RIN16

Ausgrid's basis of preparation

Ausgrid

Content

1 PURPOSE

On 30 January 2018, the Australian Energy Regulator (AER) issued a Regulatory Information Notice (Reset RIN) to Ausgrid under Division 4 of Part 3 of the *National Electricity (New South Wales) Law* (NEL). The Reset RIN requires Ausgrid to provide and to prepare and maintain the information in the manner and form specified in the Reset RIN. The AER has said that it requires the information for the performance or exercise of its functions or powers conferred on it under the NEL or the National Electricity Rules (NER).

Under paragraph 1.3 of Schedule 1 to the Reset RIN, Ausgrid is required to provide a Basis of Preparation for information other than Forecast Information. The Basis of Preparation is to be provided in accordance with the Reset RIN and the Principles and Requirements in Appendix E.

1.1 AER's instructions

In accordance with the Basis of Preparation requirements in Appendix E of the Reset RIN, Ausgrid must explain, for all information in the category data (historic) regulatory templates the basis upon which Ausgrid prepared information to populate the input cells (basis of preparation).

The Basis of Preparation must be a separate document (or documents) that Ausgrid submits with its completed regulatory templates. The Basis of Preparation must follow a logical structure that enables auditors, assurance practitioners and the AER to clearly understand how Ausgrid has complied with the requirements of the Reset RIN.

The AER has set out the minimum requirements in the Basis of Preparation. This is set out in Table 1 below.

Table 1. Minimum requirements of the Basis of Prep

Requirement No.	Minimum Requirement
1	Demonstrate how the information provided is consistent with the requirements of the Notice
2	Explain the source from which Ausgrid obtained the information provided.
3	Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made
4	Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

As part of its response, Ausgrid may provide additional detail beyond the minimum requirements if Ausgrid considers it may assist a user to gain an understanding of the information presented in the regulatory templates.

When reporting an audit opinion or making an attestation report on the regulatory templates presented by Ausgrid, an auditor or assurance practitioner shall opine or attest by reference to Ausgrid's Basis of Preparation.

Ausgrid has prepared this document (Ausgrid Basis of Preparation) in accordance with the requirements in the Reset RIN.

1.2 Other matters in the RIN

1.2.1 Clause 1.3 to Schedule 1 of the RIN

In relation to clause 1.3 to Schedule 1 of the RIN, for information other than Forecast Information we have provided in accordance with this Notice and the Principles and Requirements in Appendix E, a Basis of Preparation demonstrating Ausgrid has complied with this Notice, in respect of:

(a) the information in each Regulatory template in the Microsoft Excel Workbooks attached at Appendix A

(b) the information prepared in accordance with the following requirements in Schedule 1 of this notice:

   (i) paragraph 1.2

   (ii) paragraph 5.1(a)(ii)

   (iii) paragraph 8.5

   (iv) paragraph 13 (13.5 and 13.6)

   (v) paragraph 15 (15.2 and 15.3)

   (vi) paragraph 16 (16.2-16.7, 16.10).

1.2.2 Othher information related to Forecast RIN templates required by Appendix E

We have provided information related to the Forecast RIN templates as required by Appendix E: Instructions in this Basis of Preparation.

2 TEMPLATE 2.4 – AUGEX MODEL

2.1 Table 2.4.1 – Augex model inputs – asset status - subtransmission

The information provided in template 2.4 has been completed in accordance with the AER RIN requirements and instructions applying to template 2.4 including Appendix E and F, and the instructions in the worksheet.

2.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

This table is prepared based on the worksheets and supporting documentation as provided by Regulatory team. The data is primarily sourced from Subtransmission planning section data analysis.

2.1.2 Explain the source from which Ausgrid obtained the information provided

The data sources are set out in the following table.

Table 2. Data sources

Data	Source
Feeder Identification data	Sourced from Ausgrid's Feeder Forecast reports as prepared by Sub-transmission Planning.
Primary type of Area Supplied	Derived from a list of 11kV feeder categories by Zone substations.
Route Line Length:	Sourced from GIS and FeederZ systems for each asset identified in Ausgrid's Feeder Forecasts.
Maximum Demand	Estimated from load-flow results. Correction factors applied for Power Factor and Weather (50% POE factor).
Line Ratings	Sourced from the latest available (2017 review) Sub-transmission Planning Feeder Forecast reports. These are updated annually from the Ratings & Impedance Calculator (RIC).
Growth Rate	Based on difference between 2017/18 and 2018/19 feeder forecast results from Sub-transmission Planning. This forecast includes committed projects, spot loads and load transfers as per the established forecasting process, which is the most realistic estimate of individual asset demand at the present time. Feeders which are to be decommissioned as a result of committed projects are set to 0%.

2.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Primary type of Area Supplied (Actual):

- Actual value based on classification of Zone Substation or STS.

Feeder Identification data:

- The information provided for feeders assumes a present day network snapshot, that is, feeders that are currently in service in Ausgrid's sub-transmission network.
- In order to accurately capture the network feeder information for present day and 2014, the following assumptions are applied:

- Network feeders that have the same network connectivity in 2014 and 2018 are reported as a single element, with rating, line length and network flows for each year shown.
- Feeders that are replaced are listed as their new names, with 2014 historical data linked from the old feeder. This is limited to the case of direct replacements.
- New feeders with different connectivity are listed as new items, provided they were commissioned between 2014 and 2018.

Route Line Length (Actual):

- Feeder length data is sourced from GIS reports, cross checked against network models from the planning data management system (PDMS). Incomplete and/or missing information is estimated using system diagrams, project briefs and line route maps.

Maximum Demand (WC 50% POE MVA and MW) – both 2013/14 and 2017/18 (Estimated):

- This data was prepared based on load flow results for both 2013/14 and 2017/18. The actual substation loads are based on the SCADA system for 2012/13 and 2016/17 and they are corrected for weather, power factor and abnormal switching to obtain loads for 2013/14 and 2017/18 respectively. A network model (in PSS/E) is developed using these substation loads and load flow of each feeder is determined. The loads are prepared under the following assumptions.
  - For the greater Sydney subtransmission network and Hunter subtransmission network, loading was applied at each Zone substations peak values.
  - For the Sydney Inner Metropolitan dual function network, loading was diversified to the summer system peak.
  - Peak demand (system, STS or zone) was measured at a 50% probability of exceedance (POE).
  - Steady state feeder utilisation was modelled under system normal conditions.

Line Ratings:

Ratings are based on Ausgrid's standard rating rules and policies, and are recorded in Ausgrid's Ratings and Impedance Calculator (RIC) system. Forecast ratings of future feeders are using a standard ratings listed in Planning and Data Management System (PDMS).

Growth Rate (Estimated):

The growth rate is determined from annual base substation or feeder forecasts which include committed spots, transfers and projects. It is a derived value from the difference between 2018/19 forecast maximum demand and 2017/18 forecast maximum demand according to the relationship:

Annual Maximum Demand Growth =

*(Maximum Demand (2018/19) / Maximum Demand (2017/18)-1)*100*

Note that Ausgrid prepares detailed for forecasts for each substation which include both short term spatial and long term econometric factors, and does not use a single linear p.a. growth rate for planning purposes. This growth rate is therefore derived to achieve the expected maximum demand at each substation in accordance with Ausgrid's base spatial forecast for the 2018/19 year.

Network Segment:

The subtransmission lines asset group segmented between Sydney and Hunter.

2.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

All forecasts and weather-correction parameters are estimates.

For some individual circuits, actual data is not available and estimates have been made using substation SCADA points, load-flow results and/or engineering judgment. This data may not be available because metering points have not been installed, there are metering errors, or at the time of local area or system peak the circuit was abnormally switched. The basis of the estimates include engineering judgement about abnormal switching and metering error, with validated load-flow studies used in network analysis to derive alternative estimates. Due to the absence of any verifiable actuals, this data is the best available estimate of individual line loadings for the snapshots required by this table.

Ausgrid does not have an established process to assign sub-transmission feeders against HV feeder categories. This is an estimated value based on the estimated categorisation of zone substations.

2.2 Table 2.4.2 – Augex model inputs – asset status – high voltage feeders

2.2.1 Demonstrate how the information provided is consistent with the requirements of the Notice

This response is based on the worksheets and supporting documentation as provided by the AER up until 30th June 2017 and as interpreted by the relevant completing Ausgrid business unit. The information primarily comes from Ausgrid's SAP system. Subject matter experts were engaged in preparing this information as necessary.

2.2.2 Explain the source from which Ausgrid obtained the information provided

Line ID, feeder category, line voltage, originating substation and feeder lengths were sourced from GIS based on June 2017 and June 2014.

Maximum demand was sourced from Genload and PI.

Power factor was based on the zone PF sourced from the Spatial Demand Forecast.

Ratings are sourced from SAP.

The rate of growths and weather correction factors are sourced from the Spatial Demand 2017 Planning Forecast POE50 M.

2.2.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

High voltage feeder ID

The high voltage feeder ID is a unique identifier from GIS. Historical actual.

Feeder categorisation

Feeders are assigned a feeder category based on Business Objects report 2_01 Feeder Performance – Quarterly – Fast –v10. No calculations are necessary. Historical actual.

Voltage level

Voltage level is sourced from GIS. No calculations are necessary. 11kV feeders are assumed to operate at 11 000V, 5kV feeders are assumed to operate at 5 000V. Historical actual.

Originating substation

Originating substations is sourced from GIS connectivity. No calculations are necessary. Historical actual

Route length

Route length is sourced from GIS. No calculations are necessary. Historical actual.

Maximum demand

Maximum demand is recorded from summer 2013-14 and 2016-17 using Genload or PI. 2016-17 was selected as the most recent actual value and it is assumed that 2017-18 will be very similar to the 2016-17 value. Adjustments are made for abnormal switching where possible. Summer is assumed to be the peak season.

Loads are recorded in HV amps and adjusted by the originating zone's weather correction factor to produce a POE50 load. Weather correction factors were obtained from the 2014 (for 2013/14) and 2017 (for 2016/17) forecasts. These were converted to MVA and MW using the calculations below:

MVA = A x sqrt(3) x voltage level / 1000 000

MW = MVA x PF

The power factor is the uncompensated PF (e.g. with no capacitors in service) of the originating zone.

MVA and MW are historical estimated due to the conversion from Amps to MVA, application of weather correction and the feeder PF is approximated from the zone PF.

Rating

Thermal ratings are sourced from SAP. Operational ratings are assumed to be the same as the thermal ratings except for the CBD where the operational rating is 2/3 the thermal rating due to the N-1 triplex configuration.

Ratings are recorded in HV amps. These were converted to MVA using the calculations below:

MVA = A x sqrt(3) x voltage level / 1000 000

Historical actual.

Rate of growth

Rate of growths are based on underlying (e.g. no spot loads) summer growth for summer 2017/18. The rate of growth for each individual feeder is assumed to be the same as the source zone substation. Historical estimated

Network segment ID

Network segment ID is based on the feeder category. Historical actual.

2.2.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions

made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Refer to section above for explanation of the estimated information.

2.3 Table 2.4.3 – Augex model inputs – asset status – subtransmission substations, subtransmission switching stations, and zone substations

2.3.1 Demonstrate how the information provided is consistent with the requirements of the Notice

This response is based on the worksheets and supporting documentation as provided by the AER and as interpreted by the relevant completing Ausgrid business unit. The information primarily comes from Ausgrid's engineering and investment management systems or is based on advice from the relevant subject matter experts.

2.3.2 Explain the source from which Ausgrid obtained the information provided

The data sources are set out in the following table.

Table 3. Data sources

Data	Source
Substation Identification Data	Sourced from The Spatial Demand Forecast System. Substations in service as of June 2016/17 are included.
Primary type of Area Supplied	Sourced from list of feeder categories by Zone as provided by the Reliability group in Asset Investment.
Number of Transformers	Provided by Forecasting group from Spatial Demand Forecasting system for 2013/14 and 2016/17
Maximum Demand (WC 50% POE MVA and MW) – both 2013/14 and 2017/18	Provided by Forecasting group from the Spatial Demand Forecasting system.
Substation Ratings	Provided by Ratings Group from analysis of Ratings & Impedance Calculator (RIC) R01 (Present Zone and STS Firm Ratings) Reports and SAP equipment characteristics data using summer values. Note: substation ratings for Waratah STS are provided as Waratah (Domestic) and include Waratah (Comsteel).
Growth Rate	This is sourced from the Spatial Demand Forecasting System. The growth rate is the underlying rate of growth as calculated based on the POE50 weather corrected trend. Refer to Ausgrid 2017 Forecast Report.

2.3.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

The methodology and assumptions used to provide the information

1. **Primary type of Area Supplied (Estimated):** Estimated value for primary category based on count of feeders supplied by that zone. Each Zone to category with the most feeders at that substation. For STS, based on predominant categorisation of Zone Substation supplied by that STS.
2. **Number of Transformers (Actual):** Count of in-service transformers at a location (excluding spares).

3. **Maximum Demand (WC 50% POE MVA and MW) – both 2013/14 and 2017/18 (Estimated):** Weather corrected non-coincident load based on summer peak demand (actual for 2013/14 and forecast 2017/18), for the set of substations in service as of June 2017. The weather correction process is an estimate and is done in accordance with Ausgrid's established forecasting processes.
4. **Substation Ratings (Actual):** The name plate total ONAN ratings are based on the summation of transformer ONAN name plate rating stored in SAP as part of the equipment characteristics and does not consider any other equipment limitation. Likewise, the name plate total in service ratings are based on the contract data in SAP assuming the highest cooling mode.

While nameplate ratings are provided by the equipment manufacturer, the normal and emergency cyclic ratings are calculated and apply Ausgrid's rating rules. These consider insulation loss of life and absolute temperature limitations for the top oil and the transformer winding.

The transformer throughput rating is the maximum load which can be carried, by season and operating conditions, taking into account the capabilities of all associated equipment in the relevant transformer bay group.

Substation and N-1 ratings based on Ausgrid's standard rating rules and policies for ratings. Does not include 11kV or sub-transmission feeder limits. Zero ("0") values are used for new substations that are not yet commissioned.

The RIC R01 (Present Zone and STS Firm Ratings) report is used as a main source of data. The report contains transformer throughput ratings data for each zone and STS transformer in the network.

The capacity calculation used for each substation varies due to the configuration and is a measure of the theoretical rating achieved by utilising all transformers in a substation. This measure ignores upstream and downstream feeder restrictions. Other restrictions include substations where all the transformers cannot be physically utilised at once due to fault level issues, frequency injection restrictions, etc.

The substation capacity based on transformer emergency cyclic ratings is also produced in the R01 report. This is the rating used when Ausgrid refers to the Firm rating of the substation. This is the rating that if exceeded would mean there is load at risk at the substation and a project is needed to secure supply.

The normal and emergency cyclic ratings are calculated by RIC using long established business rules that have been in place for many years at Ausgrid.

The objective of determining the thermal rating of equipment is to achieve a compromise between equipment utilisation, return on investment, deferred or reduced capital expenditure on the one hand, and equipment damage, accelerated ageing and customer supply reliability and quality on the other.

When equipment is grouped together at a particular location such as a substation, site specific information enables the appropriate individual equipment ratings to be extracted from the full range of possibilities, and subsequently incorporated into a 'throughput rating' application according to defined rules. As an example, in a zone substation this includes equipment such as a transformer, its connection cables, switchgear and operating mode.

The output capacity of oil-filled transformers is dependent on a range of factors:

- Operating temperature limitations of its components. These are specified in relevant Australian and International standards. There may be other limits specified in purchasing contracts or nominated by Ausgrid for specific assets.

- Absolute winding current limits. These are also specified in relevant standards or purchasing contracts.
- The cumulative effects of insulation ageing which are manifested as a decrease in mechanical and electrical strength of the winding insulation and/or oil due to operation at elevated temperatures. Life-insulation temperature characteristics are also provided in the relevant standards.
- Applicable ambient temperatures as seen by the transformer including their expected daily and seasonal variation.
- Measured oil and winding temperatures during 'heat run' testing. These are carried out as part of the contract type tests to confirm the nominal design capacity of transformers and may allow a degree of thermal 'over-design' to be exploited. In some cases the testing may be limited to the 'highest' and 'lowest' cooling modes or even to the 'highest' mode only.
- The anticipated demands on the transformer. These include assumptions about the daily load variation, the seasonal load variation, the number of occasions the transformer may be required to carry emergency loads, the ratio of emergency loads to normal daily loads, the pattern of load growth and relief etc. Some of these should be logically related depending on the number of transformers in the substation and its operating design. However simplified assumptions are necessary to make the calculations manageable.
- The thermal model adopted for the transformer. These are provided in relevant Australian and International standards and are dependent on the cooling mode utilised. Standard models have changed over the years as more test data on transformer temperatures has emerged and this can only be expected to continue.
- The assumed maximum ambient temperature at the time of critical loading on the transformer (used to check that permissible operating temperatures are not exceeded).
- Any limitations due to associated equipment in the 'throughput path' such as low voltage cables, current transformers, switchgear etc.
- Oil expansion limits. These are not part of the automatic calculation procedures but may be set based on operational experience.

5. **Growth Rate (Estimate):** The growth rate is determined from trend analysis of POE50 weather corrected historical demand for each substation. Refer to Ausgrid 2017 Forecasting report for more detail.

Note that Ausgrid prepares detailed forecasts for each substation which include both short term spatial and long term econometric factors, and does not use a single linear per annum. growth rate for planning purposes. This growth rate does not include committed projects, spot loads and load transfers. Where a substation is being replaced, the growth rate reflects anticipated load on its replacement.

2.3.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Identification of Estimated vs Actual Parameters:

- All forecasts and weather-correction parameters are estimates. Actual data does not exist for these parameters. Other data is based on actuals as recorded in Ausgrid engineering systems.
- Weather correction is an estimate. The weather correction process is as the same as used in Ausgrid's forecasting process. Refer to Ausgrid Methodology document for further information on the forecasting process.
- Zone substations are not assigned a feeder category (Urban, Rural etc.) and therefore there is no actual data for this parameter.
- Zone substations primary category has been estimated based on the number of 11kV feeders in each category at each Zone.
- Growth rates are derived from forecast future demand, based on Ausgrid's established forecasting methodologies. Refer to Ausgrid Methodology document for further information on the forecasting process.

2.4 Table 2.4.4 – Augex model inputs – asset status – distribution substations

2.4.1 Demonstrate how the information provided is consistent with the requirements of the Notice

This response is based on the worksheets and supporting documentation as provided by the AER and as interpreted by the relevant completing Ausgrid business unit. The information primarily comes from Ausgrid's SAP system. Subject matter experts were engaged in preparing this information as necessary.

2.4.2 Explain the source from which Ausgrid obtained the information provided

SAP provides the substations ratings and load readings. Load readings consist of recording and estimates from various sources.

- Maximum Demand Indicator (MDI) load data is provided from field readings and provides instantaneous and maximum demand data since the previous reset date. MDI data is available for most substations except for Hunter pole top transformers and older Hunter kiosks.
- Distribution Monitoring & Control (DM&C) devices provide interval load data that is inputted into SAP after every peak season. DM&C is only installed at a small proportion of sites.
- Load Information System (LIS) provides an estimate of load data for most sites after 2016. It uses an algorithm to estimate load based on GIS connectivity and the summation of meters connected to the asset. Non-interval meter load data is substituted with interval meter data from a nearby customer with similar customer type and energy usage. This data is inputted into SAP after every peak season.

SAP contains the distribution substation to HV feeder connectivity.

Business Objects report 2_01 Feeder Performance – Quarterly – Fast –v10 contains the feeder category for each HV feeder.

The Spatial Demand 2017 Planning Forecast POE50 M contains the zone rate of growths

2.4.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Feeder category

Substations are assigned a feeder category based on the connectivity in SAP which identifies the HV feeder that it is connected to. Business Objects report 2_01 Feeder Performance – Quarterly – Fast –v10 can then be cross referenced to determine the feeder category for each HV feeder. Historical actual.

Utilisation

The complete list of Measurement Documents data was extracted from Business Intelligence (BI).

For the 2014 results, only Measurement Documents at active substations prior to 1/7/2014 was used.

For the 2017/18 results, only Measurement Documents at active substations prior to 1/7/2017 was used. It is assumed that the utilisation will be similar for 2016/17 and 2017/18 as we do not forecast load on distribution substations due to the volume involved and the infrequency of load data readings.

Substations may not have load data available for a variety of reasons, such as

- In the Hunter where MDIs are not common
- Recently commissioned substations
- Where LIS estimates cannot be provided with reasonable certainty (eg due to GIS issues, or where it vastly different than the expected load).

These substations will be counted in the “no utilisation” categories for each feeder category. In the BI reports, they are represented as having a utilisation of “.”. This is more likely in the 2014 data as LIS was not available.

The substation rating is also stored in SAP. This was extracted using Business Objects queries (Surv_05). Ratings are as of November 2017 as historical ratings are not stored within SAP. There is a possibility that some sites have had transformer uprates since 2014, but this will have an insignificant impact on the calculations within this table.

For sites that have multiple busbars, the rating was based on the maximum of the individual busbars. This is to prevent errors where ratings can be double counted. These sites are only a small portion of all sites.

Utilisation is calculated as the substation busbar load divided by the busbar rating which incorporates the transformer rating and RMI rating (including fuse).

Loads and ratings in SAP are recorded in LV amps. These loads were not weather corrected and were converted to MVA using the calculation below:

$$MVA = A \times sqrt(3) \times 415 / 1000\,000$$

Utilisation is historical estimated as the load data is often based on LIS estimates.

Utilisation percentage split

The utilisation percentage split is based on the sum of the capacity of distribution substations in that bucket divided by the sum of the capacity of all substations within that feeder category excluding those substations with no utilisation.

The substations with no utilisation are obviously not able to be split into utilisation buckets, but the total capacity is still able to be calculated.

Utilisation is historical estimated as the load data is often based on LIS estimates.

Rate of growth

The rate of growths are only provided for CBD and non-CBD (e.g. Urban, Short Rural, Long Rural and Other) as zone rate of growths are not able to be split into the same feeder categories as non-CBD zones can often supply multiple feeder categories.

Rate of growths were calculated by finding the weighted average of each zones contribution of underlying rate of growth.

Rate of growth is historical estimated as the load data is based on originating zone rate of growths which cannot be segregated into the feeder categories.

2.4.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Refer to section above for explanation of the estimated information.

2.5 Table 2.4.5 – Augex model inputs – network segment data

2.5.1 Demonstrate how the information provided is consistent with the requirements of the Notice

This response is based on the worksheets and supporting documentation as provided by the AER and as interpreted by the relevant completing Ausgrid business unit. The information primarily comes from Ausgrid's SAP system and Subtransmission planning section data analysis. Subject matter experts were engaged in preparing this information as necessary.

2.5.2 Explain the source from which Ausgrid obtained the information provided

Network segment title and AER segment group are from the AER guide to the augex model.

Distribution Feeders

Average unit cost historical is calculated from project costs from a BI report and rating changes from within 11kV reinforcement development briefs.

Capacity factor is derived from rating changes from within 11kV reinforcement development briefs and the 11kV feeder forecast.

Mean value and standard deviation of the utilisation threshold are derived from a review of historical 11kV reinforcement projects.

Distribution substations

Rating and project cost information is sourced from SAP.

Sub-transmission and Zone

Zone, STS and Sub-transmission feeders have been broken into two segments per group on a geographical basis. This is designed to broadly reflect the different network designs and operating conditions. The two areas are Sydney area networks and Hunter/Central Coast network areas. The primary differences are:

- The Sydney area feeder networks are predominantly shorter UG feeders compared to a long OH network in the Hunter and Central Coast.

- Sydney Substations are on average larger capacity with more transformers, resulting in a higher utilisation threshold than Hunter and Central Coast substations.
- There are differing average growth rates between the two areas.

Data Sources:

1. **Average Unit Cost ($/MVA):** Estimate based on project costs and added capacity. Source of capacity from Sub-transmission Planners / planning documents. Source of costs from BPC system.
2. **Capacity Factor:** Estimate from assessment of incremental capacity added by project (from planning documents or rating system).
3. **Mean value and Standard Deviation of Utilisation Threshold:** For substation segments, the estimate is based on analysis of existing normal capacity in Ausgrid RIC system and the load provided by forecasting group. For feeder data, it is based on analysis of feeder forecast results from the latest 2016/17 feeder forecast from Sub-transmission Planning.

2.5.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Historical Distribution Feeders

Average unit cost historical is calculated from project costs from a BI report and rating changes from within 11kV reinforcement development briefs. The projects were reviewed to identify the magnitude of trunk rating increase. Where rating information was unavailable, a trunk rating of 400A was assumed. For each feeder category. the total trunk rating increase was summed and divided by the sum of the project costs to provide a $/MVA figure.

Capacity factor is derived from ratings before and after project completion from within 11kV reinforcement development briefs and the 11kV feeder forecast. Where rating information was unavailable, a trunk rating of 400A was assumed. Where multiple feeders were identified as constrained, the rating was the combined feeder rating (e.g. 3 feeders constrained = 3 x 400A). When an additional feeder was built, its capacity was added to the feeder(s) that were constrained. Capacity factor for each feeder category was calculated by summing the capacity after and capacity before for each project and then applying the following formula.

Capacity Factor = (capacity after – capacity before) / capacity before

The utilisation threshold is derived from a review of historical 11kV reinforcement projects. The projects were reviewed to identify when the N or N-1 (including voltage) capacity was expected to be exceeded. The trunk section utilisation was then recorded for each project and a mean and standard deviation of these trunk utilisations was compiled for each feeder category. Where rating information was unavailable, a trunk rating of 400A was assumed.

There have been no historical augmentations in the CBD for several reasons:

- Load in the CBD has been reducing
- Customer connections fund the majority of the augmentations
- Capacity is managed during subtransmission driven projects that require load transfers.

The CBD capacity factor is assumed to be 66.67% based on the N-1 requirements of the triplex network.

Long Rural is assumed to be the same as Short Rural as there are only five Long Rural feeders and none of them have had historical augmentation investments recently.

Forecast Distribution Feeders

The average unit cost of augmentation and the capacity factor are assumed to be the same as in the historical analysis.

The mean value and standard deviation of the utilisation threshold were derived from our 11kV capex forecasting program except for the CBD which is based on the N-1 requirements of the triplex network.

For Urban and Short Rural networks, the program models the distribution (11kV) feeder network and identifies where the network is unable to be restored within four switching steps. For Long Rural feeders, the threshold is deemed to be when a section of feeder exceeds 100% utilisation. Once the feeders with LAR are identified, it is then possible to determine what the equivalent trunk section utilisation was and then determine a mean and standard deviation for each feeder category.

Historical Distribution substations

Average unit cost historical is calculated from historical project costs and rating changes from SAP for each feeder category.

Capacity factor is calculated based on before and after ratings of the historical projects from SAP.

Capacity Factor = (capacity after – capacity before) / capacity before

The mean value and standard deviation of the utilisation threshold are derived from the load and rating at the time of project initiation for the historical projects in SAP.

Forecast Distribution substations

The average unit cost, capacity factor, mean value and standard deviation of the utilisation threshold are all assumed to be the same as the historical data as there are no proposed change to the investment standards and projects are initiated reactively based on measured overloads and not forecast so it is impossible to predict how many and which substations will be augmented.

Sub-Transmission Line, STS and Zone Substations

- Augmentation unit costs and capacity factors:

  The Augmentation unit costs and capacity factors have been derived from historical data of projects completed in the current regulatory submission. As has previously been raised, the derivation of project related planning parameters for asset categories with small populations of non-uniform assets and non-uniform solutions to growth drivers (particularly sub-transmission lines, zone substations, and STS) is difficult. It is not possible to derive statistically meaningful parameters for Augmentation Unit Cost and Capacity Factor based on the both the historical and forward-looking project sets which comprise augmentation driven works at this level of the network with any level of accuracy. As noted in the AER augmentation model handbook, sample size is very important for statistical modelling, and the lack of samples (less than 30 per segment group) in the capacity augmentation area for sub-transmission and zone segment groups mean that these variables can only be considered indicative, particularly for the forecast period going forward.

  The numbers provided in Table 2.4.5 are based on historical real project costs (in real 2018/19 dollars) from last regulatory period (and the associated “capacity added”).

  For each sample project parameters are derived from the following relationship:

  Capacity Factor = [Capacity Added] / [Existing Capacity]

  or alternatively expressed as

([New Capacity] – [Existing Capacity]) / [Existing Capacity]

\$/MVA (forecast) = [Project Cost] / [Capacity Added]

An average value is then taken for each segment group.

Only sample projects where there were clear substation and feeder cost components were used to develop these estimates, to ensure no double-counting occurred.

It was found that capacity factor is very sensitive to the sample of projects used, particularly in these segments with very small sample populations. Many augmentation solutions at this level of the network are unique, driven by existing network design and constraints. No forecast capacity factor is possible due to the lack of upcoming projects driven by augmentation requirements in the upcoming submission.

- Mean value and Standard Deviation of Utilisation Threshold (Estimated):

  For substations this is based on relationships between normal cyclic rating of assets and the forecast load to trigger growth related investment. For feeders this also includes the relationship between N loading and forecast loading under worst case credible contingencies, as determined by load-flow simulation. Where data is not available, 50% is substituted for the mean value of Utilisation Threshold.

- Zone Substations and STS

  Source data for Utilisation Threshold is from Ausgrid's Network Forecasting Team. The data used to determine Utilisation Threshold are substation normal capacity and firm capacity limit. Historical thresholds are indicative only, as past practice was to combine substation and feeder limitations into the Substation firm Capacity limit. Therefore some manual correction and estimation of data was required.

  For Zone Substations and STS: Utilisation Threshold is derived from the relationship:

  "Firm Capacity" / "Normal Cyclic"

- Sub-transmission Feeders

  This is derived from a relationship:

  The relationship between the N loading and N-1 loading (in MVA) – to determine the ratio between system normal and worst-case credible contingency loading.

  Utilisation Threshold = (N loading / N-1 loading)

  This data is sampled from the Feeder Forecast results done by Area Planners.

Comments

It is Ausgrid's view that a statistical approach to modelling subtransmission level augmentation expenditure is not appropriate, due to the small population of a) assets and b) augmentation projects. This means that a statistical approach is very inaccurate. It is not expected that any other distributions would be more suitable, however it is noted that these segment groups do not exhibit a normal distribution.

2.5.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Refer to section above for explanation of the estimated information.

2.6 Table 2.4.6 – Capex and net capacity added by segment group

2.6.1 Demonstrate how the information provided is consistent with the requirements of the Notice

The template requires historical capex by Augex segment group which is a combination of asset and network type. This has been provided by analysing augmentation projects and identifying the capacity added.

2.6.2 Explain the source from which Ausgrid obtained the information provided

Data was sourced from Ausgrid corporate information reporting system (SAP BI). Historical financial data is archived and mapped by:

- Driver
- Investment program
- Project category
- Asset class.

2.6.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

The data extracted enables the templates to be populated directly with the exception of network type (CBD, urban, rural short and rural long). To obtain this data it was necessary to map projects by planning area and allocate expenditure to network type based on the proportion of network length.

2.6.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

An estimate for expenditure by network type because project data is not categorised at this level.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Estimated capex by network type has been estimated by allocating project expenditure to network type on the basis of the average proportion of feeder length by network type within individual planning areas. Given that this is the most granular and accurate data Ausgrid has relating to network category this was used as the basis for the allocation.

3 TEMPLATE 2.5 – CONNECTIONS

The information provided in template 2.5 has been completed in accordance with the AER RIN requirements and instructions applying to template 2.5 including Appendix E and F, and the instructions in the worksheet.

3.1 Table 2.5.2 – Cost metrics by Connection Classification and Table 2.5.3 – Volumes by Connection Classification

3.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

The information at an aggregated level primarily comes from Ausgrid’s SAP system or is based on advice from the relevant business unit experts. Subject matter experts were engaged in preparing this information as necessary.

3.1.2 Explain the source from which Ausgrid obtained the information provided

The information was obtained from SAP and GIS. The SAP Business Intelligence and Business Object reports were used as a basis for determining expenditure associated with new residential and commercial connections.

Connection figures for Table 2.5.2 were obtained from a detailed analysis of projects initiated by the Customer Connection driver. This was required because projects are not categorised in Ausgrid's systems in the same way as the AER's RIN categories.

The total volume and the expenditure from 2008/09 to 2016/17 is obtained from SAP Business Intelligence reports and categorised by connection type on the basis of Ausgrid’s internal project categorisation.

3.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

The information was obtained from Ausgrid’s Corporate Information System, SAP. The SAP Business Intelligence and Business Object reports were used as a basis for determining expenditure associated with new residential & commercial connections.

Connection figures for Table 2.5.2 were obtained from a detailed analysis of Ausgrid’s project categorisation within the Customer Connection program and major projects. This was required because projects were not categorised in Ausgrid's systems in the same way as the AER's RIN categories.

The instructions in relation to Connections provided by the AER, required Ausgrid to:

- Report data for non-contestable, regulated connection services (this includes work performed by third parties on behalf of Ausgrid)
- Not report data in relation to negotiated connection services or connection services which have been classified as contestable by the AER.

Ausgrid operates under a contestable connection framework within NSW so the majority of connections are contestable, however, a range of standard control services were previously provided to facilitate these connections. These are now covered primarily by a range of alternate control services which are reported separately.

The volume of connections is based on the number of practically or financially completed connection projects with a material or contracted services in the appropriate financial year.

Historically, projects were created for both non-contestable and contestable connection projects. The current practice is that projects are only created where there is a standard control service component.

Connections expenditure is accurately measured under either Ausgrid Connection Program or, in the case of major sub-transmission connection projects, under specific projects. The value of contestable connections has not been reported as per the AER's instructions. The value of these contestable connections (contributed assets) is estimated and reported separately as capital contributions in the PTRM.

Expenditure on non-contestable capital contributions are reported in Table 2.5.2 as standard control services - capital contributions as per instructions. Ausgrid has significantly reduced its involvement in providing non-contestable connection services. These services are primarily provided by contestable service providers with Ausgrid's involvement confined to unusual situations where the customer has requested that Ausgrid provide these services or where, based on a risk assessment, ASP's are not able to undertake this work within existing Ausgrid facilities.

3.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

Whilst expenditure and volumes of connection projects are based on actual data, assumptions were required to determine the volume and categorisation of connection projects due to that way in which these projects were reported historically. Ausgrid's previous connection policy provided for the funding of free-issue material in the case of relocatable equipment and a higher proportion of projects were deemed non-contestable. In addition, Ausgrid's information systems do not categorise connection projects in the exactly same way as the AER's RIN categories and therefore it was necessary to map Ausgrid's project categorisation to the AER's RIN categories.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

The information provided has been allocated to the various RIN categories on the basis of the most appropriate internal project categorisation.

In terms of estimating the historic volume of non-contestable projects (2009-2013) it was necessary to establish criteria for determining whether a project was non-contestable or not due the different connections policy that existed at the time. The criterion was based on whether the project had a material or contracted service component. It should be noted that minor connections (<$50K) were not identified as projects and were undertaken as a program of works. Since these connections are predominantly contestable it is believed that this would not result in any material reporting error.

4 TEMPLATE 2.6 – NON-NETWORK EXPENDITURE

The information provided in template 2.6 has been completed in accordance with the AER RIN requirements and instructions applying to template 2.6 including Appendix E and F, and the instructions in the worksheet

4.1 Table 2.6.4 – Information & Communications Technology – Capex by Purpose

4.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

All financial data as it relates to IT & Communications has been extracted directly from SAP and represents a subset of the financial figures as reported in our annual audited financial statements, with any assumptions in respect of the basis for estimating the respective allocation between cost categories noted within the Basis of Preparation.

The actual data for the period 2009/17has been based on an extraction of actual financial data directly from our SAP financial system. As such, the prevailing entries represent a subset of figures that have been reported in our annual audited financial statements and have been made in accordance with our CAM at the time of entry.

All the required categories of expenditure for Capital contained in table 2.6.4 have been completed. No further categories were considered material enough to be reported individually.

4.1.2 Explain the source from which Ausgrid obtained the information provided

Actual data for the period 2009/17 has been based on an extraction of actual financial data directly from our SAP financial system. Specific details of exact sources of information are shown in the below table.

Table 4. Summary for Table 2.6.4 – Information & Communications Technology – Capex by Purpose

Expense category	Source
IT & Communications Capex	SAP data extraction and ICT project information

4.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

The information provided was extracted from our SAP project system (IM/PS). The information was categorised according to the definition provided in section 8 and reconciled against actual financial data.

4.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

Not applicable.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Not applicable.

5 TEMPLATE 2.10 – OVERHEADS

5.1 Table 2.10.1 – Nework overheads Expenditure and Table 2.10.2 Corporate Overheads Expenditure

5.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided in template 2.10 has been prepared according to the AER Reset RIN requirements and definitions applicable to template 2.10. Information reported in table 2.10.1 aligns with Ausgrid's Cost Allocation Methodology (CAM).

5.1.2 Explain the source from which Ausgrid obtained the information provided

Actual data for the period 2008/09 to 2016/17 is from TM1 and SAP BI (Ausgrid financial reporting system).

5.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Overheads for each year have been calculated using the methodology outlined below.

Calculation of SCS opex overhead

For the period 2008/09 to 2013/14, Ausgrid has calculated direct costs relating to Vegetation Management, Maintenance, Emergency Response and Non-Network and also the total cost for the Metering business. The SCS opex overhead is considered to be the difference between total opex and direct costs for Vegetation Management, Maintenance, Emergency Response, Non Network and total cost for the Metering business.

Total overhead expenditure was then allocated into network and corporate overhead based on percentage split of classification of profit centres between network and corporate overheads.

For period 2015/16 to 2016/17, SCS overhead equates to numbers reported in the Category Analysis for those financial years plus Metering costs reported in SCS business.

Calculation of SCS capex overhead

Capital Expenditure has been extracted from BI for all years according to classification of costs under indirect cost category allocated to standard control services.

Network overheads including operating and capital expenditure data has been extracted from the SAP financial system using TM1 and BI.

There has been no change in Ausgrid's capitalisation policy during the period.

Calculation of ACS opex overhead

Alternative Control Services opex has been calculated based on classification of profit centres allocated to the ACS business between corporate and network overheads. Cost of Metering is reported in ACS from FY2013/14. Expenditure relating to Fee and Quoted Services is reported in ACS from FY2015/16. This is due to change in AER reporting guidelines. Overhead costs for the Metering business has been calculated using an overhead percentage for each year. Percentages used are stated in the table below:

Table 5. Overhead rates - Metering

Year	Overhead rate used for Metering Business
2013/14	35.4%
2014/15	35.4%
2015/16	71.9%
2016/17	54.3%

Overhead rate used for Quoted Services is set out in the following table.

Table 6. Overhead rates – Quoted Services

Year	Overhead rate used for Metering Business
2015/16	45.0%
2016/17	44.0%

Calculation of ACS capex overhead

Capital Expenditure has been extracted from BI for all years according classification of costs under indirect cost category allocated to alternative control services.

Calculation of Unregulated opex overhead

Unregulated opex has been calculated based on classification of profit centres allocated to the unregulated business between corporate and network overheads.

Calculation of Unregulated capex overhead

Capital Expenditure has been extracted from BI for all years according classification of costs under indirect cost category allocated to unregulated services.

5.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

No estimates reported in template 2.10.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

No estimates reported in template 2.10.

6 TEMPLATE 2.11 – LABOUR

he information provided in template 2.11 has been completed in accordance with the AER RIN requirements and instructions applying to template 2.11 including Appendix E and F, and the requirements in the worksheet.

6.1 Table 2.11.3 – Labour / Non-labour Expenditure Split

6.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided in template 2.11 has been prepared according to the AER Reset RIN requirements and definitions applicable to template 2.11. Information reported in table 2.11.3 aligns with Ausgrid's Cost Allocation Methodology (CAM).

6.1.2 Explain the source from which Ausgrid obtained the information provided

Information reported in template 2.11.3 for the period 2012/13 to 2016/17 is based on an extraction of actual financial data from TM1 from our SAP financial system (Ausgrid's financial accounting and reporting system). Ausgrid also has in place finance policies and Statement of Accounting Treatments (SATs), company policies and procedures, standard accounting and reporting systems, a centralised finance function and qualified employees who are able to manage the requirements.

6.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Table 2.11.3 Opex and Capex have been prepared in accordance with Ausgrid's CAM.

Costs relating to operating and capital expenditure listed in table 2.11.3 have been extracted from SAP via TM1 and BI for the period 2012/13 to 2016/17 according to costs allocated to Standard Control Services.

In-house labour expenditure is equivalent to total labour expenditure less labour expenditure outsourced to related parties and labour expenditure outsourced to unrelated parties. This definition was provided to Ausgrid, by Kaye Johnston from the Australian Energy Regulatory on 15 February 2016.

> Labour expenditure includes wages, salaries, overtime payments, bonuses, allowances, incentive payments, superannuation contributions, taxes (e.g. payroll and fringe benefits taxes), termination and redundancy payments, workers compensation, labour hire costs, training and study assistance, purchases made on behalf of employees (e.g. protective clothing). This is as per the labour expenditure definition set out in Appendix F of the Annual Regulatory Reporting RIN.
>
> Related party costs relates to transactions between Ausgrid, Endeavour Energy and Essential Energy for the period 2012/13 to 2016/17. From 1 July 2012, Ausgrid operated under a Networks NSW (NNSW) operating model which comprised of Ausgrid, Endeavour Energy and Essential Energy (DNSPs), the three NSW Government owned electricity distribution networks Ausgrid, Endeavour Energy and Essential Energy continued to operate as separate legal entities but were managed by a joint Board of Directors and common Chief Executive Officer (CEO).
>
> Various agreements including the Umbrella Cooperation Agreement, and Procurement and Services Joint Venture Agreement, were established to facilitate cooperation between the DNSPs to enable the identification and delivery of reform

and other efficiency measures by acting collectively and co-operatively. Following the enactment of the Electricity Network Assets (Authorised Transactions) Act 2015 the joint board arrangements for Ausgrid, Endeavour Energy and Essential Energy ceased effective 31 December 2015, as directed by the Ministerial Order from the Treasurer.

Uncontrollable non-labour expenditure as defined in Appendix F of the Annual Regulatory Reporting RIN issued on 3 February 2016 relates to all non-labour expenditure over which Ausgrid has no control. Uncontrollable non-labour expenditure is imposed by an independent (that is, not related party to Ausgrid) government body (federal, state or local) so Ausgrid has no ability to influence any amount of the expenditure incurred by the manner in which Ausgrid operates its business. Such costs include solar feed in tariff payments, jurisdictional levies/taxes and local government rates. According to the above definition, Ausgrid has included the following cost categories listed below as uncontrollable non-labour expenditure for standard control services:

- 722315 - Foreign Exchange Derivates
- 730300 - Government Audit Fee
- 736040 - Water Rates Expense
- 736065 - Payment under GCSS
- 736080 - Municipal Rates
- 778910 - Land Tax Equivalent.

6.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

No estimated information provided in the template.

7 TEMPLATE 6.1 – TELEPHONE ANSWERING

The information provided in template 6.1 has been completed in accordance with the AER RIN requirements and instructions applying to template 6.1 including Appendix E and F, and the requirements in the worksheet.

7.1 Table 6.1.1 – Telephone answering data

7.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

Using the required reporting applications, data supplied is true and correct to the best of Ausgrid's ability.

Call volumes provided are from our Emergency/Faults lines and have not excluded any major event days.

7.1.2 Explain the source from which Ausgrid obtained the information provided

The Ausgrid Contact Centre reporting is captured in a number of Genesys tables from 6.30am – 10.00pm and in an Alcatel Application (CCSupervision) from 10.00pm – 6.30am.

Business Objects is the reporting application that combines both the Genesys and Alcatel data and provides a combined result across all queues and call types.

7.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Through Business Object, the required date range is selected and all Contact Centre data is provided in the initial report.

Once the data is available, a filter would be applied to the report to exclude all calls except the Emergency/Fault call volumes, which are to be populated into the RIN report.

Any calls abandoned within 30 seconds have been subtracted from the Total Number of Calls as per the calculation requirements.

Major Event Data under Network Reliability would then be excluded from the report as required.

No assumptions have been made in this reporting period.

7.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

No estimates of data have been provided within this report.

Within the data period, there have been instances where the reporting tools have not captured part and whole days, however the data provided in the RIN report is solely what has been captured.

Each time a data error has occurred, steps have been put into place to mitigate these issues.

8 TEMPLATE 7.4 – SHARED ASSETS

The information provided in template 7.4 has been completed in accordance with the AER Reset RIN requirements issued in January 2018.

8.1 Table 7.4.1 – Total unregulated revenue earned with shared assets

8.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

Entries include the names of each shared asset unregulated service provided by Ausgrid and a description of the shared assets used to provide the service in accordance with the shared assets guideline.

For each shared asset unregulated service, actual and estimated nominal revenue provided from FY2009-10 to FY2016-17.

8.1.2 Explain the source from which Ausgrid obtained the information provided

Actual figures were obtained from Ausgrid's reporting system TM1, adjusted to exclude unregulated revenue associated with assets who have had their costs allocated in accordance with Ausgrid's CAM. Figures for the period 2009/10 to 2013/14 were reconciled to Ausgrid's 2014-19 Reset RIN.

8.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Pole and duct rental

Annual historic revenue was obtained from the following Internal Orders, which were created specifically to capture Pole and Duct rental revenue:

- 127000081 Facilities Access
- 127000083 Smart Pole Duct Rental
- 127000133 Facilities Access & Billing
- 127000134 Smart Poles Revenue
- 127000292 Facility Access & Billing
- 127000293 Smart Poles Revenue.

Property lease income

Annual historic revenue was obtained from the following Internal Order, which was created specifically to capture property lease income:

- 157000010 External tenants rental.

The total annual revenue amount was then split between revenue received from system assets and revenue received from non-system assets using an estimated percentage of system property in the property lease income projection files for each year. Given non-system assets have had their costs allocated in accordance with Ausgrid's CAM these are not considered shared assets. In contrast, system assets are 100% allocated to Standard Control Services and therefore meet the definition of a shared asset.

Night Watch (EnergyLight)

Annual historic revenue was obtained from the following Internal Orders, which were created specifically to capture Night Watch revenue:

- 137000406 Night Watch – Sydney North
- 137000408 Night Watch – Hunter Valley & CC
- 137000668 Night Watch – Sydney South.

8.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

As a result of data limitations within Ausgrid's systems, an estimate was required to account for only property lease income received from system assets and therefore those assets considered shared assets in accordance with the Shared Asset Guideline.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Ausgrid prepares a detailed property lease income projection report each year showing existing lease contracts and the related property. Each property is flagged as system or non-system. System assets would have been allocated 100% to Standard Control Services in the initial allocation. A percentage was calculated based on the lease income projection report for each year to estimate the proportion of lease income received from system assets.

8.2 Table 7.4.2 – Shared asset unregulated services – approtionment methodology

8.2.1 Demonstrate how the information provided is consistent with the requirements of the Notice

Not applicable, in each unregulated service listed in Table 7.4.1, the shared asset is the major (if not the only) component involved in the delivery of the unregulated service.

8.2.2 Explain the source from which Ausgrid obtained the information provided

Not applicable, in each unregulated service listed in Table 7.4.1, the shared asset is the major (if not the only) component involved in the delivery of the unregulated service.

8.2.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Not applicable, in each unregulated service listed in Table 7.4.1, the shared asset is the major (if not the only) component involved in the delivery of the unregulated service.

8.2.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information: (i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information; (ii) the basis for the estimate, including the approach used, assumptions

made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

Not applicable, in each unregulated service listed in Table 7.4.1, the shared asset is the major (if not the only) component involved in the delivery of the unregulated service.

9 WORKBOOK 6 - CESS

The information provided in Workbook 6 has been completed in accordance with the AER RIN requirements and instructions applying to Workbook 6 including Appendix E and F, and the requirements in the worksheet.

9.1 Table 1 – Forecast Capex for CESS Purposes (CESS Target)

There has been no historical actual or historical estimated information used to prepare this table.

Numbers have been derived from Ausgrid's 2014-19 regulatory determination.

9.2 Table 2 – Actual/Estimated Capex for CESS Purposes

For the years 2014/15, 2015/16 and 2016/17, actual information from the Annual RIN, table 8.2.4 Capex by asset class has been used to prepare this table.

Refer to the Annual RIN basis of preparations for these respective years, section 8.2.4 Capex by asset class, which provides the basis of preparation of this capex number.

10 WORKBOOK 3 – 2.2 REPEX

10.1 Table 2.2.1 – Replacement Expenditure, Volumes and Asset Failures by Asset Category

10.1.1 Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided in template 2.2 has been completed in accordance with the AER RIN requirements and instructions applying to template 2.2, including Appendix E and F, and the instructions in the worksheet.

The data for this area is obtained from two broad investment areas: major projects and replacement/duty of care programs.

Similarly the cost data for replacement programs has compatibility issues which affect reconciliation to the SAP Finance cost due to driver allocation differences.

It is worthwhile noting that the financial figures are updated at an exceptional basis as a result of a Financial Adjustments made on the 26th August (i.e. an update of the step change only, not a complete re-run of all the reports and analysis).

10.1.2 Explain the source from which Ausgrid obtained the information provided

The source for the majority of data for this section has been Ausgrid's Corporate Information System (CIS). This includes data in categories poles, transformers, switchgear, and other (excluding meters). Volume data for spatial assets (i.e. overhead conductors, underground cables and service lines) has been sourced from Ausgrid's Geographical Information System (GIS).

Historical RIN expenditure and failure data were reused where ever possible. It was necessary to re-run the financial reports for 2012/13 to 2013/14, since expenditure was not originally reported on a direct cost basis. Standard financial reports (Capex by Line of Business - Snapshot) were used to obtain the direct cost component of historic expenditure.

The originally reported replacement volumes by replacement program values were reused for the basis of the recast volumes in tables 2.2.1 of the Category Analysis RIN. These values were sourced from Ausgrid working files for the 2013/14 Reset RIN and include base data for 2012/13 and 2013/14. Data for 2014/15 to 2916/17 was based on the data used to populate the respective annual RINs.

Historical assets replacement volumes associated with the Major Project were sourced from the BPC (ARA Asset Quantities Report).

Historical asset failure data between 2014/15 – 2016/17 were as reported in the annual Category RINs within the current regulatory period. Historical asset failure data for 2008/09 to 2013/14 was not reported as the asset categorisation pre-FY2014 did not align with current RIN templates and the data accuracy may be affected due to the misalignment of asset category reporting requirements and the availability of the historical data.

In addition, historical expenditure for the same period has been reported against the Repex asset categories. This period is considered more representative than for years in the previous regulatory period. In addition, improved reporting against Repex asset categories has been achieved that allocates expenditure to the replacement asset category rather than the category of the asset installed.

10.1.3 Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Historically, Ausgrid has reported expenditure on the basis of the asset installed rather than the asset being retired, since this was the only data readily available. In the case of replacement programs, reporting on this basis is equivalent since these programs are designed to replace the existing asset with an equivalent asset. However, in the case of major projects, it is not uncommon for the retired asset to be replaced with a different asset.

In addition, previously Ausgrid's planning systems did not have sufficient detail to report expenditure and volumes of secondary asset replacements (primarily protection/control equipment and field devices). As a result, the volumes of these assets were under-reported and the expenditure was allocated to the primary equipment category associated with the secondary equipment. Ausgrid has updated its planning models to be able to report on a replacement asset basis.

To provide the expenditure and quantum of assets replaced, reports were generated from Ausgrid's corporate information system for Replacement and Compliance Programs as well as replacement/compliance driven expenditure and asset volumes for major projects (Area Plans). This extract was obtained from Ausgrid's corporate reporting tools (Business Objects (BO)/Business Intelligence (BI)).

To provide a split of staked and unstaked poles for FY2015 – FY2017, the volume for asset failure data for wood poles were mapped to the staked wood pole population data in the Category RIN for the respective reporting year.

In SCADA, two new categories were added which were 'Electromechanical Relays' and 'Non-electromechanical Relays' which were part of Field Devices in previous submissions. These assets have been moved out of Field Devices and into these two categories accordingly.

In switchgears, '<=11kV; Switchgear Panel Refurbishment' failure data was assumed to have the same failure as the 11kV circuit breaker category as a separate failure data is currently not recorded in the corporate system for these asset category.

Additional Categories

Due to the AER's revised asset categorisation Ausgrid had to recast the following assets:

- Staking of wooden poles by voltage
- Replacement of wooden poles by staked or un-staked.

The volume and expenditure of "staking of wooden poles" is apportioned by voltage using a pro-rata approach based on Ausgrid wood pole population as reported in the 2014-19 RIN (Table 5.2).

The volume and expenditure of wood poles replaced are apportioned based on a BI report showing the historical volume of staked and un-staked wooden poles replaced.

Ausgrid also updated asset mapping tables to provide a more accurate and detailed reporting of asset replacements. In past RIN's, Ausgrid allocated volumes to the new asset category instead of the retired/replaced asset category since planning systems were not able to report on this basis.

Revised Categorisation

Ausgrid's corporate information systems are designed to record expenditure and asset volumes on the basis of the assets constructed. As a result, Ausgrid previously reported Repex data on the basis of what was installed rather than what was replaced. For example, a project to replace 33kV Cables with a 132kV Cable solution would have been reported against the 132kV cable asset category.

In addition, Ausgrid asset replacement expenditures and volumes in Table 2.2.1 were previously reported on the basis of major assets categories since, at the time, planning and reporting systems were not able to report secondary and minor asset categories. For example, secondary protection and control equipment is usually required to be replaced in conjunction with primary equipment replacements since these assets are either technically obsolete or inadequate to protect the new equipment.

Ausgrid has addressed this limitation by more detailed modelling of major projects which now includes secondary assets retired in conjunction with the replacement of primary asset. This is reflected in the recast historical repex data. The reporting of secondary system assets was based on established engineering configurations which comprise:

Table 7. Engineering configurations

Primary Replacement Asset	Secondary Replacement Asset
HV Switchgear panel (11kV-132kV)	Field devices (5 per primary asset)
Power Transformer (33kV – 132kV)	Field devices (10 per primary asset)
Zone/Sub-Transmission Substation	Communication system (1 per primary asset)

Revised Expenditure Allocation Methodology

Ausgrid has revised its approach to allocating expenditure and volumes for its major project based on the assets being replaced. The revised approach involves estimating the replacement cost the assets to be replaced and allocating actual project costs on that basis. Expenditures are mapped individually using existing mapping rules.

This revised reporting approach had no impact on the reporting of replacement/duty of care programs but did impact the way in which major projects were reported.

The revised approach did impact the way in which major projects were reported since it is not unusual for these projects to replace existing assets with different assets. For major projects, Ausgrid develops detailed project estimates and asset volumes by type of asset installed and retired. Project expenditures are then allocated on the basis of the replacement cost of the assets replaced. Planning systems have been used to report the historical volume of assets replaced by its major projects. Due to the scale and duration of these projects asset volumes were aligned with expenditures on the basis of project cashflows rather than on project completion.

Please refer to RIN table 4.1 for expenditure and volume data associated with public lighting in 2016/17. This table is meant to reconcile with the 'Replacement Expenditure' in table 2.1.1 which is for standard control services only and does not include data for Alternate Control Services.

10.1.4 Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

Estimated information is set out in the following table.

Table 8. Reason for estimated data

Category	Reason
Pole replacement	Data is not held at the granular level required to populate the asset categories/asset metrics directly.

Category	Reason
Pole Top Structures	Data is not held at the granular level required to populate the asset categories/asset metrics directly.
Overhead conductors	Data is not held at the granular level required to populate the asset categories/asset metrics directly.
Underground cables	Data is not held at the granular level required to populate the asset categories/asset metrics directly.
Service lines	Data is not held at the granular level required to populate the asset categories directly.
Transformers	Data is not held at the granular level required to populate the asset categories directly.
Switchgear	Data is not held at the granular level required to populate the asset categories directly.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

The estimates and apportionment methods are set out below:

Replacement and Duty Of Care Programs

Ausgrid CIS reports provide the historical replacement volume and associated expenditure at Ausgrid's individual sub-program level. For each sub-program, Ausgrid has a detailed mapping table to apportion sub-program replacement projects across the RIN Asset Group and RIN Asset Categories that are impacted.

<u>Volume Mapping Table</u>

A detailed sub-program mapping table is used to translate sub-program volumes into the AERs Table 2.2.1 Asset Categories. The mapping table has a one to many relationships, allowing sub-program projects to be reported against multiple asset categories. For example: Ausgrid Kiosk Replacement programs are mapped to 5 different asset categories corresponding to the LV cables, 11kV Cables, Transformer, 11kV Switch and LV Switchboard assets that are retire when a kiosk is replaced.

<u>Expenditure Mapping Table</u>

A detailed expenditure map table is used to translate sub-program volumes into the AERs Table 2.2.1 Asset Categories. For each sub-program expenditure is allocated to the exact same asset categories as the volume mapping table. This enables the expenditure associated with replacement programs that span multiple asset categories to be appropriately apportioned.

<u>Recast Historical Quantities</u>

Ausgrid has recast historical expenditure and volume by apportioning historical program expenditure and volumes utilising the expenditure and volume mapping tables above.

Any Replacement or Duty of Care programs that result in the replacement of assets that are not listed in main asset groups are reported in the 'Other' asset category. These replacement are typically associated with the replacement of building assets and Duty of Care expenditure that does not result in the retirement of an asset. Since these programs have a mixed unit of measure, it is inappropriate to provide summated volumes for these assets. Detailed individual program volume is available and can be provided upon request.

Reporting of Major Replacement Projects

The Repex expenditure portions within the major projects are based on actual expenditure data. The expenditure associated with each major project is then mapped to the Repex 'Asset Group' and 'Asset Category' based on Ausgrid detailed project models in BPC.

Since Ausgrid major projects span across multiple years and due to the long lead time of major projects, it is appropriate to partially recognise the asset volume of high-value assets (e.g. sub-transmission underground feeders) based on the proportion of actual or projected project expenditure incurred in a particular year. This method ensures that expenditures and volumes for significant expenditures are aligned.

Other Repex Expenditures

System property and support costs (i.e. GIS data capture and switching) are reported as network overheads and are not reported as direct cost.

It should be noted that there were financial adjustments in a number of financial years which related to employee entitlements and these have been allocated on a direct expenditure basis.

11 OTHER MATTERS IN THE RIN

11.1 Clause 1.3 to Schedule 1 of the RIN

The information prepared in accordance with the following requirements in Schedule 1 of this notice:

11.1.1 Paragraph 1.2

When preparing our response to paragraph 1.2 we had regard to the definition of 'materiality' in Appendix F of the Reset RIN.

Our assessment of the impact of the services which are likely to change classification was based on the revenue we had recovered from these services (emergency recoverable works, sale of materials to ASPs, security lighting, and technical training). We obtained these revenue amounts from TM1 (Ausgrid's financial accounting and reporting systems).

We compared the revenue we recovered from these services against our smoothed building block revenue for 2015/16 and 2016/17. This building block revenue was taken from table 1.1 and table 1.2 from the AER's Final decision on our 2015-19 distribution determination (attachment 1 – Annual revenue requirement).

11.1.2 Paragraph 5.1(a)(ii)

The number of assets replaced due to reasons other than age/condition (i.e. not age related) was calculated by subtracting Age Related Asset Replacements volumes from Decommissioned Asset volumes for each financial year. In cases where this resulted in positive asset decommissioning's, these were reported as assets replaced for reasons other than condition or age.

Reporting of asset decommissioning's for some asset classes were not consistent and, in some cases, was less than the reported volume of asset replacements due to condition. In these cases it was assumed that no assets were replaced for reasons other than condition or age.

For some asset categories, the difference between asset replacements and decommissioning's was negative for individual years but positive number for other financial years. This is probably explained by misalignment in timing or reporting of asset replacements and decommissioning's. This occurs when certain assets are replaced and taken out of service but are kept in store as spares before being decommissioned. In these cases the following steps were taken to adjust data and apply an overall average percentage:

1. Total number of asset decommissioned across the four years (2013/14 – 2016/17) was calculated
2. Total number of assets replaced due to other reasons across the four years (2013/14 - 201617) was calculated
3. Percentage of total decommissioned assets that are replaced due to other reasons was calculated using the data from the previous steps
4. This percentage was applied to the number of decommissioned assets to calculate the number of assets replaced due to other reasons for each financial year

11.1.3 Paragraph 8.5

In the current regulatory period, Ausgrid has made no payments to embedded generators as part of a demand management project. This inactivity has been due to the lack of demand driven network investments following the decline in customer demand for electricity from 2010 to 2014. In contrast, during the 2009-14 regulatory period, Ausgrid made more than $2.6m in generator payments.

For the forthcoming regulatory period, Ausgrid has proposed a $10.5m ($2016/17) step change in operating expenditure for delivery of targeted demand management projects to defer network investment. The share of the payment amounts for network support that would be made to embedded generators is not known at this time as it will be determined through a public consultation as part of the Regulatory Investment Test process. As part of the National Electricity Rules requirements, a Regulatory Investment Test for Distributors (RIT-D) will be conducted on network investment projects, and a non-network options report published as part of the demand management process. For more information on Ausgrid's demand management process, refer to our Demand Management Engagement Document on Ausgrid's website at www.ausgrid.com.au/dm.

11.1.4 Paragraph 13.5

We are asked in paragraph 13.5 to provide revenue data for each of our alternative control services in the current and forecast period.

The historical revenue amounts are taken from our FY15 to FY17 annual RINs (template 8.1 'Income'). The basis of preparation documents supporting those RINs contain further information about any assumptions we have made when reporting those revenues.

The forecast information we have provided in response to question 13.5 is based on the AER's 2014-19 decision for the remaining years of the current period and our 2019-24 regulatory proposal.

11.1.5 Paragraph 13.6

<u>Public lighting</u>

We have answered paragraph 13.6 by referring to the labour rates set out in attachment 8.10. These labour rates are the same for both the current and forthcoming regulatory control period. The only difference relates to annual updates for inflation and real price changes in labour.

<u>Metering</u>

Refer to our response under paragraph 15.2(b).

<u>Ancillary network services</u>

The labour rates which we have provided for the current period are the labour rates the AER approved in its last determination (see AER, Final decision 2015-19, April 2015, table 16.3).

Our forecast labour rates for the 2019-24 period are based on our current rates, escalated for inflation and the 'X-factors' the AER approved in its 2014-19 determination for real price changes in the cost of labour.

11.1.6 Paragraph 15 (15.2 and 15.3)

<u>15.2 (a)</u>

No historical data provided.

15.2 (b)

We have provided a labour cost for maintenance, meter reading and installation.

The labour rate we have provided for both maintenance and installation has been calculated using data from Table 4.2.2 in our category analysis RIN for 2016/17.

To develop our maintenance labour cost of $92.86, we divided our maintenance expenditure ($708,588) and reported volumes (7,631) in that RIN. Our labour cost of $118.23 for meter installations was based on our replacement expenditure ($7,638,227) divided by our replacement volumes (64,605).

The labour rates we have provided for meter reading is based on analysis performed by Sankofa Consulting. This analysis has been included in Attachment 8.04 of our proposal.

15.2 (c)

The meter purchase costs have been taken from Ausgrid's audited responses to the AER's Category Analysis RINs from FY15 to FY17. Our estimate for FY18 is based on internal financial data from TM1 (Ausgrid's financial accounting and reporting system).

15.2 (d)

The volumes of work have been taken from Ausgrid's FY15 to FY17 audited responses to the AER's Category Analysis RINs from FY15 to FY17.

Work volumes from FY18 to FY24 are detailed in Table 4.2.2 Volumes section – with columns depicting years. The data is based on FY17 actuals and advice from Sankofa Consulting regarding the expected decline in type 5 and 6 metering population. These assumptions are set out in attachment 8.04 (Sankofa Consulting report) and section 6 of Attachment 8.01

15.2 (e)

Our charges for type 5 and 6 metering services are set out in attachment 8.03, '2019-24 prices' tab (rows 5-89 and rows 80-94).

These charges have been forecast using the AER's metering pricing model developed at our 2014-19 determination.

15.2 (f)

The revenue earned so far in the current period has been taken from our audited Category Analysis RINs for 201415 to 201617. Our forecast revenue for 201718 to 2023/24 is based on our 2014-19 determination and our proposal for the 2019-24 regulatory period.

15.3

Our actual number of metering customers was taken from our audited Economic Benchmarking RINs for 2014/15 to 2016/17 ('Operational data' tab, rows 48 and 49). Our forecast customer numbers are based on analysis performed by Sankofa Consulting (Attachment 8.04).

11.1.7 Paragraph 16 (16.2-16.7, 16.10)

16.2

Unit material rates have been sourced from SAP material master for each item. The unit rates for items that are still currently being purchased are the moving average price. Where an item is no longer being purchased, the last known price has been escalated to 2018Y19 dollars.

16.3

Ausgrid has continued to use 20 years to depreciate traditional lamp based luminaires which is consistent with the previous two regulatory submissions. In consultation with our customers, Ausgrid has priced LED luminaires based on a 10 year annuity. Annuity charges will cease at the end of the 10 year period.

16.4

Ausgrid has moved to a 4 year bulk lamp replacement for all lamp types. This is in anticipation of moving to LED throughout the forthcoming period.

16.5

Ausgrid's SAP PM data for street lights does not allow for this data to be reported. When a new luminaire is installed, the date of installation is captured, however this over writes the date for the previous luminaire which in turn does not allow for the calculation of the age of the previous luminaire.

16.6

Current luminaire inventory data is taken from the SAP PM Street Lighting Inventory Reports (transaction ZSD0014)

- Includes all commissioned lights installed on Ausgrid’s network.
- The Streetlight rate is either 01 (Ausgrid owned and maintained) or 02 (Ausgrid maintained) – rate 03 (Private) is excluded.

Forecast data has taken into consideration Ausgrid’s proposed capital replacement programs.

16.7

Asset replacement data for the current period is sourced from SAP Plant Maintenance. Data for the forthcoming period is based on forecast capital programs.

16.10

The number of public lighting customers is listed in attachment 8.08 – “Public Lighting PTRM and pricing (pre-2009) “, tab “Report – Charges”.

11.2 Other information related to Forecast RIN templates required by Appendix E

11.2.1 Table 4.3 Fee-based services & Table 4.4 Quoted services

Refer to the ‘service description tab’ of attachment 8.06 for a description of each fee and quote based service, the purpose of the service and a list of activities involved.

11.2.2 Table 5.4.1 Non-Coincident & Coincident Maximum Demand

Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided in template 5.4.1 has been completed in accordance with the AER RIN requirements and instructions applying to template 5.4.1 including Appendix E and F, and the requirements in the worksheet.

Explain the source from which Ausgrid obtained the information provided.

Data provided in Table 5.4.1 is obtained from the systems used to derive Ausgrid’s spatial demand forecast.

Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Ausgrid performs weather normalisation at 10% and 50% POE using a simulation technique at the zone substation level on a yearly basis. A planning spatial demand forecast is produced each year from the 7 year trend of 10% and 50% POE weather corrected substation loads (adjusted for block loads and transfers) for each zone and sub transmission substation.

Substation rating (MVA) is taken from Ausgrid's spatial demand forecast for each respective forecast year. The higher of the summer and winter starting load MVA for each location (derived from spatial demand forecast system) determines the dominant season. The corresponding dominant season substation rating is applied to all forecast years unless any changes in rating occur due to committed projects. Only the substation rating of the dominant year is shown.

Non-coincident 10% and 50% POE Maximum Demand for Tables 5.4.1 at each location is the forecasted value of the selected dominant season at each location in each year.

Embedded Generation values in Table 5.4.1 and Table 5.4.2 are the total accumulative value of installed solar capacity at each zone substation in that year. Future embedded generation values at the spatial level are calculated by apportioning the 48MW across all zone substation locations based on current penetration of solar at each respective zone substation. STS values are simply the summation of installed solar capacity of each zone substation connected to the STS. These are NOT adjustments made during the forecasting process.

Key assumptions include:

- For forecasting purposes, Ausgrid's winter season covers period 1st May – 31st August and in Ausgrid's view it is impractical to divide the winter season across two financial years. Therefore data provided for 2008, for example, covers the calendar period 1st May 2007 – 30th April 2008.
- All load data is obtained from Ausgrid's SCADA system or metering points. All weather data is obtained from the Australian Bureau of Meteorology weather stations.
- System diversity factors applied for all forecast years at sub transmission and zone substations are an average of the last 5 years historical system diversity factors and are used in the calculation of Coincident forecast loads at each location
- Selection of the dominant season in forecast years for Coincident Maximum Demand for Tables 5.4.1 is set at Summer for all sub transmission and zone substations. Selection of the dominant season for Non-coincident Maximum Demand for Tables 5.4.1 is as follows:
    - A comparison of the summer and winter 7 year trend starting point for each location is undertaken. The season that has the greater 7 year trend starting point value taken as dominant season for the first forecast year.
    - The dominant season for the first forecast season is held as the dominant season for all forecast years
    - New zones commissioned in future forecast years do not have 7 year trend starting points available for comparison. The dominant season is assumed to be Summer for future commissioned zones
- Embedded generation adjustments are inherent in the 7 year weather corrected load trend line which is used to determine the rate of growth for each sub. Embedded generation for future years is taken into account in the calculation of economic rates of growth applied to location.

- Data provided is based on the forecast prepared in June 2017.
- For any substation that is not commissioned in a particular year, the acronym “NC” is entered into the data table column for that year.
- Any substation that does not have any future demand values entered are new substations under construction, and the magnitude of future transfers have not yet been determined and no transfers works have been financially committed.

Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

Not applicable as this template is forecasted estimated information.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid’s best estimate, given the information sought in the Notice.

This is explained above in the discussion of the methodology.

All forecasted values used in Table 5.4.1 are estimates based on Ausgrid’s spatial demand planning forecast.

11.2.3 Table 5.4.2 Expected Unserved Energy

Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided in template 5.4.2 has been completed in accordance with the AER RIN requirements and instructions applying to template 5.4.2 including Appendix E and F, and the instructions in the worksheet.

Explain the source from which Ausgrid obtained the information provided.

The process of determining Expected Unserved Energy (EUE) per substation involves taking the values for Energy Not Supplied given in table 3.6.2, and appropriately allocating them to the substations detailed in table 5.4.1.

Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Assumptions

- That “Coincident” EUE can be ignored (this approach was validated by the AER via email)
- That the vast bulk of outages of any length occur on the distribution network (Predominantly 11kV and below).
- That the considered “Load” should be the 50% POE MVA load rating, on the basis that this is the load value used by planning, so it seems sensible to use it here.
- That there will be zero energy losses in the Sydney CBD as a result of Planned Outage and Major Event Days (note that this includes Graving Dock)

Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

Not applicable as this template is forecasted estimated information.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

The basic process is:

- Estimate unserved energy amounts for each Zone Substation
- Roll up the amount from zones to their supplying STS to determine the lost energy at Subtransmission Substations.

Note that for this process, Kooragang STS is treated as a Zone Substation, given it effectively has a 33kV distribution network.

The process for allocating unserved energy involves splitting it appropriately amongst each of the Zone Substation based on appropriate "Weighting Quantities", where this is applied as follows:

$$UEP_{Zone} = UEP_{Total} \frac{WeightingQuantity_{Zone}}{\sum_{All\ Zones} WeightingQuantity_{Zone}}$$

Where "UEP" stands for "Unserved Energy Pool". The unserved energy is broken up into three pools:

1. Planned outages
2. Unplanned outages on Major Event Days (MEDs)
3. Unplanned outages on non MEDs.

Unplanned is split into two because MED outages are mostly to do with one off events and the weather, whilst general unplanned outage can be more directly correlated with underlying reliability.

For the first two pools, the Weighting Quantity used is "NonCBDLoad", which is defined as

- Zero if the zone is classified as Sydney CBD
- 50% POE MVA load rating otherwise

This quantity is used because both of these pools have almost no impact on the CBD, and almost random in their nature.

For the last pool, the Weighting Quantity used is "CMILoad", which is defined as being (Five Year Average of total Customer Minutes Interrupted) x (50% POE MVA load rating)

Most of the data comes from sections 3.6.2 and 5.4.1 of the Reset RIN. The main exception is the CMI data, which comes from the Outage Management System.

Note that process will lead to a few effects (described below) that could be misconstrued as errors:

Table 9. Process effects

Effect	Explanation
The total amounts for Zones and Subtransmission Stations don't match	Any zone that is 132 to 11kV is supplied directly from a Transmission Bulk Supply Point, rather than from a Subtransmission Substation
The total for all Substations are greater than the figures in 3.6.2	This is a side effect of the "rolling up" process. The total energy not served should be the sum of all Zone Substations and Kooragang STS.
Graving Dock Zone has zero unserved energy.	It is considered CBD, and has had no outages in the last 5 years

Effect	Explanation
Various Subtransmission Stations have non zero load, but zero unserved energy.	The only load that they are carrying is direct feeds to High Voltage Customers.

11.2.4 Table 2.3.1 Augex Asset Data – Subtransmission Substations, Switching Stations and Zone Substations

Notes:

- Projects listed in tables 2.3.1 and 2.3.2 are area plan projects which have expenditure incurred in the FY2020-FY2024 period and their driver is demand growth or reliability improvements. There are no projects with mixed drivers.
- Some of the projects are considered ‘conditional’ projects, as there is some uncertainty over the likelihood of the project to proceed. These projects are upstream augmentations of the network triggered by major residential and/or commercial developments. A percentage has been added at the beginning of the project name to identify them and provide an indication of their likelihood of proceeding. For instances, 50% or higher means there is confidence that the project may be required, whilst 10% or less means there is significant uncertainty. Five of the projects are ‘conditional’ projects. The expenditure reported for these cases considers the percentage allocated to each project.
- For Project Type, ‘New substation establishment’ is used in projects where a substation is established on a new site. ‘Substation upgrade – capacity’ is used where new network assets are added on an existing site, resulting in an increase of the substation rating. ‘Other –specify’ is used in cases where the project is required to resolve reactive power issues (i.e. New Reactive Support) or fault level issues (i.e. New 132kV Feeder 907 reactor bypass at Canterbury STS).
- Ratings used are ‘Normal Cyclic’ Substation ratings. ‘Normal condition’ for the purposes of the Augex model is defined as the planned network configuration, with no assets unavailable due to planned or unplanned outages.
- It is assumed that Ausgrid has no Related Party Margins and/or Non-Related Party Contracts.
- Land Purchase expenditure is the direct cost element reported under property acquisitions distribution. It is reported separately from the project in SAP-BI.
- No easement expenditure is reported as this will be determined by site specific investigations once the projects are initiated.

11.2.5 Table 2.3.2 Augex Asset Data – Subtransmission Lines

Notes:

- 3 out of the 5 projects are considered ‘conditional’ projects. The expenditure reported for these cases considers the percentage allocated to each project.
- Project Type, Triggers, Voltages and Route Line Length added, Circuit KM added of Overhead and/or Underground Cables are determined by subject matter experts and reported in various engineering systems –PDMS, RIC, SAP-BI – and project governance documents. For conditional projects, the values consider the percentage allocated to each project to determine the KM quantities.

- Note there are no secondary triggers associated to the project components listed in this table.
- It is assumed that Ausgrid has no Other Plan Item expenditure for these projects.
- It is assumed that Ausgrid has no Related Party Margins and/or Non-Related Party Contracts.
- There is no land purchase required for the subtransmission line components.
- No easement expenditure is reported as this will be determined by site specific investigations once the projects are initiated.

11.2.6 Table 2.3.4 Augex – Total Expenditure

Notes:

- The expenditure reported includes the 9 projects listed in table 2.3.1 and associated subtransmission connections listed in table 2.3.2. It also includes all expenditure consolidated as non-material projects.
- Not all expenditure reported in table 2.3.1 is included, because there are three projects with cashflows after the FY2020-2024 period (i.e. "50% New 132/33kV Tx Pyrmont STS" and "New 132kV Feeder 907 Reactor Bypass Canterbury STS" have expenditure in FY2025, while "5% 33/11kV Blackwattle Bay ZN Rebuilt & 11kV LT Darling Harbour-Camperdown" will have expenditure up to FY2027).
- The expenditure also includes property acquisitions anticipated for a possible future new zone substation in the Sydney area and a possible future new zone substation in the Hunter area. This expenditure is not part of table 2.3.1 because these land purchases are provisions not yet identified or related to a specific project.
- A SAP-BI report has been prepared to include growth or reliability driven expenditure on area plan projects, using a filter to provide project's expenditure by the following asset categories:

  1. Total Sub-transmission Substation
  2. Total Zone Substation
  3. Total Subtransmission Mains OH
  4. Total Subtransmission Mains UG
  5. Distribution Mains

  For each year in the period FY2018-2024, all expenditure under items 1, 2 and 5 above is included in the row for Subtransmission Substations, Switching Stations and Zone Substations. In turn, all expenditure under items 3 and 4 above is included in the row for Subtransmission lines.
- A separate SAP-BI report has been prepared to report growth or reliability driven expenditure on property acquisitions. All expenditure under growth-driven Property Acquisitions Distribution is included in the row for Subtransmission Substations, Switching Stations and Zone Substations.
- At this point, all expenditure excludes planning supporting costs. These costs are allocated in proportion to the contribution of Subtransmission Substations, Switching Stations, Zone Substations and Subtransmission lines to the total Augex expenditure.
- The LV feeder and distribution substation data in tables 2.3.3 and 2.3.4 should not reconcile for several reasons below:

- Table 2.3.4 has been filled in based on program driver whereas 2.3.3 is based on solution. This is important as there is not a 1:1 relationship between driver and solution. A distribution substation overload may result in an LV feeder solution or vice versa.
- Table 2.3.3 does not contain all of the solutions for resolving an overload. It is missing solutions such as phase balance or installation of new switches.

11.2.7 Table 3.7.2 Terrain factors

Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided is consistent with the requirements of this Notice.

Explain the source from which Ausgrid obtained the information provided.

DOEF0205 Total Number of Spans has been projected based on historical trending. The base data was calculated using Ausgrid's Geographical Information System (GIS) data. Ausgrid's GIS data is not represented as spans or singular routes, but represents the network as individual circuits; therefore significant manipulation of the existing data model was required to provide the information consistent with "Economic benchmarking RIN Instructions and Definitions", this has been defined in Methodology and Assumptions.

The constructed span data was used to calculate:

- DOEF0204 Total Vegetation Maintenance Spans
- DOEF0202 Urban and CBD Vegetation Maintenance Spans
  - Combined with 2016 reliability feeder classifications
- DOEF0203 Rural Vegetation Maintenance Spans
  - Combined with 2016 reliability feeder classifications
- DOEF0201 Rural Proportion
  - Combined with 2016 reliability feeder classifications
- DOEF0212 Tropical Proportion
  - Combined with Bureau of Meteorology Climate Classification Maps based on standard 30 year climatology (1961 -1990)
- DOEF0213 Standard Vehicle Access
  - Combined with current (July 2016) road corridor data from the Land and Property Information
- DOEF0214 Bushfire Risk
  - Combined with Rural Fire Service 2017 Bushfire Prone Land data
- DOEF0210 Average Number of Defects per Urban and CBD Vegetation Maintenance Span
  - Combined with 2016 reliability feeder classifications,
  - 2016/17 recorded vegetation trimming locations
- DOEF0211 Average Number of Defects per Rural Vegetation Maintenance Span
  - Combined with 2016 reliability feeder classifications
  - 2016/17 recorded vegetation trimming locations
- DOEF0208 Average Number of trees per Urban and CBD Vegetation Maintenance Span

- Combined with 2016 reliability feeder classifications
- 2016/17 vegetation observations

- DOEF0209 Average Number of trees per Rural Vegetation Maintenance Span
  - Combined with 2016 reliability feeder classifications
  - 2016/17 vegetation observations
- DOEF0206 and DOEF0207
  - Was obtained from contract management information and is based on the typical network maintenance cycle observed.

Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

Span Calculation and Feeder Classification

Ausgrid's 2017/18 Span count forecast is calculated through trend analysis of historic data.

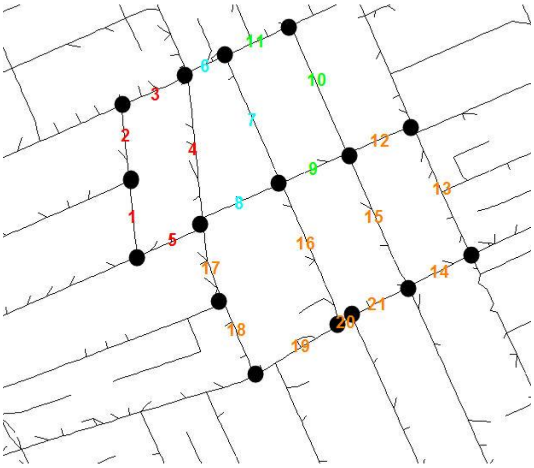
Ausgrid assessed the Australian Energy Regulator's (AER) recommendation to use number of poles minus one to calculate the number of spans. Further analysis found this methodology to be fundamentally flawed where the overhead network was not linear in nature. For example if the spans created a closed loop the number of spans equals the number of poles, however if the spans formed a grid (adjoining loops sharing a span) the number of poles has no relationship to the number of spans.

In Figure 1 (below) the numbers represent the count of spans, black lines represent actual network span data in an area west of Sydney, and black circles represent poles.

For simplicity poles in-between main vertices and the small line segments teeing off the main line have been ignored. This has no impact on the formula or result.

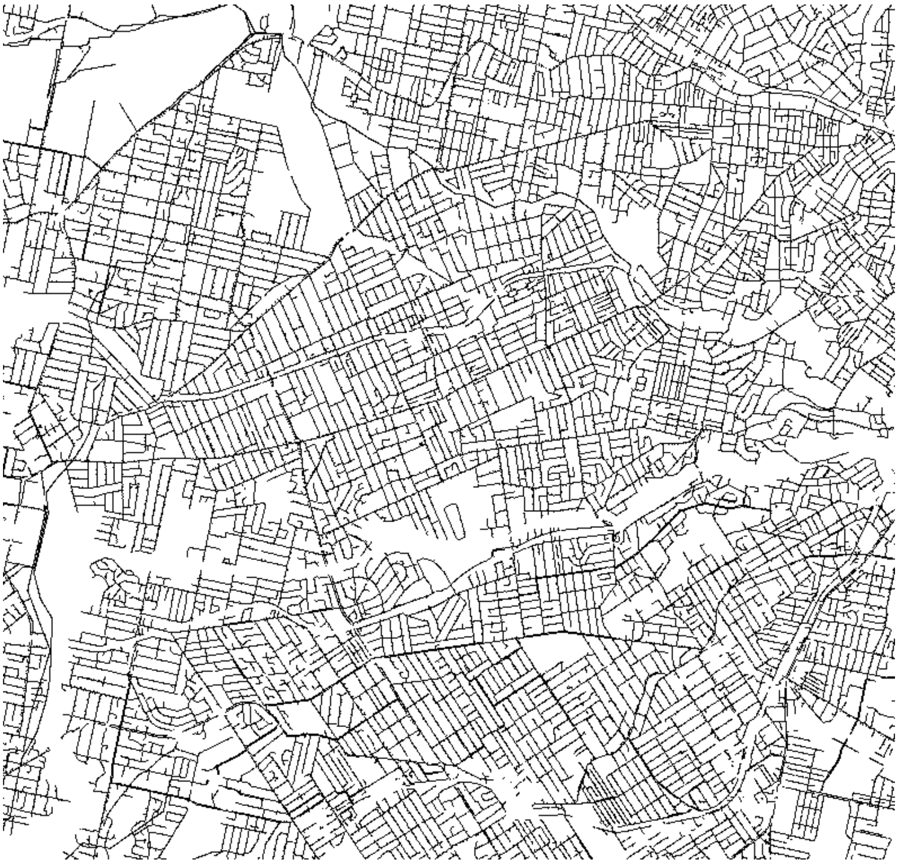
- Red numbered spans (1-5) – this is a simple loop (common in residential areas which are not densely populated).
  - The span count equals the number of poles. (20% error using pole count minus one)
- Combining the red and blue numbered spans (1-8) – this is the simplest form of a grid (common in residential areas which are not densely populated).
  - The span count equals the number of poles plus one. (33% error using pole count minus one)
- Combining the red, blue, and green numbered spans (1-11) – this is a larger grid (common in residential areas).
  - The span count equals the number of poles plus two. (22% error using pole count minus one)
- Combining red, blue, green, and orange numbered spans (1-21) – this forms a grid consisting of multiple rows and columns (this is the most common span configuration throughout residential, urban, and CBD areas).
  - The span count equals the number of poles plus five. (31% error using pole count minus one)

Figure 1. Span counts



A larger sample area showing that these areas are not insignificant.

Figure 2. Span count – larger area



Additionally, an overhead service from Ausgrid's network to the first point of attachment is known as "Service Mains", is considered part of Ausgrid's network and may or may not be between poles, therefore increasing the error in the AER's pole minus one methodology.

Ausgrid calculated the number of spans for 2016/17 to be 1,195,740 but only consists of 510,284 poles.

These errors are exacerbated further when calculating the number of spans with bushfire risk. The individual, scattered polygons recorded in the Rural Fire Services bushfire prone land dataset results in cases where the spans cross at risk areas, but the poles at either end of the span fall outside. Using the AER's suggested methodology, results in this span not being counted in bushfire prone land.

The span connected to Ausgrid's network where it is connected to the point of attachment, or the first span to a private pole is known as "Service Mains" and is considered part of Ausgrid's network therefore it has been counted as one span.

To calculate the number of spans Ausgrid spatially manipulated the data using the following methodology:

- The circuit data was split into individual line segments at every pole.
- Where the line segments ran parallel to each other they were snapped together.
- For spans which contained multiple conductors with different feeder classifications (Rural portion, Urban, and CBD), the highest voltage's classification was attributed to the span, with all other line segments ignored. If the span represented conductors with different feeder classifications and of the same voltage the following hierarchy was applied to the span:

  1. CBD
  2. Urban
  3. Rural.
- The AER has requested the span data be provided by feeder classification, however Transmission feeders (feeders > 22kV), Street Light circuits, and HV Customers do not have a feeder classification of CBD, Urban, or Rural. A Transmission feeder typically supplies multiple feeders with different classifications. As a consequence, spans which are Transmission only feeders are not assigned a CBD, Urban, or Rural category. If a span only consisted of Transmission it received a classification of Transmission. If there was also a conductor of lesser voltage in the span, Transmission voltage was ignored and the classification of the lower voltage was applied to the span.
- The RIN templates only show spans associated with low voltage and high voltage mains. Transmission only, Street Light only, and HV Customer only spans were not included in the RIN Template. The template could not be modified to include these spans so the results have been provided below;

  Transmission only spans (16,985), HV Customer Spans (168), Street Light only spans (20,997) are included in "total number of maintenance spans" (DOEF0204), and "total number of spans" (DOEF0205).

Average Number of Trees and Defects

Ausgrid does not record individual trees or defects in its systems.

Different methodologies have been utilised in the calculation of tree and defect data, up to and including the 2016/17 submission. Ausgrid's 2017/18 forecast has used tree and trim count data captured as part of vegetation management works on a sample of spans. Sampled spans covered 28% of Urban, 67% Long Rural, and 50% Short Rural feeders.

The sample data did not fully cover Ausgrid's network, nor was it an equal sample of construction types, environmental, and demographic variations within its supply area. The percentage of spans sampled in 2017 is shown in the following table.

Table 10.   Sample Data Representative of Total Network

Feeder Classification	2017
Transmission	67%
Rural	50%
Urban/CBD	28%

The AER has requested the defects and trees be categorised by feeder classification, however Transmission feeders (feeders > 22kV) do not have a feeder classification of CBD, Urban, or Rural. A transmission feeder typically supplies multiple feeders with different classifications. As a consequence, spans which are transmission only feeders are not assigned a CBD, Urban, or Rural category. If a span only consisted of transmission it received a classification of transmission, and therefore the defect and trees along the same span received the same classification. If there was also a conductor of lesser voltage in the span, transmission voltage was ignored and the classification of the lower voltage was applied to the span, associated defects, and trees.

The RIN templates only accommodate the reporting of trees and defects associated with low voltage and high voltage mains, therefore Transmission only trees and defects were not included in the RIN Template. The transmission defect and tree quantities are as follows for 2017:

- The average number of trees per Transmission span equals 6.478.
- The average number of defects per Transmission span equals 2.553.

An increase in number of defects per span is due to the recording of actual vegetation trimming locations collected at the time of vegetation management activities. Prior years have reported the vegetation encroachments identified by LiDAR data, however this is not reflective of defects resulting in trimming, but non-compliance of vegetation clearing at the time of data collection.

Vegetation Maintenance Spans

Ausgrid's 2017/18 vegetation maintenance spans forecast has been calculated using trend analysis of historic data.

There has been a change in methodology between 2015/16 and 2016/17. Vegetation maintenance spans 2016/17 base data is representative of the increase in scope of vegetation maintenance.

In parts of Ausgrid's network the Service Mains (Service Mains - The low voltage overhead mains belonging to the company between the company's Distribution Mains and the Point of Supply. Point of Supply – The point of delineation i.e. junction between the company owned overhead mains and the Consumer's Mains) span is subject to vegetation management practises and it has been counted as a span. The increase in number of maintenance spans is accounted for the increased scope of vegetation managed service spans in 2016/17. In previous years, the number of vegetation service spans has been limited to discrete geographic areas, but has since been expanded to include all service spans in the Ausgrid network.

Due to the source data structure used to calculate the feeder classifications, street lighting data was not able to be assigned a classification and therefore omitted from the feeder category split results. For this reason, and the omission of the Transmission only spans, the sum of the "Urban and CBD" (DOEF0202) and "Rural" (DOEF0203) number of maintenance spans will not equal the "total number of maintenance spans" (DOEF0204). Transmission only spans (16,985), HV Customer Spans (168) and street light only spans (20,997) are included in "total number of maintenance spans" (DOEF0204), and "total number of spans" (DOEF0205).

Tropical Proportion

Ausgrid's 2017/18 tropical proportion forecast has been calculated using trend analysis of historic data.

Service lines have been excluded.

Standard Vehicle Access

Ausgrid's 2017/18 standard vehicle access forecast has been calculated using trend analysis of historic data.

Ausgrid's calculation of 2016/7 base data assumes that Standard Vehicle Access DOEF0213 is the length of spans not accessed by a standard vehicle as defined in the definition.

Standard Vehicle Access is defined by the AER in the RIN Instructions and Definitions (page 50) as:

> *"Distribution route Line Length that does not have Standard Vehicle Access. Areas with Standard Vehicle Access are serviced through main roads, gravel roads and open paddocks (including gated and fenced paddocks). An area with no standard Vehicle Access would not be accessible by a two wheel drive vehicle."*

Ausgrid does not record information with regard to length of network accessible in relation to vehicular capability or terrain.

The estimated values for Standard Vehicle Access have been calculated as follows: Spans which are not within a 10m buffer of a designated road corridor formed or unformed were identified using GIS spatial analytical software. The spans output of this query were then removed if the continuous line segment length was less than 100m, thus removing small segments which in most cases run parallel with the road corridor (assumed to be also accessible via a standard vehicle).

Service Mains[1] have been excluded because (length is not measured) Ausgrid applies an arbitrary length of 10m towards the centre of the supplied land parcel. Actual lengths could extend much further than 10m and Ausgrid has no way of determining this length. Using an arbitrary length would compromise the validity of the actual route length calculated. The total number of service mains consists of 720,139 spans (an extra 7,201 km of mains if an arbitrary length of 10m per service was used) in total.

Underground network has been excluded from this calculation.

Note: because underground is included in the route line length;

> *"Standard Vehicle Access" divided by the "Route Line length" is not an accurate measure of "proportion of network not accessible via a standard vehicle".*

Bushfire Risk

Ausgrid's 2017/18 bushfire risk forecast has been calculated using trend analysis of historic data.

Includes Service Mains1 where they are subject to vegetation management.

[1] The low voltage overhead mains belonging to the company between the company's Distribution Mains and the Point of Supply

Rural proportion

Ausgrid's 2017/18 rural proportion forecast has been calculated using trend analysis of historic data.

Services Mains1 lengths are an arbitrary length of 10m towards the centre of the supplied land parcel, therefore they have been excluded.

Underground cables are excluded for calculating the Route length classified as short or long rural in km, and the Total network Line. Therefore the figures reporting the Rural proportion excludes underground network cables.

Average Vegetation Management Cycles

Ausgrid ensures vegetation management activities are executed under a contract arrangement whereby the contractor is required to maintain clearances throughout the term of the contract.

The frequency in which the contractor carries out activities to fulfil their responsibilities is not known by Ausgrid and would vary depending on the vegetation type, area, and contractor.

There is no clause or requirement in the contract to carry out vegetation maintenance activities in a cyclic manner. However, the typical maintenance review cycle is 1 year.

Use of estimated information

- DOEF0213 - Standard vehicle access

  Ausgrid does not record information with regard to length of network accessible in relation to vehicular capability or terrain.

  The estimated values for Standard Vehicle Access have been calculated as follows: Spans which are not within a 10m buffer of a designated road corridor formed or unformed were identified using GIS spatial analytical software. The spans output of this query were then removed if the continuous line segment length was less than 100m, thus removing small segments which in most cases run parallel with the road corridor (assumed to be also accessible via a standard vehicle).

- DOEF0206 - Average urban and CBD vegetation maintenance span cycle, and
- DOEF0207 – Average rural vegetation maintenance span cycle

  There is no clause or requirement in the contract to carry out vegetation maintenance activities in a cyclic manner. However, the typical maintenance review cycle is 1 year.

Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

Not applicable as this template is forecasted estimated information.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

This is explained above in the methodology and assumptions section.

11.2.8 Table 3.7.3 Service area factors

Demonstrate how the information provided is consistent with the requirements of the Notice

The information provided is consistent with the requirements of this Notice.

Explain the source from which Ausgrid obtained the information provided.

DOEF0301 Route Line Length was calculated using Ausgrid's Geographical Information System (GIS) data. Ausgrid's GIS data is not represented as spans or singular routes, but represents the network as individual circuits; therefore significant manipulation of the existing data model was required to provide the information consistent with "Economic benchmarking RIN Instructions and Definitions", this has been defined in Methodology and Assumptions.

Explain the methodology Ausgrid used to provide the required information, including any assumptions Ausgrid made

In this section we explain the methodology Ausgrid applied to provide the required information, including any assumptions Ausgrid made.

Ausgrid's 2017/18 route line length forecast has been calculated using trend analysis of historic data.

To calculate the route line length base data, Ausgrid spatially manipulated the data using the following methodology:

- The circuit data was split into individual line segments at every pole.
- Where the line segments ran parallel to each other they were snapped together.
- For spans which contained multiple conductors duplicates were removed and the length calculated.

Services Mains[2] lengths are an arbitrary length of 10m towards the centre of the supplied land parcel, therefore they have been excluded. The total number of service mains consists of 720,139 overhead services and approximately 230,808 underground services (an extra 9,527km of mains if an arbitrary length of 10m per service was used).

The definition of Route Line Length (DOEF0301) as defined by the AER to include underground cables has been accommodated.

> *"This email concerns the "Route Line Length" variable (DOEF0301)*
>
> *We have received a question as to whether Route Line Length captures the length of underground cables. We confirm that the intention of this variable is to capture the length of both underground cables and overhead lines. However we note that the wording of the definition in the economic benchmarking RIN isn't clear regarding this.*
>
> *We request that you include the route length of underground cables in route line length. This will ensure that this measure is consistent across NSPs and will appropriately account for the route length of all conductors should this be used as a benchmarking metric."*

(Source: email from the AER titled "EBT RIN – Route Line Length" on 07/04/2014 at 02:50pm)

The original definition of Route Line Length to be "measured as the length of each span between poles and/or towers" is not relevant to underground cables; therefore length for each underground conductor circuit was added to the overhead route line length which was calculated in accordance with the original definition. That is for overhead lines; "each span is considered only once irrespective of how many circuits it contains".

Explain circumstances where Ausgrid cannot provide input for a variable using actual information, and therefore must provide estimated information:

(i) why an estimate was required, including why it was not possible for Ausgrid to provide actual information;

[2] The low voltage overhead mains belonging to the company between the company's Distribution Mains and the Point of Supply

Not applicable as this template is forecasted estimated information.

(ii) the basis for the estimate, including the approach used, assumptions made and reasons why the estimate is Ausgrid's best estimate, given the information sought in the Notice.

This is explained above in the methodology and assumptions section.