Appendix 5.01: Operating expenditure base year and trend forecast efficiency

Access Arrangement Information for the 2016-21 ACT, Queanbeyan and Palerang Access Arrangement

Submission to the Australian Energy Regulator

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Contents

Introduction

ActewAGL Distribution has adopted two methods for forecasting operating expenditure (opex) in the 2016-21 access arrangement period:

- A ***base-step-trend approach*** has been used for controllable costs.
- ***Annual category specific forecasts*** have been used for non-controllable costs where base year costs do not reflect ActewAGL Distribution's expectations of these costs over the 2016-21 access arrangement period.

This appendix details the efficiency of ActewAGL Distribution's base opex and trend forecast for controllable costs in the 2016-21 access arrangement period. The step changes included in the 'step' component of ActewAGL Distribution's opex forecast are detailed in appendix 5.4. ActewAGL Distribution's category specific forecasts for non-controllable costs are detailed in section 5.4.6 of attachment 4.

Regulatory requirements and efficiency

Rule 91(1) of the National Gas Rules (the Rules) requires opex to be:

> *… such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of delivering pipeline services.*

There are two components of prime importance in this definition.

The first is the term 'efficiently'. In the context of the National Electricity Objective, which is fundamentally consistent with the National Gas Objective (NGO), Greg Houston outlines the three generally accepted dimensions of efficiency as:[1]

- *productive efficiency, which is concerned with the means by which goods and services are produced, and is attained when production takes place with the least-cost combination of inputs;*
- *allocative efficiency, which is concerned with what is produced and for whom, and is attained when the optimal set of goods and services is produced and allocated so as to provide the maximum benefit to society; and*
- *dynamic efficiency, which is concerned with society's capacity to achieve the efficient production and allocation of goods and services over time, in the face of changing productivity and/or technology (which reduces the cost of production and alters the optimal mix of inputs), and the changing preferences of consumers, which alters the good and services that are desired the most by consumers.*

[1] HoustonKemp, 2014, *Economic Review of ERA's Draft Decision*, November, p. 5.

These definitions are consistent with those set out in Geoff Swier's expert report on the economic considerations for the interpretation of the NGO for Jemena Gas Networks (JGN).[2]

The second key component of Rule 91(1) is the use of the term 'sustainable' which, as Greg Houston states, indicates that the 'balance of emphasis is to be given to the long term, dynamic dimension of efficiency'.[3]

In the context of these key concepts, the following sections discuss ActewAGL Distribution's base opex and trend forecast used in its opex forecast for controllable costs in the 2016-21 access arrangement period.

1 Base year operating expenditure efficiency

1.1 Efficiency of revealed costs under incentive regulation

ActewAGL Distribution has been subject to an incentive mechanism during the 2010-15 access arrangement period, known as the rolling carryover mechanism.[4]. This mechanism is designed to apply a continuous incentive to ActewAGL Distribution to pursue efficiency gains throughout the access arrangement period removing any incentive to increase base year costs. Operating under this scheme, ActewAGL Distribution has made efficiency gains relative to the opex approved by the Australian Energy Regulator (AER) for the 2010-15 access arrangement period, including in 2014/15, the year used as its base year for the purpose of preparing its opex forecast. The efficient cost revealed under the incentive mechanism in this year serves as a starting point to form an opex forecast that has been arrived at on a reasonable basis, and represents the best forecast possible in the circumstances.

The incentive scheme in ActewAGL Distribution's access arrangement operates in essentially the same manner as the Efficiency Benefit Sharing Scheme (EBSS) for electricity distribution network service providers, on which the AER states: [5]

> *The EBSS aims to provide an incentive for [Network Service Providers] to pursue efficiency improvements in opex and to share efficiency gains between NSPs and network users. The scheme achieves this by rewarding NSPs that make incremental efficiency gains and penalising NSPs that make incremental efficiency losses.*

Such an incentive mechanism provides a constant, time-invariant incentive to reduce costs and be both efficient in the short-run and in the long-run, as a service provider under such an incentive mechanism makes decisions based on the present value of cost savings. In this way, the

[2] Swier, G, 2014. *Economic considerations for the interpretation of the National Gas Objective, Expert Report prepared by Geoff Swier for Jemena Gas Networks (NSW) Ltd*, 23 May, pp. 13-14 .

[3] HoustonKemp, 2015, *Opex and the Efficiency Benefit Sharing Scheme*, January, p. 4.

[4] Set out in section 4 of the 2010-15 access arrangement

[5] AER, 2013, *Better Regulation, Explanatory Statement - Efficiency benefit sharing scheme for Electricity Network Service Providers,* November, p.11

incentive mechanism provides a clear incentive for service providers to reveal its sustainable efficient costs.

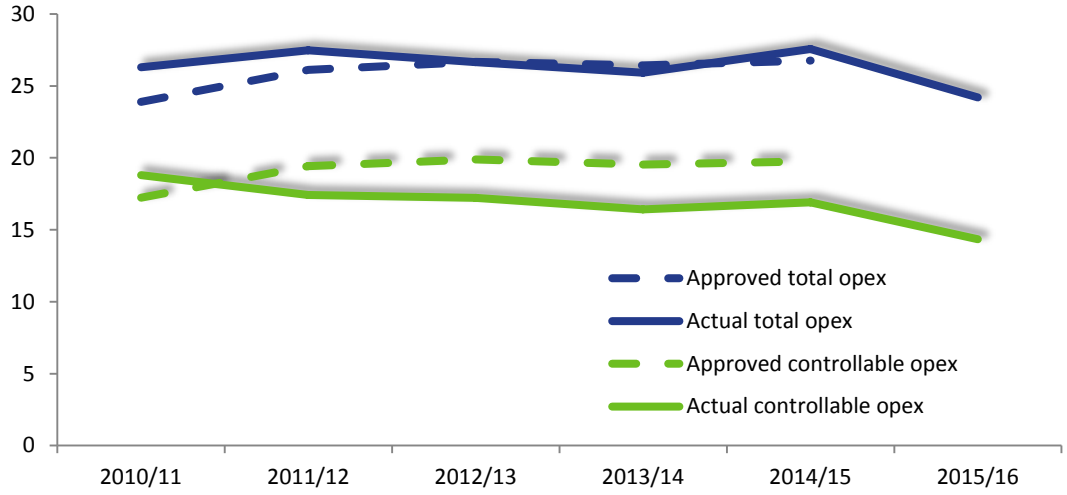
When assessing opex forecasts, the AER typically uses revealed expenditure in the second or third last year of the previous regulatory control period as the base year [6] to assess efficiency, particularly when a service provider is subject to an incentive mechanism.[7]

Incentive mechanisms are intended to incentivise service providers equally in terms of penalties and gains to sustainably and prudently reduce costs. This incentive serves the long term interests of consumers as benefits are shared with the service provider's customers. This sharing arrangement is in the long term interests of customers as it means that any inefficiencies are removed and that over the long term, prices reflect their efficient level without affecting quality, safety, reliability or security of supply. This is consistent with the NGO.

1.1.1 ActewAGL Distribution's performance under incentive mechanisms

Under the rolling carryover mechanism in place for the 2010-15 access arrangement period ActewAGL Distribution has consistently achieved savings in controllable costs relative to the opex approved by the AER for this period(see Figure 1.1 of this appendix). ActewAGL Distribution has sustainably sought and achieved efficiencies within its controllable opex. ActewAGL Distribution's opex in 2014/15 represents the base opex of a prudent service provider acting efficiently, to achieve the lowest long term sustainable cost.

Figure 1.1 Actual opex against approved amounts over 2010-15 access arrangement period ($millions, 2015/16)



[6] AER, *Better Regulation Forecast Expenditure Forecast Assessment Guideline Explanatory Statement,* November 2013, p. 92

[7] AER, 2014, *Draft Decision Jemena Gas Networks (NSW) Ltd Access Arrangement 2015-20 Attachment 7 – Operating expenditure*, November, p.7 – 15

1.2 Secondary supporting evidence of efficiency

1.2.1 Efficiency of service delivery model

As detailed in attachment 4 of this access arrangement information, Jemena Asset Management (JAM) provides gas network asset management, network operations and maintenance services through the Distribution Asset Management Services (DAMS) Agreement. Opex incurred through this agreement is categorised into management services and asset services, which are based on direct and indirect costs incurred by JAM and allocated in accordance with the cost allocation method (CAM) applied by JAM, which shares the principles applied across other Jemena businesses and networks

As explained in attachment 4, these fees are based on historical costs which are adjusted annually for changes in CPI along with any step changes that are required. An annual 'true-up' mechanism exists for any prudent and efficient discrepancies between forecast and actual costs.

Incentives contained in the DAMS agreement

As explained in attachment 4, the new DAMS Agreement includes specific provisions and incentives to ensure that JAM's costs are transparent, competitive and efficient. Costs are reviewed annually through approval of the Services Plan. If costs are less than the approved target cost estimate, JAM retains the savings in that year and base forecasts for the following year on the actual lower opex amount. If costs are higher than the approved estimate, JAM must provide detailed explanation of expenditure above the estimate.

Assessment of service delivery model efficiency for Jemena Gas Networks

JAM also provides gas network asset management, network operations and maintenance services to JGN in New South Wales. The AER's final decision for JGN's 2015-20 access arrangement found its opex forecast to be efficient.[8] The approach to asset management, governance and cost allocation for JGN by JAM that has led to the AER determining JGN's costs to be efficient is consistent with the approach for its services to ActewAGL Distribution.

JAM's cost allocation method enables the calculation of individual components to ensure that the fees are actual, ascertainable, reasonably justifiable, verifiable costs, consistent with the transparency principle within the DAMS Agreement. Where possible, costs are directly allocated based on specified drivers. Costs that are not directly attributed to ActewAGL Distribution by JAM are allocated using an adjusted fair value driver.

[8] The AER accepted approximately 99 per cent of JGN's revised access arrangement proposed opex, only deviating by exclusion of one step change and a reduction to the opex rate of change estimate; see AER, 2015, *Final Decision Jemena Gas Networks (NSW) Ltd Access Arrangement 2015-20 Attachment 7 – Operating expenditure*, June.

1.2.2 Benchmarking analyses

ActewAGL Distribution considers benchmarking to be a useful but limited tool, which should not be used deterministically. Rather, it can be used alongside more robust evidence to test conclusions and identify anomalies that require further investigation.

In preparing its opex forecast for the 2016-21 access arrangement period, ActewAGL Distribution engaged ACIL Allen Consulting to undertake a productivity study of ActewAGL Distribution's gas network. The study included estimating ActewAGL Distribution's cost function and forecast partial factor productivity growth rate as well as historic unilateral total factor and partial factor productivity (TFP and PFP).

The cost function analysis compares ActewAGL Distribution's performance against other gas distributors using data provided by ActewAGL Distribution as well as publicly available data. This analysis provides insights into the relative performance of ActewAGL Distribution and helps to identify whether ActewAGL Distribution's revealed opex under the incentive mechanism appears efficient, or whether anomalies exist that require further investigation.

ActewAGL Distribution notes that this type of analysis should be considered with caution due to issues with model selection, model parameter specification and data limitations. ACIL Allen noted these concerns in its report:[9]

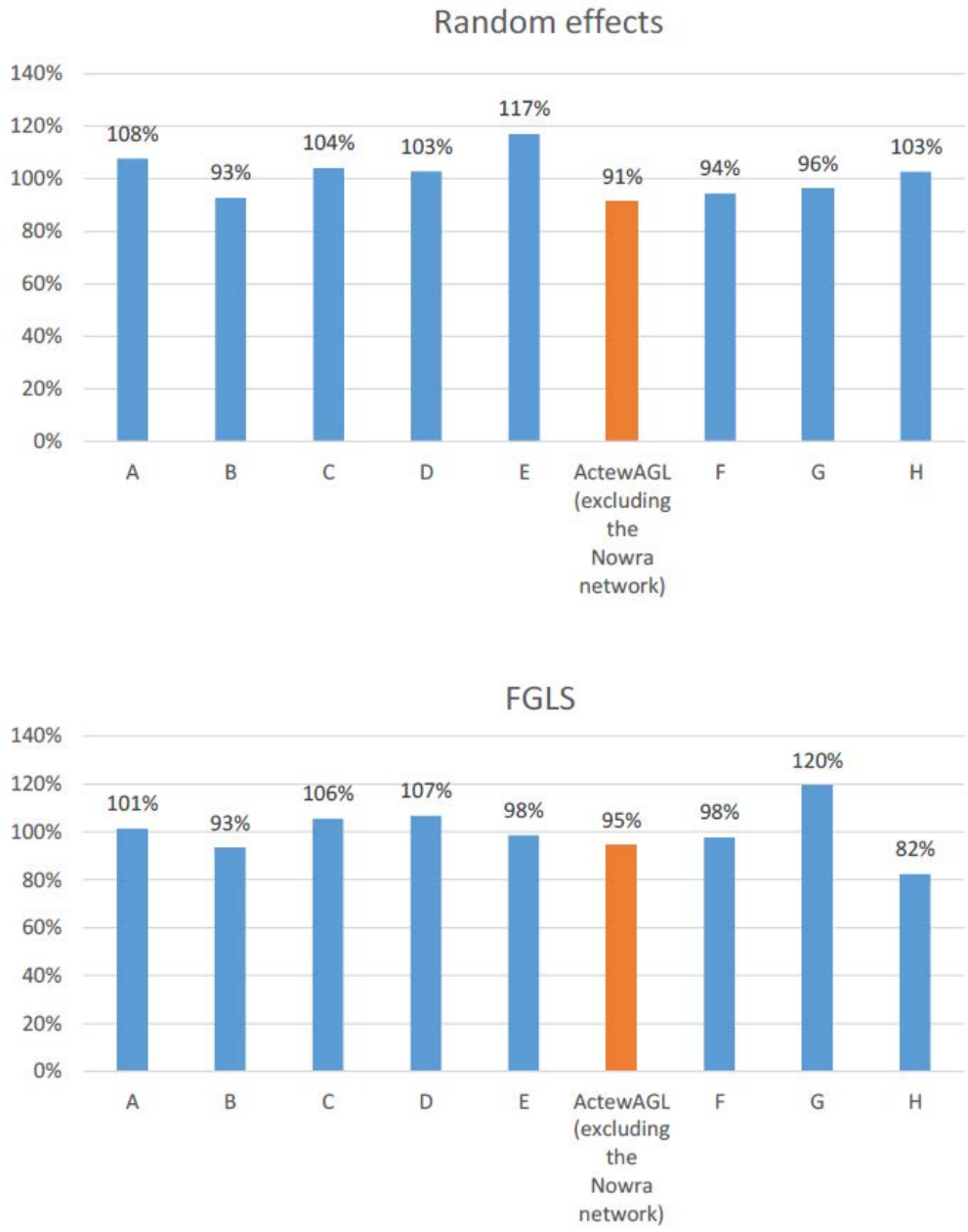
> *It is important to recognise that, due to the limitations of data and of the benchmarking techniques, the efficiency and productivity measures produced in this study are approximate rather than exact. There are often challenges associated with accounting for differences in relevant operating environment factors, in accurately measuring inputs and outputs, and in gaining comparable, quality data over long time periods.*

Within these limitations, ACIL Allen has undertaken econometric modelling to calculate the ratio of actual opex to predicted opex, which results in a form of base opex benchmarking.[10] Figure 1.2 shows that for the cost function estimates, ActewAGL Distribution ranks as one of the lowest cost gas distributors (lowest using a random effects (RE) model and third lowest using a feasible generalised least square model (FGLS)). While these findings should be interpreted with caution as discussed above, they do serve as a reference point to check and support the reasonableness of conclusions about ActewAGL Distribution's revealed base opex efficiency.

[9] ACIL Allen Consulting 2015, *Productivity study: ActewAGL Distribution Gas Network – final report*, 29 April 2015, pp. 8-9

[10] Although the opex cost function analysis uses 2012/13, rather than ActewAGL Distribution's selected base year of 2014/15, controllable opex over the period has remained relatively stable and estimated controllable expenditure in the base year of 2014/15 is below that of the analysis year.

Figure 1.2 ACIL Allen model outputs - ActewAGL Distribution's ratio of actual to predicted opex relative to other gas businesses (RE and FGLS models)



Source: ACIL Allen Consulting 2015, Productivity study: ActewAGL Distribution Gas Network – final report, 29 April p. 35

Historically from a unilateral perspective, ACIL Allen's opex PFP analysis is consistent with the evidence that ActewAGL Distribution has responded to the incentives in place to achieve efficiency gains, demonstrated through strong average annual productivity growth of 4.23 per cent over the analysis period of 2003/04 to 2013/14.[11]

[11] ACIL Allen Consulting 2015, *Productivity study ActewAGL Distribution Gas Network – final report*, 29 April, p.45

These findings are broadly consistent with those of benchmarking analysis submitted by ActewAGL Distribution with its access arrangement information in 2009,[12] since which time controllable opex has remained relatively stable. This analysis focussed on simple partial performance indicators (PPI) of opex per customer, opex per mains kilometre and opex per dollar of regulatory asset base (RAB). In each of these PPIs, ActewAGL Distribution was below the mean. Whilst PPIs can be useful to show simple trends over time, caution should similarly be applied in the interpretation of these metrics, as they only take into account a single cost driver at a time.

Noting the caution that should be maintained when interpreting the results of these analyses, ActewAGL Distribution considers the findings do not flag any anomalies that require further investigation. These results are consistent with the conclusions regarding ActewAGL Distribution's revealed cost efficiency under the incentive mechanism and therefore appear to support this primary evidence that ActewAGL Distribution's opex is efficient.

2 Trending base year operating expenditure

The AER's preferred methodology for forecasting opex is the 'base-step-trend' approach.[13] The 'trend' accounts for any changes in efficient costs that differ from normal inflation in each year of the forecast access arrangement period. This is represented as the rate of change in operating expenditure, determined by the following formula:[14]

$$Rate\ of\ change_t = output\ growth_t + real\ price\ growth_t - productivity\ growth_t$$

where $output\ growth_t$ is the expected growth in output, $real\ price\ growth_t$ is the real rate of change in input costs (labour and materials), and $productivity\ growth_t$ is the rate of change of productivity improvements.

A summary of the each of the components of ActewAGL Distribution's proposed rate of change to be applied to trend base opex in each year of the 2016-21 access arrangement period is provided in Table 2.1, both in percentage and dollar terms. The remainder of this section addresses ActewAGL Distribution's proposal for each of these three components of the rate of change.

[12] Jemena Asset Management 2009, *access arrangement information Attachment E - Benchmarking of ActewAGL Gas Network's Operating Expenses (confidential)*

[13] AER 2013, *Better Regulation Forecast Expenditure Forecast Assessment Guideline for Electricity Distribution,* November, p.22

[14] As set out in section 4.2 of the AER's November 2013 *Better Regulation Forecast Expenditure Forecast Assessment Guideline for Electricity Distribution,* p.23

Table 2.1 ActewAGL Distribution's proposed rate of change

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Per cent						
Real input price growth	0.38	0.60	0.85	1.03	1.06	1.00
Output growth	0.56	0.55	0.59	0.58	0.62	0.57
Productivity growth	0.00	0.00	0.00	0.00	0.00	0.00
Rate of change %	**0.93**	**1.15**	**1.44**	**1.61**	**1.68**	**1.57**
$millions, 2014/15						
Real input price growth	0.06	0.17	0.31	0.49	0.68	0.86
Output growth	0.09	0.19	0.29	0.39	0.50	0.60
Productivity growth	0.00	0.00	0.00	0.00	0.00	0.00
Rate of change ($m)	**0.16**	**0.35**	**0.60**	**0.88**	**1.18**	**1.46**

2.1 Real labour cost escalation

ActewAGL Distribution engaged BIS Shrapnel to provide an expert report on the outlook for relevant labour and materials cost escalators in both the ACT and NSW. These forecasts are used as inputs into setting opex and capital expenditure (capex) forecasts for the 2016-21 access arrangement. Labour is the main input into ActewAGL Distribution's gas network opex. The BIS Shrapnel report is provided as appendix 5.03, with the remainder of this section providing a brief overview of the forecasts and ActewAGL Distribution's application of these to trend its base opex.

ActewAGL Distribution has used BIS Shrapnel's Wage Price Index (WPI) for both NSW and the ACT, adjusted for forecast inflation, to determine the real rate of change of labour costs. Due to ActewAGL Distribution's sourcing arrangements whereby services are provided by JAM through the DAMS Agreement, some labour is NSW based and some is ACT based, and so estimates are required for each. ActewAGL Distribution has adopted WPI forecasts for the electricity, gas, water and waste services (EGWWS) sector for all types of labour within the business. As there are no estimates of ACT-specific EGWWS labour costs, BIS Shrapnel has used the national average as a proxy for ACT labour. These results are shown in Table 2.2.

Table 2.2. ActewAGL Distribution input cost escalators (per cent change, real)

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
EGWWS labour WPI change – NSW	0.83	1.08	1.64	1.92	1.97	1.91
EGWWS labour WPI change – ACT*	0.43	0.88	1.14	1.42	1.47	1.30

**Australian average used as proxy for ACT*

Source: Australian Bureau of Statistics/BIS Shrapnel analysis

ActewAGL Distribution's opex is split between labour (NSW and ACT labour) and non-labour with the following weightings:

- NSW labour – 28.7 per cent;
- ACT labour – 32.8 per cent; and
- Other (non-labour) – 38.6 per cent.

The labour components, totalling 61.4 per cent, have been escalated using the EGWWS WPI and the non-labour component has been escalated by CPI. ActewAGL Distribution considers the use of these firm specific weightings, rather than benchmark weightings, contributes to the best possible opex estimate in its circumstances and represents a reasonable basis for the application of the rate of price change. To confirm the reasonableness of these weightings, ActewAGL Distribution has compared these to the benchmark weightings adopted by the AER in its final decision for Jemena Gas Networks 2015-20 access arrangement, which uses a labour weighting of 62 per cent and a non-labour weighting of 38 per cent.[15] These weightings are in line with those applied to the forecast, and therefore ActewAGL Distribution considers its weightings to be reasonable.

The EGWWS WPI labour escalators outlined in Table 2.2 have been weighted by the proportion of labour used in NSW and the ACT to arrive at a total real price growth rate to apply to ActewAGL Distribution's opex forecast. These results are shown in Table 2.3.

Table 2.3. Proposed forecast real price change

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Real price growth (%)	0.38	0.60	0.85	1.03	1.06	1.00
Real price growth ($m, 2015/16)	0.06	0.17	0.31	0.49	0.68	0.86

2.2 Output growth rate

In addition to input quantities and prices, operating and maintenance costs are driven by ActewAGL Distribution's outputs. ActewAGL Distribution considers a key driver of gas network opex to be customer numbers. Other possible drivers such as length of main tend to be positively correlated to customer numbers. As a result applying customer numbers as a cost driver can, to the extent that they apply, largely take these cost drivers into account.

Consistent with its approach adopted for the 2010-15 access arrangement revision proposal, ActewAGL Distribution has calculated the output growth rate based on a 'bottom-up' assessment of incremental costs associated with growth in customer connections. This approach is based on an analysis of the actual cost incurred to service a growing number of customers.

[15] AER, 2015, *Final decision Jemena Gas Networks (NSW) Ltd Access arrangement 2015-20 Attachment 7 – Operating expenditure*, June, p.7-17

ActewAGL Distribution has also considered the alternative of a top-down approach using the results of the ACIL Allen productivity study. This analysis is, however, based on a range of economic and statistical assumptions in addition to the limitations of the data set upon which the analysis is based. As such, ActewAGL Distribution considers the results of this top-down benchmarking approach must be treated with caution. Rather than relying upon the forecast estimate of output growth derived from this analysis, ActewAGL Distribution considers it prudent to use the results of the top-down approach as a check of the reasonableness of the bottom-up assessment forecast. A key finding of this benchmarking study is that throughput is no longer a significant cost driver. Instead, the analysis finds that customer numbers are a key driver of opex, which is consistent with ActewAGL Distribution's use of a bottom-up approach based on customer growth.

The remainder of this section discusses the primary (incremental cost) and secondary (benchmarking) sources of evidence to determine a reasonable output growth rate to apply in ActewAGL Distribution's opex forecast.

2.2.1 Incremental cost

The primary methodology ActewAGL Distribution has used in setting the output growth rate is a bottom-up calculation of the incremental cost of servicing an additional customer on the network.

This concept of incremental cost can be explained with reference to related definitions of cost. *Average cost per customer* captures all costs, from additional metering and billing costs to large scale capital investments. The *additional direct cost per customer* (similar to short run marginal cost) captures only the immediate impact on costs of an additional customer — for example, the costs associated with additional metering and billing requirements. The *incremental cost per customer* (similar to long run marginal cost), includes additional direct costs as well as certain forward looking investments required to support continued operation of the network. This cost lies between the average cost and the additional direct cost per customer.

The use of incremental cost is adopted as it recognises that economies of scale exist in gas networks and that while some costs incurred with servicing an additional customer will have a one-to-one relationship, others will decrease on a per customer basis as more customers connect to the network.

2.2.1.1 Methodology

An estimate of the incremental cost per customer has been calculated by using only those categories of cost that apply to the secondary (1,050 kPa) network and the medium pressure network and dividing through by the number of customers serviced over the period.

A full list of costs included in the calculation of incremental costs is shown in Box 1. These costs are then divided by the number of customers serviced over the observed period.

Box 1. Direct costs included in calculating the incremental cost per customer

- SCADA service
- Monitoring and control service
- Planned maintenance
    - SCADA
    - Metering assets
    - Meter data agent
    - > 1050 kPA pipework and facilities
    - = 1050 kPa pipework and facilities
- Corrective maintenance
    - SCADA
    - Metering assets
    - Meter data agent
    - > 1050 kPA pipework and facilities
    - = 1050 kPa pipework and facilities
- Fault response (response centre)
- Corrective R&M audit
- Residential appliance audit
- Non-residential appliance audit
- Urgent response
- Planned
    - Easement patrol
    - Cathodic protection
    - Leakage surveillance
- Corrective
    - Easement patrol
    - Cathodic protection
- Client support
- Client delivery supervision and management.

Increases in opex associated with new assets on the trunk and primary systems are excluded from the calculation of incremental cost. This is because they relate to large step-ups in growth support requirements that can be clearly identified and have a material 'step' (rather than a gradual trend) impact on costs due to the relatively small size of ActewAGL Distribution's gas network. Instead these costs are considered as step changes in the base-step-trend approach adopted by ActewAGL Distribution and are detailed in appendix 5.04 of this access arrangement information.

ActewAGL Distribution has used an average of actual costs in 2013/14 and estimated costs in 2014/15 to estimate incremental costs for the purpose of its opex forecast. These years have

been used as they represent the best estimate available and provide a comparable basis following the new DAMS Agreement coming into effect from July 2013.

2.2.1.2 Results

Over the two years 2013/14 and 2014/15, the estimate of the direct average cost per customer ranges from $25.81 to $26.27 ($2014/15). These values average to$26.04. Using ActewAGL Distribution's forecast of residential customer connections for the 2016-21 access arrangement period, Table 2.4 outlines the incremental operating costs required to maintain these additional customers on the network.

Table 2.4. Forecast output growth rate calculated using the incremental cost approach ($2014/15)

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Incremental cost ($)	26.04	26.04	26.04	26.04	26.04	26.04
Forecast customers (cumulative)	3,511	6,981	10,722	14,445	18,459	22,149
Total incremental cost ($millions)	0.09	0.18	0.28	0.38	0.49	0.59
Output growth rate (%)*	0.56	0.55	0.59	0.58	0.62	0.57

**Based on 2014/15 base opex of $16.46 million ($2014/15)*

These values incorporate productivity improvements and economies of scale achieved in the 2010-15 access arrangement period. This can be seen by the comparison of the incremental cost incorporated into the opex forecast approved by the AER in its final decision for ActewAGL Distribution's 2010-15 access arrangement. At this time, the incremental cost per new connection was $32 ($2009/10). The estimate of $26.04 ($2014/15) applied for ActewAGL Distribution's forecast represents a considerable reduction in nominal terms, meaning an even larger real benefit to customers. The productivity improvements inherent in this real reduction in costs will be shared with customers in the future through the incentive mechanism in operation throughout the 20010-15 access arrangement period.

2.2.2 Comparison of bottom-up approach with statistical benchmarking findings

As discussed in 1.2.2, ActewAGL Distribution engaged ACIL Allen to, in part, to determine a cost function model. The model identified outputs of the gas network as customer numbers and throughput, however ACIL Allen found:[16]

> *A key characteristic of these [cost function] models is that the energy variable (TJ of gas throughput) has a negative coefficient. Moreover it is not statistically significant at the 1 per cent level in three of the five models. These results are not surprising given that gas throughput has been declining for the majority of distribution businesses over the period from 2005 to 2013, while operating expenditures have continued to increase.*
>
> *This suggests that energy (gas throughput) is no longer a key driver of increasing operating expenses for the nine gas distribution businesses under consideration. As a result an additional model specification is estimated excluding gas throughput.*

[16] ACIL Allen Consulting 2015, *Productivity study ActewAGL Distribution Gas Network – final report*, 29 April, p. 31

As noted previously, ACIL Allen cautions against the deterministic use of such statistical benchmarking given the limitations of the data and modelling. ActewAGL Distribution has used these econometric modelling outputs as secondary evidence, to serve as a test of the reasonableness of the bottom-up analysis or whether further investigation and analysis is required.

In performing this test, ActewAGL Distribution has used the findings of ACIL Allen's analysis by applying a 100 per cent weight to forecast growth in customer numbers to determine the impact if it was to be applied to ActewAGL Distribution's opex forecast. This has the effect of an opex output growth rate set equal to customer growth. These results are shown in Table 2.5.

Table 2.5. Output growth rate using ACIL Allen cost function analysis output and forecast customer growth ($2014/15)

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Output growth rate (%)	2.54	2.45	2.58	2.50	2.63	2.36
Output growth ($millions)	0.42	0.83	1.28	1.72	2.20	2.64

These results indicate a considerably higher required opex for ActewAGL Distribution over the forthcoming access arrangement period compared with that forecast using the incremental bottom-up approach. ActewAGL Distribution considers that the general direction – that opex will grow with customers – is appropriate. Consequently, ActewAGL Distribution has used this cost function analysis as secondary evidence, which confirms the reasonableness of the bottom-up forecast, and in fact suggests that this forecast is a very conservative estimate. Further, it supports the use of customer numbers as a key driver of opex growth.

2.3 Productivity growth

Productivity is a measure of how well a business utilises its inputs to produce outputs. An increase in productivity could be due to an increase in outputs for a given level of inputs or a decrease in inputs for a given level of outputs. The AER's rate of change formula includes a component to account for changes in a service provider's productivity.

Under the rolling carryover incentive mechanism in ActewAGL Distribution's 2010-15 access arrangement (and proposed in its 2016-21 access arrangement), any efficiency gains (or losses) are shared with customers, who retain approximately 70 per cent over the long term.[17]

ActewAGL Distribution considers this mechanism for achieving efficient costs to be preferable to an approach that involves both efficiency gains being targeted through the incentive mechanism as well as expected productivity growth being set through the application of a specified productivity growth rate. It is difficult to separate one change in opex from the other. That is, what portion of the change in a service provider's costs is attributed to efficiency gains (losses)

[17] AER, 2013, *Better Regulation, Explanatory Statement - Efficiency benefit sharing scheme for Electricity Network Service Providers,* November, p.11

that it should be rewarded (penalised) for, and what portion is attributed to growth or decline in productivity.

For example, in order to achieve opex productivity growth resulting from technological improvements, management must actively implement productivity improvement measures to achieve productivity gains, and the rolling carryover mechanism provides the appropriate incentive to implement these improvements.

Further to this principle, ActewAGL Distribution's considers it preferable to exclude a specified productivity growth target from the rate of change (i.e. in effect setting a productivity growth rate of zero) due to the relatively arbitrary nature of a specified productivity growth rate.

For example, the limitations and concerns with benchmarking discussed previously – model selection and model parameter and data limitations –apply equally to productivity growth estimates derived from this analysis. ACIL Allen's analysis produces an average forecast opex partial productivity growth rate of 0.5 per cent per annum.[18] This analysis is useful in that it can provide insight on the general direction and trend of ActewAGL Distribution's forecast productivity growth. However, ActewAGL Distribution does not consider the findings of such benchmarking analysis to be suitably robust to apply deterministically to trend its opex forecast due to the uncertainties and limitations inherent in this type of analysis, as this may result in ActewAGL Distribution not being provided with a reasonable opportunity to recover at least the efficient costs, as required by the revenue and pricing principles set out in section 24 of the NGL.

Having regard to the limitations of benchmarking and the tested incentive mechanism in place that ensures efficient costs are achieved, ActewAGL Distribution has not include a specified productivity growth target in the rate of change applied to forecast its efficient opex for the 2016-21 access arrangement period.

[18] ACIL Allen Consulting 2015, *Productivity study ActewAGL Distribution Gas Network – final report*, 29 April, p. 40

Abbreviations used in this document

Abbreviation	Full term
ACT	Australian Capital Territory
AER	Australian Energy Regulator
CAM	cost allocation method
capex	capital expenditure
CPI	Consumer Price Index
DAMS	Distribution Asset Management Services Agreement
EBSS	efficiency benefit sharing scheme
EGWWS	Eelectricity, gas, water and waste services
ESC	Victorian Essential Services Commission
FGLS	feasible generalised least square model
JAM	Jemena Asset Management Pty Ltd
JGN	Jemena Gas Networks (NSW) Ltd
kPa	kilopascal(s)
m	metre(s) / millions (when relating to financial information)
NGL	National Gas Law
NGO	National Gas Objective
NGR	National Gas Rules (also 'the Rules')
NSW	New South Wales
opex	operating and maintenance expenditure
PFP	partial factor productivity
PPI	partial performance indicators
RE	random effects model
Rules, the	National Gas Rules
TJ	terajoule(s) use TJ per annum in text and TJ p.a. in tables
ZNX(2)	ZNX (2) Pty Ltd