Nuttall Consulting

Regulation and business strategy

AER augex model

Assessing the TasNetworks augex forecast

A report to TasNetworks

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Executive summary

Nuttall consulting has been engaged by Tasmanian Networks Pty Ltd (TasNetworks) to undertake an assessment of its augmentation expenditure (augex) forecast. This assessment must use the predictive model the Australian Energy Regulator (AER) has indicated it will use as part of the process it will apply to assess expenditure forecasts. This model is called the AER augex model.

To prepare this model, we have used the loading and rating data that TasNetworks will report in its Reset Regulatory Information Notices. This process has been supported by other data provided by TasNetworks and other comments and advice provided during the course of two workshops with relevant TasNetworks personnel.

We have been able to assess approximately 60% of TasNetworks' augex forecast using this model[1].

To make this assessment, we have undertaken a range of studies using the model. These studies have used model planning parameters from various sources, including parameters derived from TasNetworks' recent augmentations (over 2011/12 to 2013/14) and parameters sourced from public documents on similar modelling exercises we have performed for two Victorian DNSPs (Jemena and United Energy).

These studies can be viewed in terms of two types:

- indicative intra-company (or business-as-usual) benchmark studies
- indicative inter-company benchmark studies.

Before turning to the findings of this assessment, it is worth noting that we have only a limited set of parameters to determine accurate benchmarks. Therefore, some caution must be placed on these findings. Nonetheless, we still believe they are sufficient to provide some level of confidence in their findings. It is also important to note that the augex model forecast is sensitive to TasNetworks' peak demand forecast, with the model forecasting a similar level of change in augex for the change in this assumption. Therefore, should the TasNetworks' demand growth assumption change significantly then the findings of this assessment could also change significantly.

Key assessment findings

Our assessment using the AER's augex model largely supports TasNetworks' augex forecast.

Over a five-year assessment period, commencing at the start of the next regulatory period, TasNetworks' forecast is less than the majority of the augex model studies. Most notably:

- TasNetworks' forecast is less than all of our indicative intra-company (i.e. business-as-usual) benchmark studies, with TasNetworks' forecast ranging between 66% and 80% of the study forecasts.

[1] The remaining 40% is associated with the component of TasNetworks' augex forecast that was not considered to be covered by an assessment using the augex model.

- TasNetworks' forecast is less than the indicative inter-company benchmark studies reflecting its closest peer in our studies, United Energy, with TasNetworks' forecast ranging between 59% and 98% of the study forecasts.

Over the two-year assessment period covering TasNetworks' next regulatory period, the results are less supportive, due to TasNetworks' higher per-annum forecast over this period:

- TasNetworks' forecast is *still* less than the two most representative indicative intra-company (i.e. business-as-usual) benchmark studies[2], with TasNetworks' forecast ranging between 87% and 95% of the study forecasts.
- But TasNetworks' forecast is 35% above the indicative inter-company benchmark study that used the forecast parameters of United Energy in place of the TasNetworks parameters we were unable to derive.

The studies using Jemena's parameters tend to be less supportive of TasNetworks' forecast. However, Jemena is very much an urban DNSP, with very little rural network. As such, we would expect the use of its parameters to result in a lower forecast relative to TasNetworks.

United Energy has a greater proportion of rural network, and therefore, we have treated it as TasNetworks' closest peer in our assessment[3]. However, United Energy is still predominantly an urban distributor and has a much smaller proportion of rural network compared to TasNetworks. Therefore, even in the case of the studies using United Energy's parameters, these are likely to understate TasNetworks' augex needs.

That said, it is not clear to us if the less supportive results over the two-year assessment period could be solely due to the other DNSPs being more urban than TasNetworks. Nonetheless, we consider that the two-year period is most likely too short for a reliable assessment using the augex model, due to its "averaging" approach. Therefore, if this result remained a concern to the AER, it would need to be assessed using the other assessment approaches the AER may apply.

Therefore, given these points, we believe our assessment using the AER augex model largely supports TasNetworks' augex forecast. Most notably, the intra-company studies suggest TasNetworks' forecast should represent an efficiency improvement over its recent history and the intercompany studies suggest TasNetworks' forecast is broadly in accordance with the practices of its peers[4].

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[2] These two studies use the historical and forecast parameters of United Energy in place of the TasNetworks parameters that we were unable to derive.

[3] Note here, we are not claiming United Energy is TasNetworks' closest peer in the National Electricity Market, which is more likely to be one of the predominantly rural network businesses.

[4] Allowing for its rural nature and TasNetworks' forecast growth in peak demand.

1 Introduction

1.1 Background and scope

Tasmanian Networks Pty Ltd (TasNetworks) has engaged us, Nuttall Consulting, to assist in its preparations for its next regulatory determination by the Australian Energy Regulator (AER). This determination will cover the two-year period from 1 July 2017 to 30 June 2019[5].

As part of this engagement, TasNetworks has requested that we:

- develop a model of TasNetworks' augmentation capex (augex) using the AER's augex model
- use the model to assess TasNetworks' augex forecast, using an approach that could be applied by the AER
- reconcile the model forecast with TasNetworks' own augmentation forecast to identify the parameters within the model driving the differences
- prepare an independent report, which can be used as a supporting document to TasNetworks' building block proposal to the AER, that sets out the forecast and explains how we developed the model and forecast.

This document serves as the report indicated above.

The following definitions are used in this report:

- **Augmentation capex** (or **augex**) has the meaning given to it by the AER in its recent advice on how it will conduct expenditure forecast assessments, which broadly covers the demand-driven reinforcement, extension or enhancement of the network, excluding similar activities due specifically to the connection of customers.
- We use the term **AER augex model** to mean the generic excel workbook that the AER has advised it will use as an assessment technique in its determinations – and the AER calls the augex model.
- We use the term **TasNetworks augex model** to mean the model we have prepared of TasNetworks' network using the AER augex model. The TasNetworks augex model is used here to produce augex forecasts of the TasNetworks network.
- We use the term **asset** here in a very general sense to reflect the physical unit of network that is accounted for in the AER augex model. This typically reflects an individual line or an individual substation[6].

[5] This shorter period from the usual five-year period is to align future Tasmanian distribution determinations with the transmission determinations.

[6] Note the difference here to an asset in the repex model – or TasNetworks' systems – which is likely to account for a sub component of the augex model's asset.

- When discussing the model and providing results in Sections 2 and beyond, we will use the year representation 200*x*, to represent the regulatory year 200*x*-1/200*x*.

In addition, all expenditure and costs shown in this report represent **direct real 2015 dollars**.

1.2 Nuttall Consulting experience in this task

Nuttall Consulting, using Dr Brian Nuttall (the author of this report), developed the Excel workbook that serves as the basis of the AER's augex model and advised the AER on its possible roles and application in regulatory determinations.

Moreover, we were engaged by the AER to provide advice that informed the AER's current determinations of the Victorian and Tasmanian Distribution Network Service Providers (DNSPs). As part of these engagements, Dr Nuttall developed models and forecasts using the AER's repex model. Although the augex model is aimed at a different expenditure activity (network augmentation, rather than asset replacement) it is broadly based upon similar principles.

1.3 Key information sources

We have used the following key information to develop TasNetworks' augex model:

- the AER augex model and AER augex model handbook, published on the AER website
- asset loading and rating data, provided in the format of the asset status tables in Template 2.4 of the Reset Regulatory Information Notice (RIN); this data covers the two years 2010/11 (2011) and 2014/15 (2015)[7]
- TasNetworks' historical augex covering the period from 2009/10 to 2014/15[8]
- TasNetworks' forecast augex covering the period from 2015/16 (2016) to 2024/25 (2025)[9].

We have also held a number of workshops with relevant TasNetworks personnel to clarify data requirements. Where gaps exist, we have made a number of assumptions to prepare the models. The critical assumptions and their basis will be discussed in this report.

1.4 Structure

This report is structured as follows:

- In section 2 we provide an overview of the AER augex model, summarising how it develops a forecast, its inputs and outputs, and how the AER may use it to assess a DNSP's augmentation forecasts.

[7] Provided in email from TasNetworks, dated 5/10/15
[8] Provided in email from TasNetworks, dated 1/10/15
[9] Provided in email from TasNetworks, dated 1/10/15

- We discuss the methodology we have used to develop the TasNetworks augex models in Section 3.
- In Section 4 we explain the approach we have used to assess TasNetworks' augex forecast using the augex model
- Section 5 summarises and discusses the results of this assessment.
- In Appendix A we provide additional analysis that investigates variations between TasNetworks' forecast and the model forecast at the network group level. This analysis also indicates how the model parameters contribute to the variations.

2 The AER's augex model

Before explaining the development of TasNetworks' augex model, we first provide an overview of the AER's augex model and its application. This should help provide some context to the results and discussions in the sections that follow.

2.1 Overview of augex model

The AER augex model is an Excel workbook, with a structure, formulas and VBA functions and macros set up by the AER in order that it can be used by the AER to develop a network model of a DNSP and use this to prepare augex forecasts.

The DNSP's network is constructed within the AER augex model as a series of asset populations. The model uses a probabilistic augmentation algorithm to make predictions of augmentation needs for each population. The probabilistic augmentation algorithm assumes that the maximum utilisation that an asset will reach before it must be augmented (called its utilisation threshold in the model) is normally distributed across any asset population represented within the model.

From this, the model predicts future augmentation volumes based upon a current utilisation profile for an asset population represented in the model.

The AER has indicated that it will use this model to make top-down assessments of a DNSP's augex forecast. In this regard, it has indicated that it may use the model in two ways to develop a benchmark forecast:

1 **Intra-company** – it will develop a benchmark forecast within the model that reflects the historical augmentation decisions of the DNSP (this reflects an assumption that these decisions were prudent and efficient)

2 **Inter-company** – it will develop a benchmark forecast within the model that reflects its view of the appropriate augmentation decisions it has determined from the set of DNSPs (this reflects an assumption that the DNSP's decisions were not prudent and efficient, and so it has substituted its view on this matter from the augex models of other DNSPs).

It is important to stress that at this stage the AER has not published any of its analysis of the above form of benchmarking. As such, it is unclear how it may approach the assessment of TasNetworks' augex forecast.

2.2 AER augex model form, inputs and output

2.2.1 Network specification inputs – network segments and groups

As indicated above, a DNSP's network is defined as a series of distinct asset categories within the augex model. These are called network segments in the AER's documentation and represent the set of network assets that may have similar planning arrangements i.e. lines or substations.

To facilitate analysis and reporting, each network segment defined in the model is assigned to a smaller set of groups. In this regard, a model may use a large number of network segments, to improve the accuracy of the analysis, but a much smaller number of groups to provide aggregate forecasts for reporting (and benchmarking) purposes.

2.2.2 Network specification inputs - utilisation profile

A utilisation profile must be provided for each network segment used in the model. This profile represents a snap-shot of the utilisation of the population of assets in that segment for the initial year of the model. That is, the utilisation profile is essentially a vector that holds the volume of assets (measured in capacity units e.g. MVA) at one-percentage increments of utilisation.

The timing of a capacity-related augmentation is typically sensitive to the maximum demand on an asset. That is, it is the amount of the maximum demand that is above various capacity limits of an asset that defines the risks and/or service constraints associated with using the asset. Therefore, within the augex model, the utilisation of any asset (e.g. the utilisation of a line or substation) is defined as:

- *the maximum demand on that asset / the assets capacity limit or rating*.

The model itself does not define exactly how the measures of maximum demand or capacity must be specified. However, the AER has indicated its preference for these measures in an effort to place all DNSPs on a consistent basis[10], where:

- the maximum demand should be weather corrected to represent a 50% probability of exceedance condition (and reflect normal network arrangements)
- the capacity of an asset should reflect its thermal rating, assuming a normal load cycle if applicable (i.e. an asset's normal cyclic rating).

It is important to note that once the units of capacity in a segment are defined, all measures of utilisation, capacity being augmented, or capacity needing to be augmented are reported in the model on that basis.

2.2.3 Network specification inputs – utilisation growth

To predict a network's augmentation needs, the model needs to first predict what the utilisation of the network will be in the future. To do this, the model requires the growth

[10] See discussion in Section 5 of AER augex model manual.

in utilisation (assuming no augmentation) to be input for each network segment. This is essentially the growth in maximum demand for each network segment.

The model represents this growth as a single annual compounded growth rate (percentage growth in one year) that should represent the average annual growth rate over the period being considered (note here that the model does not hold individual growth rates for each year of the forecast period).

2.2.4 Planning parameters inputs

The model uses four planning parameters to define the approach it uses to predict future augmentation needs:

- The utilisation threshold, which is represented as a normal probability distribution, is defined by two of these parameters:
  - the mean utilisation threshold
  - the standard deviation of the utilisation threshold.

  The utilisation threshold specifies when existing capacity requires augmentation, and is used to measure this amount from the utilisation profile. In this way, this parameter defines how the *need* for augmentation is measured.

- The capacity factor is the third parameter, reflecting the amount of additional capacity that is added to the network, given the amount of existing capacity that requires augmentation. It is defined as a proportion of the capacity requiring augmentation.

  For example, if the capacity factor is set at 50%, this means that if the model calculates that 100 MVA of the existing capacity will require augmentation in the future then it will assume that 50 MVA of capacity will be added to the network to address that need.

  This parameter relates to the *scale*, in capacity terms, of the augmentation solution that is used to address a *need*.

- The fourth parameter reflects the average augmentation unit cost, where a unit is specified in terms of the relevant unit of capacity for that network segment (i.e. $ / kVA of capacity).

Using these parameters, the capacity added to the network, calculated via the utilisation threshold and capacity factor, multiplied by the augmentation unit cost produces the expenditure forecast.

2.2.5 Model outputs

The model produces various outputs. These outputs provide various measures of the input utilisation profile, such as average utilisation, average threshold, total quantity of capacity, and total augmentation cost (i.e. quantity x augmentation unit cost).

The model also produces forecasts (by year over a 20-year period), including augmentation capacity volumes, augmentation expenditure, and average utilisation.

These outputs are provided at the network segment, segment group and total network level. When averages are calculated at the network group or network level, the model uses a weighted average using the augmentation cost of each asset category as the weighting.

2.3 Calibration

The calibration of a DNSP's model is the critical process that is applied by the AER to produce the intra-company benchmark model.

The calibration process concerns deriving the set of planning parameters that reflects the actual augmentation outcomes (volumes and expenditure) over the calibration period (e.g. the last 5 years)[11].

The following process can be used to calibrate the augex model[12].

This process relies on calculating three parameters for each network segment (or segment group) from the available data, namely:

- the augex in that segment (or segment group) over the calibration period
- the capacity added (through augmentation) in that segment (or segment group) over the calibration period
- the capacity that required augmentation in that segment (or segment group) over the calibration period.

2.3.1 Augmentation unit cost

The augmentation unit cost parameters for each segment is simply the augex divided by the capacity added to the segment.

2.3.2 Volume planning parameters

The utilisation threshold parameters (mean and standard deviation) and capacity factor for each segment need to be set to ensure the model reflects the capacity added (through augmentation) over the calibration period.

However, the calculation of these planning parameters is more complicated because:

- we have three parameters to determine and typically only one variable (the total capacity added)
- we are looking at history and not predicting into the future.

[11] The model can also be calibrated to other periods, such as a forecast period, provide appropriate expenditure and capacity data is available.

[12] The AER augex model manual does not discuss the calibration process in any detail. However, we understand the AER will apply a similar process to the one it has indicated it will use to calibrate its repex model. The process we have defined here should reflect this similar process.

Therefore, the calibration of the utilisation threshold parameters is slightly more involved and involves the following:

- First, in the absence of better information, the need to determine the standard deviation is removed by making it dependent on the mean. We have assumed that the standard deviation is the square root of the mean to reflect a similar assumption the AER has advised it will use for the repex model calibration process.
- Second, the capacity factor is set at a specific value. There are various ways this could be calculated. Here, we have estimated it from the TasNetworks data provided.
- Third, an augex model is developed to reflect the beginning of the calibration period, with the growth set to represent the growth that occurred over the calibration period. The mean utilisation is determined within this model to ensure that the forecast produced by the model over the calibration period equals actual capacity added due to augmentations during the calibration period.

The above defines the process that will typically be applied. However, this process will not produce utilisation threshold parameters in circumstances where, on average, there has been negative growth in a segment.

This is the case for TasNetworks over the historical period studied here. There are various methods to allow for this situation. In section 3.3, we will explain how we have adjusted this calibration process to derive TasNetworks' utilisation thresholds.

2.4 Alterations to the published AER model

We have not changed the underlying structure, format, and predictive algorithm of the AER augex model. However, we have added a number of sheets to aid in the modelling and reporting exercise.

These additional sheets are used to:

- perform the calibration process and scenario analysis
- aid in the reporting of results and produce comparisons with TasNetworks' forecast
- hold the TasNetworks forecast and TasNetworks' historical augex.

3 Augex model development

3.1 Overview

As discussed in Section 2.3, the process to calibrate a model and prepare a forecast requires the preparation of two augex models:

- The calibration model – This model is developed from the 2011 loading and rating data. The planning parameters are calculated within this model to ensure the forecast produced by the model to 2015 (i.e. capacity added and augex) matches what actually occurred.
- The forecast model – This model is developed from the 2015 loading and rating data. This model is used to prepare the forecasts over the next period, using the planning parameters developed in the 2011 calibration model or other benchmark parameters.

The development of these two models, including the parameter calibration process, is discussed in this section.

3.2 Augex model development

3.2.1 Segmentation

The model produces forecasts for a set of network segments that represent the DNSP's network. As such, each segment defined in the model requires its own set of inputs (i.e. utilisation profile and planning parameters) and the model produces forecasts for each segment.

Segments have been developed that reflect those model categories, defined by the AER in its Reset RIN, which are relevant to TasNetworks. The table below summarises the groups and segments we have developed for the TasNetworks augex models.

Table 1 TasNetworks augex model network segments

Network group	Network segment
Sub-transmission lines	All lines
Zone substations	All substations
HV feeders	Urban Short Rural Long Rural
Distribution substations	Urban Short Rural Long Rural

3.2.2 Utilisation profiles

Utilisation definition

In the model, the utilisation of an asset (e.g. an HV feeder or zone substation) is defined as:

Utilisation (%) = weather corrected peak demand (MVA) / asset rating (MVA).

For each segment, two utilisation profiles have been prepared reflecting the loading in 2011 and 2015. These profiles use the following asset ratings defined in the asset status tables of template 2.4 of the Reset RIN.

Table 2 augex model asset rating definitions

Network type	asset rating
Sub-transmission lines	normal cyclic thermal rating
Zone substations	substation normal cyclic thermal rating
HV feeders	normal thermal rating
Distribution substations	normal cyclic thermal rating

It is important to note that any capacities referred to in this report as inputs or outputs of the TasNetworks augex model are measured on the above basis. This also includes any references to utilisation and the augmentation unit costs.

Weather correcting 2011 and 2015 maximum demand

In the RIN asset status tables provided by TasNetworks for this modelling exercise, the actual maximum demand has been provided. Calibrating the model parameters, using actual maximum demands, can give misleading results as the effects of the weather conditions on the recorded maximum demand can result in misleading calculations of demand growth over the calibration period. Therefore, ideally, the maximum demands should be weather corrected to reflect a 50% probability of exceedance (PoE).

To reduce the burden on TasNetworks of developing weather corrected maximum demands (down to individual distribution substations), we have calculated fixed weather correction factors, applicable to all assets in a year, to weather correct the actual maximum demands provided by TasNetworks.

These two weather correction factors were calculated from the TasNetworks coincident network-level actual peak demand and 50% PoE weather corrected demand that have been reported in TasNetworks' category analysis RINs (table 5.3.1).

This simplification was considered reasonable given:

- the asset aggregation approach used by the augex model
- the expected accuracy of the augex model
- the role the AER may use the model for in assessing an augex forecast.

The table below summarises the underlying data and weather corrections factors we have used.

Table 3 2011 and 2015 weather correction factors

	2011	2015
Raw coincident MD (MW)	1,022.8	953.2
50% PoE weather corrected coincident MD (MW)	1,060.0	974.6
50% PoE weather correction factor	**1.036**	**1.022**

Scaling of distribution substation ratings in the augex models

TasNetworks has a significant portion of distribution substations with a very high utilisation, which is near or above the model's maximum utilisation input limit (150%). Therefore, to ensure that this limit does not affect our modelling, we have scaled the distribution rating by a factor of two and performed all calibration and modelling using this scaling.

In our experience, there is nothing unusual in applying this scaling to TasNetworks' distribution substations. We have applied similar scaling in the models we have prepared for other DNSPs. We do not consider that this scaling should have a material effect on the validity or accuracy of the model's forecast.

To avoid confusion, in the tabulated results presented in this report, we show unscaled values in order that they can be readily interpreted by TasNetworks. However, we also present the scaled values in brackets in order that they can be reconciled to the model files.

Summary model inputs

The utilisation profiles need to be viewed through the augex model. However, to aid in the validation of the model, the following table summarises some important parameters associated with this set of profiles.

Table 4 Summary loading, rating and utilisation data in the augex models

Segment	Weather correct peak demand (MVA)		Asset capacity (MVA)		Average utilisation (%)		Asset capacity >100% utilisation (MVA)	
	2011	2015	2011	2015	2011	2015	2011	2015
All sub-transmission lines	**247**	**270**	**486**	**567**	**50.9**	**47.6**	**0.0**	**0.0**
All zone substations	**271**	**260**	**748**	**845**	**36.3**	**30.7**	**0.0**	**0.0**
Urban HV feeders	*676*	*646*	*1233*	*1299*	*54.9*	*49.7*	*47.0*	*8.1*
Short Rural HV feeders	*600*	*537*	*1570*	*1568*	*38.2*	*34.2*	*22.2*	*13.2*
Long Rural HV feeders	*93*	*92*	*234*	*234*	*39.5*	*39.1*	*0.0*	*0.0*
All HV feeders	**1369**	**1274**	**3037**	**3102**	**45.1**	**41.1**	**69.2**	**21.3**
Urban substations	*589*	*588*	*1363 (2726)*	*1441 (2883)*	*43 (22)*	*41 (20)*	*61 (123)*	*38 (77)*
Long Rural substations	*72*	*74*	*515 (1030)*	*761 (1521)*	*14 (7)*	*10 (5)*	*0 (0)*	*0 (0)*
Short Rural substations	*551*	*495*	*1882 (3763)*	*2179 (4358)*	*29 (15)*	*23 (11)*	*17 (34)*	*0 (0)*
All distribution substations[a]	**1212**	**1157**	**3759 (7519)**	**4381 (8761)**	**32 (16)**	**26 (13)**	**78 (156)**	**38 (77)**

a – brackets indicate distribution substation parameters, allowing for the rating scaling that is applied in the model

3.2.3 Load growth

For each segment, the growth in peak demand is an important input that drives the forecast. The growth rates used in the two augex models (noted in the introduction to this section) are calculated as the average annual compound growth rate as follows:

- For the 2011 calibration model, the growth rates reflect the weather corrected peak demand from 2011 to 2015, as this period reflects the 4 years of growth that the planning parameters are calibrated to represent.
- For the 2015 forecast model, the growth rates reflect the weather corrected peak demand from 2015 to 2024, based upon the annual growth rate forecasts provided by TasNetworks on the asset status tables of template 2.4 of its Reset RIN.

For both models, the growth rate used for each segment is calculated by summing the maximum demand of all assets in that segment in the two relevant years and then calculating the growth rate from these two aggregate measures[13].

Distribution substation growth rate adjustment

A significant portion of the growth seen in the peak demand for distribution substations is due directly to customer connection activities, and so, does not drive network augmentations.

It was agreed with TasNetworks to assume that 50% of the growth in peak demand will relate to these connection activities. Therefore, for modelling purposes, this 50% scaling factor has been applied to the distribution substation growth rates in the model.

The table below summarises the segment growth rates used in the TasNetworks augex model, calculated using the method described above.

[13] For the avoidance of doubt, it is not calculated as the simple average (i.e. mean) growth rate across all assets in the segment.

Table 5 Augex model growth rates

Segment	Average annual growth rate	
	2011 to 2015	2015 to 2024
All sub-transmission lines	**2.23%**	**2.14%**
All zone substations	**-1.11%**	**2.10%**
Urban *HV feeders*	*-1.16%*	*1.97%*
Short Rural *HV feeders*	*-2.76%*	*1.68%*
Long Rural *HV feeders*	*-0.22%*	*2.43%*
All HV feeders	**-1.78%**	**1.89%**
Urban *substation*	*-0.02%*	*0.83%*
Long Rural *substation*	*0.26%*	*0.83%*
Short Rural *substation*	*-1.33%*	*0.83%*
All distribution substations[a]	**-0.58%**	**0.83%**

3.3 Model calibration

3.3.1 Historical calibration period

The historical calibration period reflects the 4-year period prior to the base year, but inclusive of it. As such, the calibration period covers 2012 to 2015. That is, the model is calibrated to reflect the augmentations (i.e. the network-initiated capacity added and augex) that occurred in 2012, 2013, 2014 and 2015.

Importantly, this 4-year period has been used because the Reset RIN collects historical utilisation data for 2011 and 2015. This only covers a 4-year period of growth in utilisation (i.e. growth from summer 2011 to summer 2015). That is, to cover a 5-year calibration period, which included 2011, we would need to run the model from 2010 to make it predict what would need to be augmented in 2011, but the Reset RIN does not collect the utilisation data for that year.

3.3.2 Set up of calibration data

As discussed in Section 2.3, the initial phase in calibrating the augex model, involves determining three parameters for each segment. The parameters reflect the augmentations that have occurred over the calibration period (2012 to 2015), namely:

- the augex
- the increment capacity added (because of demand-driven augmentations)
- the capacity that required augmentation (because of demand-driven augmentations).

The table below summarises these parameters for each segment in the TasNetworks augex model.

Table 6 Augex model calibration parameters

	augex $ (millions)	capacity added (MVA)	capacity requiring augmentation (MVA)
All sub-transmission lines	**4.3**	**0.0**	**0.0**
All zone substations	**10.1**	**0.0**	**0.0**
Urban HV feeder		*27.9*	*162.5*
Short Rural HV feeder		*36.5*	*212.4*
Long Rural HV feeder		*0.0*	*0.0*
All HV feeders	**11.9**	**64.4**	**374.9**
Urban substations		*9 (5)*	*15 (8)*
Long Rural substations		*4 (2)*	*6 (3)*
Short Rural substations		*13 (7)*	*21 (11)*
All distribution substations[a]	**7**	**26 (13)**	**42 (21)**

a – brackets indicate distribution substation parameters, allowing for the rating scaling that is applied in the model

These parameters have been calculated using the following methodology and assumptions.

Augex

The augex parameters have been calculated directly from the 2012 to 2015 augex data provided by TasNetworks. However, this parameter is only defined at the network group level as this represented the finest resolution provided in the TasNetworks data.

Capacity added and capacity requiring augmentation

The capacity added and capacity requiring augmentation parameters for each segment have been calculated as summarised below.

Sub-transmission lines and zone substations	Although the rating data for 2011 and 2015 indicates that capacity was added over the calibration period, TasNetworks has advised that none of the additional capacity was required because of distribution constraints. TasNetworks has advised that all capacity added in these network segments was a result of new zone substation developments and associated sub-transmission line works that were required to address constraints in transmission assets. Given that these transmission constraints cannot be assessed through this model, and the incorporation of their effects on network capacity in the calibration process could bias the forecasting, we have set these parameters to zero for calibration

	purposes.
HV feeders	The capacity requiring augmentation has been estimated from feeders that either changed rating during the calibration period or were subject to a very high load reduction (set at greater than 15%). The load reduction criteria was set to capture feeders that may have had load transfers to address constraints. The capacity added was calculated at the group level based upon the difference between the total capacity in 2011 and 2015. The capacity added for each segments was then estimated pro rata to the capacity requiring augmentation for that segment. This approach was applied because a direct calculation of the capacity added parameter in segments resulted in a negative capacity added parameter for the short rural segments. It is assumed that this is not an error; rather, it is due to capacity additions to urban feeders enabling load transfers from short rural feeders, which in turn allowed the aggregate capacity of short rural feeders to reduce. The calibration process does not easily allow for this situation, and therefore, the alternative approach was used.
Distribution substations	A direct calculation of the capacity added parameter from the 2011 and 2015 rating is difficult because of the additions that occurred due to customer connections. Therefore, TasNetworks has provided the assumptions it uses to prepare its capacity forecast for this network group[14]. This information defines the typical transformer upgrades it applies for augmentation reasons, indicating the capacity added and the capacity requiring augmentation. The historical capacity added and capacity requiring augmentation parameters for each segments were then estimated by scaling the equivalent forecast capacity parameters in proportion to the augex over both periods.

3.3.3 Determining planning parameters

The calibration of the planning parameters is performed using the 2011 calibration model. This model is populated using the 2011 utilisation profiles and 2011 to 2015 load growth, as defined above, and the planning parameters for each segment are determined to ensure the model outputs the parameters set out above (in Table 6).

[14] Provided in email, dated 1/10/15

As discussed in Section 2.3.2, we used an adjustment to the typical calibration process because of the negative growth rates over the calibration period required by the model. This adjusted process can be consider in two steps:

- calculating the unit cost and capacity factor parameters
- calculating the utilisation threshold parameters.

These two steps are discussed in turn below.

3.3.3.1 Calculating the $/kVA and capacity factors

The calculation of the unit costs ($/kVA) and capacity factors is not affected by the negative growths; and therefore, we have used the typical process to determine this set of parameters.

The process involves the following, using the parameters shown in Table 6:

1 we have calculated the augmentation unit costs ($/MVA) for each segment, based upon the formula:

 - augex in segment group / total capacity added in segment group

 Noting each segment in the segment will use the same augmentation unit cost.

2 we have calculated the set of capacity factors for each segment, based upon the formula:

 - capacity added (for that segment) / capacity requiring augmentation (for that segment).

3.3.3.2 Calculating the utilisation threshold parameters

In circumstances of positive growth, the utilisation threshold is determined through the model by finding the threshold value that forces the model to forecast the capacity that was known to have been added over the calibration period. However, in circumstances such as TasNetworks', where a segment has a negative growth rate over the calibration period, the model will always produce a forecast of zero capacity added. Therefore, it is not possible to determine a utilisation threshold[15].

There are various approaches to allow for this situation. For TasNetworks, we used an approach that we believe should result in a reasonable estimate of the utilisation threshold that reflects TasNetworks' planning decisions over the calibration period.

In this approach, we have adjusted the peak demand growth rates by a set factor in order to produce a positive growth rate. This adjusted growth rate is used in the calibration model to derive a utilisation threshold in the usual way. However, this threshold is then adjusted (outside of the model) by the adjustment factor that was applied to the growth rate. This adjusted threshold is then used for forecasting purposes.

[15] It is worth noting that, for related reasons, the accuracy of threshold derived in this way also may be affected by small positive growth rates.

We used an adjusted growth rate of 2% per annum for the segments with negative growth. We used this value because we have found this to provide a relatively stable estimate of the utilisation threshold.

The following process has been used to apply this approach:

1 Input the unit cost and capacity factor planning parameters in the 2011 calibration model

2 Assume the standard deviation of the utilisation threshold, for each segment, is the square root of the mean for that segment.

3 Calculate the adjusted model growth rate and associated adjustment factor (see formulas in model files).

4 Using the model, determine the mean utilisation threshold parameter that sets the model's forecast of capacity added to the network to be equal the actual capacity added in the relevant segments. Excel's goal seek function is used for this purpose

5 Calculated the adjusted mean utilisation threshold by applying the adjustment factor (over the calibration period) to the threshold determined in step 4 above – noting these are applied as downward adjustments to the threshold.

3.3.4 Summary of calibrated planning parameters

The table below summarises the segment planning parameters used in the TasNetworks augex model, calculated using the calibration method described above.

Table 7 Augex model calibrated planning parameters

	Augex unit cost $'000 / MVA	capacity factor	Mean utilisation threshold (%)
All sub-transmission lines		Unable to be calibrated	
All zone substations		Unable to be calibrated	
Urban HV feeders	184.6	0.17	75.0
Short Rural HV feeders	184.6	0.17	56.8
Long Rural HV feeders		Unable to be calibrated	
HV feeders			
Urban substations	1072.0 (536.0)	0.61	183.1 (91.5)
Short Rural substations	1072.0 (536.0)	0.61	46.7 (23.4)
Long Rural substations	1072.0 (536.0)	0.61	145.6 (72.8)
Distribution substations[a]			

a – brackets indicate distribution substation parameters, allowing for the rating scaling that is applied in the model

It is important to note that there are a number of historical planning parameters that we are unable to determine from this calibration process because capacity has not been added over the calibration period. We will discuss in the next section how we have allowed for these omissions when using the model to make forecasts.

4 Assessment approach

The 2015 forecasting model has been used to perform various studies, using a range of planning parameters, to assess TasNetworks' augex forecast.

In this section, we explain the approach we have applied to perform this assessment.

4.1 Assessment period

We have used a five-year forecast period as the primary focus of our assessment. This period commences at the start of TasNetworks' next regulatory period, 2017-18 (defined as 2018 in the model and below), but extends to 2021-22 (defined as 2022 in the model and below).

We did not use the two-year period reflective of TasNetworks' next regulatory period as the primary focus of our assessment as we consider that the model is not likely to be as reliable an estimator of the forecasts when using such short periods.

That said, in the results presented in this report we will still discuss the forecast results in terms of the two time periods, 2018 to 2019 and 2018 to 2022.

4.2 The augex component assessed through the model

The model is aimed at forecasting demand-driven network augmentation that is related to the distribution capacity of the network. TasNetworks has advised of components of its historical and forecast augex that are not specifically due to these factors. These components have been excluded from our assessment. This "unmodelled" component covers the following programs allocated to TasNetworks' HV feeder asset group:

- augmentations to address supply reliability issues
- augmentations to comply with power quality standards
- augmentations to address fault level limitations.

This "unmodelled" component represents:

- 12% of the historical four-year calibration period (on average $1.1 million per annum)
- 37% of the forecast over the two-year regulatory period (on average $3.1 million per annum)
- 42% of the forecast over the five-year period, 2018 to 2022 (on average $3.1 million per annum).

4.3 Model studies considered

As noted in Section 3.3.4, there are a number of gaps in the model planning parameters we have been able to deduce from TasNetworks' augmentations over the calibration period. This limits the form of intra-company (or business-as-usual) benchmark we can prepare using the model.

Furthermore, the AER has not provided intercompany benchmark parameters for the augex model (as it has done for its repex model). Therefore, we are also limited in preparing an intercompany benchmark forecast through the model.

However, we have prepared augex models for two Victorian DNSPs, Jemena and United Energy Distribution (United), as part of their regulatory proposals to the AER. Our reports on this modelling have been made publically available, via the AER website[16].

Given we know these models have been prepared using a similar method to that used here, we have used the planning parameters published in these reports to generate a set of "indicative" intra-company benchmark and intercompany benchmark studies to assess TasNetworks' augex forecast against.

For the indicative intra-company studies, we have used the equivalent planning parameters for each DNSP to fill any gaps in TasNetworks' planning parameters. For the indicative inter-company studies, we have used all the DNSP's equivalent planning parameters.

This approach has led to the following eight studies, which we have assessed TasNetworks' forecast against. The "historical" and "forecast" term used in these study names indicates whether we have used the planning parameters calibrated to reflect the relevant DNSP's historical outcomes or its forecast outcomes (over the regulatory period under review for that DNSP).

Table 8 Augex model benchmark studies

	Study name
Intra-company	Jemena - Historical
	Jemena - Forecast
	United - Historical
	United - Forecast
Inter-company	Jemena - Historical
	Jemena - Forecast
	United - Historical
	United - Forecast

[16] Report to Jemena, "AER augex model – calibration report", dated April 2015. Report to United, "AER augex model – Assessing the UED augmentation forecast", dated April 2015.

4.4 Demand growth sensitivity study

The augex forecast produced by the model is usually sensitive to the assumed forecast growth in demand.

Therefore, to examine how the model's augex forecast may change due to a significant change in this assumption, we also ran the eight studies above allowing for a 1% per annum reduction in the demand growth assumptions (e.g. the zone substation annual growth has been reduced from 2.1% per annum to 1.1% per annum).

5 Augex forecast assessment

In this section we discuss our assessment of TasNetworks' augex forecast, using the model studies defined in the previous section.

In keeping with the AER's recent approach to the use of its repex model, this assessment is focused on the *aggregate* augex forecast.

5.1 Model study results and discussion

Table 9 summarises the augex model's forecasts for the eight studies defined in Section 4.3. The table also shows the difference between the augex model's forecast and TasNetworks' (e.g. a 50% difference indicates that the augex model forecast is 50% greater than the TasNetworks forecast).

The results are provided as the average per-annum augex forecast for the two time periods:

- the five-year period commencing at the start of TasNetworks' next regulatory period (2018 to 2022)
- the two-year period covering TasNetworks' next regulatory period (2018 to 2019).

The table also indicates the results for the load growth sensitivity study.

Table 9 Augex model study results summary

		augex forecast over assessment period (average per annum)					
		2018 – 2022		2018 – 2019		LG[b] 2018 – 2022	
	Augex model study	$ million	difference[a]	$ million	difference[a]	$ million	difference[a]
Intra-company	Jemena - Historical	$5.0	26%	$5.0	-5%	$2.4	-41%
	Jemena - Forecast	$5.0	25%	$5.0	-5%	$2.4	-41%
	United - Historical	$6.0	51%	$6.1	15%	$3.0	-25%
	United - Forecast	$5.6	41%	$5.5	5%	$2.6	-34%
Inter-company	Jemena - Historical	$3.1	-22%	$3.0	-43%	$1.4	-64%
	Jemena - Forecast	$3.0	-25%	$2.9	-45%	$1.4	-66%
	United - Historical	$6.8	71%	$7.5	42%	$3.8	-5%
	United - Forecast	$4.1	2%	$3.9	-26%	$1.9	-54%
	TasNetworks forecast	**$4.0**		**$5.3**		**$4.0**	

a – difference (%) = study forecast / TasNetworks' forecast - 1
b - "LG" signifies the load growth sensitivity study results

The profile of TasNetworks' augex compared to the model's forecasts are shown in Figure 1 (the indicative intra-company studies) and Figure 2 (the indicative inter-company studies).

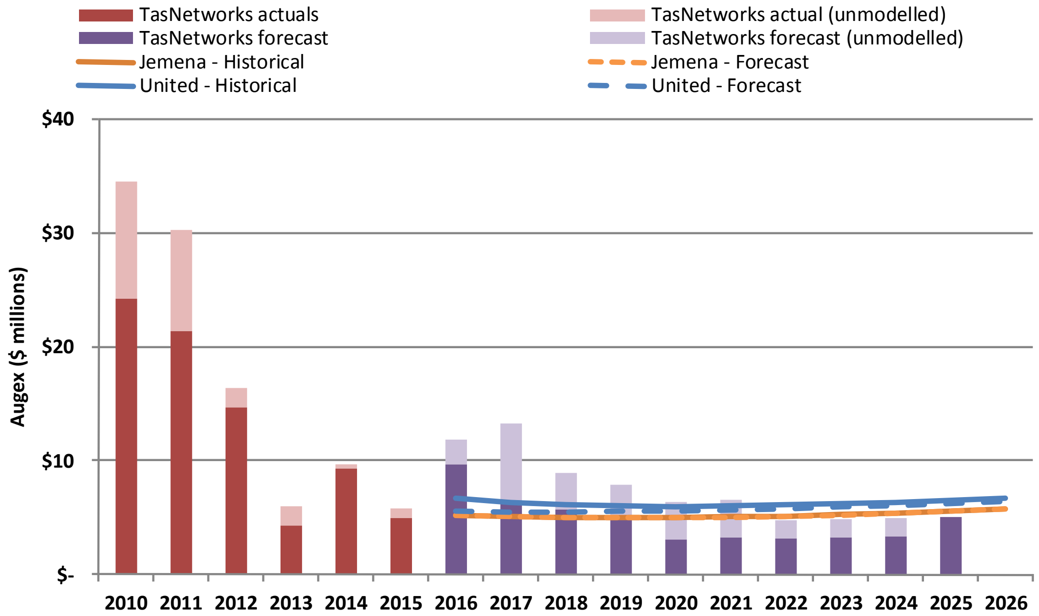

Figure 1 intra-company study results

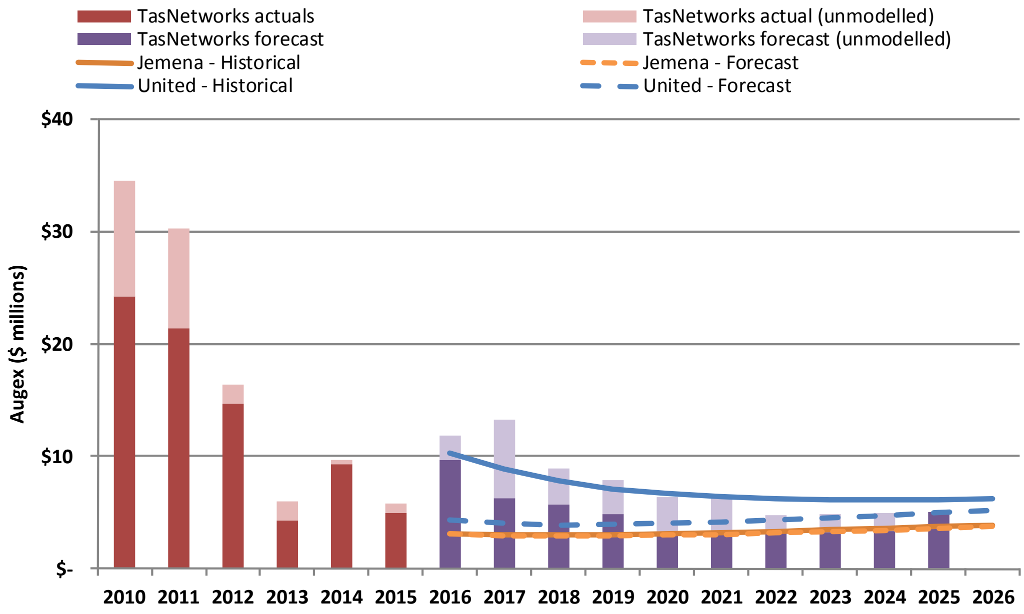

Figure 2 inter-company study results

The augex profiles above indicate that TasNetworks' augex has reduced significantly from 2010 to 2011 levels. TasNetworks is forecasting this trend to continue.

The augex model results tend to support TasNetworks' forecast, particularly over the five year assessment period (2018 to 2022).

TasNetworks' forecast is supported by the indicative intra-company studies

Over the five-year assessment period, TasNetworks forecast is significantly less than all the intra-company studies, with TasNetworks' forecast ranging from between 66% to 80% of the four study forecasts.

The difference is less over the two-year period, where the TasNetworks forecast is marginally above the two studies using Jemena's parameters, but below the two studies using United's parameters. Noting that for these intra-company studies the other DNSPs' parameters are only used for those segments where we were not able to determine TasNetworks' parameters.

We consider the Jemena study results to be neither grounds for rejection of TasNetworks' forecast nor entirely unexpected. Jemena is predominantly an urban DNSP. It has very few rural feeders, all of which are short rural. It has such a small amount of rural network that this component was not modelled separately when we used the augex model to assess its augex forecast. Therefore, for these studies its planning parameters are effectively urban parameters. We would expect utilisation thresholds in rural areas to be typically lower than urban areas, particularly for the distribution network, as voltage constraints (due to longer line lengths in rural areas) are more likely to limit transfer capacities below thermal ratings. Therefore, given TasNetworks has a far greater portion of its network in rural areas, including a significant portion defined as long rural, it could be expected that Jemena's utilisation threshold parameters would materially understate TasNetworks' augmentation needs.

United is also predominantly urban, but has enough rural for this to be significant in its modelling. Therefore, the United studies are a better peer business for comparisons. Even here, however, United is not rural to the extent of TasNetworks; it has no long rural feeders. As such, we would still expect it, on average, to have higher thresholds than TasNetworks for the reason discussed above. Therefore, we may still expect that these studies could understate TasNetworks' augex needs to some degree.

Given the points above and the finding that TasNetworks' forecast is below the United studies for both time periods, we consider that these intra-company study results support TasNetworks' forecast.

TasNetworks' forecast is supported by the indicative inter-company studies over the five-year assessment period, but is more weakly supported over the two-year assessment period

The results for the four intercompany studies are less supportive of TasNetworks forecast. For most studies (other than that using United's historical parameters), the study forecasts have reduced significantly compared to the equivalent intra-company studies[17].

This reduction in the intercompany study forecasts means that the TasNetworks forecast is significantly above the studies over both assessment time periods when the Jemena

[17] With regard to equivalent intra-company studies, we mean the intra-company study that used the same DNSP parameters in place of those parameters that could not be deduced for TasNetworks.

parameters are used. This result however is not unexpected given Jemena's largely urban utilisation thresholds are being applied to TasNetworks' rural network. For the reasons discussed above, this is likely to significantly understate TasNetworks' needs, and therefore, these studies do not represent a good peer business for these benchmarking purposes.

The intercompany study results using the United parameters are more supportive of TasNetworks' forecast, particularly over the five-year assessment period, with TasNetworks' forecast ranging between 59% to 98% of the two study forecasts over this period.

As discussed above, United is a better peer business. However, even here, its short rural utilisation thresholds may still understate TasNetworks' rural augmentation needs. Therefore, given TasNetworks' forecast is below the two United studies, over the five year assessment period, we consider that TasNetworks' forecast is supported by the inter-company studies over this period.

TasNetworks' forecast is not as clearly supported by the United studies over the two-year assessment period, covering TasNetworks' next regulatory period. TasNetworks' forecast is 30% below the study using United's historical parameters, but 35% above the study using United's forecast parameters. This 35% difference is possibly too high for it to be justified purely on the basis of the urban/rural mix of TasNetworks compared to United – although, we do not have analysis to definitively say this one way or the other.

However, we believe this two-year period may be too short for a reliable assessment through the augex model. As such, if the AER has concerns with this result, it would need to consider TasNetworks' augex forecast further using the other assessment techniques it has available.

Therefore, although we raise this result as a possible issue, given the more rural nature of TasNetworks' and the short assessment period associated with this result, we do not believe it is sufficient to say that the TasNetworks forecast is not supported by our analysis.

The load growth sensitivity study results suggest a reduction in the model forecast broadly in line with a reduction in the demand growth assumption

The results for the load growth sensitivity studies show a significant reduction in the augex forecast across all studies of approximately 50% over the five-year assessment period. This reduction is to be expected given that the 1% per annum reduction in demand growth, applied in these sensitivity studies, results in a reduction in demand growth of approximately 50% over the same period.

Given this large reduction, all studies are below TasNetworks' forecast over the five-year and two-year assessment periods. However, it may be expected that such a large reduction in the assumed demand growth would also have some downward effect on TasNetworks' forecast, and therefore, these findings would most likely overstate the true difference.

The more important point from this analysis is that the model suggests a close correlation between the demand growth assumption and the augex forecast produced by the model. Therefore, similar modelling for an alternative demand growth assumption could produce significantly different findings, which would not be so favourable for a reduced growth assumption.

5.2 Summary and conclusions

Our assessment using the AER's augex model largely supports TasNetworks' augex forecast[18].

Over a five-year assessment period, commencing at the start of the next regulatory period, TasNetworks' forecast is less than the majority of model studies. Most notably:

- TasNetworks' forecast is less than all of the indicative intra-company (i.e. business-as-usual) benchmark studies
- TasNetworks' forecast is less than the indicative inter-company benchmark studies reflecting its closest peer in our studies, United.

Over the two-year assessment period covering TasNetworks' next regulatory period, the results are less supportive, due to TasNetworks' higher per-annum forecast over this period:

- TasNetworks' forecast is less than the two indicative intra-company (i.e. business-as-usual) benchmark studies that used the historical and forecast parameters of United in place of the TasNetworks parameters we were unable to derive.
- But TasNetworks' forecast is above the indicative inter-company benchmark study that used the forecast parameters of United in place of the TasNetworks parameters we were unable to derive.

That said, we consider that the two-year period is possibly too short for a reliable assessment using the augex model due to its "averaging" approach. Therefore, there would be a greater need to assess this pattern of augex (i.e. the higher levels in 2018 and 2019) using the other assessment approaches they AER may apply, such as a detailed technical review.

Finally, we have also assessed the sensitivity of these results to forecast demand growth assumption in the model. This has found the model forecast is sensitive to this assumption, providing a similar change in the forecast to the change in this assumption. Therefore, should the demand growth assumption change significantly then the findings of this assessment could also change significantly.

[18] Some caution must be placed on this finding as we have only a limited set of parameters to determine accurate benchmarks.

A Segment group results

In addition to the assessment of TasNetworks' augex forecast discussed in the main body of this report, we have also compared TasNetworks' forecast to the model at the network segment level.

The aim of this analysis is to highlight the network group forecasts that deviate the greatest from the augex model forecast, and discuss the reasons for these differences in terms of the model's planning parameters.

A.1. Analysis results

Table 10 below presents the network group results for the eight studies over the five-year forecast period (2018 to 2022) on an average per annum basis.

This table indicates significant variations at the network group level between studies. To aid in understanding the causes of these variations, we have also calibrated the model planning parameters to the TasNetworks forecast, using a process similar to that described in Section 3.3 (see Table 11 below). These forecast parameters have been compared against TasNetworks' historical calibrated parameters (see Table 7) or the equivalent parameters of the two comparator DNSPs to determine why the model is predicting a difference.

Table 10 – TasNetworks augex model – network segment summary augmentation expenditure

	Average per annum augex forecast (2018-2022) - $ millions								
		Inter-company studies				Intra-company studies			
	TasNetworks forecast	Jemena - Historical	Jemena - Forecast	United - Historical	United - Forecast	Jemena - Historical	Jemena - Forecast	United - Historical	United - Forecast
Sub-transmission lines	0.5	0.4	0.4	0.7	0.7	0.4	0.4	0.7	0.7
Zone substations	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HV feeders	1.6	2.5	2.1	5.4	2.7	4.4	4.3	5.0	4.6
Distribution substations	1.9	0.3	0.5	0.6	0.6	0.3	0.3	0.3	0.3
Total	**4.0**	**3.1**	**3.0**	**6.8**	**4.1**	**5.0**	**5.0**	**6.0**	**5.6**

Table 11 TasNetworks forecast model planning parameters

	Augex unit cost $'000 / MVA	capacity factor	Mean utilisation threshold (%)
All sub-transmission lines	74	0.16	48.8
All zone substations	Unable to be calibrated as no forecast for this segment		
Urban HV feeders		1.35	92.9
Short Rural HV feeders	76	0.64	74.2
Long Rural HV feeders		0.64	79.5
HV feeders			
Urban substations		0.61	152.4 (76.2)
Long Rural substations	1298 (649)	0.61	39.2 (19.6)
Short Rural substations		0.61	74.3 (37.1)
Distribution substations[a]			

a – brackets indicate distribution substation parameters, allowing for the rating scaling that is applied in the model

A.2. Discussion and findings

With regard to each network group, the key points to note from this analysis are as follows.

A.2.1. HV feeders

The HV feeder network group covers the greatest portion of the various augex model study forecasts, representing between 71% and 86% of the study forecasts.

TasNetworks' augex forecast for this network group is a significantly lower proportion, representing only 39% of TasNetworks' total augex forecast (covered by this assessment). Furthermore, TasNetworks' augex forecast for this network group is significantly lower than all the model study forecasts. Most notably, TasNetworks' forecast is approximately one third of the intra-company benchmark studies.

This result appears to be driven to a large extent by the utilisation threshold. For the TasNetworks forecast, these parameters have increased significantly from the historical parameters. For example, the urban feeder segment has increased from 75% to 93%, and the short rural feeder segment has increased from 57% to 74%. This increase suggests that TasNetworks' forecast is allowing for its HV feeders to be loaded to greater levels before it is anticipating the need to augment.

Adding to this, the augex unit costs have reduced from $184,000 per MVA added (over the historical calibration period) to $76,000 per MVA added for TasNetworks' forecast.

The effect of these two positive changes is offset somewhat by changes in the capacity factor, which has increased significantly from 0.172 (urban and short rural) to 1.35 (urban) and 0.64 (short rural).

A.2.2. Distribution substations

The distribution substation network group is the most significant group (as a proportion of augex) in the TasNetworks forecast, representing 48% of TasNetworks' augex forecast.

Across all studies, the TasNetworks' augex forecast for this network group is significantly higher than the study forecasts. Most notably, TasNetworks' forecast is over six times the intra-company benchmark studies.

A reduction in the utilisation thresholds for the forecast seems to be a significant factor in this result. The forecast utilisation threshold for short rural substations has almost halved from 146% to 74%. The utilisation threshold for urban substations has also reduced from 183% to 152%.

That said, the historical parameters for urban and short rural substations are very high, which could suggest an issue with the historical calibration. The urban forecast threshold is more in line with the Jemena and United thresholds, suggesting this is not too low. However, the rural forecast thresholds are much lower than the Jemena and United thresholds.

Compounding the effects of the above changes, the augex unit cost has also increased by approximately 20%, from $1,072,000 per MVA to $1,298,000 per MVA. This unit cost is significantly higher than the Jemena and United parameters. It is noted however that the TasNetworks forecast for this network group has a large component of LV network augmentation that is allocated to this category[19]. This will be causing an uplift in the unit costs that is not in the other DNSPs as they do not have a similar proportion of LV network augmentation programs (relative to augex on distribution substations)[20].

A.2.3. Sub-transmission lines

The sub-transmission line group is a far less significant network group (as a proportion of augex), representing only 12% of TasNetworks' augex forecast. Furthermore, we were unable to prepare historical parameters for this group because there was no "modellable" capacity added over the calibration period. Therefore, the intra-company results are equivalent to the intercompany results as the same parameters were applied.

TasNetworks' augex forecast for this network group is approximately 30% higher than the Jemena studies, but 30% lower than the United studies.

The forecast utilisation threshold is noticeably lower than the Jemena and United thresholds, with the TasNetworks threshold at 49% compared to approximately 70% for these two DNSPs.

[19] This allocation of LV network augex reflect how we understand the AER applies the model, and we have applied it for other DNSPs.

[20] As indicated by the augex forecast provided on Table 2.3.4 of their Reset RINs.

However, the effect of this parameter is offset by the capacity factor and augex unit costs, which are noticeably lower than the two comparator DNSPs. The combined effects of these parameter changes is not sufficient to make up the difference for the Jemena studies, but more than enough for the United studies.

All that said, the sub-transmission line capacity factor and unit costs can be very sensitive to the few projects that a DNSP may do over a five-year period. Furthermore, we understand that TasNetworks operates a more radial sub-transmission network than Jemena and United, which could affect the efficient maximum loading level. Therefore, these differences need to be treated with some caution.

A.2.4. Zone substations

TasNetworks is not forecasting any material level of zone substation augmentation over the study period. This is also supported by the intercompany benchmark studies, which also forecast a materially insignificant level of zone substation augmentation.