Development of a Cost of Service Model for the ACT, Queanbeyan and Palerang Gas Distribution Network

A Report for ActewAGL Distribution

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Disclaimer

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Executive Summary

HoustonKemp have been engaged by ActewAGL Distribution (AAD) to construct a cost of service model (COSM) to support the development of AAD's 2016-2021 Access Arrangement proposal. The COSM satisfies the tariff principles set out in the National Gas Rules and so provides estimates for each tariff class of:

- the stand alone cost for providing services related to the tariff class;
- the avoidable cost associated with the tariff class; and
- the long-run marginal cost (LRMC) for each tariff component (ie, consumption, fixed fee by tariff class).

This report sets out the details of the approach that we have used to develop the COSM, and to estimate each of these costs. We also summarise the overall results of the model.

Stand alone and avoidable costs

In economic theory the stand alone cost represents the maximum amount that would be capable of being recovered from customers of a service to avoid the potential for these customers to inefficiently bypass the use of the network. For AAD's COSM, the stand alone cost for a tariff class are the costs incurred by AAD to provide a gas distribution network to only supply customers within that tariff class.

In contrast, the avoidable cost for a tariff class represents all the costs that are directly caused by the supply of services to customers within that tariff class. It represents the theoretical lower bound amount to be recovered from these customers. If revenue was to fall below this amount then the revenue that the business received from supplying the customer would be less than the additional costs incurred to supply the customer, requiring the business to recover the difference from other customers (ie, cross subsidise) or earn a lower return. It follows that the avoidable cost for a tariff class are all the costs that AAD would not incur (i.e., avoid) if it were to no longer supply network services to customers within that tariff class.

To estimate stand alone and avoidable costs we have therefore first decomposed AAD's total costs into:

- costs that are attributable to a single tariff class, ie dedicated costs; and
- costs that are common to multiple tariff classes, ie shared costs.

We have used AAD's regulated asset base (RAB) to determine the dedicated costs for each tariff class (ie, residential and business tariff classes), with the remaining costs being identified as shared costs, to be shared between the tariff classes. After decomposing the total costs, avoidable costs for a tariff class are estimated as the dedicated costs for that tariff class, and the stand alone costs are calculated as the avoidable costs for the tariff class plus the total shared costs.

Our estimates of AAD's resultant stand alone and avoidable costs as well as average tariff revenue are set out in Table 1 below.

Table 1: ActewAGL Distribution's stand alone and avoidable costs and average tariff revenue ($/GJ)

Tariff Class	2016-17	2017-18	2018-19	2019-20	2020-21
Residential					
Residential Standalone Cost	13.16	13.45	14.54	15.82	16.62
Residential Avoidable Cost	4.20	4.26	4.61	4.82	5.25
Average Residential Tariff Revenue	11.52	11.98	12.43	12.89	13.36
Business					
Business Standalone Cost	17.14	17.15	18.07	19.60	19.97
Business Avoidable Cost	1.19	1.21	1.30	1.36	1.48
Average Business Tariff Revenue	5.14	5.27	5.40	5.61	5.81

Table 1, demonstrates that AAD's proposed tariffs for the residential and business tariff classes falls below the standalone costs and above the avoidable costs.

Long run marginal costs

The LRMC is an estimate of the future costs that would be caused by an incremental change in demand, including the possible need to expand the capacity of the network so as to satisfy the incremental change in demand. This implies that the LRMC can be estimated by examining hypothetical upgrades of capacity to satisfy expected changes in demand.

The network capacity needs of AAD are likely to be driven by a number of factors including:

- number of customers – AAD's total customers served has been increasing over the entire period for which we have data (ie, from 2007-08), and we understand that it is expected to continue to increase in the future;
- maximum demand – we understand that AAD's maximum demand has been increasing due to increasing customer numbers and changes in customer consumption behaviour; and
- energy throughput – AAD's total annual energy throughput has been declining since 2013-14 and we understand that it is expected to continue to fall over the near future.

Our approach to the COSM involved developing estimates for AAD's LRMC associated with each of these factors, i.e., growth in energy throughput, customer numbers and maximum demand.

We estimated AAD's LRMC associated with changes in energy throughput using an average incremental cost (AIC) approach. This involves measuring the LRMC as the present value of the future stream of growth related capital expenditure, divided by the present value of the change in energy throughput over the same period. As energy throughput is declining over the foreseeable future period (i.e., it is negative), the AIC methodology leads to the LRMC estimate being undefined, and so this methodology provides no insight as to whether the LRMC is low (ie, close to zero) or potentially high, as declining demand potentially brings opportunities to defer or resize needed replacement infrastructure.

That said, should AAD believe that incremental changes in demand would have no practical effect on the sizing or timing of replacement infrastructure (and so incremental reductions in demand would not change AAD's future replacement costs) then it might be appropriate to assume that the associated LRMC is low or close to zero.

The LRMC associated with the expected growth in customer numbers has also been estimated using the AIC approach. It was calculated as the LRMC per connection per annum for each tariff class. The LRMC per connection per annum has been calculated by assuming that the payment per customer can be expressed as a constant payment over the life of a 20 year annuity. This approach ensures that the price signal embedded within the LRMC per connection per annum estimate is provided to customers over the expected life of the connection.

The remainder of AAD's growth capital expenditure is attributable to the need to expand the capacity of the network in response to anticipated increases in peak demand, driven from growing customer numbers adding to peak usage and potentially changes in per customer usage during peak periods. Given that customers' usage is not recorded in time increments there is no information on peak demand usage, associated peak demand forecasts or the cost of each additional unit of peak demand, and so the model at this point does not include estimates of the LRMC arising from anticipated increases in peak demand. In principle, an LRMC estimate in relation to peak demand could be translated into an equivalent usage-based LRMC so as to provide some, albeit limited, signal to users about peak demand usage

It follows that part of the price signal arising from the growth in customer numbers would be appropriately allocated to a maximum demand based charge (ie, a capacity utilisation charge) to the extent that such a charge was feasible. In the absence of a demand based charging mechanism, the price signal arising from maximum demand growth could be given to customers via the energy throughput tariff.

In this circumstance, part of our estimate of the LRMC per customer could be appropriately apportioned to energy throughput, as a proxy for maximum demand. However, in the absence of specific information on maximum demand growth, we have not estimated the LRMC for maximum demand to allow for such an apportioning to be undertaken.

Our resultant estimates for AAD's LRMC are set out in Table 2 below.

Table 2: ActewAGL Distribution's Long Run Marginal Cost, by tariff component

Cost	Annual Cost
LRMC Energy Consumption ($/GJ)	Undefined
LRMC residential tariff class ($/connection/annum)	459.79
LRMC business tariff class ($/connection/annum)	460.59

1. Introduction

HoustonKemp have been engaged by ActewAGL Distribution (AAD) to construct a cost of service model (COSM) to support the development of AAD's 2016-2021 Access Arrangement proposal. The COSM satisfies the tariff principles set out in the National Gas Rules and so provides estimates for each tariff class of:

- the stand alone cost for providing services related to the tariff class;
- the avoidable cost associated with the tariff class; and
- the long-run marginal cost (LRMC) for each tariff component (ie, consumption, fixed fee by tariff class).

The remainder of this report is structured as follows:

- section 2 provides a brief background to ActewAGL's gas network and the current distribution pricing principles as set out in the NGR;
- section 3 describes the methodology that we have used to estimate the threshold costs specified by these pricing principles, namely the stand alone costs and avoidable costs;
- section 4 sets out our approach to estimating the long run marginal cost (LRMC) for each tariff component; and
- section 5 sets out our results from the application of the COSM, ie our estimates of AAD's stand alone costs, avoidable costs and LRMC.

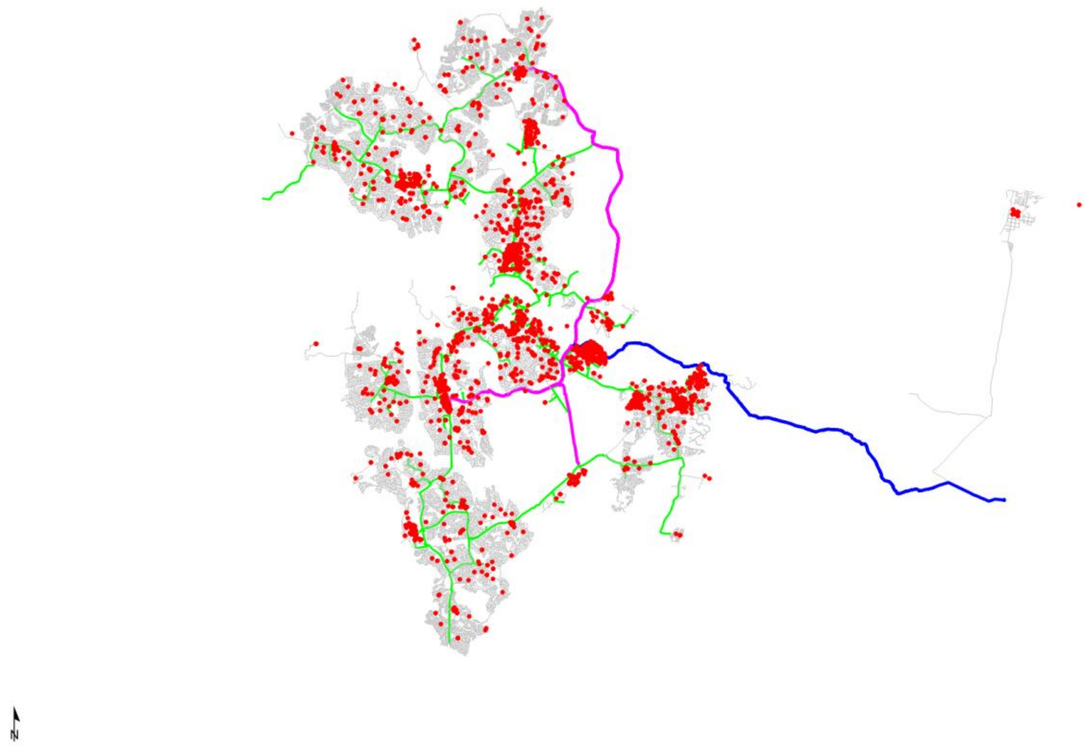
2. Context

In this section we briefly describe AAD's gas distribution business and the current distribution pricing principles set out in the NGRs.

2.1 ActewAGL Distribution

ActewAGL Distribution (AAD) owns and manages a gas distribution network that distributes natural gas to over 130,000 homes and business across the ACT, Queanbeyan and Palerang. AAD's network comprises of more than 4,900km of pipeline – see Figure 1 for a map of AAD's network.

Figure 1: ActewAGL Distribution's network map



2.2 Distribution pricing principles in the National Gas Rules

Rule 94 of the National Gas Rules (NGR) sets out the principles to be applied by distributors when determining reference tariffs to apply to distribution pipelines.

It requires that customers be divided into tariff classes and specifies the revenue bound for each tariff class.[1] Specifically, Rule 94(3) requires that:

> 94(3) For each tariff class, the revenue expected to be recovered should lie on or between:
>
> (a) an upper bound representing the stand alone cost of providing the reference service to customers who belong to that class; and
>
> (b) a lower bound representing the avoidable cost of not providing the reference service to those customers.

In addition, Rule 94(4) specifies that:

> 94(4) A tariff, and if it consists of 2 or more charging parameters, each charging parameter for a tariff class:
>
> (a) must take into account the long run marginal cost for the reference service or, in the case of a charging parameter, for the element of the service to which the charging parameter relates;
>
> (b) must be determined having regard to:
>
> (i) transaction costs associated with the tariff or each charging parameter; and
>
> (ii) whether customers belonging to the relevant tariff class are able or likely to respond to price signals.

[1] NGR, 94(1) and 94(3).

3. Estimating Stand Alone and Avoidable Costs

This section first sets out the economic principles underpinning the concepts of stand alone and avoidable cost, which is followed by a description of the approach we have adopted to estimate these costs.

3.1 Economic principles

The revenue bounds of stand alone cost and avoidable cost represent the theoretical bounds beyond which a business would not promote the efficient use of, and investment in, the infrastructure needed to provide network services.

Stand alone costs represents the estimated costs to replicate or bypass the network for the provision of network services to a group of customers. It follows that pricing above the stand alone costs would create incentives for the group of customers to inefficiently bypass the network, compared to the alternative of making use of the existing network services. The stand alone costs therefore also represent the upper bound for pricing, and associated revenue.

In the context of AAD, the stand alone costs for a tariff class can be approximated by estimating the costs that AAD would incur if it was to provide a gas distribution network to supply only that tariff class.

Avoidable costs represent those costs that would be avoided by a network business if it no longer supplied a customer or group of customers. Pricing at a level that would generate revenue less than the avoidable costs means that a network business would need to recover the difference from other customers (ie, cross subsidise) or earn a lower return. It follows that pricing below the avoidable costs promotes the inefficient use of the network and creates incentives for network businesses to disconnect those customers. The avoidable costs therefore also represent the lower bound for pricing and associated revenue.

In the context of AAD, the avoidable costs for a tariff class are those costs that AAD would avoid if it were to cease supplying to that tariff class.

3.2 Approach to estimate stand alone and avoidable costs

The approach we have used to estimate stand alone costs is based on the total revenue requirements for AAD. This approach assumes that AAD's actual costs are a good approximation of the costs that would be incurred to replicate or bypass AAD's network. An alternative approach would be to directly estimate the costs of any necessary infrastructure, given prevailing construction costs (e.g., by estimating the optimised replacement cost (ORC)). The difference between an ORC cost and the actual costs of AAD will reflect changes in construction costs or innovation in infrastructure technology. Given the nature of AAD's infrastructure, we believe that this is unlikely to lead to a significantly different outcome.

To estimate stand alone and avoidable costs we have therefore first decomposed AAD's total costs into:

- costs that are attributable to a single tariff class, i.e. dedicated costs; and
- costs that are common to multiple tariff classes, i.e. shared costs.

After allocating total costs, avoidable costs for a tariff class are estimated as the dedicated costs for that tariff class (i.e., all the costs that are directly caused by, and so could be avoided by, not supplying that tariff class). The stand alone costs are calculated as the avoidable costs for the tariff class plus the total shared costs. This approach is appropriate for AAD because of its intermeshed network and so the entire AAD network would be needed to supply each tariff class.

Specifically, for each tariff class, we calculated the stand alone and avoidable costs as follows:[2]

$$stand\ alone\ cost\ (\$/GJ) = \frac{annual\ dedicated\ costs(\$) + annual\ shared\ costs(\$)}{residential\ throughput\ (GJ)}$$

$$avoidable\ cost\ (\$/GJ) = \frac{annual\ dedicated\ costs(\$)}{residential\ throughput\ (GJ)}$$

In the remainder of this section we describe AAD's costs and the approach we took to estimating the shared and dedicated costs.

3.3 ActewAGL Distribution's costs

We have used the total revenue calculated in AAD's post-tax revenue model (PTRM) to represent AAD's approved total costs – this figure represents the total economic costs that AAD is able to recover. The total revenue is calculated as the sum of the following:

- return on equity;
- return on debt;
- return of capital (regulatory depreciation);
- operating expenditure (opex);
- revenue adjustments; and
- tax payable (less the value of imputation credits).

To calculate these values we have used data sourced from AAD – we set out these values in Table 3 below.

Table 3: Model assumptions

Parameter	Value
Inflation rate	2.5%
Value of imputation credits (gamma)	25%
Proportion of equity funding	40%
Proportion of debt funding	60%
Post-tax nominal return on equity	9.87%
Post-tax real return on equity	7.14%
Corporate tax rate	30%
Nominal pre-tax return on debt	5.34%
Real pre-tax return on debt	2.72%

To calculate AAD's stand alone and avoidable costs, we apportioned each of the cost items across the tariff classes. We describe our allocation approach below.

[2] Note that we use the term "costs" to refer to the economic costs of AAD. These costs equate to revenue that AAD is able to recover.

3.4 Cost allocation

As stated in section 2.1, AAD has two tariff classes, namely the residential tariff class and the business tariff class. Therefore, we allocated each of AAD's costs to:

a) costs that are specific to the residential tariff class;

b) costs that are specific to the business tariff class; and

c) costs that are shared across these two tariff classes.

We used AAD's regulated asset base (RAB) to allocate its costs across the costs described above in paragraphs a) – c). We used RAB values for the allocation because these values represent a reasonable approximation for the replacement value of AAD's business. Further, it is possible to estimate the proportion of specific assets associated with the residential tariff class, the business tariff class and shared across both tariff classes. For example, pipelines are often shared by the residential and business tariff class, whereas meters are specific to each customer within the tariff classes.

To undertake the allocation, we first assigned each item of AAD's opening RAB to dedicated residential, dedicated business and shared assets using proportions set out in Table 4 below.

Table 4: Opening RAB allocation proportions

RAB Item	Dedicated Residential Assets	Dedicated Business Assets	Shared Assets	Total
HP Mains	-	6.9%	93.1%	100.0%
HP Services	-	14.3%	85.7%	100.0%
MP Mains	74.5%	4.3%	21.2%	100.0%
MP Services	74.5%	4.3%	21.2%	100.0%
TRS and DRS – Valves and Regulators	-	-	100.0%	100.0%
Contract Meters	-	100.0%	-	100.0%
Tariff Meters	97.4%	2.6%	-	100.0%
Equity Raising Costs	-	-	100.0%	100.0%
IT System	-	-	100.0%	100.0%

Source: AAD Estimates

We understand that the allocation of mains was based on an assessment of the length of pipelines used to service either the residential tariff class, the business tariff class, or both tariff classes. While it was assumed that all valves and regulators, equity raising costs, as well as IT systems were used by both tariff classes. Finally, meter assets were allocated on the basis of customer numbers.

We then used the allocation proportions to apportion each item of AAD's opening RAB to dedicated residential, dedicated business and shared assets to obtain the total RAB associated with each asset group – see Table 5 below.

Table 5: Opening RAB allocation values ($'m nominal)

RAB Item	Dedicated Residential Assets	Dedicated Business Assets	Shared Assets	AAD's Total Opening RAB
HP Mains	-	6.62	89.27	95.89
HP Services	-	0.11	0.66	0.76
MP Mains	112.17	6.40	31.90	150.46
MP Services	54.40	3.10	15.47	72.98
TRS and DRS – Valves and Regulators	-	-	19.79	19.79
Contract Meters	-	9.16	-	9.16
Tariff Meters	17.80	0.47	-	18.28
Equity Raising Costs	-	-	-	
IT System	-	-	-	
Total	184.37	25.86	157.08	367.32

Notes and sources: AAD's total opening RAB from its PTRM. The RAB values of the dedicated residential, dedicated business and shared assets were calculated by multiplying AAD's total opening RAB by the relevant allocation proportions, as set out in Table 4.

Finally, we calculated the proportion of AAD's total opening RAB associated with each group – see Table 6. We used these proportions to allocate AAD's costs across the three groups.

Table 6: Proportions used to allocate AAD's costs

	Total Opening RAB Value ($'m nominal)	Proportion of AAD's Total Opening RAB
Dedicated Residential Assets	184.37	50%
Dedicated Business Assets	25.86	7%
Shared Assets	157.08	43%
AAD's Total Opening RAB	367.32	100%

Notes: See Table 5 for the calculation of the total opening RAB values.

4. Estimating the Long Run Marginal Cost

Rule 94 of the NGR also specifies that if a tariff consists of two or more charging parameters, each charging parameter for a tariff class must be set having regard to the LRMC of the particular services to which the parameters relate. The NGR require that gas distributors consider the LRMC in setting tariffs because a necessary condition for economic efficiency is that the price of a service is set equal to its marginal cost, ie, the cost of producing an additional unit of the service. That said, the rules provide flexibility to deviate from setting charges equal to marginal cost so as to ensure revenue recovery,

Marginal cost can be estimated either in the short run or the long run. The fundamental distinction between short run and long run marginal cost is the timeframe within which production processes can be adjusted so as to minimise cost. Specifically:

- short run marginal cost (SRMC) is defined as the future costs arising from an incremental change in demand, holding at least one factor of production constant; whereas
- LRMC relaxes the constraints of its short run equivalent, and so reflects the future costs arising from an incremental change in demand assuming all factors of production can be varied.

Given that the LRMC allows for all factors of production to be varied, the LRMC captures the future cost of building additional capacity so as to satisfy the increment in demand.

In the remainder of this section, we describe the methodologies for estimating the LRMC and the application of these approaches to estimate AAD’s LRMC.

4.1 Methodologies for estimating long run marginal cost

There are three main approaches to estimate the LRMC, namely:

- the perturbation approach;
- the average incremental cost approach; and
- the stand-alone cost, or ‘greenfields’ approach.

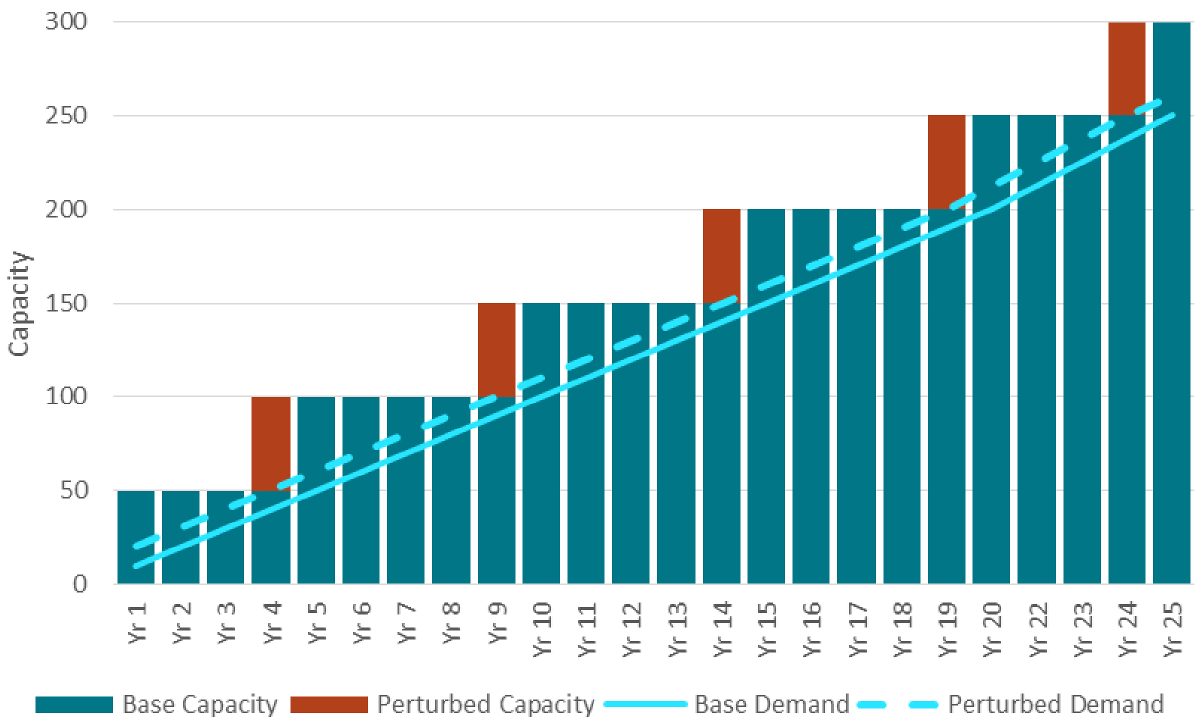
We describe and illustrate the application of each of these approaches in the following sections.

4.1.1 Perturbation approach

The perturbation approach considers the costs that would be incurred if current forecasts of demand growth are ‘perturbed’ by a fixed and permanent small increment. The perturbation triggers a change in the timing of new capacity investment (or the sizing of replacement infrastructure if demand is falling), and so results in a change in total supply costs.

Figure 2 sets out an illustrative example of the application of the perturbation approach in a circumstance of rising demand, indicating projected levels of demand, network capacity and the change in capacity effected by the perturbation.

Figure 2: Illustration of the perturbation approach



In this example, a hypothetical network asset experiences periodic upgrades to satisfy rising demand. The perturbation results in an increase in the demand requirement in every year, and so capacity upgrades must occur earlier (as indicated in red).

The change in costs arising from the perturbation divided by the change in demand is the basis of the estimate of LRMC, ie:

$$LRMC = \frac{PV(expenditure\ with\ perturbed\ demand - \ expenditure\ with\ base\ demand)}{PV(perturbed\ demand - base\ demand)}$$

In practice, calculation of the perturbation approach requires that we have:

- an existing estimate of total operating expenditure and capital expenditure for each year over the relevant time horizon (ie, expenditure with base demand);
- the cost and size (in GJ) of a network capacity upgrade (or downgrade), so as to estimate expenditure with perturbed demand);[3] and
- forecasts of load growth for the relevant network asset over the relevant time horizon.

In general, the perturbation approach requires more information than alternative approaches, but has the advantage of being capable of being used during periods of declining or flat demand.

4.1.2 Average incremental cost approach

The average incremental cost approach estimates LRMC as the average change in projected operating and capital expenditure attributable to future increases in demand. In practice it is estimated by:

[3] This will require an engineering assessment of changes in forward looking expenditure associated with perturbed demand.

- first, projecting future operating and capital costs attributable to expected increases in demand;
- second, forecasting future load growth for the relevant network asset (or assets); and
- third, dividing the present value of projected costs by the present value of expected increases in demand.

In simple terms, the average incremental cost approach averages the total cost of supplying new growth in demand across that growth in demand.

Figure 3: Illustration of the average incremental cost approach

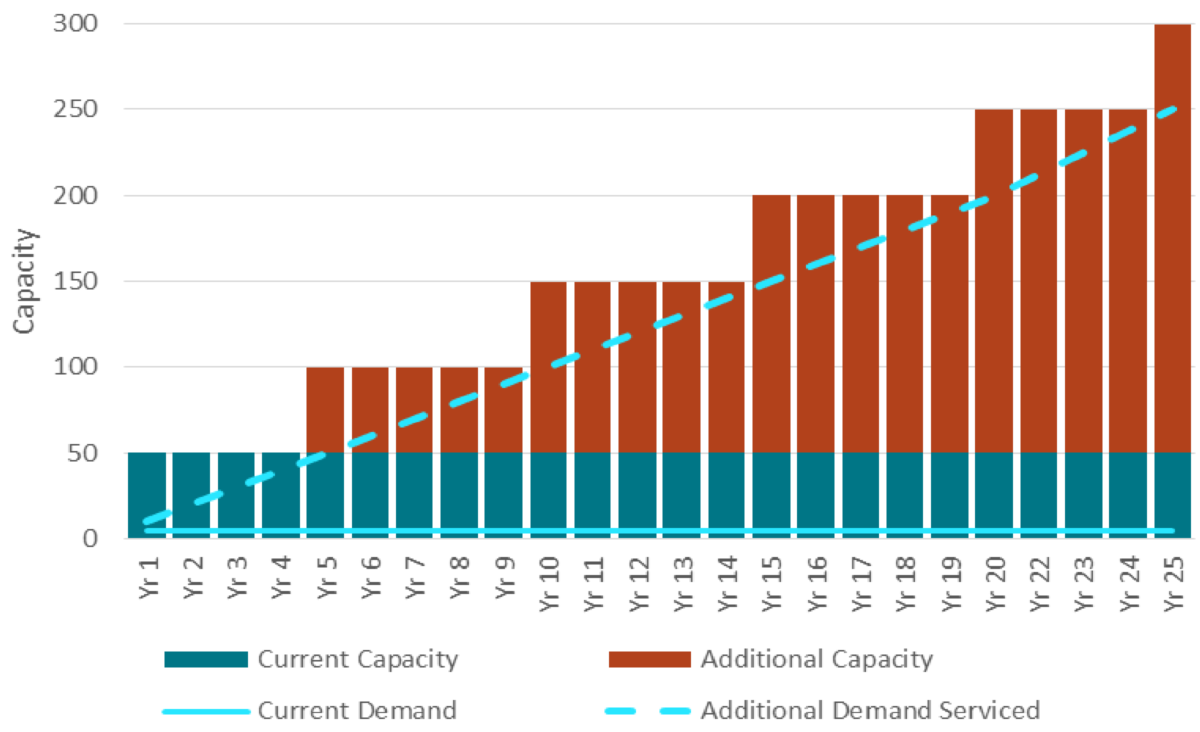


Figure 3 sets out an illustrative example of the application of the average incremental cost approach. By way of explanation:

- the blue line represents the current level of demand;
- the green bars represent the current network capacity;
- the dashed blue line represents projected increases in demand above its current level; and
- the red bars represent projected increases in network capacity required to meet the projected increases in demand.

Using the projected cost attributable to the increases in capacity, the formula for estimating the average incremental cost is:

$$LRMC = \frac{PV(expenditure\ relating\ to\ new\ network\ capacity)}{PV(additional\ demand\ serviced)}$$

We note that the average incremental cost approach requires that there be a positive increment in demand. Put another way, the average incremental cost approach is undefined when demand is flat or falling.

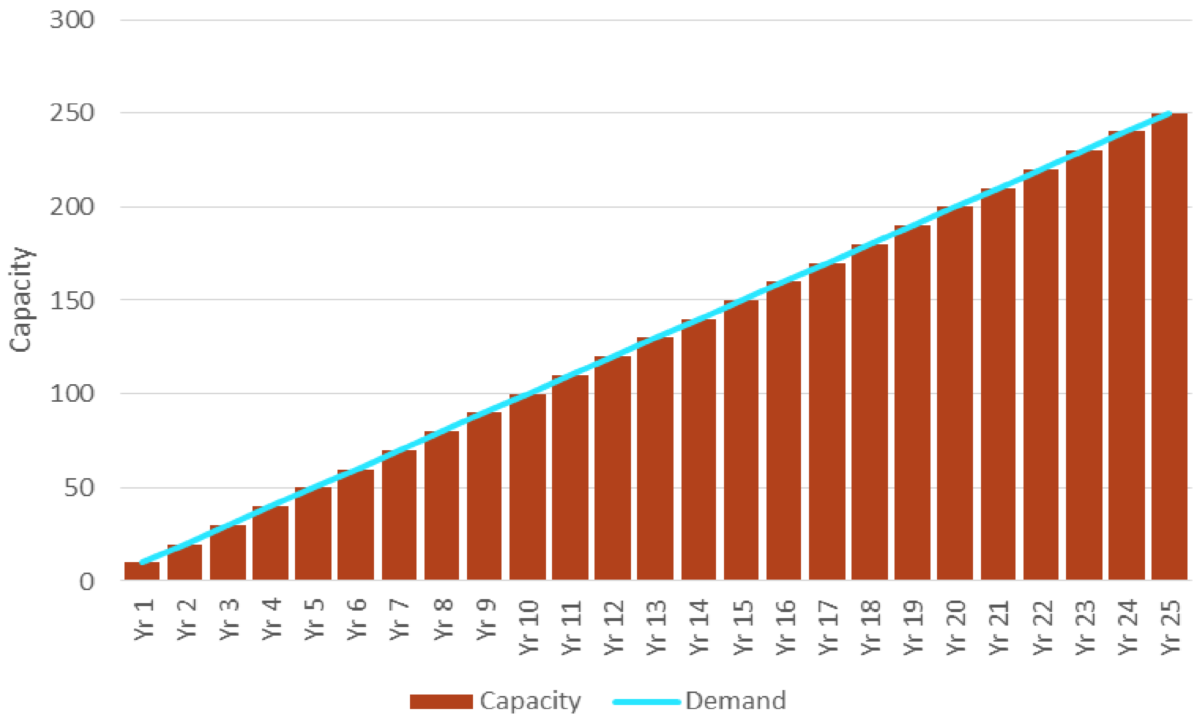
4.1.3 Stand alone approach

The stand alone approach estimates LRMC based on the cost to build the network anew, ie, assuming that there is no pre-existing network to serve prevailing gas demand.[4] The stand alone cost is therefore unaffected by the current level of capacity, and so is effectively a measure of constructing new network infrastructure.

The stand alone approach is a relatively crude method for estimating LRMC, and tends to be most appropriate in markets where demand is increasing and where supply can be increased in relatively small increments.

Figure 4 illustrates the build profile that is implicit in the stand alone cost approach. Unlike the lumpy build profiles exhibited by the perturbation and average incremental cost approaches, the stand alone cost method assumes that a network service provider can build the exact amount of capacity required to meet its annual demand.

Figure 4: Illustration of the stand alone approach



The lumpy nature of gas network investment therefore means that the stand-alone approach tends to produce estimates of LRMC that are a poor proxy for actual changes in network costs arising from changes in demand.

4.2 Application to ActewAGL Distribution

LRMC reflects the cost of an incremental change in demand, including the cost of building additional capacity to meet that demand. This implies that LRMC can be estimated by examining hypothetical upgrades of capacity to satisfy expected demand.

[4] We note that the stand alone approach to estimating LRMC is not the same as the stand-alone cost for a tariff class. Despite their similar names, they are distinct concepts.

The capacity requirements of gas distributors can be driven by a number of factors – this is in contrast to the capacity requirements of electricity distributors, which are primarily driven by maximum demand. We examine the key cost drivers for AAD, and how these drivers may impact AAD's costs and tariffs in the remainder of this section.

4.2.1 Drivers of ActewAGL Distribution's network costs

There are three key drivers of the underlying costs incurred from providing network services by AAD, namely:

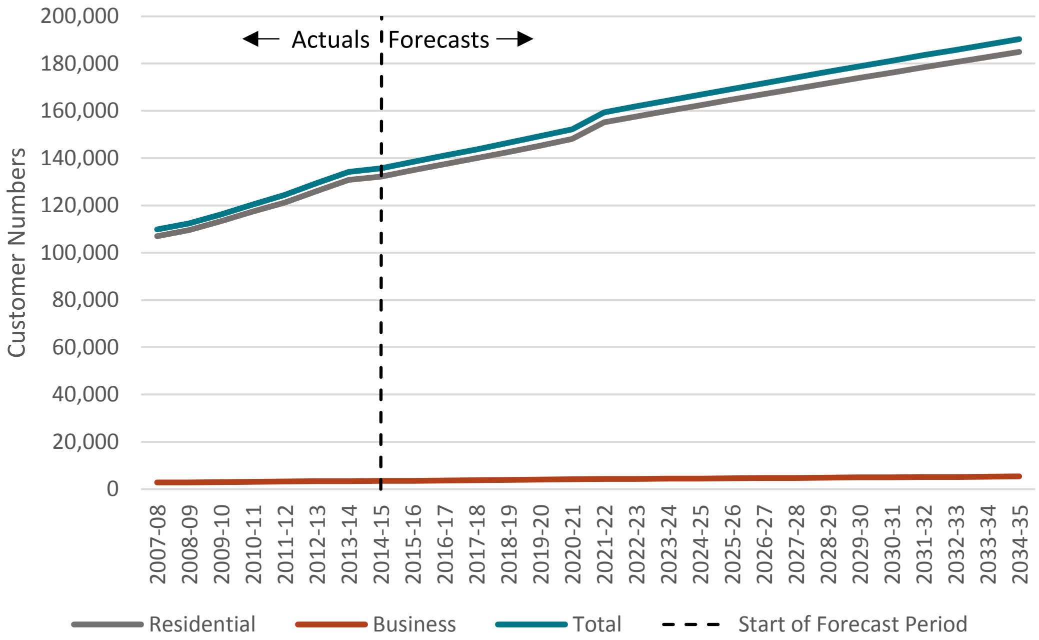
- number of customers – ie, the total number of connections to AAD's network;
- maximum demand – ie, the peak amount of gas demanded on ADD's network; and
- energy throughput – ie, the total amount of gas delivered to its customers in GJ.

We describe each of these cost drivers below.

Number of customers

AAD's annual number of customers has been increasing over the entire period for which we have data (ie, from 2007-08) and this trend is forecast to continue in the future –Figure 5. The increase in AAD's customer numbers is largely driven by increasing residential customer numbers. However, business customer numbers have been also increasing.

Figure 5: ActewAGL Distribution's annual number of customers



Maximum demand

We understand that AAD's maximum demand will continue to grow as customer numbers continue to grow and customer consumption behaviour changes despite falling throughput per customer connection. This is because AAD has advised us that most of the gas in AAD's network is consumed over the winter for heating, with intraday peaks during the winter mornings and afternoons. Further, these intraday peaks coincide with the significant use of gas appliances which may cause large quantities of gas to be withdrawn from the network over a short period of time, such as instantaneous gas hot water appliances.

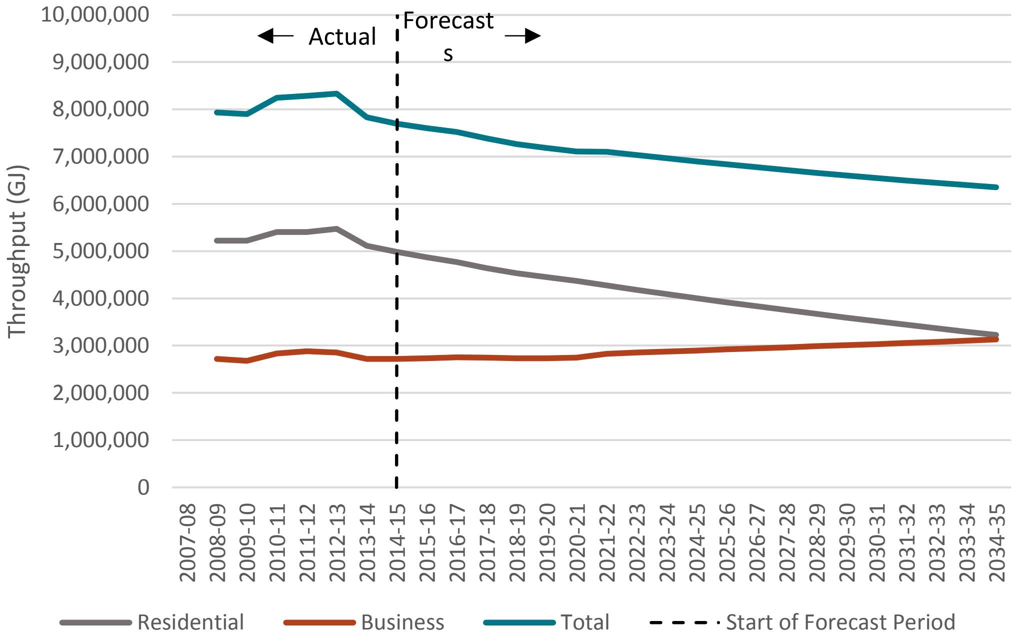
Table 7: Actual maximum demand

Pipeline daily demand (TJ)	Actual 2010/11	Actual 2011/12	Actual 2012/13	Actual 2013/14	Estimate 2014/15 (*)
Minimum demand	61.73	65.75	59.62	62.34	62.94
Maximum demand per connection	4.22	4.97	4.81	3.95	5.07
Average demand per connection	23.66	23.80	22.93	21.26	22.51

Energy throughput

AAD's total annual energy throughput has been declining since 2013-14 and is forecast to continue to fall in the future – Figure 6. Decreasing annual energy throughput is being driven by falling throughput per residential customer, with total throughput falling since 2013-14 and being forecast to continue to fall. Comparatively, business throughput has declined in the past three years but it is expected to increase annually from 2015-16.

Figure 6: ActewAGL Distribution's annual energy throughput

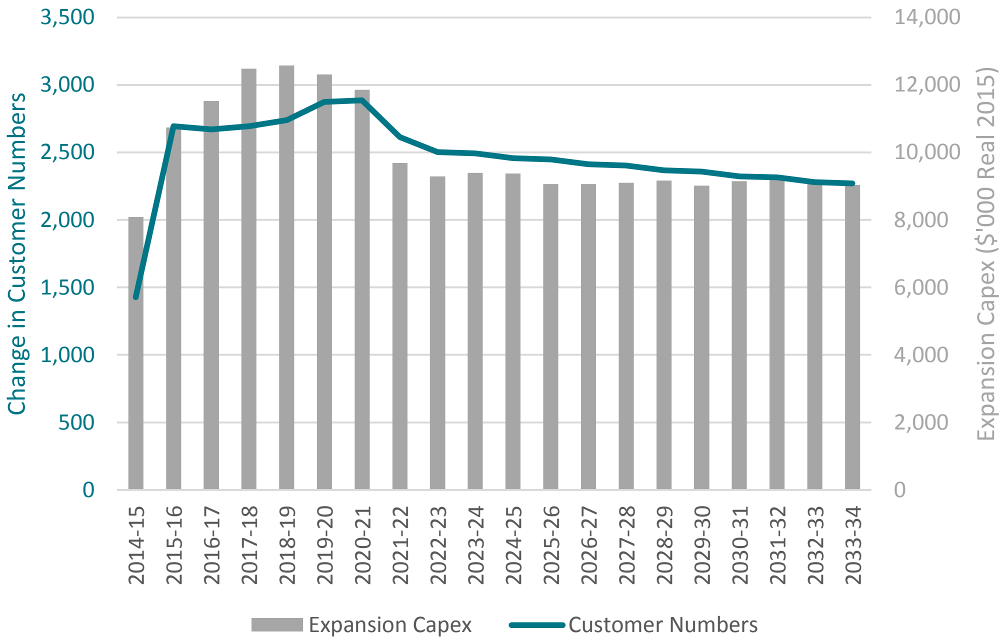


4.2.2 Implications for AAD's costs

AAD has declining energy throughput, this factor is unlikely to be a contributor to AAD's future expansion related costs.

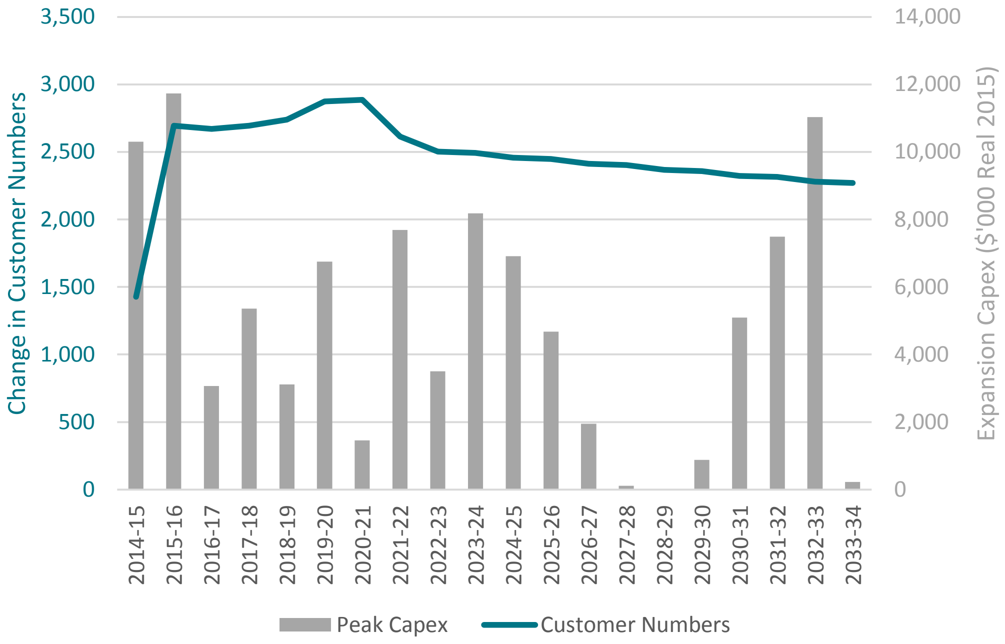
Comparatively, AAD is expecting continuing growth in the number of customer connected to the network. The connection of new customers leads to additional infrastructure investment in some circumstances. As such, increasing customer numbers lead to greater capital expenditure associated with growth and connections. Figure 7 below sets out forecast capex associated with growth and connections, and the forecast annual change in AAD's number of customers.

Figure 7: ActewAGL Distribution's expansion capex and change in customer numbers



We have been informed by AAD that peak demand has been increasing due to the increase in customer numbers as well as increases in consumption at peak time by existing customers. Increases in peak demand has resulted in AAD undertaking capacity development – ie, capex associated with peak demand. Figure 8 below sets out the amount of forecast capex associated with peak demand, as well as the forecast annual change in AAD's number of customers.

Figure 8: ActewAGL Distribution's peak capex and change in customer numbers



4.2.3 Estimating ActewAGL Distribution's LRMC for tariff components

We understand that the current network tariff components comprise a fixed charge per connection, and a charge based on energy throughput. It follows that we have estimated the LRMC for energy throughput and customer numbers.

That said, we understand that the principal driver of expansion capital expenditure is related to maximum demand growth that is driven in part by ongoing growth in the number of customer connections. It follows that part of the price signal arising from the growth in customer numbers would be appropriately allocated to a maximum demand based charge (ie, a capacity utilisation charge) to the extent that such a charge was feasible. In the absence of a demand based charging mechanism, the price signal arising from maximum demand growth could be given to customers via the energy throughput tariff.

In this circumstance, part of our estimate of the LRMC per customer could be appropriately apportioned to energy throughput, as a proxy for maximum demand. However, in the absence of specific information on maximum demand growth, we have not estimated the LRMC for maximum demand to allow for such n apportioning to be undertaken.

The remainder of this section sets out our approach to estimating the LRMC for customer numbers and energy throughput.

Customer numbers

We have estimated the LRMC associated with the growth in customer numbers as the LRMC per connection per annum for each tariff class. To estimate these values we have utilised the average incremental cost approach.

Specifically, to estimate the LRMC per connection per annum for each tariff class we first divided the present value of the projected growth costs by the present value of expected increases in customer numbers and then added the average variable costs associated with the tariff class, ie:

$$LRMC = \frac{PV(expenditure\ relating\ to\ new\ network\ capacity)}{PV(additional\ total\ new\ customers\ serviced)} + PV(average\ varaible\ cost)$$

Here the expenditure relating to new network capacity includes growth capex and growth opex, and these values are the same across both tariff classes. The average variable costs represent metering costs and are specific to the tariff classes. The calculation results in the LRMC associated with the growth in customer numbers.

We then translate the LRMC values into tariff charges per tariff class (so that the LRMC estimates are appropriately comparable) by assuming that the payment per customer can be expressed as a constant payment over the life of a 20 year annuity. In other words, the estimated LRMC values can be considered as the present value of annual constant payments by customers over a period of 20 years. To estimate this constant payment we solved for the annuity assuming a discount rate equal to the real vanilla WACC (of 4.78 per cent), ie:

$$LRMC\ chargeable\ to\ each\ tariff\ class = LRMC \times \frac{WACC}{1-(1+WACC)^{-20}}$$

This results in the LRMC per customer connection per annum.

Energy throughput

As outlined earlier, energy throughput is expected to fall in aggregate (despite variations between residential and business customers). It follows that the typical methodology for estimating the LRMC for the energy usage tariff component, namely the AIC, is undefined in this circumstance.

Importantly, a finding that the LRMC is undefined when applying the AIC is not equivalent to assuming that the LRMC is low or zero. Indeed, it is possible for the LRMC to be positive if incremental changes in demand meant that expected replacement capital expenditure could be sized differently thereby avoiding some capital costs. In this circumstance, the avoided costs divided by the increment needed to avoid those capital costs would form the basis for a positive LRMC. Such an estimate for the LRMC could be obtained through application of the perturbation LRMC approach.

In order to estimate the LRMC for energy throughput in the circumstances where throughput is falling would therefore require a hypothetical consideration of changes in both expansion and replacement capital expenditure arising from incremental changes in demand. However, such an exercise goes beyond the usual investment planning processes of a network business. Given the absence of readily available information on this, we have not sought to estimate the LRMC by applying the perturbation approach.

Finally, should AAD believe that incremental changes in demand would have no practical effect on the sizing or timing of replacement infrastructure land so incremental reductions in demand would not change AAD's future replacement costs), then it might be appropriate to assume that the associated LRMC is low or close to zero.

Such a finding would not imply that usage based charges should be low or set to zero, given the need for AAD to recover its total costs through a combination of fixed charges and mark-ups on usage charges.

5. Results

In this section we provide the results of the COSM for each tariff class. Specifically, for each of these tariff classes, we set out the stand alone and avoidable costs in Table 8 below, and LRMC in Table 9.

Table 8: ActewAGL Distribution’s stand alone and avoidable costs and average tariff revenue ($/GJ)

Tariff Class	2016-17	2017-18	2018-19	2019-20	2020-21
Residential					
Residential Standalone Cost	13.16	13.45	14.54	15.82	16.62
Residential Avoidable Cost	4.20	4.26	4.61	4.82	5.25
Average Residential Tariff Revenue	11.52	11.98	12.43	12.89	13.36
Business					
Business Standalone Cost	17.14	17.15	18.07	19.60	19.97
Business Avoidable Cost	1.19	1.21	1.30	1.36	1.48
Average Business Tariff Revenue	5.14	5.27	5.40	5.61	5.81

Table 9: Estimates of the long run marginal cost for ActewAGL Distribution

Cost	Annual Cost
LRMC ($/GJ)	Undefined
LRMC - Residential tariff class ($/connection/annum)	459.79
LRMC - Business tariff class ($/connection/annum)	460.59

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