Draft decision paper

Forecasting productivity growth for electricity distributors

November 2018

AUSTRALIAN ENERGY REGULATOR

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Request for submissions

The Australian Energy Regulator (AER) invites interested parties to make submissions on this draft decision by 21 December 2018.

We prefer that all submissions are in Microsoft Word or another text readable document format. Submissions on our draft decision paper should be sent to AERinquiry@aer.gov.au.

Alternatively, submissions can be sent to:

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We prefer that all submissions be publicly available to facilitate an informed and transparent consultative process. Submissions will be treated as public documents unless otherwise requested. Parties wishing to submit confidential information should:

- clearly identify the information that is the subject of the confidentiality claim
- provide a non-confidential version of the submission in a form suitable for publication.

We will place all non-confidential submissions on our website. For further information regarding our use and disclosure of information provided to us, see the ACCC/AER Information Policy (June 2014), which is available on our website.

Please direct enquires about this paper, or about lodging submissions to AERinquiry@aer.gov.au or to the transmission and gas branch of the AER on (03) 9290 6931.

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Overview

Productivity growth is one element in the trend component of our operating expenditure (opex) forecasting approach. Our productivity growth forecast is intended to capture the productivity improvements an efficient and prudent electricity distributor can make in providing distribution services. It reflects our best estimate of the shift in the productivity frontier. It is not intended to include any 'catch up' to the frontier for a distributor that is materially inefficient. We have outlined more details on how we use the forecast opex trend to assess distributors' opex proposals in our *Expenditure forecast assessment guideline* (the Guideline).

We have applied the same approach to forecasting productivity growth since we published the Guideline in 2013. We have applied this approach to all of the electricity distributors in the National Electricity Market (NEM). We think it is now an appropriate time to review this approach.

The measurement of productivity is an increasingly important regulatory tool. We use econometric models and multilateral partial factor productivity (MPFP) analysis to identify the productivity that can be achieved by the best performing networks, which we term as the 'frontier'. By measuring how the frontier has progressed in productivity, we gain an understanding of how productivity is changing over time within the industry. When assessing a distributor's opex proposal, we compare the distributor's productivity performance against that of the frontier to determine the distributor's efficiency in operating its network business. By including a productivity growth forecast that is consistent with the productivity growth observed in the industry, our opex forecast incorporates the expectation that an efficient and prudent distributor should achieve at least the same level of productivity growth as the frontier distributors. We consider such an opex forecast would reasonably reflect the opex criteria in the National Electricity Rules (NER).

Our productivity analysis shows that opex MPFP declined over the period 2006–12. Over the same period our econometric models estimated a negative time trend. However, we have not been satisfied that the negative productivity growth we were seeing reflected business as usual circumstances. During this time new regulatory obligations were introduced that significantly increased costs. Consequently, when we forecast opex productivity growth in our past determinations, we stated that we did not consider the negative productivity growth would continue and we expected distributors to make positive productivity growth in the medium to long term.[1] We therefore have been forecasting zero productivity growth.

We have continued to monitor opex productivity performance and evidence now suggests that distributors across the industry have improved their productivity performance since around 2012. This can be seen in the industry's opex MPFP performance for the period 2012–16. Given the positive opex productivity growth has persisted in recent years, we consider it timely and appropriate to reconsider how we forecast opex productivity growth going forward.

1 AER, *Ausgrid distribution determination 2014–19, Draft decision*, Attachment 7, November 2014, p. 154.

We have identified the following information sources that may help inform our approach to forecasting opex productivity growth:

- opex MPFP performance
- econometric opex cost function analysis
- labour productivity growth.

Drawing on these information sources, we have identified six options for forecasting opex productivity growth:

1. the status quo (zero productivity growth)
2. using the productivity growth from the increased proportion of undergrounding as estimated by our electricity distribution econometric studies (0.5 per cent productivity growth)
3. using the productivity growth from the increased proportion of undergrounding as estimated by our electricity distribution econometric studies, plus the time trend estimated in gas distribution econometric studies (1.0 per cent productivity growth)
4. using industry average opex MPFP growth, adjusted to remove catch up (1.6 per cent productivity growth)
5. labour productivity growth forecasts (0.9 per cent productivity growth)
6. a holistic approach that draws on all sources of information to forecast productivity growth (1.0 per cent productivity growth).

We are of the view that each of the available information sources is broadly consistent and when considered together support an opex productivity growth forecast between 0.5 and 1.6 per cent.

We do not consider option 1, the status quo, is a reasonable option because it does not account for the opex productivity growth from the change in the proportion of undergrounding. We understand that the proportion of undergrounding is a significant factor in driving lower operating and maintenance costs. We consider that our forecast of productivity growth should account for the impact of undergrounding, since it does not require distributors to otherwise change their technology or processes to achieve the associated productivity savings.

We consider option 2 is likely to understate the productivity growth that can be achieved because it does not account for relevant drivers of productivity growth. Specifically, it only accounts for productivity growth from the increasing proportion of undergrounding, and does not account for productivity growth that can be achieved by changes to technology or processes.

Option 4, which is based on opex MPFP growth over the period from 2012 to 2016, is likely to overstate forecast productivity. We consider that the MPFP growth we have seen since 2012 is unlikely to continue at the same rate. The MPFP growth we have observed since 2012 has been driven by various factors which we do not believe will persist. For instance, some distributors had drastically reduced their opex within this period in response to lower revenue allowances, privatisation or incentives introduced by economic benchmarking. All of

which are unlikely to impact on the distributors' opex going forward as they did within the 2012–16 period. Also, labour productivity growth is forecast to slow. For these reasons, we consider that productivity growth is unlikely to continue at the same rate as we have observed in recent years.

We note that options 3 and 5, produce similar forecasts of 1.0 per cent and 0.9 per cent respectively. We consider that these two options should be given more weight, since we consider them to be unbiased.

Our draft decision is to adopt a holistic approach to forecast productivity growth by relying on all information sources that reasonably reflect productivity expectations, that is, option 6. Having consider all the information available, and on the basis that both options 3 and 5 are close to, or equal to, 1.0 per cent, we are satisfied that this a reasonable expectation of the opex productivity growth that an efficient and prudent distributor can achieve.

We intend to use this opex productivity growth forecast of 1.0 per cent for our next regulatory determination for each electricity distributor. We would not expect that we would need to update this forecast unless there is a significant change in the underlying economic drivers.

We are seeking feedback on the opex productivity growth forecast of 1.0 per cent proposed in this paper. Throughout this paper we have posed a series of questions. We welcome stakeholders' answers to these questions as well as any other feedback stakeholders may have (see page 3 for details on how to make a submission).

This paper marks the start of our review of our approach to forecasting opex productivity growth. Table 1 sets out the steps in the process and indicative timing.

Table 1 indicative consultation timeframes

Key steps	Indicative dates
Workshop	December 2018
Submissions	due 21 December 2018
Publish final decision	February/March 2019
Submissions on implementation in open resets	March/April 2019

In addition to seeking submissions from interested stakeholders, we also intend to hold a workshop for interested stakeholders to discuss this review. We will provide details for this workshop on our website when they are finalised.

Once we have considered all submissions, and the views expressed at the workshop, we will publish our final position on our approach to forecasting opex productivity growth. We expect to publish this in the first quarter of 2019.

We intend to apply the productivity growth forecast we arrive at through this consultation process to the electricity distribution final decisions we will publish in April 2019. We will provide the relevant distributors an opportunity to submit their views on how we should apply our final decision on productivity growth to their specific circumstances. We will take those submissions into account in our final regulatory determinations for those distributors.

1 How do we currently forecast opex productivity growth?

Our role is to form a view about whether a business's forecast of total opex is reasonable. Specifically, we must form a view about whether a business's forecast of total opex 'reasonably reflects the opex criteria'.[2] In doing so, we must have regard to each of the opex factors specified in the National Electricity Rules (NER).[3]

If we are satisfied the business's forecast reasonably reflects the criteria, we accept the forecast.[4] If we are not satisfied, we substitute an alternative estimate that we are satisfied reasonably reflects the opex criteria for the business's forecast.[5]

The *Expenditure forecast assessment guideline* (the Guideline), together with an explanatory statement, set out our intended approach to assessing opex in accordance with the NER.[6]

We apply the assessment approach outlined in the Guideline to develop our estimate of a business's total opex requirements (our alternative estimate). Our alternative estimate serves two purposes. First, it provides a basis for testing whether a business's proposal is reasonable. Second, we can use it as a substitute forecast if a business's proposal does not reasonably reflect the opex criteria.

As set out in the Guideline, we use a base-step-trend approach to derive our alternative estimate. We call the trend component of this forecast the rate of change. To forecast the rate of change we forecast the growth in outputs, productivity and the price of inputs.[7]

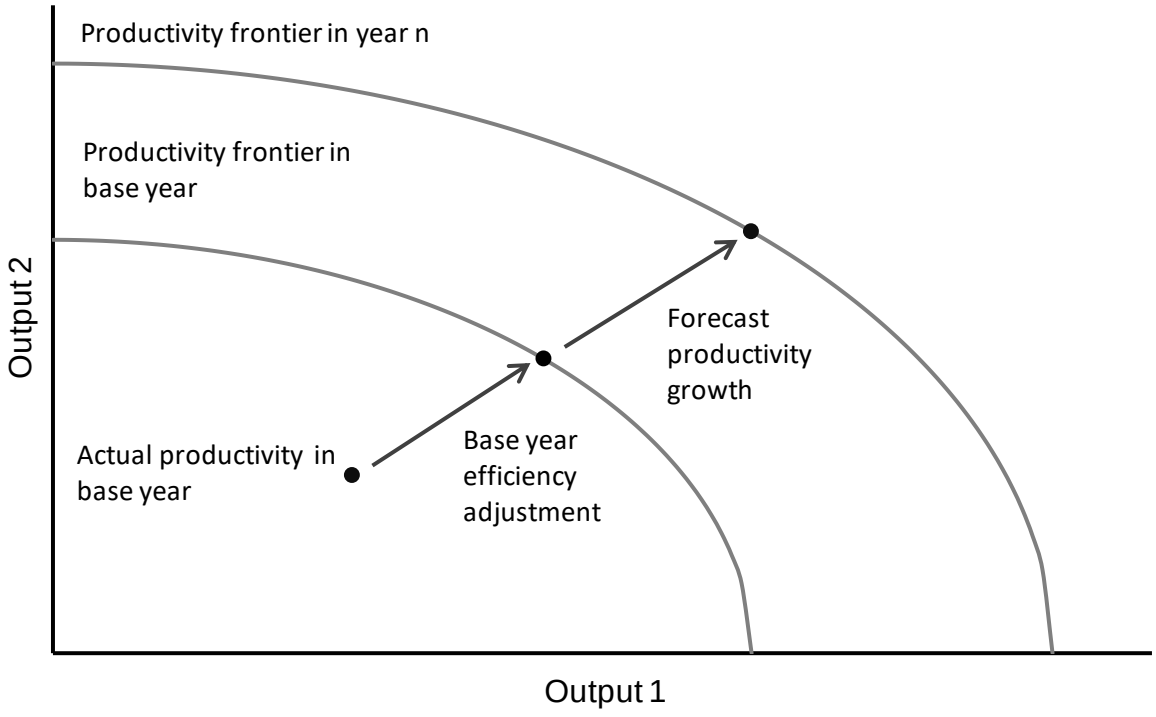
Productivity measures how much output can be produced using a given quantity of inputs. If a firm can produce more output using the same quantity of inputs then it has increased its productivity. By accounting for forecast price, output and productivity growth, we forecast the rate of change in opex required to deliver the forecast increase in outputs. It is important when forecasting the rate of change that the productivity growth forecast best reflects the same definitions of outputs and inputs used when forecasting output and price growth respectively. If the rate of change forecast is derived from a productivity growth measure that reflects different outputs and inputs, this inconsistency should be taken into account.

When we apply this approach it is important to remember that forecast opex must reflect the efficient costs of a prudent firm.[8] To do this it must reflect the productivity improvements a prudent and efficient distributor can reasonably be expected to achieve.[9] For this reason, our forecast of productivity growth reflects our best estimate of the shift in the productivity

2 NER, cl. 6.5.6(c).
3 NER, cl. 6.5.6(e).
4 NER, cl. 6.5.6(c).
5 NER, cll. 6.5.6(d) and 6.12.1(4)(ii).
6 AER, *Expenditure forecast assessment guideline for electricity distribution*, November 2013; AER, *Expenditure forecast assessment guideline*, Explanatory statement, November 2013.
7 AER, *Expenditure forecast assessment guideline for electricity distribution*, November 2013, pp. 23–24.
8 NER cll. 6.5.6(c)(1) and 6.5.6(c)(2).
9 AER, *Expenditure forecast assessment guideline*, Explanatory statement, November 2013, pp. 65–66.

frontier. Our productivity growth forecast should not include any productivity growth required for an inefficient firm to catch-up to the productivity frontier. If we consider that a distributor is materially inefficient, we make an efficiency adjustment to its revealed opex (also referred to as base opex).[10] This sets opex equal to the level required by an efficient and prudent firm on the productivity frontier in the base year. To the extent we think that the productivity frontier will shift over the forecast period, we account for this in the forecast productivity growth rate. We have demonstrated this in figure 1.

Figure 1 Forecast productivity growth is the forecast shift in the productivity frontier



Note: The productivity frontier represents the maximum quantity of outputs a firm can produce for a constant quantity of inputs. If a firm is under the productivity frontier then it is not producing the full quantity of outputs for the quantity of inputs it is using. If productivity improves, and more outputs can be produced from the same quantity of input then the frontier shifts out to the right.

The Guideline doesn't specify how we will forecast productivity growth. It simply states that in doing so we will likely consider (but may not be limited to):[11]

- forecast output growth
- forecast changes in the distributor's specific business conditions
- forecast technological change
- how close the distributor under consideration is to the efficient frontier in our benchmarking analysis

10 AER, *Expenditure forecast assessment guideline*, Explanatory statement, November 2013, p. 66.
11 AER, *Expenditure forecast assessment guideline*, November 2013, pp. 23–24.

- historical productivity performance
- any difference between industry average productivity change and the rate of productivity change at the efficient frontier.

Since publishing the Guideline in 2013 we have looked at the productivity growth estimated by our stochastic frontier analysis Cobb Douglas cost frontier model as the primary information source to inform our forecast of productivity growth. One advantage of this approach, and one reason why we adopted it, was for consistency between our productivity, output and price growth forecasts. We used the output weights estimated by the same model to forecast output growth.

If we are going to use historic productivity growth to forecast we need to be satisfied that past productivity performance is reflective of what can be achieved going forward. However, we have not been satisfied that the past productivity growth that we have estimated, particularly for the period 2006 to 2012, occurred in 'business as usual' conditions. This reflects the significant new regulatory obligations that distributors were required to meet, and which required significantly increased opex, but with no change in measured output. Consequently we did not use the estimated negative historic productivity growth to forecast opex productivity growth.

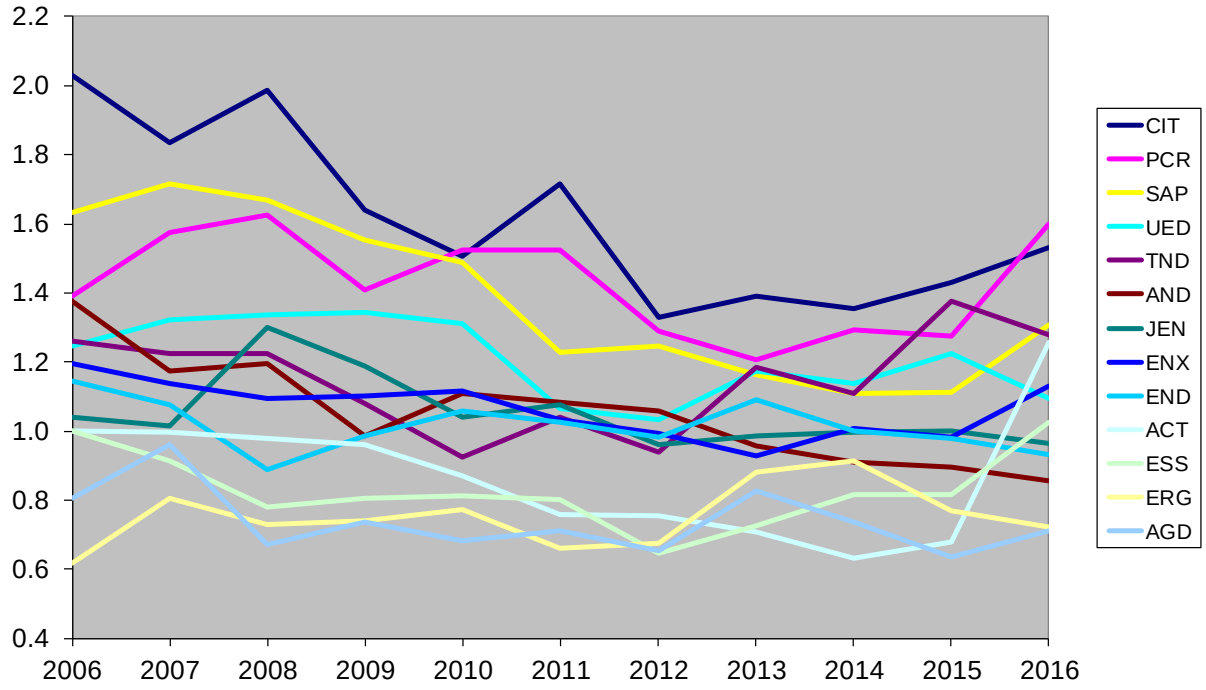
We considered that a prudent and efficient distributor would not reduce its productivity over time unless it needed to increase its costs to meet a non-discretionary obligation. Given that we generally fund the costs of new and material regulatory obligations through step changes we have, in the past, forecast zero productivity growth. We maintain the view that, as long we provide step changes for the costs of new regulatory obligations, forecast productivity growth should be non-negative. 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.[12]

12 AER, *Ausgrid distribution determination 2014–19, Draft decision*, Attachment 7, November 2014, p. 154.

2 Why are we reviewing our approach?

We have continued to monitor opex productivity performance and evidence now suggests that distributors across the industry have improved their opex productivity performance since around 2012. This can be seen in the industry's opex MPFP performance (figure 2).

Figure 2 Opex multilateral partial factor productivity, 2006 to 2016



Source: Economic Insights, *Economic benchmarking results for the Australian Energy Regulator's 2017 DNSP benchmarking report*, 31 October 2017, p. 16.

We also note that we have applied the same approach to forecasting productivity growth since we published the Guideline in 2013. We have now applied this approach to all of the electricity distributors in the NEM. Given this, and the apparent opex productivity growth since 2012, we consider it is an appropriate time to reconsider how we forecast opex productivity growth.

We also acknowledge that, in the context of the current NSW, ACT, Tasmania and Northern Territory resets, the Consumer Challenge Panel (CCP) has submitted that it is reasonable to expect continuous improvement in productivity. It 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.[13] We agree with the CCP that it is reasonable

13 Consumer Challenge Panel, *CCP10 Response to Evoenergy regulatory Proposal 2019–24 and AER Issues Paper*, May 2018, p. 12.

to expect an efficient and prudent distributor to be continually looking for, and making, productivity gains.

It is important to note that we are not proposing a change in how we incorporate productivity growth in our approach to forecasting opex. We have not changed our view that we should include forecast productivity growth in our alternative opex estimate, and that forecast should reflect our best estimate of the shift in the productivity frontier.[14] We have been forecasting zero productivity growth because we considered that to be the best estimate of productivity growth, not because we thought productivity growth should not be included from our alternative opex estimate.

14 AER, *Expenditure forecast assessment guideline*, Explanatory statement, November 2013, pp. 65–66.

3 What information is available?

To help inform our forecast of opex productivity growth, we have identified the following relevant information sources:

- opex MPFP performance
- econometric opex cost function analysis
- labour productivity growth

We have examined information specific to electricity distribution, gas distribution, the broader utilities sector and the Australian economy as a whole.

We consider each of these information sources below.

Question 1: Are there any other sources of information, for example, any economy wide measures of productivity growth, that we should take into account when we forecast opex productivity growth?

Question 2: Should all information sources be given equal weight or should we give greater or lesser weight to specific sources? If we should give greater or lesser weight to a specific information source, which source and why?

3.1 Opex MPFP performance

Opex MPFP is measured by comparing the quantity of specified outputs produced to the quantity of opex used. In this sense it is 'partial' in that it doesn't look at the total quantity of inputs used. That is, it only looks at opex and does not include the quantity of capex inputs used.

We have seen the opex MPFP performance of electricity distributors improve since 2012 (see figure 2). Because forecast productivity growth should only represent the forecast shift in the productivity frontier we need to consider whether performance since 2012 includes any frontier 'catch-up'.

To identify any catch-up we have identified the distributors that we found to be materially inefficient in our most recent determination (see Table 2). Some of these distributors have since achieved very strong opex MPFP growth, for example Essential Energy and Evoenergy, and we consider this likely represents catch-up. For those distributors that we did not find to be materially inefficient, annual productivity growth since 2012 has ranged from –5.3 per cent to 7.7 per cent. Average annual productivity growth for those distributors was 1.6 per cent.

Table 2 Average annual opex MPFP growth by business, per cent

Distributor	Current period	Base year efficient?	Average annual opex MPFP growth		
			2006–16	2006–12	2012–16
Evoenergy	2014–19	No	2.3	–4.7	12.7
Ausgrid	2014–19	No	–1.2	–3.5	2.2
CitiPower	2016–20	Yes	–2.8	–7.1	3.6
Endeavour Energy	2014–19	Yes	–2.1	–2.5	–1.4
Energex	2015–20	No	–0.6	–3.1	3.3
Ergon	2015–20	Yes	1.6	1.5	1.6
Essential Energy	2014–19	No	0.3	–7.3	11.5
Jemena	2016–20	Yes	–0.7	–1.3	0.1
Powercor	2016–20	Yes	1.4	–1.2	5.4
SA Power Networks	2015–20	Yes	–2.2	–4.5	1.2
AusNet Services	2016–20	Yes	–4.7	–4.4	–5.3
TasNetworks	2017–19	Yes	0.1	–4.9	7.7
United Energy Distribution	2016–20	Yes	–1.3	–3.1	1.4
Industry average			**–0.9**	**–3.5**	**3.0**

Note: Distributors marked with an asterisk are those we found to be materially inefficient in our most recent regulatory determination.
Source: Economic Insights, *Economic benchmarking results for the Australian Energy Regulator's 2017 DNSP benchmarking report*, 31 October 2017; AER analysis.

So while the industry has averaged opex MPFP growth of 3.0 per cent per annum between 2012 and 2016, this is likely to include a degree of 'catch-up' that we do not want to include in our opex productivity growth forecast. We think the average growth rate of 1.6 per cent for those distributors whose base opex we did not find materially inefficient is more reflective of the shift in the productivity frontier over the period 2012–16 than the average rate over the whole industry.

3.2 Econometric modelling results

Our econometric models allow us to estimate three different components of productivity growth:

1. the time trend (sometimes also called technical change)
2. economies of scale
3. the productivity associated with changes in business conditions (specifically, the proportion of undergrounding).

We have considered all three of these components of opex productivity growth to see what they could tell us about forecast opex productivity growth.

Forecast time trend

The time trend in our econometric analysis estimates the change in productivity over time not attributable to other variables in the cost function. The drivers of this time trend include changes in technology, changes in process, or changes in legislative or regulatory obligations.

Our econometric modelling has estimated a positive coefficient for the year variable for the period starting 2006 (see table 3), indicating negative productivity growth. It is worth noting that the econometric modelling applied assumes that the time coefficient is constant. We can see, however, that opex MPFP growth in Australia changed from negative to positive in 2012 (as shown in figure 2). Therefore, the time trend estimated by our econometric models may not reflect more recent productivity performance in Australia, and may not reflect future productivity growth. In other words, the estimated time trend will be influenced by the drivers of productivity decline in the 2006–12 period that we don't consider will continue to prevail in the future.

Table 3 Estimated time coefficients for electricity distribution, 2006 to 2016, per cent

SFA Cobb–Douglas	LSE Cobb–Douglas	LSE translog
1.8	1.9	1.9

Note: A positive time coefficient indicates that opex increases as time passes. This indicates negative productivity growth, all else equal.
Source: Economic Insights, *Economic benchmarking results for the Australian Energy Regulator's 2017 DNSP benchmarking report*, 31 October 2017, pp. 19–20.

Because we are not satisfied the estimated time trend from our econometric models reflects what distributors will be able to achieved going forward we have looked at the productivity performance achieved in other industries. Specifically we have looked at the time trend estimated for gas distributors. We think this information is useful because:

- the gas distribution sector shares many similarities with the electricity distribution sector
- past productivity performance has been more stable in gas distribution than for electricity distribution and has not been subject to the same regulatory changes
- we have technical change estimates for gas distributors estimated using econometric models similar to those we use for electricity distribution.

We have reviewed the time coefficients estimated by the four most recent gas distribution econometric studies submitted to us (table 4), which were conducted in 2015 and 2016. We note that the estimated time coefficients were negative (that is, positive productivity growth was estimated) for all the model specifications and estimation techniques used. On average, across the four studies, opex reduced by 0.5 per cent each year, holding everything else constant.

Table 4 Estimated time coefficients for gas distribution, per cent

Report	Number of outputs	Number of specifications / estimation techniques	Minimum	Maximum	Average
ACIL Allen 2016	One	Three	–0.26	–0.73	–0.43
Economic Insights 2015	Two	Two	–0.69	–0.71	–0.70
ACIL Allen 2016	Two	Three	–0.26	–0.62	–0.45
Economic Insights 2016	Two or three	Six	–0.52	–0.64	–0.59

Source: Economic Insights, *Relative opex efficiency and forecast opex productivity growth of Jemena Gas Networks*, 25 February 2015; Economic Insights, Gas *distribution businesses opex cost function*, 22 August 2016; ACIL Allen Consulting, *Opex partial productivity analysis*, 20 December 2016.

Question 3: Do you agree that the time trend achieved by gas distributors is reasonably reflective of the time trend that electricity distributors can achieve? If not, do you think the gas results overstate or understate what can be achieved by electricity distributors? Why?

Forecast productivity growth from the change in the proportion of undergrounding

Our econometric models include the proportion of undergrounding as a 'business condition' explanatory variable. This was included because underground cables are usually cheaper to operate and maintain. Vegetation management is also not required and there are fewer failures to rectify because the cables are not exposed. Consequently you would expect that if a distributor increases the proportion of its network that is underground its opex would decrease, all else equal. That is, it would improve its opex productivity.

In Table 5 we set out the undergrounding coefficients estimated by our three econometric models for our 2017 *Annual benchmarking report*. These show that, on average across the three models, a one percent growth in the proportion of undergrounding results in a 0.16 per cent reduction in opex.

Table 5 Estimated elasticities of the proportion of undergrounding in our econometric models, 2006–16

SFA Cobb–Douglas	LSE Cobb–Douglas	LSE translog
–0.144	–0.177	–0.159

Source: Economic Insights, *Economic benchmarking results for the Australian Energy Regulator's 2017 DNSP benchmarking report*, 31 October 2017, pp. 19–20.

We have also looked at how the proportion of undergrounding changes over time (see table 6).

Table 6 Proportion of undergrounding, 2006–16

	Average (2006–16), per cent	Average annual growth, per cent
Ausgrid	35.2	1.4
AusNet Services	11.7	4.1
CitiPower	47.2	1.5
Endeavour Energy	31.8	2.6
Energex	30.7	2.6
Ergon Energy	4.6	8.1
Essential Energy	3.6	5.2
Evoenergy	51.6	1.5
Jemena	26.0	2.6
Powercor	6.4	5.3
SA Power Networks	18.3	1.9
TasNetworks	10.0	2.1
United Energy	20.2	1.8
Industry average	**12.6**	**3.4**

Source: AER analysis

So we can see that, historically, all the distributors have increased the underground proportion of their networks. Across the industry, the proportion of undergrounding has increased by 3.4 per cent each year on average. This equates to an estimated industry average reduction in opex of 0.5 per cent per year due to increased undergrounding.

Question 4: Should we account for changes in the proportion of undergrounding when we forecast opex productivity growth?

Forecast economies of scale

Another potential contributor to opex productivity growth is economies of scale. However, our econometric models have found it to be immaterial. This remains the case in our latest econometric analysis in our 2017 *Annual benchmarking report*. In table 7 we show the elasticities for each of the output measures under our three econometric models. These show that, on average, across the three models, a one per cent increase in output results in a 0.99 per cent increase in opex. This suggests that economies of scale are immaterial and that differences in output growth are unlikely to drive different opex productivity performance.

Table 7 Output elasticities

Output measure	SFA Cobb–Douglas	LSE Cobb–Douglas	LSE translog
Customer numbers	0.769	0.697	0.581
Circuit length	0.097	0.112	0.109
Ratcheted maximum demand	0.131	0.191	0.281
Total	**0.997**	**1.000**	**0.971**

Source: Economic Insights, *Economic benchmarking results for the Australian Energy Regulator's 2017 DNSP benchmarking report*, 31 October 2017, pp. 19–20.

Question 5: Should we account for economies of scale when we forecast opex productivity growth? If so, on what basis should we forecast economies of scale?

3.3 Labour productivity performance

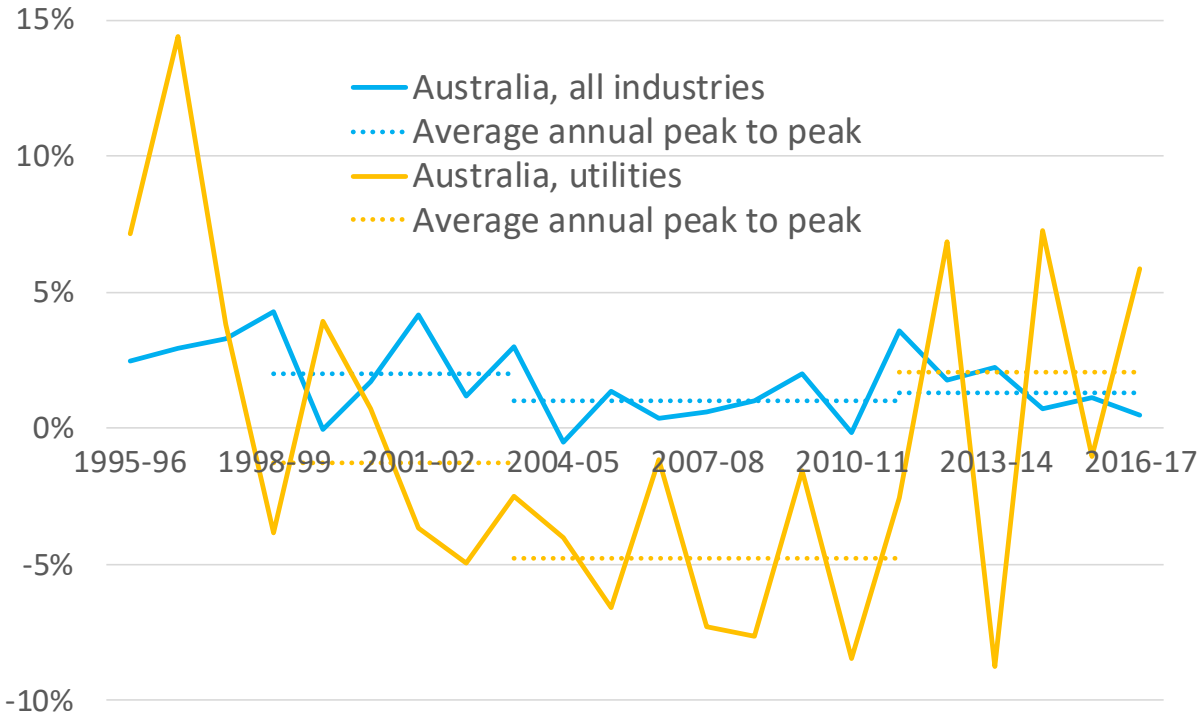
We have also sought to identify other relevant productivity measures from other industries and the broader economy. However, we have not identified any other directly comparable measures. The Australian Bureau of Statistics (ABS), for example, does not estimate opex productivity. The most relevant measure that the ABS provides is quality adjusted labour productivity. Quality adjusted labour productivity is relevant because labour costs are a large proportion of opex costs.

The ABS measures quality adjusted labour productivity as the amount of output produced for a quality adjusted hour of work. The measure of output used is gross domestic product at the economy wide level, or gross value added at the industry level. Quality adjusted hours worked captures both changes in hours worked and changes in quality (for example, changes in education and experience). Consequently we need to be mindful that quality adjusted labour productivity does not reflect the same outputs and inputs we use when we forecast the opex rate of change.

We have presented quality adjusted labour productivity since 1994–95 in

figure 3. This includes quality adjusted labour productivity for the Australian economy as a whole as well as for the electricity, gas, water and waste services (utilities) industry, which includes electricity distribution.

Figure 3 Quality adjusted labour productivity



Source: ABS

Apart from greater year to year volatility, quality-adjusted labour productivity in the utilities industry appears to follow the same broad pattern as it does for the economy as a whole. We can see that for both the utilities industry and the economy as a whole, quality adjusted labour productivity fell in the period 2003–04 to 2011–12 before rising again in the period from 2011–12 to 2015–16 (see table 8). This suggests that economy wide productivity drivers also influence the utilities industry.

Table 8 Period average quality adjusted labour productivity growth, per cent

	1998–99 to 2003–04	2003–04 to 2011–12	2011–12 to 2015–16
All industries	2.0	1.0	1.3
Utilities	–1.3	–4.8	2.0

Source: ABS

Quality-adjusted labour productivity in the utilities industry also appears to follow a similar pattern as opex MPFP. Quality-adjusted labour productivity declined between 2003–04 and 2011–12, after which it has shown positive growth. Opex MPFP for electricity distribution displays the same pattern, with performance improving significantly from 2012. We would expect to see this correlation given that electricity distribution is a significant proportion of the utilities industry and labour is a major component of opex.

For our current round of distribution determinations (for the Australian Capital Territory, New South Wales, the Northern Territory and Tasmania) Deloitte Access Economics has

provided us with quality adjusted labour productivity growth forecasts for the utilities industry (see table 9).

Table 9 Forecast quality adjust labour productivity growth for the utilities industry, per cent

Jurisdiction	2019–20	2020–21	2021–22	2022–23	2023–24
Australia	1.7	1.6	1.6	1.4	1.2
Australian Capital Territory	1.7	1.6	1.6	1.4	1.2
New South Wales	1.6	1.4	1.4	1.3	1.1
Northern Territory	1.7	1.6	1.6	1.4	1.3
Tasmania	1.6	1.6	1.6	1.4	1.3

Source: Deloitte Access Economics

Comparing these forecasts to the most recent growth rates reported by the ABS may give us some indication of opex productivity growth over the forecast period. For example, we note that Deloitte Access Economics have forecast that quality-adjusted labour productivity will continue to grow, but the speed of that growth will moderate.

Question 6: What is the best way to use quality adjusted labour productivity growth (both past and forecast) to inform our opex productivity growth forecast?

4 How can we use this information to forecast?

We have considered each of these information sources and have identified the following options for forecasting opex productivity growth:

- Option 1: the status quo (zero productivity growth)
- Option 2: using the productivity growth from the increased proportion of undergrounding as estimated by our electricity distribution econometric studies (0.5 per cent productivity growth)
- Option 3: using the productivity growth from the increased proportion of undergrounding as estimated by our electricity distribution econometric studies, plus the time trend estimated by gas distribution econometric studies (1.0 per cent productivity growth)
- Option 4: using industry average opex MPFP growth, adjusted to remove catch up (1.6 per cent productivity growth)
- Option 5: using forecasts of labour productivity growth (0.9 per cent productivity growth)
- Option 6: a holistic approach that draws on all sources of information to forecast productivity growth (1.0 per cent productivity growth).

We discuss the advantages and disadvantages of each of these approaches below.

4.1 Option 1: the status quo

The first option we have considered is a continuation of our current approach. Under this approach we have looked at the productivity growth estimated by our preferred stochastic frontier analysis Cobb Douglas cost frontier model as the primary information source to inform our estimate of productivity growth. One advantage of this approach, and one of the reasons why we adopted it, was that it ensured consistency in the parameters we use for our productivity, output and price growth forecasts.

However, if we are going to use our Cobb Douglas cost frontier model to forecast, we need to be satisfied that past productivity performance is reflective of what can be achieved going forward. 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.[15]

One disadvantage of this approach, however, is that it does not appear to be consistent with the opex productivity growth we are currently seeing, as shown by opex MPFP performance.

15 AER, *Ausgrid distribution determination 2014–19, Draft decision*, Attachment 7, November 2014, p. 154.

It also does not account for the productivity growth attributable to the increased proportion of networks that is underground. This productivity growth is independent of the productivity growth a distributor can achieve through changes in technology and processes and should be included in the overall estimate of productivity growth to reflect what an efficient and prudent distributor can reasonably achieve. Another disadvantage of this approach is that it relies on a single econometric model, which the Australian Competition Tribunal had expressed concerns with in the context of determining the efficient level of base opex.[16]

4.2 Option 2: Productivity growth from increased undergrounding

Option 1 primarily relies on the results from one of our econometric models. Despite the negative productivity growth we have estimated, we set the opex productivity growth forecast to zero because we have not been satisfied that past productivity performance is reflective of what can be achieved going forward. An alternative approach that also relies on econometric modelling is to forecast the estimated productivity impact from increasing the proportion of undergrounding. This equates to a forecast productivity growth rate of 0.5 per cent. This approach assumes a time trend of zero, that is, it assumes no productivity growth from changes in technology or process.

As discussed above, historically, all the distributors have increased the proportion of their networks that is underground. On average, across the industry, the proportion of undergrounding has increased by 3.4 per cent each year. This approach recognises that the proportion of distribution networks that is underground is increasing and that this has positive opex productivity effects.

We have estimated that, on average across our three econometric models, a one percent growth in the proportion of undergrounding results in a 0.16 per cent reduction in opex (see

16 Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1.

table 5). This equates to an estimated industry average reduction in opex of 0.5 per cent per year when you apply this to the industry average growth in the proportion of undergrounding.

An advantage of this approach, similar to option 1, is that it provides consistency in the input and output specifications that we use to forecast productivity, output and price growth. It also relies on all of our econometric models rather than a single model. However, it does not account for any technical change, with the time trend assumed to equal zero.

4.3 Option 3: Undergrounding productivity plus the gas distribution time trend

A variation of option 2 is to use the econometric results from gas distribution studies to estimate the time trend for electricity distribution, rather than setting it to zero. Under this option we would forecast 1.0 per cent opex productivity growth based on:

- 0.5 per cent productivity growth from the increase in the proportion of undergrounding as estimated from our electricity distribution econometric studies, plus
- an additional 0.5 per cent productivity growth to account for technical change based on the time trend measured for gas distributors.

An advantage of this approach compared to option 2 is that it accounts for technical change by using the gas distribution time trend, rather than setting the time trend to zero. However, this relies on the assumption that the time trend estimated for gas distribution is reflective of what is achievable in electricity distribution. As discussed in section 3.2, we consider the time trend estimated for gas distribution should be reasonably reflective of the time trend that can be achieved by an efficient and prudent electricity distributor.

4.4 Option 4: Using industry average opex MPFP growth

Under this approach we would forecast opex productivity growth based on historic industry average MPFP growth since 2012. This is similar to the approach that we use for electricity transmission (where we don't have any econometric modelling because our dataset is too small). However, opex MPFP performance for transmission has been more consistent over time than it has been for distribution.

As we have previously stated, we do not consider the period up to 2012 represents business as usual conditions. Consequently we are not satisfied that a reasonable forecast should use measured productivity performance from this period.

As discussed in section 3.1above, we also think industry average opex MPFP performance since 2012 includes a significant degree of catch up which we would need to account for. One way we could account for industry catch-up since 2012 is to not include those distributors whose base opex we have found to be materially inefficient when we measure productivity growth. Doing so produces an average opex MPFP growth rate of 1.6 per cent per year for the period since 2012. Under this option we would forecast productivity growth of 1.6 per cent based on this.

One advantage of this approach is that it relies on evidence for electricity distribution and does not require evidence from other industries. The estimated opex MPFP appears to

provide clear evidence that Australian electricity distributors have made positive opex productivity growth since 2012.

One disadvantage of this approach is that it relies on data from a relatively short period and uses only a reduced number of distributors. This will increase the uncertainty around how reflective this forecast will be of opex productivity that can be achieved going forward.

4.5 Option 5: Using forecast labour productivity growth

Under this approach we would base our opex productivity growth forecast on forecast labour productivity growth for the utilities industry multiplied by our labour input weight (59.7 per cent). Using the labour productivity growth forecasts we have recently received from Deloitte Access Economics (see table 9) this gives an opex productivity growth forecast of 0.9 per cent per annum.[17]

An advantage of this approach is that it is forward looking, rather than relying solely on historic averages. It can take into account expected movements in economic drivers and their impact on labour productivity in the utilities industry.

However, a disadvantage is that labour productivity does not reflect the same defined econometric outputs and inputs we use when forecasting output and price growth.

4.6 Option 6: A holistic approach

Our preferred option is to use a holistic approach that takes into account all of the available information. We recognise that none of the identified data sources is perfect and they all provide valuable information that should be taken into account. Consequently, we don't think we should use one of these sources alone to set our opex productivity growth forecast.

This approach does not use a mechanistic approach that relies on a single measure of productivity growth or applies explicit weights to specific productivity growth measures. Rather, it takes into account all information and uses regulatory judgement to determine the forecast opex productivity growth for an efficient and prudent distributor.

We think that each of the available information sources are broadly consistent and when considered together support an opex productivity growth between 0.5 and 1.6 per cent.

Since 2012 opex MPFP performance has improved and most electricity distributors have achieved positive opex MPFP growth. However, we consider forecast opex productivity growth is unlikely to exceed the industry average opex MPFP growth of 1.6 per cent when we exclude those distributors that we previously found to be materially inefficient. We have excluded those distributors to account for catch-up effects, which we do not want to include in our forecast since we are trying to forecast productivity frontier shift.

We consider that the MPFP growth we have seen since 2012 is unlikely to continue at the same rate. The MPFP growth we have observed since 2012 has been driven by various factors which we do not believe will persist. For instance, some distributors had drastically reduced their opex within this period in response to lower revenue allowances, privatisation

[17] This is the average of the forecasts for the Australian utilities industry (row 2) in Table 9.

or incentives introduced by economic benchmarking. All of which are unlikely to impact on the distributors' opex going forward in the same way as they did within the 2012–16 period.

Also, labour productivity growth is forecast to slow. Forecast labour productivity growth for the 2019–24 period is lower than what was achieved in the 2012–16 period. This suggests that opex productivity growth will also slow somewhat and is unlikely to match the level of growth achieved in the 2012–16 period. If we apply our labour input weight (59.7 per cent) to the Deloitte Access Economics' labour productivity growth forecasts (table 9) this gives an opex productivity growth forecast of 0.9 per cent per annum.[18]

Econometric analysis also supports a forecast opex productivity growth rate of less than 1.6 per cent. Analysis from the electricity and gas distribution industries suggest opex productivity growth of around 1.0 per cent based on:

- gas distribution industries time trend of around 0.5 per cent, plus
- the historical change in the proportion of undergrounding applied to the undergrounding elasticity we have estimated for electricity distribution suggest addition productivity growth of 0.5 per cent
- no economies of scale.

At the bottom end of the range, we consider that opex productivity growth will be at least 0.5 per cent. This is the forecast opex productivity growth from the change in the proportion of undergrounding (option 2). We consider that our forecast of productivity growth should at least account for this since the distributors can be reasonably expected to achieve this productivity growth without having to change their technology or processes.

We note that the two options that do not form the boundaries of our range, namely option 3 and option 5, are quite close at 1.0 per cent and 0.9 per cent respectively. We consider that these two options should be given more weight, since they partly avoid the issues identified in options 1, 2 and 4. On the basis that both of the options are close to, or equal to, 1.0 per cent, we are satisfied that this a reasonable expectation of the opex productivity growth that an efficient and prudent distributor can achieve.

4.7 Questions

Question 7: Are there any other forecasting approaches we should consider?

Question 8: Which option do you consider to be the best approach to forecast opex productivity growth for a prudent and efficient distributor? Why?

Question 9: How much opex productivity growth do you think an efficient distributor can reasonably achieve? Why? What information are you relying on to inform this view?

18 This is the average of the forecasts for the Australian utilities industry (row 2) in Table 9.

5 Implementation

At this stage, we are proposing to use the opex productivity growth forecast decided in this review process in our determinations for each electricity distributor, starting with the determinations in April 2019. We have listed the relevant determinations in table 10.

Table 10 Relevant distribution determinations

Distributor	Regulatory control period commencing
Ausgrid	1 July 2019
AusNet Services	1 January 2021
CitiPower	1 January 2021
Endeavour Energy	1 July 2019
Energex	1 July 2020
Ergon Energy	1 July 2020
Essential Energy	1 July 2019
Evoenergy	1 July 2019
Jemena	1 January 2021
Powercor	1 January 2021
SA Power Networks	1 July 2020
TasNetworks	1 July 2019
United Energy	1 January 2021

We do not expect that we would need to update this forecast prior to 2021 unless there is a significant change in the underlying economic drivers. However, we recognise there is a trade-off between updating the forecast more frequently with more up-to-date data and providing predictability. We are interested in stakeholders' views on how frequently we should update our opex productivity growth forecast.

Question 10: Do you agree that we should apply the productivity growth forecast determined by this review process in our next regulatory determination for each electricity distributor? If not, how frequently should we update our forecast? Why?

We intend to apply the opex productivity growth forecast approach determined in this review process to the electricity distribution regulatory determinations we will publish in April 2019. We will provide the relevant distributors an opportunity to submit their views on how we should apply the opex productivity growth forecast we determine to their specific circumstances. We will take those submissions into account in our final regulatory determinations for those distributors.

Other distributors will be able to express their views on how productivity growth should be applied in their specific circumstances when they submit their regulatory proposals. We will take these views into account in our regulatory determinations for those distributors.

6 Questions

Throughout this paper we have posed a series of questions. We welcome stakeholders' answers to these questions as well as any other feedback stakeholders may have (see page 3 for details on how to make a submission). We have listed them here for your convenience.

Question 1: Are there any other sources of information, for example, any economy wide measures of productivity growth that we should take into account when we forecast opex productivity growth?

Question 2: Should all information sources be given equal weight or should we give greater or lesser weight to specific sources? If we should give greater or lesser weight to a specific information source, which source and why?

Question 3: Do you agree that the time trend achieved by gas distributors is reasonably reflective of the time trend that electricity distributors can achieve? If not, do you think the gas results overstate or understate what can be achieved by electricity distributors? Why?

Question 4: Should we account for changes in the proportion of undergrounding when we forecast opex productivity growth?

Question 5: Should we account for economies of scale when we forecast opex productivity growth? If so, on what basis should we forecast economies of scale?

Question 6: What is the best way to use quality adjusted labour productivity growth (both past and forecast) to inform our opex productivity growth forecast?

Question 7: Are there any other forecasting approaches we should consider?

Question 8: Which option do you consider to be the best approach to forecast opex productivity growth for a prudent and efficient distributor? Why?

Question 9: How much opex productivity growth do you think an efficient distributor can reasonably achieve? Why? What information are you relying on to inform this view?

Question 10: Do you agree that we should apply the productivity growth forecast determined by this review process in our next regulatory determination for each electricity distributor? If not, how frequently should we update our forecast? Why?