005 and 2013 found in Economic Insights (2014a,b).

PEG (2014a) also uses a real rate of return of 4 per cent compared to the real pre–tax rate of return of 5.1 per cent used in Economic Insights (2014b) which is consistent with the latest Commerce Commission (2014c) rate of return decision.

The effects of these differences are highlighted by comparing the annual user cost values for the EDB industry in 2012. The aggregate user cost used in PEG (2014a) for 2012 is $641 million (including Orion) compared to $722 million (excluding Orion) in Economic Insights (2014b). The effect of PEG (2014a) using a relatively low depreciation rate and a low real rate of return will be to underweight capital inputs and overweight opex inputs in forming their TFP measure.

Measure used to proxy the capital input quantity

PEG (2014a) uses the constant price depreciated asset value to proxy the quantity of capital input in any given year. In our view this measure is not a good proxy for the annual quantity of capital input given the characteristics of electricity distribution assets. Electricity distribution poles, wires, cables and transformers are all long–lived assets that exhibit little reduction in their capacity to supply services over their lifetime, provided they are properly maintained. As such, their physical depreciation profile is close to that of 'one–hoss shay' whereby the annual input quantity the asset is able to provide to the production process is constant over its lifetime. One way of proxying the quantity of annual input from assets with this depreciation profile is by using the physical capacity of the assets. Another is to use the gross (ie undepreciated) asset value. We believe physical measures are likely to provide a more accurate proxy because EDBs in New Zealand generally have relatively good engineering records of assets installed but, until recently, there has been less emphasis on keeping detailed records of the historic cost of assets and, in some cases, such records may no longer exist. For the purpose of productivity analysis, reliance on optimised deprival value estimates of asset value is less preferred.

Using the constant price depreciated asset value as a proxy for capital input quantity introduces a number of potential inaccuracies. Firstly, PEG (2014a) forms it constant price depreciated asset value by using a geometric depreciation assumption which is not a good reflection of the physical characteristics of EDB assets. This assumption tends to overestimate the decline in the asset's ability to supply services to the production process over time.

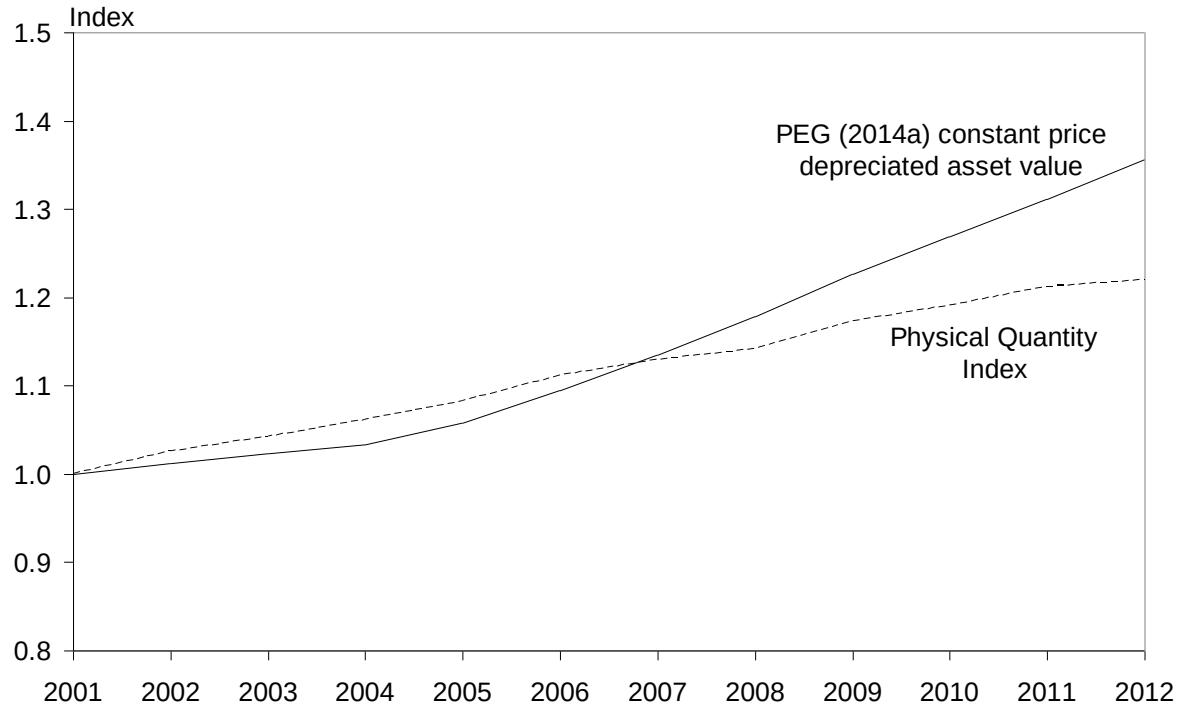
And, secondly, when a depreciated asset value measure is used, at each point in time capex (both replacement investment and new investment) is higher relative to the capital stock base than is the case with a physical proxy or a gross capital stock measure. This is particularly the case during periods of relatively high investment where it can produce a quite distorted measure of the capital input quantity. And this appears to be what is happening over the last several years in New Zealand when one examines the PEG (2014a) capital quantity measure.

Consider the situation when capex ramps up due to an increased need to replace aging assets which may have been installed over a relatively short period several decades ago. When the assets are replaced the ability of the capital stock to supply services will be little changed. That is, the capacity of the new assets will be similar to the assets they replaced (unless old assets are replaced by new, higher capacity assets) and so the quantity of annual capital input will be little changed. Indeed, it will only increase as the footprint of the network increases in response to population growth or as the capacity of assets is increased to meet higher levels of demand from existing customers. A physical quantity proxy as used in Economic Insights (2014a,b) will capture this situation accurately. However, a constant price depreciated asset value proxy such as that used in PEG (2014a) will overestimate the increase in capital quantity as the replacement capex comes into the asset base at full value to replace assets whose value has been depreciated to near zero – even though the new and old assets have similar capacity to provide annual inputs to production.

This situation is illustrated quite starkly in figure 1 where we plot the PEG (2014a) capital input quantity measure in index form and compare it to the physical quantity–based capital input quantity index from Economic Insights (2014b) covering overhead lines, underground

cables and transformers for the same period. The physical quantity–based index increases relatively evenly over the period at a modest annual rate of 1.8 per cent. The annual growth rate up to 2007 was 2 per cent while that from 2007 to 2012 was 1.5 per cent. By contrast, the constant price depreciated asset value measure used in PEG (2014a) increased at a faster annual average rate of 2.8 per cent over the whole period. But the asset value–based measure grew at an average annual rate of 2.1 per cent up to 2007 compared to a very large 3.6 per cent after 2007. According to PEG (2014b) it is the second half of the period when EDB replacement investment started to increase markedly. The physical quantity–based measure shows that the expansion of EDB capacity actually slowed down after 2007 but the depreciated asset value measure implies a large increase in the quantity of capital input after 2007, simply because replacement capex is then a larger proportion of a smaller depreciated asset base.

Figure 1: **Alternate indexes of capital input quantity, 2001–2012**



Source: Economic Insights EDB database and PEG (2014a, p.18)

Figure 1 clearly illustrates how use of the constant price depreciated asset value as a proxy for the capital input quantity in PEG (2014a) leads to an overestimate of the growth rate of capital input quantity, particularly at a time of increasing replacement investment. This will produce a corresponding underestimate of the TFP growth rate.

EDB coverage

PEG (2014a) includes all New Zealand EDBs in its industry coverage. The Commission's information request asked what, if any, adjustment had been made for the effects of the February 2011 Christchurch earthquake. In its response PEG indicated that no adjustment had been made.

The February 2011 Christchurch earthquake was one of the most severe natural disasters to affect a major southern hemisphere city in the last century. It caused major loss of life, widespread destruction of buildings and ongoing disruption to residents' daily lives. Large sections of the Christchurch CBD had to be abandoned for an extended period.

The effects of this major natural disaster on Orion, the local EDB, were severe. Orion's opex increased by 50 per cent in 2012. This increase represented over 4 per cent of the EDB industry's opex in 2012. As a result of the exceptional circumstances it faced as a result of the earthquake, Orion is the only New Zealand EDB to have been granted a customised price path to date.

Given the very unusual and disruptive circumstances Orion has faced in recent years, Economic Insights (2014a,b) excluded Orion from its industry and non–exempt EDB coverage rather than attempt to make an adjustment for the affects of the earthquake (given the limited information available on the ongoing impact of the earthquake at the time the studies were undertaken). To include Orion and not make any adjustment for the affects of the earthquake – as PEG (2014a) does – would be to bias productivity measures downwards. Again, this is a particular problem with PEG (2014a) due to its use of endpoint–to–endpoint growth rate measures and given that its time period finishes in 2012. This will cause PEG (2014a)'s opex partial productivity measure to be particularly biased downwards.

Confusion over forms of regulation

Both PEG (2014a,b) reports appear to exhibit some confusion over the way EDB price regulation works in New Zealand. In many cases explanations appear to confuse the operation of the high level building blocks method – which is likely to apply to most non–exempt EDBs – with 'pure' productivity–based regulation mechanisms. There also appears to be a lack of appreciation for the role of price resets which form an integral part of building blocks regulation and which have an impact broadly similar to what is described as 'decoupling' in North America.

This will be discussed at more length in the following section but, for now, the following quote from PEG (2014a, p.6) illustrates the point:

> 'The TFP estimate in the rate of change formula should have the same output specification used to project opex PFP. If this is not the case, the empirical parameters in the Commission's ratemaking formulae will be internally inconsistent.'

This statement is incorrect and simply does not reflect how building blocks regulation works. A projection of opex PFP is only used in the application of building blocks where it is one component of the opex rate of change method used to forecast the EDB's future opex requirements. The other components of the opex rate of change method are the growth rates in opex input prices and output (or scale). We agree it is desirable to have consistency within the opex rate of change formula itself between the specification of output (or scale) components and output components used in the opex PFP projection. However, there is no requirement for consistency between the specification used here and the TFP estimate used in setting the X factor.

Rather, the way building blocks works is that forecasts are made of the EDB's opex and capex requirements for the relevant period. These are then used to form a cost forecast based on the forecasts of opex requirements, the return of capital, the return on capital and taxes. Once that exercise is completed, a price reset or 'P_0' and an X factor are chosen to equate the NPV of the forecast revenue for the EDB, based on separate forecasts of movements in its billed output quantities, with the NPV of the cost forecast. There are an infinite number of P0 and X factor combinations that will achieve this equality. The Commerce Act specifies that the X factor should be set to reflect the long run productivity growth rate of the industry. But there is no requirement for consistency between the TFP specification used here and the opex PFP specification used in the opex rate of change formula. In building blocks regulation, the X factor is simply a price smoothing device that, along with the P_0 or price reset, equates the NPV of the forecast value of future revenue with the NPV of the forecast value of future costs.

It can thus be seen that building blocks regulation works in quite a different way to more pure productivity–based regulation which uses the so–called differential of differentials formula to set the X factor and where there is often no price reset. The Commission has indicated it will use the latter formula, should it decide to roll prices over for some EDBs rather than apply a building blocks–based price reset and X factor.

A detailed illustration of the differences between the building blocks and productivity–based regulation methods can be found in the models Economic Insights (2010) prepared for the Australian Energy Market Commission.

Benign acceptance of long–run negative productivity growth

PEG (2014a, p.34) argues that ongoing negative TFP and opex PFP trends should not necessarily be a cause for concern as:

> 'it simply means that the inputs needed for EDBs to provide service have been growing more rapidly than their outputs. This trend is clearly evident for the EDBs, which registered negative TFP growth in each of the last ten years for which data are available.'

Earlier PEG (2014a, p.17) stated that 'the relatively constant growth of opex inputs over time means the Commission can have a high degree of confidence that past opex PFP trends will be a good proxy for opex PFP trends going forward'.

We have concerns with the benign acceptance of negative productivity growth implicit in these statements. The second statement in particular could be interpreted as implying that because things have been getting worse for the past decade, you can be confident they will continue to get worse. While we acknowledge the distinction between the underlying state of technological knowledge in the electricity distribution industry and the impact of cyclical factors that may lead to periods of negative measured productivity growth, the latter would be expected to be very much the exception, step change issues aside.

We have concerns with the potentially adverse incentive effects of including negative opex partial productivity growth rates in the opex 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.

Many of the EDB submissions the Commission has received highlight increasing responsibilities due to regulatory and legislative changes as a key reason for the steady increase in EDB opex over the past decade. Such increases in regulatory and legislative responsibilities are often described as step changes in building blocks regulation. They reflect the fact that opex is being applied to an expanding range of functions over time and so simply measuring opex PFP using an unchanged definition of outputs will lead to measured opex PFP understating underlying opex PFP growth because like is not being compared with like.

All else equal, failure to allow for the effect of past reset opex step changes in subsequent resets will lead to EDBs being over–remunerated as the measured opex productivity growth rate will underestimate the actual opex productivity growth rate. The opex partial productivity growth rate used in the opex rate of change formula needs to reflect productivity growth excluding step changes or else, if measured opex productivity is used, negative step changes (ie reductions in base year opex) may be required to equate the net present value of the actual opex requirements going forward and the allowance resulting from application of the opex rate of change formula. To avoid negative step changes, this points to the use of a forecast productivity growth rate higher than measured from historic data spanning more than one regulatory period.

Because PEG (2014a) does not allow for the impact of step changes such as those documented in the EDBs' submissions, its measured opex PFP growth rate will underestimate the underlying rate of opex PFP growth for like–with–like functions – and this is quite apart from the other factors examined in this section which lead to underestimates of opex PFP and TFP growth rates. Unquestioning acceptance of negative productivity trends is also likely to have adverse incentive effects.

3 RESPONSE TO PEG REVIEW OF ECONOMIC INSIGHTS' DRAFT REPORT

The Commission has requested us to provide a response to the PEG (2014b) review of the Economic Insights (2014a) draft report. The PEG review was undertaken for and submitted by the ENA.

In this section we provide our response to PEG (2014b). In section 3.1 we commence by reviewing areas of agreement with the PEG review before moving to areas of disagreement in section 3.2.

3.1 Areas of agreement

A point consistently raised in submissions on productivity measurement aspects of the Commission's draft report, including in PEG (2014b), was that Economic Insights (2014a) did not include the two–output specification used by the Commission in other parts of its rate of change modelling of EDB opex requirements. The Commission's two–output specification includes customer numbers and line length and is used in the output (or scale) component of the opex rate of change formula. In Economic Insights (2014b) we have reported productivity results using the two–output specification (covering customer numbers and circuit length) used by the Commission, the three–output specification we have used in previous reports for the Commission (covering energy, system capacity and customer numbers), and the four–output specification used by PEG (2013) in benchmarking work for the Ontario regulator (covering energy, ratcheted maximum demand, customer numbers and circuit length). We use the Commission's two–output specification in discussing the opex productivity growth rate to be included in the opex rate of change formula.

As noted in the preceding section, under building blocks regulation there is no need for the same output specification to be used in the rate of change calculation of future opex requirements and for the overall X factor. This is because under building blocks regulation the X factor is simply a smoothing device for the price path over the regulatory period and the initial price reset is usually used to equate the net present values of forecast revenues and the revenue requirement subject to the chosen X factor. Hence, while the Commerce Act stipulates that the X factor should be based on the long–run average productivity improvement rate achieved by EDBs, there is no requirement for the productivity specification to be the same as that used in the opex rate of change formula. However, for simplicity and to avoid confusion, we recommend that the two–output specification also be used in the X factor calculation. Likewise, there is no real need for the time periods covered to be identical either but, for simplicity, we use the period 2004–2014 for all calculations.

PEG (2014b) also noted that Economic Insights (2014a) used the Electricity, gas, water and waste (EGWW) sector labour cost index to deflate the labour component of opex in its productivity calculations whereas the Commission had used the All industries labour cost index in its calculation of the opex input price component of the opex rate of change formula. To be consistent with the approach adopted by the Commission in other parts of its rate of change method of rolling forward opex input requirements, the all industries labour cost

index is used to measure the price of labour inputs in Economic Insights (2014b). In our earlier productivity studies for the Commission we have used the sector–specific labour cost index as the sole measure of EDB opex prices.

3.2 Areas of disagreement

There are a large number of arguments made in PEG (2014b) which we disagree with. Many of these issues have been discussed at length on previous occasions and we do not propose to again cover previous material in depth. For the record, however, we will summarise the important points and respond to new material. The major areas of disagreement relate to:

- output specifications
- functional versus billed outputs
- capital input quantity proxies
- confusion in PEG (2014a,b) over the way building blocks regulation works compared to productivity–based regulation, and
- implications of negative productivity growth estimates for regulatory parameters.

In this section we address each of these issues in turn.

Output specifications

PEG (2014b, pp.14–24) commences its discussion of output specification issues by questioning whether it is appropriate to include measures of system capacity as output measures in productivity calculations. It goes on to question whether it is appropriate to include anything as an output that is not directly charged for – that is, it effectively argues that only so–called 'billed' outputs should be included and no 'functional' outputs (ie outputs that are valued by the consumer but not explicitly charged for by the EDB) should be included.

We find this whole discussion in PEG (2014b) somewhat puzzling given that the PEG (2013) productivity benchmarking study for the Ontario Energy Board includes two functional outputs – one a measure of system capacity and the other of line length. As noted in the preceding section, we think the PEG (2013) four–output specification has considerable merit. It covers similar dimensions of system capacity to the system capacity output used in Economic Insights (2009a, 2014a) but improves upon our measure by including the components separately rather than in a multiplicative form and it also introduces an element of the demand–side to the system capacity measure.

More broadly, it is certainly appropriate to include measures of system capacity as outputs in EDB productivity measures. EDBs are required to provide sufficient capacity to meet consumers' demand and throughput requirements at the places where consumers are located. The input requirements allowance in building blocks regulation is predicated on EDBs providing that capacity so it is appropriate – and only reasonable – to measure their performance by counting that capacity as part of the EDB's output. A potential problem may arise though if too much emphasis is placed on supplying capacity and not enough emphasis is placed on supplying the capacity that is actually needed or demanded.

There is a long history of measuring both supply–side and demand–side measures of productivity in other infrastructure industries. Henscher et al (1992) provides an early example in public transport whereby the network operator's supply–side productivity is measured by including a measure of seat–kilometres as an output while their demand–side productivity is measured by including a measure of passenger–kilometres. Energy networks' productivity performance can be measured in similar ways.

The PEG (2013) measure of system capacity is a hybrid between supply–side and demand–side capacity. It is a measure of ratcheted maximum demand (also called 'system peak demand' in PEG 2013). This variable is simply the highest value of peak demand observed in the time period up to the year in question for each DNSP. It thus recognises capacity that has actually been used to satisfy demand and gives the DNSP credit for this capacity in subsequent years, even though annual peak demand may be lower in subsequent years. That is, although this measure is initially a measure of demand–side capacity, it would subsequently become a measure of supply–side capacity if peak demand fell.

PEG (2014a, p.15) also argues that the earlier Economic Insights system capacity measure uses the same transformer capacity and capacity adjusted line length measures as both outputs and inputs. This is not correct. The MVAkms capacity adjusted line length measure was used on the input side where it was divided into overhead and underground components which were separately weighted according to their respective costs. On the output side only line length (unadjusted for capacity differences) entered the calculation of system capacity. And, on the output side, only transformer capacity at the final level of transformation (ie the distribution transformer level) entered the calculation of system capacity whereas information on transformers at all transformation levels were included on the input side, where this was available. We thus believe there was more than adequate differentiation between the line length and transformation variables used to measure system capacity on the output side and to measure the capital input quantities on the input side. We do note, however, that this differentiation is further improved in the four–output functional specification used in PEG (2013) and which is included in Economic Insights (2014a,b).

PEG (2014b, pp.22–23) attempts to argue that continuing growth in the output specification containing a measure of system capacity used in Economic Insights (2014a) is not consistent with our statements that electricity distribution demand has slowed. Since electricity throughput received only a 25 per cent weight in that output specification while the other two outputs were customer numbers (which grows roughly in line with population growth) and system capacity (which continued to increase over the sample period), it is not surprising that the output measure continued to grow at a steady rate despite a reduced growth in energy delivered. We do not see this as a contradiction. It could, however, indicate that some degree of excess capacity may emerge going forward.

The PEG (2014b) contention that measures of system capacity should not be included as outputs in EDB productivity studies thus has no merit in our view and runs counter to recent practice in PEG (2013).

Functional versus billed outputs

PEG (2014b, p.16) makes the following statement:

> 'In PEG's opinion, it is conceptually problematic to include unbilled, "functional" outputs in a productivity study used to set utility rates.'

The report goes on to present a simple example of why PEG thinks including unbilled functional outputs will not allow the EDB to recover its costs. However, the analysis presented in PEG (2014b) on this subject is misguided on a number of fronts. Firstly, the discussion and example presented assumes a pure productivity–based regulation framework and is not relevant to how rates are set under a building blocks regulation framework. And, even under productivity–based regulation it is not correct. This issue has been addressed in detail in appendix B3 of Economic Insights (2009a) and in our detailed technical report for the Commission (Economic Insights 2009b).

PEG suggest that the measure of output used in the definition of TFP must be the same as that used for pricing purposes, with the implication that if an output measure is not priced then it should not be included in the calculation of TFP. However, this interpretation is based on the inappropriate assumption of competitive conditions in the energy distribution industry. It does not take account of the increasing returns and sunk cost characteristics actually observed in the industry. Economic Insights (2009b) shows that TFP can be decomposed into a pure technical change term and terms showing the divergence between price and marginal cost and the divergence between capital prices and the marginal saving in operating costs from capital investment where the industry in characterised by non–competitive conditions.

In particular, for the purposes of productivity–based regulation of natural monopoly industries, it is desirable to include all economic or functional outputs (of which billable outputs will be a subset). As was demonstrated in Economic Insights (2009a,b), limiting coverage to only billed outputs and using revenue weights can actually introduce significant distortions, particularly if one X factor is to be applied across a diverse range of firms.

And, in a building blocks framework, the PEG (2014b, p.16) proposition is not relevant as discussed in the preceding section because the elements of forecasting cost requirements to supply the functional outputs which the regulator makes allowance for and of setting prices so that forecasting revenue from billed outputs covers the forecast costs are quite separate. Productivity measures are mainly used in building blocks regulation to forecast future costs. The X factor in building blocks regulation is a price smoothing factor only and the 'heavy lifting' of ensuring forecast costs and revenues match (in NPV terms) is typically done by the reset or P_0 term.

The PEG (2014b) contention that functional output measures should not be included in productivity measures used in utility rate setting is thus not correct. It was disproved in Economic Insights (2009a,b) in the context of productivity–based regulation and is not relevant to building blocks regulation. It also runs counter to recent practice in PEG (2013).

Capital input quantity proxies

PEG (2014b, p.26) argues that 'physical capital metrics … do not reflect the costs of capital replacement spending'. PEG argue for the use of so–called monetary proxies for the capital input quantity instead. Although PEG's proposition is not clearly stated or explained, we assume they are arguing that in a period of increasing replacement capex, the 'monetary' proxy – because it is a net rather than gross capital stock measure – will show rapid increase and thus produce a lower TFP growth rate which would allow the EDB to recover its increased capital costs.

We have discussed at some length in section 2 how use of the constant price depreciated asset value as a proxy for capital input quantity does not accurately reflect the quantity of annual capital input given the relatively one–hoss–shay physical characteristics of EDB assets. We further illustrated in figure 1 how this is particularly problematic in a time of increasing replacement capex.

The PEG proposition does not appear to recognise the important role that price resets play in all forms of building blocks regulation and in many forms of productivity–based regulation. An accurate representation of the case of increasing replacement capex is that the quantity of annual capital input only increases to the extent that system capacity is augmented by increases in line length or to the extent that old assets are replaced with new assets of higher capacity. However, the value of the capital stock – and the annual user cost of capital – increases because the new assets now have many years of service left whereas the assets they replace only had a few years of service left. Hence, when a building blocks review takes place the higher cost of the replaced assets leads to a higher forecast revenue requirement, even though the EDB's productivity may not have been affected by the substitution of new assets for old assets (although there may be some change due to the increased weight being given to capital input with its now higher annual user cost).

Under building blocks regulation, there will be a P_0 reset to equate forecast revenue with the higher forecast revenue requirement resulting from the replacement of some old capital with new capital. Furthermore, the reset will be done in such a way that ensures ex–ante FCM is achieved. That is, the EDB will be given every opportunity to recover its costs, provided it operates efficiently. The cost recovery process that PEG (2014b, p.26) appears to advocate will be far less certain to allow the EDB's costs to be recovered as it only relies on a reduction in measured TFP growth to provide more revenue for the EDB. It was for this reason that the form of productivity–based regulation considered by the AEMC (2011) involved periodic price resets to equate EDB revenue with costs in the reset year.

A detailed illustration of how both building blocks and productivity–based regulation work when there is a large increase in replacement capex – sometimes somewhat colourfully described as the 'wall of wire' – can be found in the models Economic Insights (2010) prepared for the AEMC.

When the role of productivity and associated cost measures are considered within the broader regulatory framework applying in New Zealand, the concerns PEG (2014b) appears to express regarding the scope for cost recovery when physical proxies for the capital input quantity are used can be seen to be misplaced. Furthermore, the use of so–called monetary proxies for the quantity of capital input can introduce significant distortions given the production characteristics of EDBs.

Confusion over forms of regulation

As noted in section 2 and illustrated above, both PEG (2014a,b) reports appear to exhibit some confusion over the way EDB price regulation works in New Zealand. In many cases explanations appear to confuse the operation of the high level building blocks method – which is likely to apply to most non–exempt EDBs – with 'pure' productivity–based regulation mechanisms. There also appears to be a lack of appreciation for the role of price resets which form an integral part of building blocks regulation and which have an impact broadly similar to what is described as 'decoupling' in North America.

Implications of negative productivity growth estimates

PEG (2014b, pp.27–32) restates the contention that, because PEG (2014a) opex PFP and TFP growth rates have been negative for most of the decade to 2012, then opex PFP and TFP growth rates going forward will also be negative.

In section 2 we presented a number of factors which will lead the PEG (2014a) opex PFP and TFP growth rates to underestimate productivity growth. These range from the inclusion of Orion without adjusting for the effects of the Christchurch earthquake combined with the use of endpoint–to–endpoint growth rates to the use of depreciated asset value proxies for capital input quantity which overstate the increase in the annual capital input quantity.

In section 2 we also noted concerns with the potentially adverse incentive effects of including negative opex partial productivity growth rates in the opex 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.

As will be summarised in the following section, many of the EDB submissions the Commission has received highlight increasing responsibilities due to regulatory and legislative changes as a key reason for the steady increase in EDB opex over the past decade. Such increases in regulatory and legislative responsibilities are often described as step changes in building blocks regulation. They reflect the fact that opex is being applied to an expanding range of functions over time and so simply measuring opex PFP using an unchanged definition of outputs will lead to measured opex PFP understating underlying opex PFP growth because like is not being compared with like.

Failure to explicitly allow for these increases in EDB functions and responsibilities in the application of building blocks regulation by simply accepting both the increase in base year opex and the resulting lower measured productivity growth rates will lead to the EDBs being over–remunerated and ex–ante FCM not being satisfied. This is because like is not being compared with like when productivity is being measured and output from the increased functions and responsibilities is not being recognised. The EDBs are then effectively compensated twice for the increased functions they have to perform – once through the additional costs being included in base year opex and, secondly, through a lower productivity growth rate being used in the opex rate of change formula. To maintain ex–ante FCM, it is necessary to either include the costs of the added functions in base year opex and use the higher opex PFP growth rate for like–with–like activities in the opex rate of change formula

or to use the measured opex PFP growth rate in the rate of change formula but exclude the costs of new functions from base year opex.

Since it would be difficult to accurately identify the extent of costs associated with new functions and responsibilities given current reporting requirements, we believe the preferred option in this case is to use a higher opex PFP growth rate in the opex rate of change formula than that measured from reported data. Consequently, Economic Insights (2014b) recommends use of a zero per cent opex PFP growth rate.

The PEG (2014a,b) reports make no allowance for changing regulatory and legislative responsibilities of EDBs over time. We do, however, note that in the excerpt from PEG's work for the Ontario Energy Board quoted in PEG (2014b, pp.31–2), PEG expressed concern that inclusion of a negative productivity growth rate could 'double–count costs that are being recovered elsewhere'. This is similar to the point we make above regarding the effects of ignoring the effects of changing regulatory and legislative responsibilities on measured opex productivity growth and base year opex. PEG also quoted a potential move to 'decoupling' and the availability of multiple ratemaking options for EDBs as other reasons it recommended use of a zero productivity rate in Ontario even though measured productivity to 2012 was negative. We note that the effects of building block regulation are broadly similar to decoupling and New Zealand EDBs with unusual characteristics or facing special circumstances also have the option of applying for a Customised Price Path if the default price path proves to be too onerous. The reasons PEG gives for recommending a zero productivity growth rate in Ontario therefore appear to be broadly similar to the situation in New Zealand.

4 OTHER SUBMISSIONS ON PRODUCTIVITY

A number of EDBs made comments on productivity issues in their submissions on the Commission's draft report. Some of these submissions, such as ENA (2014a,b), simply repeat propositions advanced in PEG (2014a,b). As we have already responded to those points in sections 2 and 3, we will not repeat the response in this section.

Increased regulatory and legislative responsibilities

In sections 2 and 3 we highlighted the impact increased regulatory and legislative responsibilities can have on measured productivity and base year opex and how these need to be allowed for to avoid EDBs being over–remunerated. A number of EDBs and the ENA provided examples of how increased regulatory and legislative responsibilities have led to ongoing increases in opex.

ENA (2014a, p.14) stated:

> 'Factors in ENBs' operating environment that have given rise to increases in rising opex include changes to health and safety, ongoing increases in regulatory requirements, growing customer demands for quality of service such as those arising from Consumer Guarantees Act changes ... These factors are independent of the level of output used to calculate productivity.'

ENA (2014b, p.11) also stated:

> 'Factors such as the increasing prevalence of cycle lanes, which require extensive traffic management to keep cyclists separate from other traffic. This can drive significant costs in otherwise simple jobs.'

Powerco (2014, p.16) stated:

> 'A range of changes in our operating environment have imposed costs, such as tree management regulations, health and safety legislation …'

Network Tasman (2014, p.1) stated:

> 'EDB's growing obligations concerning traffic management, health and safety, consenting requirements, land access and tree management and growing industry regulatory burdens all mean that it is now more costly and resource intensive to provide the same outputs than it was in prior periods.'

More specific detail was provided by The Lines Company (2014, p.3) which stated:

> 'our opex has increased over time, and one of the key reasons for this is the increasing compliance requirements. Health and safety is one example. The increased levels of audit, oversight, reporting and control for health & safety has imposed increased costs in the order of two FTE's. Further, the continued development of work standards, most notably on equipotential zones and arc-flash impose overheads in the form of new personal protective equipment, training and lengthier actual work practices. … Other reasons we have increased opex since FY10 are related to our customer engagement model. Having a direct relationship

> with our customers necessitates having regulatory compliant billing processes and systems (e.g., Fair Trading, EGCC and Electricity Authority), credit and debt control facilitates, call centre operations, customer liaison, etc.'

While these are all examples of likely legitimate increases in expenditure EDBs have had to incur due to regulatory and legislative changes in responsibility, including these increased expenses in base year opex and also using the resulting lower measured opex PFP rate in the opex rate of change formula used in building blocks will lead to EDBs being compensated twice – once through the base year opex increase and, secondly, by the use of too low an opex PFP growth rate in the rate of change formula. As discussed in the preceding sections, to ensure ex–ante FCM is satisfied, either a higher opex PFP growth rate has to be used or a negative adjustment has to be made to base year opex.

Other points

Vector (2014, pp.21–2) argues that it 'defies logic' to recommend a different X factor based on whether building blocks or productivity–based regulation is used. This appears to show a lack of understanding of the way building blocks and productivity–based regulation mechanisms each operate. As discussed in sections 2 and 3, the differential of differentials mechanism is relevant to productivity–based regulation which the Commission has indicated it will use for any non–exempt EDB where it decides to roll prices over. However, for EDBs where the Commission decides price resets are required based on current and projected profitability, building blocks will be used and a more direct measure of EDB long run productivity growth is then appropriate as there is no logic to using the differential of differentials measure with building blocks.

We note that the wording of the section 53P(6) of the Commerce Act is as follows:

> 'The rate of change must be based on the long–run average productivity improvement rate achieved by either or both of suppliers in New Zealand, and suppliers in other comparable countries, of the relevant goods or services, *using whatever measures of productivity the Commission considers appropriate*.' (emphasis added).

We are of the view our recommendation for different X factor measures for building blocks regulation and productivity–based regulation – but both based on the long–run average productivity improvement rate – is consistent with the Act as well as being logically correct.

Finally, ENA (2014c, p.1) states the following:

> 'while Dr Lawrence is a recognised expert in calculating productivity measures, he is not an expert in the specific operations of electricity distribution businesses.'

A broadly similar statement is made in PwC (2014, p.10). For the record, while Denis Lawrence's training is in economics, his co–author John Kain is an electrical engineer who has held the positions of Chief Engineer and General Manager – Engineering of a major EDB. Economic Insights staff therefore do have collective expert knowledge of the specific operations of EDBs as well as of productivity measurement.

5 CONCLUSIONS

In undertaking our review of the PEG (2014a) productivity study of New Zealand EDBs we have identified a number of issues. These include:

- data period used is unnecessarily short and out of date
- output cost shares do not use New Zealand information
- opex series used does not adjust for differences in coverage before and after 2008
- capex series used before 2008 cannot be verified
- annual user cost (AUC) used appears to be too low and does not provide a good approximation to that used in building blocks regulation
- 'monetary' method used to proxy the capital input quantity appears to distort capital input and, hence, total factor productivity (TFP) growth rates
- inclusion of Orion will distort productivity growth rates due to the effects of the Christchurch earthquake
- there appears to be confusion over the way building blocks regulation works compared to productivity–based regulation, and
- benign acceptance of long–run negative productivity growth rates is questionable.

The capital input quantity proxy used and the inclusion of Orion, in particular, mean PEG (2014a) will tend to underestimate EDB industry TFP growth rates while the latter will lead to underestimation of opex PFP growth rates.

Based on our review of the PEG (2014b) critique of our draft report, we have some areas of agreement and quite a few areas of disagreement. We agree it is desirable to have consistency in output and input specifications across the various components of the opex rate of change formula used to forecast opex under building blocks. Consequently, we include the Commission's two–output specification covering customer numbers and circuit length in Economic Insights (2014b) and use the All industries Labour cost index to deflate the labour component of opex. We note there is no requirement for consistency between the specification used in the opex rate of change and the X factor under building blocks but adopt a similar specification in our discussion to avoid confusion.

The major areas of disagreement relate to:

- output specifications
- functional versus billed outputs
- capital input quantity proxies
- apparent confusion in PEG (2014a,b) over the way building blocks regulation works compared to productivity–based regulation, and
- implications of negative productivity growth estimates for regulatory parameters.

Most of the issues raised in PEG (2014b) have been previously addressed in Economic Insights (2009a,b). We have set out our response to the issues above in section 4 of this report.

Based on our consideration of submissions on productivity matters received by the Commission and updating our EDB database to include 2014 data, in Economic Insights (2014b) we recommend:

- –1 per cent as the X factor in building blocks analyses where the Commission opts to reset EDB prices
- zero opex PFP growth rate to be used in the opex rate of change formula in building blocks analyses, and
- a productivity–based regulation X factor of –1.5 per cent where the Commission opts to roll over current EDB prices.

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