
# ASSET MANAGEMENT DISTRIBUTION ANNUAL PLANNING REPORT 2019

**December 2019**

essential energy

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# EXECUTIVE SUMMARY

Since 1 January 2013, the National Electricity Rules (NER) have stated that all Distribution Network Service Providers (DNSPs) operating in the National Electricity Market (NEM) are required to:

- Conduct an annual planning review and publish a Distribution Annual Planning Report (DAPR)
- Conduct economic assessments of potential project options under a new Regulatory Investment Test for Distribution (RIT-D)
- Implement a Demand Side Engagement Strategy to consult with and engage non-network providers in the development and evaluation of potential solutions to identified network needs.

The annual planning review includes the planning for all assets and activities carried out by Essential Energy that would materially affect the performance of its network. This includes planning activities associated with the replacement and refurbishment of assets and negotiated services. The objective of the annual planning review is to enable DNSPs to plan for and adequately address possible future issues in a timely manner. The outcome of the annual planning review is the DAPR.

Essential Energy is required to prepare and publish a DAPR that is compliant with the requirements of the NER (Section 5.13.2 and Schedule 5.8) to:

- Provide transparency to Essential Energy's decision making processes and provide a level playing field for all regions in the NEM in terms of attracting investment and promoting efficient decisions
- Set out the results of Essential Energy's annual planning review, including joint planning, covering a minimum five year forward planning period for distribution assets
- Inform registered participants and interested parties on the annual planning review outcomes - report on capacity and load forecasts for sub-transmission lines, zone substations and transmission-distribution connection points, plus, where they have been identified, any primary distribution feeders which were overloaded or forecast to be overloaded within the next two years
- Provide information on Essential Energy's demand management activities and actions taken to promote non-network initiatives each year, and plans for demand management and embedded generation over the forward planning period
- Assist non-network providers, Transmission Network Service Providers (TNSPs), DNSPs and connection applicants to make efficient investment decisions.

The DAPR covers a minimum five year forward planning period for distribution network assets.

# 1. INTRODUCTION

## 1.1 About Essential Energy

Essential Energy's purpose is '*to enable energy solutions that improve life'*, with a vision to be '*empowering communities to share and use energy for a better tomorrow'.*

The organisation builds, operates and maintains the electricity network across 95 per cent of regional, rural and remote New South Wales (NSW) and parts of southern Queensland. The business maintains and develops the infrastructure – the poles and wires – that delivers power to more than 855,000 customers including homes, hospitals, schools, businesses and community services. With approximately 3,000 employees based in around 100 local depots and regional offices, Essential Energy is an economic enabler for regional, rural and remote NSW and parts of southern Queensland – with customers in locations as diverse as Broken Hill, Byron Bay and Bega.

Essential Energy aims to continuously improve safety performance for employees, contractors and the community, and the reliability, security and cost efficiency of the network, while striving to maintain downward pressure on the network component of customers' electricity bills.

Essential Energy's business objectives are:

- continuous improvements in safety culture and performance
- operate at industry best practice for efficiency, delivering best value for customers
- deliver real reductions in customers' distribution network charges
- deliver a satisfactory Return on Capital Employed.

These will be achieved through enhanced customer engagement, investing in best practice systems, processes and technology, and improving commercial capabilities to enable the business to operate safely and efficiently.

Essential Energy's footprint is divided into ten operations areas encompassing a wide range of geographical, climatic and environmental conditions.

In the far west of the State, an operating division, Essential Water, services a population of approximately 18,000 people in the communities of Broken Hill, Sunset Strip, Menindee and Silverton. It delivers a secure water supply to around 10,500 customers and reliable sewerage services to around 9,700 customers in Broken Hill through a network of dams, water treatment plants, sewage treatment plants, reservoirs, water and sewage pumping stations, mains, and other related infrastructure.

### 1.1.1 Operating Environment

Essential Energy is a New South Wales (NSW) Statutory State Owned Corporation and Energy Services Corporation, regulated by state and national statutory and legislative requirements. In addition to being subject to specific electricity distribution laws and rules, Essential Energy is subject to most of the statutory and other legal requirements that other businesses are subject to; including workplace health and safety (WHS), environmental, competition, industrial, consumer protection and information laws. Essential Energy is also required to follow government and regulatory direction.

At a national level, Essential Energy is subject to the National Electricity Law (NEL) and the National Electricity Rules (NER) which regulate the National Electricity Market (NEM). Essential Energy operates in the NEM as a Distribution Network Service Provider (DNSP). The Australian Energy Regulator (AER) regulates the transmission and distribution sectors of the NEM under the NEL and NER.

At a state level, Essential Energy's activities are governed by the NSW Electricity Supply Act 1995, the Energy Services Corporations Act 1995 and a NSW Distribution Network Service Provider licence. The NSW Department of Planning and Environment develops and administers Essential Energy's Network Design, Reliability and Performance Licence Conditions, and the Independent Pricing and Regulatory Tribunal (IPART - Electricity) is responsible for monitoring compliance with licence requirements.

Essential Energy ensures compliance with these laws and regulations through its internal codes and policies and a common control framework, which comprises plans, policies, procedures, delegations, instruction and training, audits of compliance and risk management. Operations are guided by policies and codes, including Safety Policy, Environmental Code of Conduct and Policy, Statement of Business Ethics, and Code of Conduct.

### 1.1.2 Essential Energy Statistics

**Table 1 – Essential Energy Statistics for FY2018/19**

| Category | Number at 30/6/19 |
|---|---|
| Distribution Customer Numbers (Total) | 858,068 |
| Customer Numbers at Year End (Coastal) | 115,427 |
| Customer Numbers at Year End (Ranges) | 57,867 |
| Customer Numbers at Year End (Mid North Coast) | 170,511 |
| Customer Numbers at Year End (Northern Tablelands) | 80,130 |
| Customer Numbers at Year End (North Western) | 28,743 |
| Customer Numbers at Year End (Macquarie) | 98,092 |
| Customer Numbers at Year End (Riverina Slopes) | 75,870 |
| Customer Numbers at Year End (South Eastern) | 117,480 |
| Customer Numbers at Year End (Murray) | 66,180 |
| Customer Numbers at Year End (Central) | 47,768 |
| Maximum Demand (MW) | 2,537 |
| Feeder Number CBD | 0 |
| Feeder Number Urban | 296 |
| Feeder Number Short Rural | 926 |
| Feeder Numbers Long Rural | 243 |
| Energy Received by Distribution Network to Year End GWh | 13,469 |
| Energy Distributed to Year End (Residential) GWh | 4,608 |
| Energy Distributed to Year End (Non-Residential including un-metered supplies) GWh | 8,122 |
| Energy Distributed to Year End (Coastal) GWh | 873 |
| Energy Distributed to Year End (Ranges) GWh | 741 |
| Energy Distributed to Year End (Mid North Coast) GWh | 1,483 |
| Energy Distributed to Year End (Northern Tablelands) GWh | 1,239 |
| Energy Distributed to Year End (North Western) GWh | 350 |
| Energy Distributed to Year End (Macquarie) GWh | 3,389 |
| Energy Distributed to Year End (Riverina Slopes) GWh | 1,298 |
| Energy Distributed to Year End (South Eastern) GWh | 1,173 |
| Energy Distributed to Year End (Murray) GWh | 956 |
| Energy Distributed to Year End (Central) GWh | 1,229 |

| Category (Continued) | Number at 30/6/19 |
|---|---|
| System Loss Factor (%) | 5.48 |
| Substation - Zone (Number)[1] | 339 |
| Substation - Distribution (Number) | 138,589 |
| High Voltage Overhead (km) | 157,754 |
| High Voltage Underground (km) | 2,765 |
| Low Voltage Overhead (km)[2] | 25,570 |
| Low Voltage Underground (km) | 6,449 |
| Pole (Number)[3] | 1,390,806 |
| Streetlights (Number) | 159,415 |

Notes: Distances for overhead and underground lines are circuit km.

[1] The number of zone substations reported include only those sites where the forecast is published within this document.

[2] LV Services and Streetlight circuits excluded, LV Services classification only includes the last span from the pole to the Point of Attachment, and no longer includes the road crossing section.

[3] This number includes in service poles only.

## 1.2 Essential Energy's Network

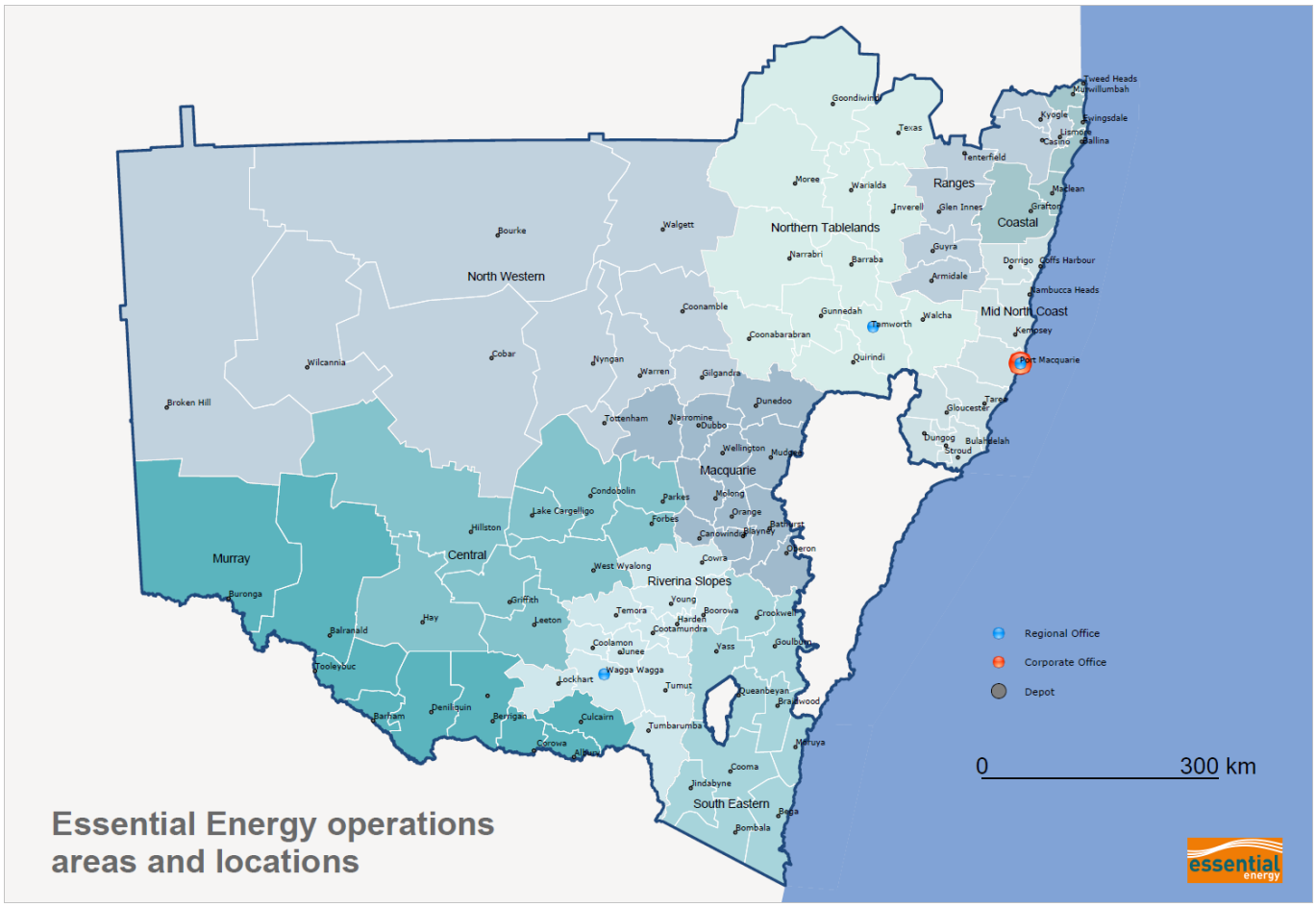



**Figure 1 – Essential Energy's Network Area**

Essential Energy's core business is the distribution of electricity to customers in a specified geographical boundary of NSW and authorised supply areas of Queensland; covering approximately 737,000 square kilometres and 95 per cent of NSW (see Figure 1). It is one of the world's largest and most geographically distributed electricity networks, and is unique in terms of the geographic area it covers, the terrain it traverses, the vegetation that grows within it and the diversity of weather that impacts upon it.

The network services more than 855,000 customers; from large single customers, including mines, shopping complexes, feedlots and abattoirs to urban commercial and residential centres, rural farms, villages and remote Single Wire Earth Return (SWER) connected customers.

The network has a large number of asset types across different voltage levels. Customers can be connected at any voltage level from 220,000 volts down to low voltage (400/230 volts), depending on their power needs. Figure 2 illustrates the variety of network components owned by Essential Energy, with shaded portions showing examples of connected customers and bulk supply points not owned by Essential Energy – the distribution network is one component of an integrated system by which electricity is generated, transmitted and distributed to customers.

The majority of costs associated with electricity distribution are not driven by the number of customers or their demand on the network. Rather, network costs are driven by the number of assets required to deliver electricity to each customer. Whether there are 50 customers connected to one pole or 50 poles connecting one customer, each asset needs to be inspected, safely maintained and replaced at the end of its life.

### 1.2.1 Number and Types of Distribution Assets

Essential Energy's network consists of around 183,000 kilometres of sub-transmission, high voltage distribution and low voltage distribution power lines, and around 1.3 million poles. Approximately 95 per cent of the network is of an overhead construction type and 95 per cent of distribution substations are pole-mounted due to the predominately rural nature of the network.

The majority of the distribution network is radial, with most parts supplied from one source, providing little opportunity for interconnection with other circuits for security and continuation of supply when performing maintenance activities or in the event of unplanned outages. This is equally true of the radial 132,000 volt and 66,000 volt sub-transmission networks.

Essential Energy reviews the level of reliability received by our customers against the nationally defined Value of Customer Reliability (VCR) and ensure that the level of network investment is in line with this measure of customer expectation. This approach does limit the level of reliability able to be delivered to our remote customers, primarily due to the level of investment required. Essential Energy is, however, committed to continually reviewing the reliability of its network in all parts of its supply area with a view to utilising available technologies and appropriate practices to provide the maximum reliability and security of supply possible within these constraints.

**Table 2 – Network Assets at 30 June 2019**

| ASSETS | Circuit kilometres | | Transformers | |
|---|---|---|---|---|
| | Overhead lines | Underground cables | Number | Nominal capacity (MVA) |
| 220kV | 3.0 | 0 | 0 | 0 |
| 132kV | 2,119.0 | 11.0 | 81 | 3,124.5 |
| 110kV | 21.0 | 0 | 3 | 300 |
| 66kV | 7,592.2 | 37.9 | 418 | 5,911.23 |
| 33kV | 5,422.1 | 51.1 | 1,586 | 1,721.71 |
| 22kV | 42,531.0 | 347.0 | 34,888 | 2,553.19 |
| 11kV and below | 70,390.5 | 2,277.4 | 93,585 | 7,474.52 |
| SWER (all voltages) | 29,675.1 | 40.5 | 8,687 | 146.53 |
| Low voltages | 25,570.1 | 6,449.1 | 0 | 0 |
| **Total network** | **183,323.9** | **9,214.1** | **139,248** | **21,231.68** |

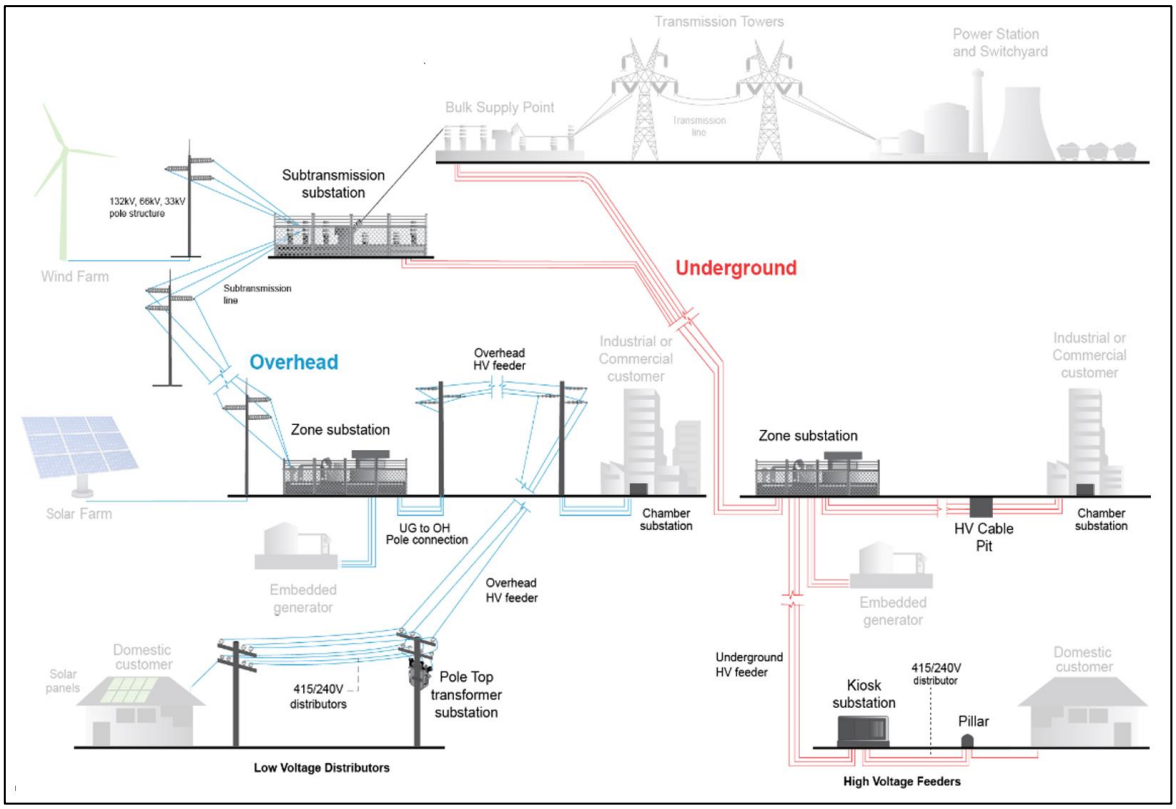



**Figure 2 – Typical components of Essential Energy's electricity network**

## 1.3 Annual Planning Review

The NER require that the Annual Planning Review includes the planning for all assets and activities carried out by Essential Energy that would materially affect the performance of its network. This includes planning activities associated with the replacement and refurbishment of assets and negotiated services. The objective of the Annual Planning Review is to identify possible future issues that could adversely impact the performance of the distribution network to enable DNSPs to plan for and adequately address such issues in a timely manner. The outcome of the Annual Planning Review is the DAPR.

This DAPR provides information to Registered Participants and interested parties on the nature and location of emerging constraints on Essential Energy's sub-transmission and high voltage distribution network assets, commonly referred to as the Distribution Network. The timely identification and publication of emerging network constraints allows the market to identify potential non-network solutions and Essential Energy to develop and implement appropriate and timely solutions to them.

Essential Energy has worked closely with the Institute of Sustainable Futures (ISF) to publish network opportunity maps. These maps use the Australian Renewable Energy Mapping Infrastructure (AREMI) platform to provide a visualisation of emerging constraints over the next 10 years. These maps can be accessed through the AREMI website https://nationalmap.gov.au/renewables/, under Electricity Infrastructure, Network Opportunities.

### 1.3.1 Network Planning Process

The planning and development process for the distribution network is carried out in accordance with the NER Chapter 5 Part D Planning and Expansion.

Essential Energy carries out network planning at both a strategic and project level. The processes used for each of these levels of network planning are set out in the Essential Energy procedural guideline "*Sub-transmission and*

*Distribution Network Planning Criteria and Guidelines*", housed and administered through Essential Energy's Business Management System.

The Essential Energy investment governance process ensures continuous review and assurance that capital prudence and efficiency are being achieved, as well as being consistently aligned with longer term strategic planning as set out within the Essential Energy Corporate Objectives, Strategic Business Plans and Strategic Asset Management Plan (SAMP).

The Essential Energy network planning process uses a quantified approach to monetise the value of risk for Network Constraints and a value-based approach to identify the most effective ways to minimise risk, while delivering benefit to network users.

The first stage of the network planning process involves researching the data required to assess all constraints and assemble a whole-of-network view. This includes historical and existing peak demands, the preparation of a range of seasonal demand forecasts, examining network capacity limits, assessing asset condition and risk of failure, forecasting new customer connections (including new or augmented 'spot' loads and/or embedded generators) and taking into account duty of care and regulatory obligations.

The forecast adequacy of the network is assessed against key criteria, including:

- Meeting modern infrastructure standards, including safety and security of the network and environmental compliance
- Addressing any 'demand – capacity' imbalance
- Risk, reliability and power quality performance
- Asset condition and re-investment considerations
- Customer connection requirements (loads and embedded generation).

When emerging network limitations are identified and quantified according to Essential Energy Asset Risk Management and Appraisal Value Frameworks, a range of feasible options, including both network and non-network solutions, are developed to address the network need and to ensure continuing compliance.

All relevant potential credible options, including non-network and operational alternatives are considered in determining how to best meet network performance obligations and the objectives of the NEL.

There is a robust selection process based on analysis of the Net Present Value of options and a range of sensitivity analyses that explicitly trade off alternative investment options. These use quantified estimates for credible option costs and market benefits against business performance targets to identify the optimum portfolio of projects that minimises the risk and cost of achieving the desired performance.

In accordance with NER obligations and statutory requirements, network augmentation and demand management options are assessed impartially using a consistent value-based review process. Demand management and non-network options are evaluated on the extent to which they can avoid or defer the need for traditional network augmentation.

This DAPR seeks to inform stakeholders and provides advice on emerging network limitations and network adequacy. It also provides details of the expected time required to allow appropriate corrective network augmentation, non-network alternatives or modifications to connection facilities.

The Essential Energy network planning approach is outlined in its Network Management Plan and is consistent with the principles of the NSW Government Total Asset Management framework.

Essential Energy is required to comply with mandatory service standards in accordance with the *Reliability and Performance Licence Conditions for Electricity Distributors (July 2014*) and subsequent variations.

This document provides information for locations where investment is required to address network limitations due to forecast demand and other prudent considerations.

## 1.4 Significant Changes from previous DAPR

The majority of the 2019 DAPR consists of only minor changes. The content has been improved based on feedback from various stakeholders including the AER. The forecasting process is constantly evolving, this year including the calculation of a series of short to long term trends to use in the analysis, and improvements to the process used to reconcile forecasts against interconnected areas of the network. The forecasting changes are described in further detail in Sections 1.4.1 and 2.2.

The operating regions and operational areas have changed this year, reducing to only one region and ten operational areas. These operational areas do not align with the footprints of each Transmission – Distribution Connection Point, so the supply areas often span multiple operational areas. The supply areas have been maintained as it summarises the zone substations supplied by the same Transmission – Distribution Connection Point.

The 2019 DAPR can be visualised through our new website https://dapr.essentialenergy.com.au/. This site contains an interactive map of the network, including forecasts, limitations and planned projects.

### 1.4.1 Analysis and explanation of forecast changes

Although there was a spike in the measured total network demand for 2018/19, individual site forecasts are generally indicating low steady growth. As site data and the forecasting process is improved, the quality of each forecast is also improving. At all levels from Transmission-Distribution Connection Points to the sub-transmission and zone substation level, forecasts have been adjusted to account for expected load transfers for new and decommissioned sites.

There have been a number of changes to Essential Energy's network including the commissioning and decommissioning of zone substations and sub-transmission lines. These may affect the recorded loads on the existing system based on various load transfers.

The methodology used to generate site forecasts has changed in a number of ways since the forecasting methodology used for the 2018 DAPR. There have been more improvements to the forecasting process, now using the calculation results of multiple methods across different numbers of years in the analysis of each site, expansion of the method for calculating power factor, and other minor adjustments that are expected to improve the accuracy of the forecasts. This process uses concepts from AEMOs latest connection point forecasting methodology published in July 2016.

### 1.4.2 Analysis and explanation of changes in other information

The main focus for this document was data quality improvements and adjustments to the forecasting methodology, so the majority of sections within the document contain only minor changes.

# 2. FORECASTS FOR THE FORWARD PLANNING PERIOD

This section provides a detailed assessment of the current peak demand forecast process.

Peak demand forecasts provide Essential Energy with the basis for identifying network limitations, evaluating the credible network and non-network options to address those limitations and (if applicable) commencing the RIT-D process. It also feeds into the SAMP and identification of the capital and operating investment expected to be required for the forward planning period.

Essential Energy's Network System peak demand for the Summer 2018/19 and Winter 2019 periods peaked in Summer at 2,537 megawatts (MW) at 6:00pm (AEST) on Thursday, 17 January 2019.

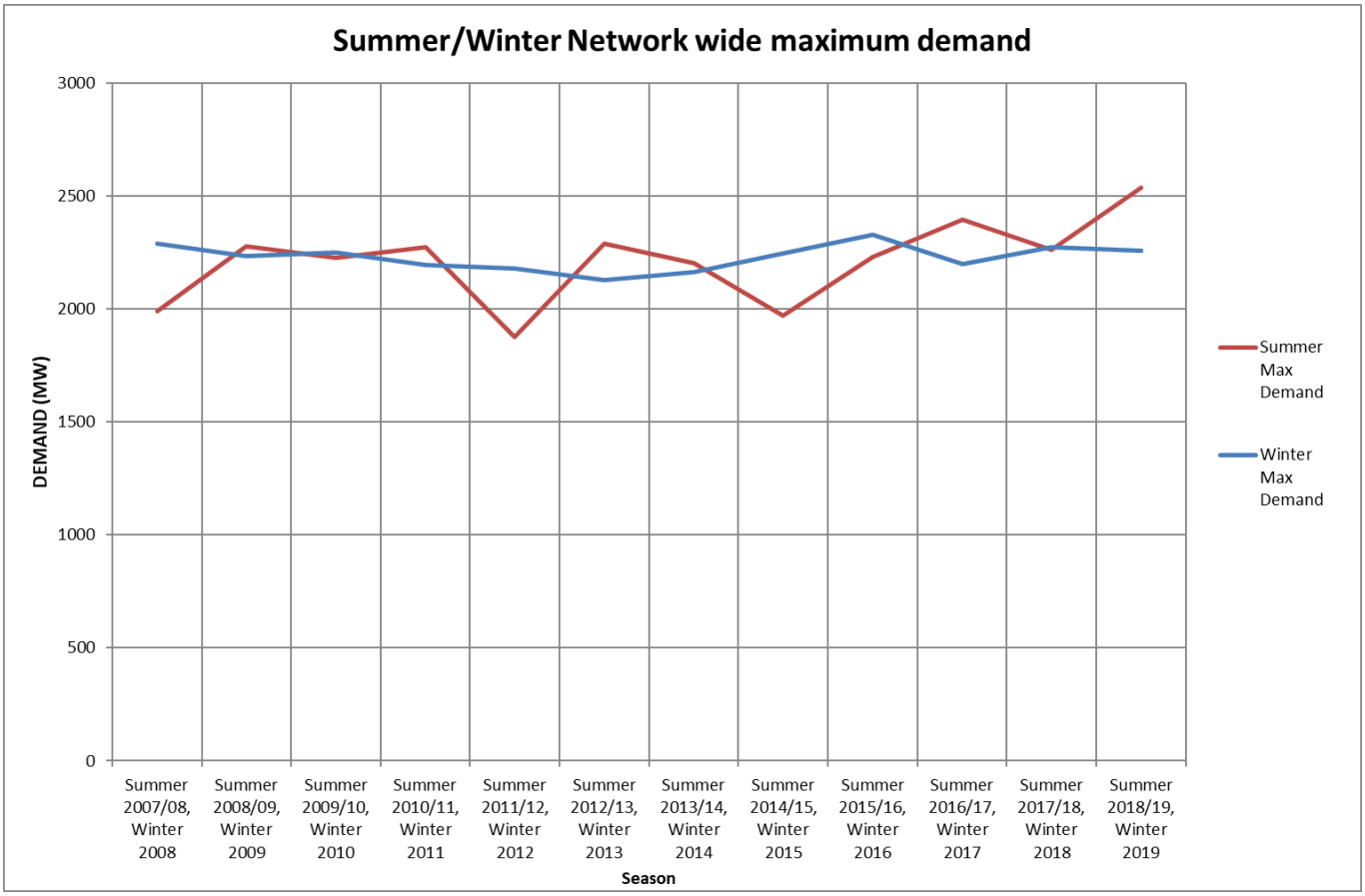



**Figure 3 – Essential Energy's recorded maximum demands**

## 2.1 Load Forecasting Strategy

A primary driver in network development and the identification of specific projects is the forecast of electricity demand and energy. The spatial demand forecast is a critical process that supports planning, development of the capital program and the regulatory submission.

Given the importance of the demand forecast on the required capital expenditure and the SAMP, Essential Energy's main objectives are:

- Efficient, closed-loop development and refinement of the forecasting process, data and documentation
- Engagement of the wider audience to appropriately inform the impacts and building blocks of demand.

In the process of moving towards achieving these objectives, Essential Energy has seen a substantial transition in the network forecasting methodology and process from a relatively simplistic process (such as minimal weather correction and reconciliation between top-down and bottom up forecasts) which required a high level of subjectivity to a more complex, repeatable process using concepts from the AEMO connection point forecasting methodology.

## 2.2 Load Forecasting Methodology and Process

The forecasting methodology has been developed and refined using two main vision items as the driving force, these items are:

- That the demand forecasting process undertaken is commensurate with the benefits the forecast provides
- That all demand forecasts are auditable and repeatable.

Essential Energy has developed a methodology which provides for the establishment of the building blocks required to achieve this vision. This methodology is summarised in Figure 4.

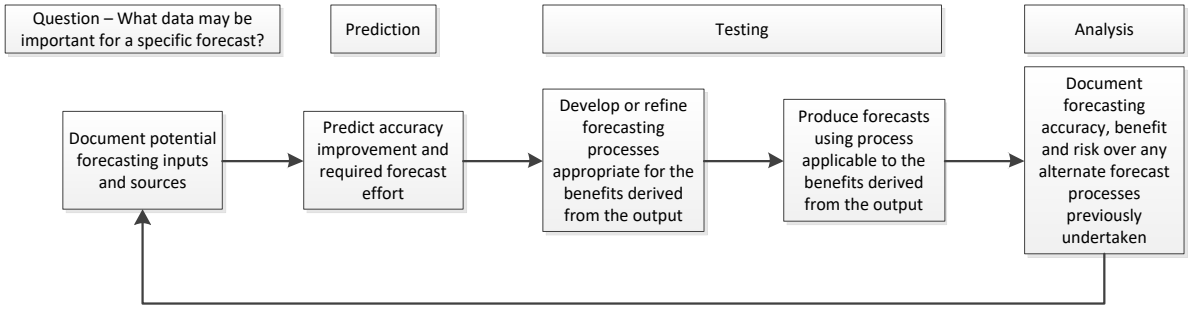



**Figure 4 – Forecasting Methodology**

As shown in Figure 4, Essential Energy's methodology calls for continuous improvement in the forecasting process specific to the site in question and dependent on the predicted cost/benefit. As an example some sites may have poor input data and hence poor forecasting accuracy, however if no benefits can be identified from improving the forecast, the cost to improve the process cannot be justified and the forecast inaccuracy specific to the site in question will remain. Alternatively high benefits (such as capital deferral) would justify substantial forecasting effort and the appropriate level of expense and rigour.

To assist in the network planning process and to identify regional growth patterns, several levels of forecast are used by Essential Energy:

- Overall Essential Energy network forecast
- Regional TransGrid and other TNSP connection point forecasts
- Sub-transmission feeder forecast
- Zone substation forecasts
- Local distribution feeder forecasts as necessary.

The forecasting process used by Essential Energy is heavily influenced by the Australian Energy Market Operators' (AEMOs) published Connection Point Forecasting Methodology[4].

[4] Australian Energy Market Operator – AEMO Connection Point Forecasting Methodology – Forecasting Maximum Electricity Demand in the National Electricity Market 29 July 2016

At a high level, the process consists of:

- **Data collection and collation**

  To cater for regional and local needs, a forecast of the demand at each zone substation is developed based on historical demands and information provided by major customers. Account is taken of load diversity between connection points. Embedded generation is recognised and included in the forecast where it offers firm capacity at the time of demand.

- **Outlier removal / Data preparation**

  In order to ensure only system normal conditions are evaluated, short-term network switching and abnormal metering outputs are removed.

- **Temperature correction (or normalisation)**

  Historical demand is temperature-corrected in order to provide a reference set of conditions from which each year can be compared (with a probability of exceedance of 50 per cent).

- **Repeat for each season over the time periods available**

  The forecast covers both summer and winter demands and uses data going back up to ten years. Where the load is very consistent the historical data is not analysed in separate seasons. This variation improves the accuracy of some forecasts, especially when step changes in total load occurs.

- **Determine the most applicable growth rate based on known variables**

  A series of short and long-term trends in the ten years of temperature-corrected historical demand are analysed and growth rate selected based on the median of such trends. Where the median does not accurately reflect a sites' growth (e.g. significant changes in historical configuration, customer mix, etc) an alternative growth rate is selected to reflect the current status of the site. In some cases, it may be necessary to remove certain time periods from the analysis where configuration changes have been deemed to impact the trend analysis.

- **Determine starting point of forecasts**

  Forecasts generated from a linear regression and a seasonal time series model are compared and the most suitable model is chosen as the starting point of each sites' forecast. Where both models generate poor results (e.g. small dataset, major configuration changes, etc) then the starting point is taken to be the value of the most recent historical seasonal maximum demand.

- **Calculate forecast load**

  The forecast extends over a planning horizon of ten years, with the first five years published in this report. The forecast power factor used is the median power factor during the top 1% of half-hourly demands over the last two years.

- **Apply any post model adjustments**

  Where there is known potential for the connection of major spot load developments, such as mining loads and major subdivisions, the forecast takes into account any reasonably firm step load increases in the medium term.

- **Reconciliation of forecasts**

  Calculation to ensure the forecast aligns with upstream and downstream network components, and identification of changes to previously developed forecasts.

### 2.2.1 Sources of load forecast input information

Potential inputs to an individual forecast and the applicable source data may include:

**Table 3 – Potential sources of load forecast input information**

| Potential Inputs | Potential Source Data |
|---|---|
| Historic demands | Interval meter data, supervisory control and data acquisition (SCADA) data, recloser data, derived loads, assumed factors |
| Seasonal indicators | Seasonal trends |
| Future step loads (large customer or residential subdivision) | Information from large customers and developers |
| Residential growth rates | Department of Planning |
| Economic conditions | Australian Bureau of Statistics |
| Weather patterns | Bureau of Meteorology |
| Generation | Interval meter data, Bureau of Meteorology, customer information |
| Individual customer demands | Interval meter data |
| Regulatory variation | AER documentation, Minimum Energy Performance Standards (MEPS) reports, other government initiatives |
| Distribution changes | Network information (planning, operations, load control) |
| Distribution programs | Network program information (planning, load control) |
| Tariff changes | Network Tariff information |
| Residential Solar Generation | Solcast estimates from measured solar irradiance |
| Electric Vehicle Charging | Interval meter data, forecasts of new car sales, connection applications |

### 2.2.2 Assumptions applied to load forecasts

Numerous assumptions are required in order to streamline the forecasting process. Some of these include:

- All large customers and embedded generators are recorded appropriately
- Historic demand data used for summer forecasts comprise the high temperature days from months November to March inclusive while winter forecasts consider the low temperature days from months May to September
- All load information is actual (i.e. no erroneous readings, metering drift, etc)
- All switching events are recorded or easily detected in analysis
- All temperature related data is actual
- The selected temperature sites are the best currently available to Essential Energy for representation of the conditions at the load sites
- All historic network changes have been accounted for
- Information provided by large load customers and developers will come to fruition
- Sub-transmission feeder forecasts are a special case, using a proportion of the Bulk Supply point forecast rather than an actual forecast. Hence, sub-transmission forecasts may not reconcile to zone substation forecasts
- Site forecasts are performed individually. Deviations to combined upstream forecasts can easily occur due to individual peak demands occurring at different times.

## 2.3 Supply Area Forecasts

### 2.3.1 Terranora Supply Area

#### Description of Terranora area

All zone substations in the Terranora area are in the Coastal region.

The Terranora sub-transmission substation is owned by Essential Energy and is supplied from the Queensland transmission system via 2 x 110kV lines that are jointly owned by Essential Energy and Powerlink.

A high voltage direct current transmission network is connected between Mullumbimby and Terranora (via Bungalora) which allows supply to be either injected into the Lismore area from Terranora or injected into the Terranora area from Lismore.

| TERRANORA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 757 | 110 | Powerlink Mudgeeraba 275/110kV STS | Terranora 110/66kV STS | 106 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 119 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 758 | 110 | Powerlink Mudgeeraba 275/110kV STS | Terranora 110/66kV STS | 106 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 | 119 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 |
| 9501 | 66 | Terranora 110/66kV STS | Cudgen ZS | 59 | 22.2 | 23.0 | 24.2 | 29.0 | 29.9 | 66 | 23.7 | 24.6 | 25.7 | 30.5 | 31.3 |
| 9502 | 66 | Terranora 110/66kV STS | Murwillumbah ZS | 61 | 10.0 | 10.1 | 10.2 | 10.2 | 10.3 | 68 | 9.7 | 9.9 | 10.1 | 10.3 | 10.5 |
| 9503 | 66 | Terranora 110/66kV STS | Banora Pt ZS | 59 | 29.9 | 30.1 | 30.3 | 31.2 | 31.3 | 66 | 25.3 | 25.2 | 25.1 | 25.8 | 25.7 |
| 9504 | 66 | Terranora 110/66kV STS | Condong Sw Stn | 61 | 9.0 | 9.1 | 9.1 | 9.2 | 9.3 | 68 | 8.9 | 9.0 | 9.2 | 9.4 | 9.6 |
| 9505 | 66 | Cudgen ZS | Banora Point ZS | 53 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 59 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 9508 | 66 | Terranora 110/66kV STS | Tweed Heads ZS | 41 | 16.9 | 16.7 | 16.6 | 17.6 | 17.4 | 46 | 12.8 | 12.6 | 12.6 | 13.6 | 13.4 |
| 9510 | 66 | Banora Point ZS | Tweed Heads South ZS | 43 | 16.0 | 16.4 | 16.8 | 17.2 | 17.6 | 50 | 16.2 | 16.2 | 16.2 | 16.2 | 16.2 |
| 9514 | 66 | Condong Sw Stn | Murwillumbah ZS | 61 | 17.0 | 17.2 | 17.3 | 17.4 | 17.5 | 68 | 15.9 | 16.3 | 16.6 | 16.9 | 17.3 |
| 9516 | 66 | Tweed Head South ZS | Tweed Heads ZS | 43 | 4.0 | 4.0 | 4.0 | 4.2 | 4.1 | 50 | 3.0 | 3.0 | 3.0 | 3.2 | 3.2 |
| 9406 | 33 | Cudgen ZS | Casuarina Sw Stn | 17 | 10.6 | 10.9 | 11.1 | 11.3 | 11.5 | 19 | 11.3 | 11.6 | 11.8 | 12.0 | 12.2 |
| 9407 | 33 | Casuarina Sw Stn | Hastings Pt ZS | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9409 | 33 | Casuarina Sw Stn | Hastings Pt ZS | 20 | 10.6 | 10.9 | 11.1 | 11.3 | 11.5 | 20 | 11.3 | 11.6 | 11.8 | 12.0 | 12.2 |

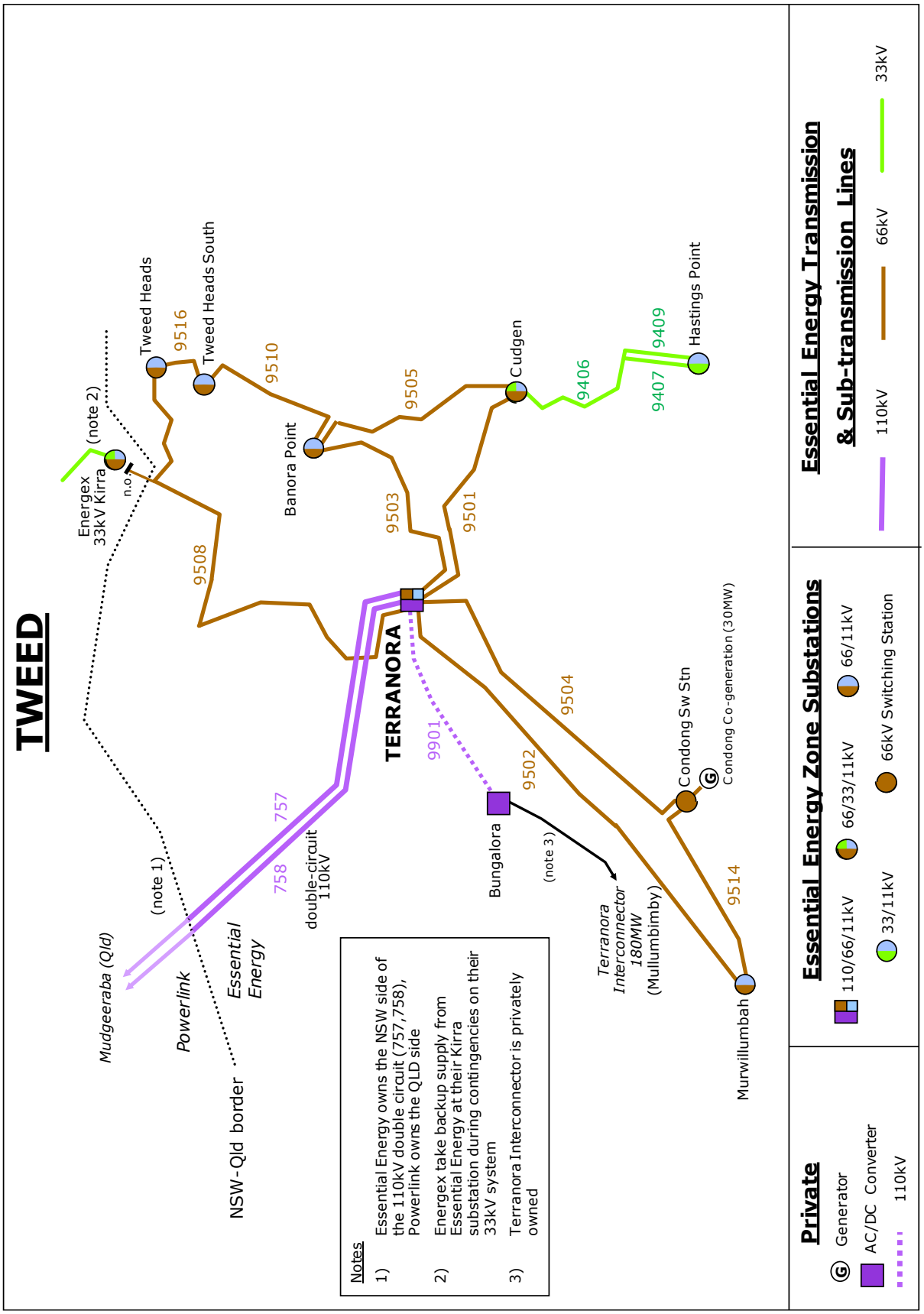
A 30MW biomass generator is located at Condong and is connected to the Terranora 110/66kV sub-transmission substation at 66kV via feeders 9504, 9514 and 9502.

## STS and ZS load forecast

| SUMMER | Terranora Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Banora Point | 66/11 | 24/30 | 24/30 | | 33 | 0.99 | 11.4 | 11.4 | 11.4 | 11.4 | 11.4 | 7.15 | 3 |
| Cudgen 11kV | 66/33/11 | 70/40/30 | 70/40/30 | | 33 | 0.99 | 13.6 | 14.3 | 15.4 | 20.5 | 21.1 | 6.41 | 2 |
| Cudgen 33kV | 66/33/11 | 70/40/30 | 70/40/30 | | 44 | 1.00 | 11.1 | 11.3 | 11.6 | 11.8 | 12.1 | 0.00 | 2 |
| Hastings Point | 33/11 | 15 | 15 | | 16.5 | 1.00 | 10.6 | 10.9 | 11.1 | 11.3 | 11.5 | 7.00 | 2 |
| Murwillumbah | 66/11 | 15/20/25 | 15/20/25 | | 27.5 | 0.98 | 20.1 | 20.2 | 20.3 | 20.4 | 20.6 | 10.24 | 4 |
| Terranora 110/66kV | 110/66 | 70/100 | 70/100 | 70/100 | 220 | 1.00 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 0.00 | 3 |
| Terranora 11kV | 66/11 | 24/30 | 24/30 | | 33 | 1.00 | 5.3 | 5.3 | 5.3 | 5.2 | 5.2 | 3.87 | 3.5 |
| Tweed Heads | 66/11 | 25 | 25 | | 27.5 | 0.97 | 16.1 | 15.9 | 15.8 | 16.7 | 16.6 | 2.00 | 7.5 |
| Tweed Heads South | 66/11 | 20/30 | 20/30 | | 33 | 0.99 | 15.2 | 15.6 | 16.0 | 16.4 | 16.8 | 6.89 | 4 |

| WINTER | Terranora Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Banora Point | 66/11 | 24/30 | 24/30 | | 36 | 1.00 | 11.3 | 11.3 | 11.3 | 11.3 | 11.3 | 7.15 | 1.5 |
| Cudgen 11kV | 66/33/11 | 70/40/30 | 70/40/30 | | 36 | 1.00 | 14.7 | 15.4 | 16.5 | 21.6 | 22.3 | 6.41 | 1 |
| Cudgen 33kV | 66/33/11 | 70/40/30 | 70/40/30 | | 48 | 1.00 | 11.7 | 11.9 | 12.1 | 12.3 | 12.5 | 0.00 | 1 |
| Hastings Point | 33/11 | 15 | 15 | | 18 | 1.00 | 11.3 | 11.6 | 11.8 | 12.0 | 12.2 | 7.00 | 1 |
| Murwillumbah | 66/11 | 15/20/25 | 15/20/25 | | 30 | 1.00 | 17.7 | 18.1 | 18.4 | 18.8 | 19.2 | 10.24 | 2 |
| Terranora 110/66kV | 110/66 | 70/100 | 70/100 | 70/100 | 240 | 1.00 | 74.6 | 74.6 | 74.6 | 74.6 | 74.6 | 0.00 | 2.5 |
| Terranora 11kV | 66/11 | 24/30 | 24/30 | | 36 | 1.00 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 3.87 | 1.5 |
| Tweed Heads | 66/11 | 25 | 25 | | 30 | 1.00 | 12.1 | 12.0 | 12.0 | 12.9 | 12.8 | 2.00 | 7 |
| Tweed Heads South | 66/11 | 20/30 | 20/30 | | 36 | 1.00 | 15.4 | 15.4 | 15.4 | 15.4 | 15.4 | 6.89 | 1 |

## Sub-transmission Single Line Diagram of Terranora area



### 2.3.2 Lismore Supply Area

Description of Lismore area

Zone substations in the Lismore area are spread across both the Coastal and Ranges regions.

The Lismore 132/66kV sub-transmission substation is owned by Essential Energy. It receives its supply via three Essential Energy 132kV lines from the TransGrid 330/132kV sub-transmission substation at Lismore.

A high voltage direct current transmission network is connected between Mullumbimby and Terranora (via Bungalora) which allows supply to be either injected into the Lismore area from Terranora or injected into the Terranora area from Lismore.

| **LISMORE – Identified System Limitations** | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – LHD3B5 Lennox West | 3.3 |
| Feeder – DUN3B3 Nimbin | 3.3 |

## Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 9U8 | 132 | TransGrid Lismore 330/132 STS | Lismore 132/66kV STS | 183 | 54.4 | 55.2 | 56.0 | 56.8 | 57.6 | 214 | 49.7 | 49.5 | 49.2 | 49.0 | 48.7 |
| 9U9 | 132 | TransGrid Lismore 330/132 STS | Lismore 132/66kV STS | 128 | 50.3 | 51.0 | 51.8 | 52.5 | 53.2 | 143 | 46.0 | 45.8 | 45.6 | 45.3 | 45.1 |
| 9W1 | 132 | TransGrid Lismore 330/132 STS | Lismore 132/66kV STS | 128 | 46.5 | 47.2 | 47.9 | 48.6 | 49.3 | 143 | 42.6 | 42.4 | 42.2 | 42.0 | 41.8 |
| 9G2 | 132 | Ballina ZS | Lennox Head ZS | 124 | 11.9 | 12.1 | 12.3 | 12.5 | 12.6 | 139 | 9.9 | 9.9 | 9.8 | 9.8 | 9.7 |
| 9G3 | 132 | Lennox Head ZS | Suffolk Park ZS | 124 | 16.0 | 16.3 | 16.5 | 16.7 | 17.0 | 139 | 14.5 | 14.4 | 14.4 | 14.3 | 14.2 |
| 9G4 | 132 | Suffolk Park ZS | Ewingsdale ZS | 124 | 22.4 | 22.7 | 23.1 | 23.4 | 23.7 | 139 | 20.9 | 20.8 | 20.7 | 20.6 | 20.5 |
| 9G5 | 132 | Ewingsdale ZS | Mullumbimby ZS | 122 | 39.0 | 39.6 | 40.2 | 40.7 | 41.3 | 137 | 39.7 | 39.5 | 39.3 | 39.1 | 38.9 |
| 9U6 | 132 | Lismore 132/66kV STS | Mullumbimby ZS | 107 | 24.6 | 24.9 | 25.3 | 25.7 | 26.0 | 123 | 25.4 | 25.3 | 25.2 | 25.0 | 24.9 |
| 9U7 | 132 | Lismore 132/66kV STS | Dunoon ZS | 107 | 27.7 | 28.2 | 28.6 | 29.0 | 29.4 | 123 | 28.3 | 28.2 | 28.0 | 27.9 | 27.8 |
| 9U7/1 | 132 | Dunoon ZS | Mullumbimby ZS | 107 | 21.4 | 21.7 | 22.0 | 22.3 | 22.6 | 123 | 22.4 | 22.3 | 22.2 | 22.1 | 21.9 |
| 892 | 66 | Lismore 132/66kV STS | Woodburn ZS | 11 | 6.8 | 6.9 | 7.0 | 7.1 | 7.2 | 19 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| 893 | 66 | Lismore 132/66kV STS | Casino ZS | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 894:LME | 66 | Lismore 132/66kV STS | Kyogle ZS | 11 | 8.0 | 8.2 | 8.5 | 8.7 | 8.9 | 19 | 7.1 | 7.1 | 7.2 | 7.2 | 7.3 |
| 0897:LME | 66 | Lismore 132/66kV STS | Alstonville ZS | 62 | 19.1 | 19.4 | 19.7 | 20.0 | 20.2 | 69 | 18.6 | 18.5 | 18.4 | 18.3 | 18.2 |
| 8502 | 66 | Lismore East ZS | Alstonville ZS | 62 | 10.1 | 10.3 | 10.4 | 10.6 | 10.7 | 69 | 10.4 | 10.4 | 10.3 | 10.3 | 10.2 |
| 8503 | 66 | Ballina ZS | Alstonville ZS | 62 | 8.9 | 9.0 | 9.1 | 9.3 | 9.4 | 69 | 8.3 | 8.2 | 8.2 | 8.1 | 8.1 |
| 8507 | 66 | Alstonville ZS | Ballina ZS | 61 | 10.2 | 10.4 | 10.5 | 10.7 | 10.8 | 68 | 9.6 | 9.6 | 9.5 | 9.5 | 9.4 |
| 8510 | 66 | Lismore Sw Stn | East Lismore ZS | 61 | 23.0 | 23.3 | 23.7 | 24.0 | 24.3 | 68 | 22.2 | 22.1 | 22.0 | 21.9 | 21.7 |
| 8511 | 66 | Lismore 132/66kV STS | Lismore Sw Stn | 62 | 20.1 | 20.4 | 20.7 | 21.0 | 21.3 | 69 | 18.4 | 18.3 | 18.2 | 18.1 | 18.0 |
| 8512 | 66 | Lismore Sw Stn | Lismore University ZS | 54 | 9.1 | 9.2 | 9.4 | 9.5 | 9.6 | 54 | 6.9 | 6.9 | 6.8 | 6.8 | 6.7 |
| 8513 | 66 | Lismore Sw Stn | Lismore University ZS | 54 | 9.1 | 9.2 | 9.4 | 9.5 | 9.6 | 54 | 6.9 | 6.9 | 6.8 | 6.8 | 6.7 |
| 8514 | 66 | Lismore 132/66kV STS | South Lismore ZS | 68 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 68 | 8.7 | 8.6 | 8.6 | 8.6 | 8.5 |
| 8515 | 66 | Lismore 132/66kV STS | South Lismore ZS | 68 | 10.5 | 10.5 | 10.5 | 10.5 | 10.5 | 68 | 8.6 | 8.5 | 8.5 | 8.5 | 8.4 |
| 8516 | 66 | Lismore 132/66kV STS | Lismore Sw Stn | 62 | 20.0 | 20.3 | 20.6 | 20.9 | 21.2 | 69 | 18.3 | 18.2 | 18.1 | 18.0 | 17.9 |

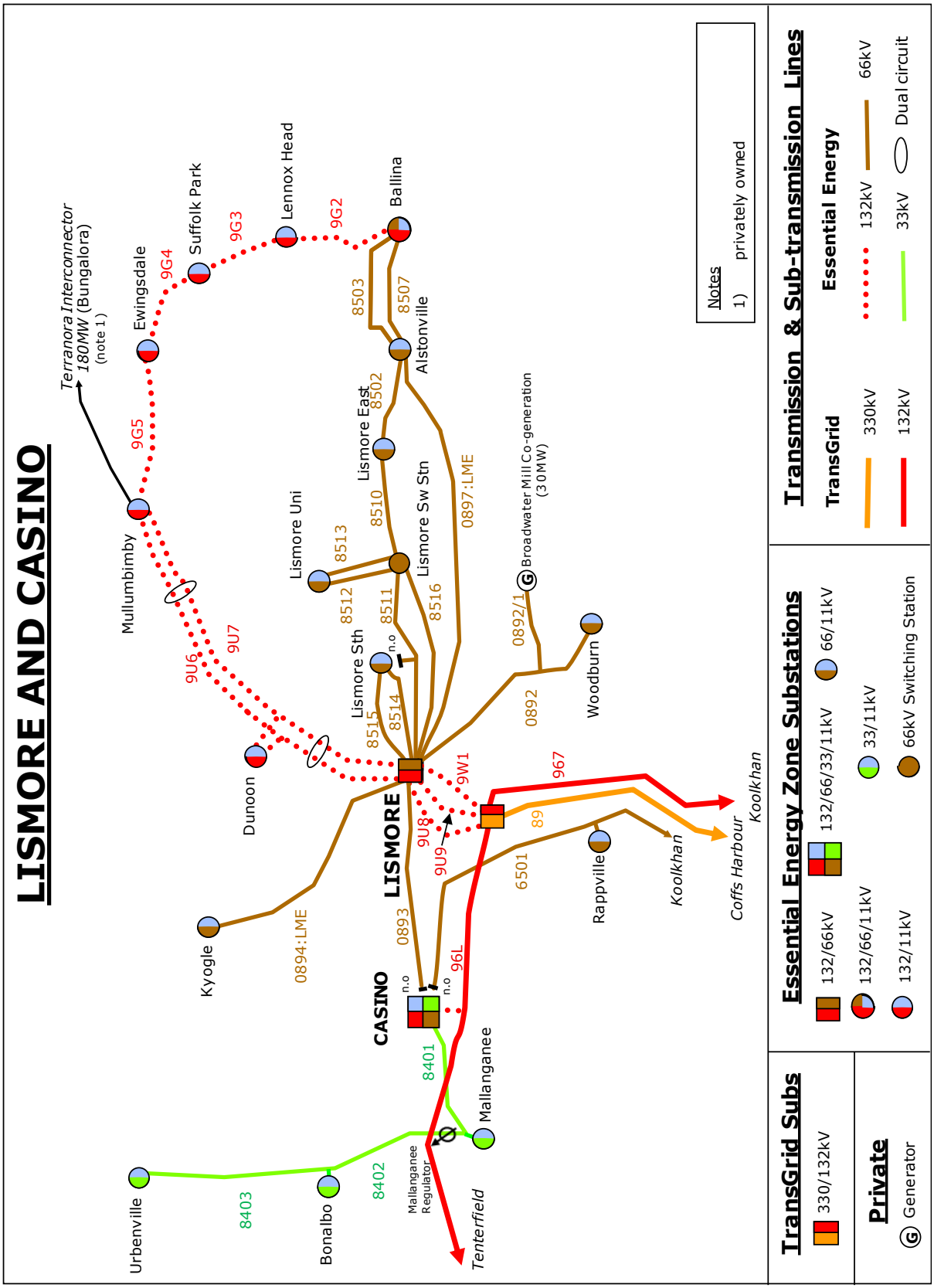
A 30MW biomass generator is located at Broadwater and is connected to the Lismore 132/66kV sub-transmission substation at 66kV via feeder 0892.

## STS and ZS load forecast

| SUMMER | Lismore Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Alstonville | 66/11 | 20 | 16/20 | | 22 | 1.00 | 11.8 | 11.8 | 11.8 | 11.9 | 11.9 | 7.00 | 3 |
| Ballina | 66/11 | 30 | 30 | | 33 | 1.00 | 27.0 | 27.1 | 27.2 | 27.4 | 27.5 | 11.61 | 1 |
| Ballina 132kV | 132/66 | 35/45/60 | | | 0 | 1.00 | 18.2 | 18.7 | 19.3 | 19.8 | 20.4 | 0.00 | 1 |
| Dunoon | 132/11 | 10 | 10 | | 11 | 0.99 | 7.2 | 7.6 | 7.9 | 8.2 | 8.6 | 3.44 | 2.5 |
| Ewingsdale | 132/11 | 30/45 | 30/45 | | 49.5 | 0.99 | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | 7.47 | 7.5 |
| Kyogle | 66/11 | 8/10 | 8/10 | | 11 | 0.96 | 8.0 | 8.2 | 8.5 | 8.7 | 8.9 | 3.27 | 2 |
| Lennox Head | 132/11 | 16 | 16 | | 17.6 | 1.00 | 4.7 | 4.8 | 5.0 | 5.1 | 5.2 | 3.35 | 1.5 |
| Lismore 132/66kV | 132/66 | 80/120 | 80/120 | 80/120 | 264 | 0.99 | 83.0 | 81.7 | 80.4 | 79.2 | 77.9 | 0.00 | 4.5 |
| Lismore East | 66/11 | 17/22/24.5 | 15/20/25 | | 26.95 | 0.98 | 15.2 | 15.6 | 16.1 | 16.6 | 17.1 | 6.54 | 2 |
| Lismore South | 66/11 | 25 | 23 | 20/25 | 52.8 | 1.00 | 21.2 | 21.2 | 21.2 | 21.2 | 21.2 | 5.23 | 2.5 |
| Lismore Uni | 66/11 | 20/30 | 20/30 | | 33 | 0.98 | 18.3 | 18.5 | 18.7 | 19.0 | 19.2 | 4.73 | 1.5 |
| Mullumbimby | 132/11 | 16 | 10 | | 11 | 1.00 | 7.1 | 7.2 | 7.3 | 7.4 | 7.5 | 4.75 | 3.5 |
| Suffolk Park | 132/11 | 30 | | | 0 | 1.00 | 8.4 | 8.6 | 8.9 | 9.1 | 9.3 | 5.12 | 6 |
| Woodburn | 66/11 | 8/10 | 8/10 | | 11 | 0.98 | 6.8 | 6.9 | 7.0 | 7.1 | 7.2 | 3.41 | 1.5 |

| WINTER | Lismore Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Alstonville | 66/11 | 20 | 16/20 | | 24 | 1.00 | 11.6 | 11.6 | 11.7 | 11.8 | 11.8 | 7.00 | 1 |
| Ballina | 66/11 | 30 | 30 | | 36 | 0.99 | 25.7 | 26.1 | 26.4 | 26.8 | 27.2 | 11.61 | 3 |
| Ballina 132kV | 132/66 | 35/45/60 | | | 0 | 1.00 | 16.9 | 17.4 | 17.8 | 18.3 | 18.8 | 0.00 | 3 |
| Dunoon | 132/11 | 10 | 10 | | 12 | 1.00 | 6.7 | 6.9 | 7.0 | 7.1 | 7.2 | 3.44 | 1.5 |
| Ewingsdale | 132/11 | 30/45 | 30/45 | | 54 | 1.00 | 18.5 | 18.7 | 18.9 | 19.1 | 19.4 | 7.47 | 2 |
| Kyogle | 66/11 | 8/10 | 8/10 | | 12 | 0.99 | 7.1 | 7.1 | 7.2 | 7.2 | 7.3 | 3.27 | 2 |
| Lennox Head | 132/11 | 16 | 16 | | 19.2 | 1.00 | 6.2 | 6.4 | 6.5 | 6.6 | 6.7 | 3.35 | 2 |
| Lismore 132/66kV | 132/66 | 80/120 | 80/120 | 80/120 | 288 | 1.00 | 74.7 | 74.3 | 73.9 | 73.5 | 73.0 | 0.00 | 2.5 |
| Lismore East | 66/11 | 17/22/24.5 | 15/20/25 | | 29.4 | 1.00 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 6.54 | 1.5 |
| Lismore South | 66/11 | 25 | 23 | 20/25 | 57.6 | 1.00 | 17.4 | 17.3 | 17.2 | 17.1 | 17.0 | 5.23 | 4.5 |
| Lismore Uni | 66/11 | 20/30 | 20/30 | | 36 | 1.00 | 13.8 | 13.7 | 13.6 | 13.6 | 13.5 | 4.73 | 2.5 |
| Mullumbimby | 132/11 | 16 | 10 | | 12 | 1.00 | 8.5 | 8.5 | 8.5 | 8.6 | 8.6 | 4.75 | 2 |
| Suffolk Park | 132/11 | 30 | | | 0 | 1.00 | 11.8 | 11.9 | 12.0 | 12.0 | 12.1 | 5.12 | 1.5 |
| Woodburn | 66/11 | 8/10 | 8/10 | | 12 | 0.99 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 3.41 | 1 |

Sub-transmission Single Line Diagram of Lismore area



### 2.3.3 Casino Supply Area

#### Description of Casino area

All zone substations in the Casino area are in the Ranges region.

The Casino area sub-transmission system is supplied from the Essential Energy 132/66kV sub-transmission substation at Casino which is teed off the TransGrid 132kV Tenterfield to Lismore line. On loss of the single 132/66kV transformer, 66kV supply reverts to Lismore 132/66kV substation via the Lismore – Casino 66kV line (0893).

| CASINO – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 96L | 132 | Transgrid Casino 132kV 96L Tee | Casino ZS | 140 | 28.2 | 28.9 | 29.7 | 30.5 | 31.2 | 157 | 23.7 | 24.0 | 24.3 | 24.7 | 25.0 |
| 6501 | 66 | Casino ZS | Rappville Tee | 16 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 25 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 |
| 8401 | 33 | Casino ZS | Mallanganee ZS | 4 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 6 | 3.2 | 3.2 | 3.3 | 3.3 | 3.4 |
| 8402 | 33 | Mallanganee ZS | Bonalbo ZS | 4 | 2.2 | 2.2 | 2.3 | 2.3 | 2.4 | 6 | 1.9 | 1.9 | 2.0 | 2.0 | 2.0 |
| 8403 | 33 | Bonalbo ZS | Urbenville ZS | 4 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 7 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 |

#### STS and ZS load forecast

| SUMMER | Casino Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95%Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bonalbo | 33/11 | 3 | 2.5 | | 2.75 | 0.90 | 1.0 | 1.1 | 1.1 | 1.1 | 1.2 | 0.39 | 2.5 |
| Casino 132/66kV | 132/66 | 35/45/60 | | | 0 | 0.97 | 29.2 | 30.0 | 30.8 | 31.6 | 32.4 | 0.00 | 8.5 |
| Casino 66/11kV | 66/11 | 20/30 | 20/30 | | 33 | 0.98 | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | 6.96 | 2.5 |
| Casino 66/33kV | 66/33 | 8 | 3.5 | | 3.85 | 0.98 | 3.7 | 3.8 | 3.8 | 3.9 | 3.9 | 0.00 | 1.5 |
| Mallanganee | 33/11 | 5/8 | 2.5 | | 2.75 | 0.99 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | 0.40 | 2 |
| Rappville | 66/11 | 5/6.25 | 5 | | 5.5 | 0.97 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.32 | 3 |
| Urbenville | 33/11 | 5/8 | 2.5 | | 2.75 | 0.99 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.25 | 2 |

| WINTER | Casino Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95%Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bonalbo | 33/11 | 3 | 2.5 | | 3 | 0.90 | 0.9 | 0.9 | 0.9 | 1.0 | 1.0 | 0.39 | 1 |
| Casino 132/66kV | 132/66 | 35/45/60 | | | 0 | 1.00 | 23.5 | 23.7 | 24.0 | 24.2 | 24.4 | 0.00 | 1.5 |
| Casino 66/11kV | 66/11 | 20/30 | 20/30 | | 36 | 1.00 | 19.4 | 19.4 | 19.4 | 19.4 | 19.4 | 6.96 | 1.5 |
| Casino 66/33kV | 66/33 | 8 | 3.5 | | 4.2 | 1.00 | 3.6 | 3.7 | 3.7 | 3.7 | 3.8 | 0.00 | 0.5 |
| Mallanganee | 33/11 | 5/8 | 2.5 | | 3 | 1.00 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.40 | 1 |
| Rappville | 66/11 | 5/6.25 | 5 | | 6 | 0.97 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.32 | 1.5 |
| Urbenville | 33/11 | 5/8 | 2.5 | | 3 | 1.00 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.25 | 0.5 |

## Sub-transmission Single Line Diagram of Casino area

Please refer to the Sub-transmission Single Line Diagram of Lismore area on Page 26.

### 2.3.4 Grafton Supply Area

#### Description of Grafton area

All zone substations in the Grafton area are in the Coastal region.

The Grafton area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Koolkhan.

| GRAFTON – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – GRN3B7 Grafton West | 3.3 |
| Feeder – MLN3B2 Maclean Town | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 825 | 66 | TransGrid Koolkhan 132/66kV STS | Koolkhan ZS | 62 | 20.9 | 21.2 | 21.4 | 21.7 | 21.9 | 69 | 18.6 | 18.9 | 19.1 | 19.4 | 19.6 |
| 826 | 66 | TransGrid Koolkhan 132/66kV STS | Grafton North ZS | 61 | 17.1 | 17.3 | 17.5 | 17.7 | 17.9 | 68 | 14.8 | 15.0 | 15.2 | 15.4 | 15.6 |
| 6503 | 66 | Grafton North ZS | South Grafton ZS | 24 | 11.2 | 11.3 | 11.4 | 11.6 | 11.7 | 25 | 8.7 | 8.8 | 8.9 | 9.0 | 9.1 |
| 6504 | 66 | Five Mile Sw Stn | South Grafton ZS | 61 | 4.8 | 4.9 | 4.9 | 5.0 | 5.1 | 68 | 3.7 | 3.8 | 3.8 | 3.9 | 3.9 |
| 6505 | 66 | Koolkhan SS | Grafton ZS | 52 | 18.6 | 18.8 | 19.0 | 19.3 | 19.5 | 58 | 16.0 | 16.2 | 16.4 | 16.7 | 16.9 |
| 6506 | 66 | Shannon Creek ZS | Nymboida ZS | 14 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 21 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 6508 | 66 | Maclean ZS | Yamba ZS | 28 | 10.4 | 10.4 | 10.4 | 10.5 | 10.5 | 32 | 11.0 | 11.1 | 11.3 | 11.4 | 11.5 |
| 6509 | 66 | Shannon Creek ZS | Five Mile Sw Stn | 14 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 | 21 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 |
| 6510 | 66 | Grafton North ZS | Five Mile Sw Stn | 28 | 6.0 | 6.1 | 6.2 | 6.3 | 6.3 | 34 | 4.6 | 4.7 | 4.8 | 4.8 | 4.9 |
| 896:MLN | 66 | TransGrid Koolkhan 132/66kV STS | Maclean ZS | 21 | 9.9 | 10.1 | 10.2 | 10.3 | 10.4 | 25 | 9.0 | 9.1 | 9.2 | 9.3 | 9.5 |
| 8G1 | 66 | TransGrid Koolkhan 132/66kV STS | Maclean ZS | 68 | 12.7 | 12.9 | 13.1 | 13.2 | 13.4 | 68 | 11.4 | 11.5 | 11.7 | 11.8 | 12.0 |
| 6402 | 33 | Maclean ZS | Yamba Tee | 8 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 9 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 6403 | 33 | Yamba Tee | Redcliff ZS | 3 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 6404 | 33 | Yamba Tee | Yamba ZS | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

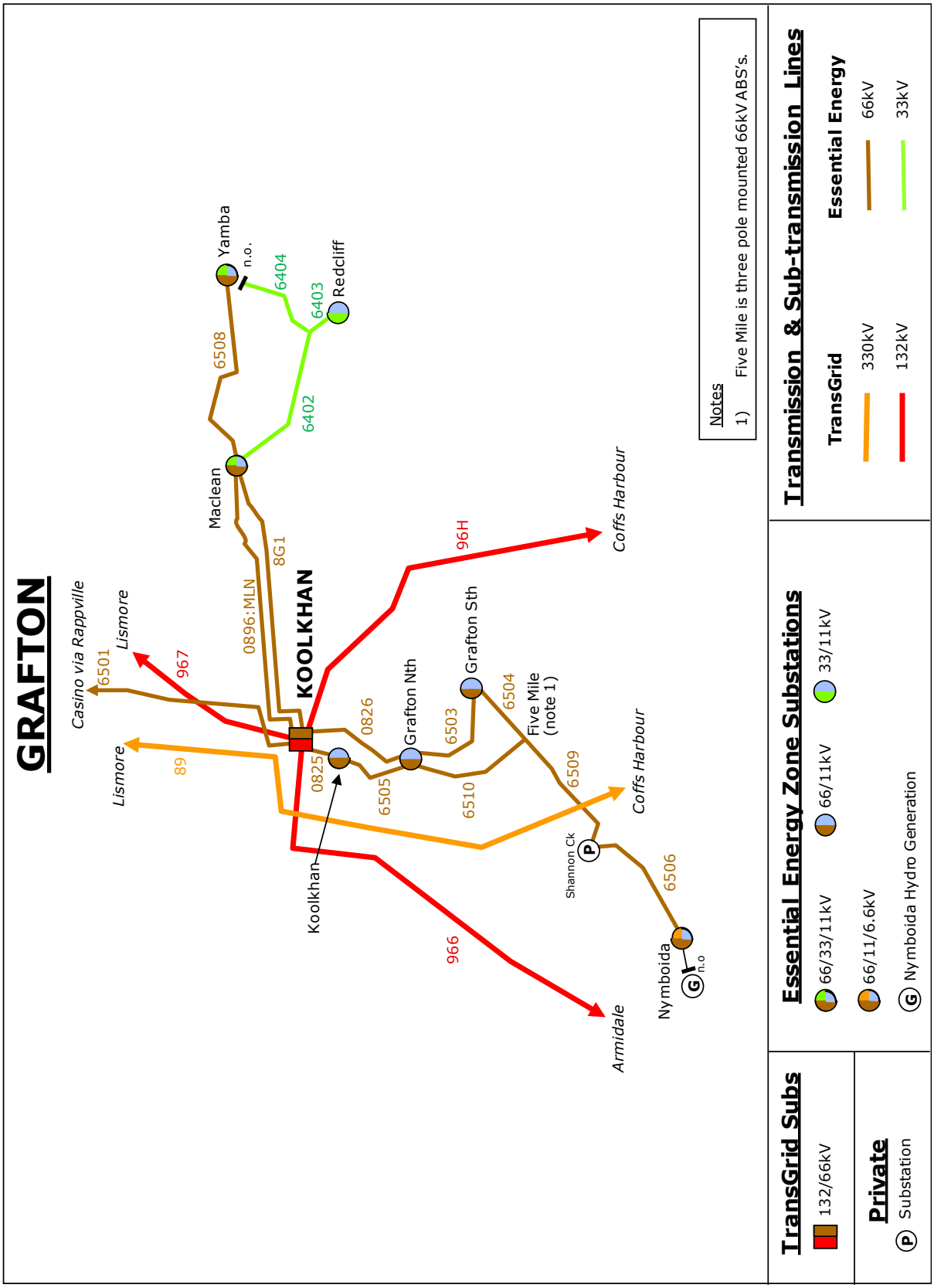
## STS and ZS load forecast

| SUMMER | Grafton Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Grafton North | 66/11 | 24/30 | 15/20/25 | | 27.5 | 0.97 | 16.5 | 16.7 | 16.9 | 17.1 | 17.4 | 4.83 | 3 |
| Grafton South | 66/11 | 15/19/25 | 15/19/24.5 | | 26.95 | 0.96 | 21.1 | 21.2 | 21.3 | 21.4 | 21.5 | 6.64 | 1.5 |
| Koolkhan 11kV | 66/11 | 7.5/10 | | | 0 | 0.94 | 3.6 | 3.6 | 3.7 | 3.8 | 3.9 | 1.10 | 0.5 |
| Maclean 66/11kV | 66/11 | 16 | 16 | | 17.6 | 0.99 | 8.9 | 9.0 | 9.1 | 9.2 | 9.3 | 4.33 | 2.5 |
| Maclean 66/33kV | 66/33 | 8/10 | | | 0 | 0.96 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.00 | 2 |
| Nymboida | 66/11 | 0.6 | 0.6 | | 0.66 | 0.95 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.23 | 4.5 |
| Redcliff | 33/11 | 0.5 | 0.5 | | 0.55 | 0.96 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.14 | 2 |
| Shannon Creek | 66/11 | 8 | | | 0 | 0.99 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.00 | 8 |
| Yamba | 66/11 | 20/30 | 15/19/23 | | 25.3 | 1.00 | 10.4 | 10.4 | 10.4 | 10.5 | 10.5 | 4.49 | 4 |

| WINTER | Grafton Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Grafton North | 66/11 | 24/30 | 15/20/25 | | 30 | 1.00 | 12.9 | 12.8 | 12.8 | 12.8 | 12.8 | 4.83 | 1.5 |
| Grafton South | 66/11 | 15/19/25 | 15/19/24.5 | | 29.4 | 0.99 | 12.9 | 12.9 | 12.9 | 12.8 | 12.8 | 6.64 | 1 |
| Koolkhan 11kV | 66/11 | 7.5/10 | | | 0 | 0.99 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 1.10 | 2 |
| Maclean 66/11kV | 66/11 | 16 | 16 | | 19.2 | 0.95 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 4.33 | 1 |
| Maclean 66/33kV | 66/33 | 8/10 | | | 0 | 0.98 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.00 | 4.5 |
| Nymboida | 66/11 | 0.6 | 0.6 | | 0.72 | 0.95 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.23 | 2.5 |
| Redcliff | 33/11 | 0.5 | 0.5 | | 0.6 | 0.98 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.14 | 4.5 |
| Shannon Creek | 66/11 | 8 | | | 0 | 0.99 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 0.00 | 13 |
| Yamba | 66/11 | 20/30 | 15/19/23 | | 27.6 | 0.99 | 11.0 | 11.1 | 11.3 | 11.4 | 11.5 | 4.49 | 2.5 |

The Nymboida hydro generation has reached end of life so has been decommissioned.

Sub-transmission Single Line Diagram of Grafton area



### 2.3.5 Coffs Harbour Supply Area

#### Description of Coffs Harbour area

All zone substations in the Coffs Harbour area are in the Mid North Coast region.

The Coffs Harbour area sub-transmission system is supplied from the TransGrid 330/132/66kV sub-transmission substation at Coffs Harbour (Karangi). The Dorrigo substation is normally connected via the Essential Energy 132kV tee line from the TransGrid 132kV transmission line between Armidale and Coffs Harbour with back up from the 66kV system. Boambee South is an Essential Energy 132/66/11kV zone substation that is supplied by the TransGrid 132kV transmission network between Kempsey and Coffs Harbour.

| COFFS HARBOUR – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – DOR3B3 Mt Moombil | 3.3 |
| Feeder – MNE3B6 Emerald Beach | 3.3 |
| Feeder – WGA3B3 Wooli | 3.3 |

#### Sub-transmission feeder load forecast

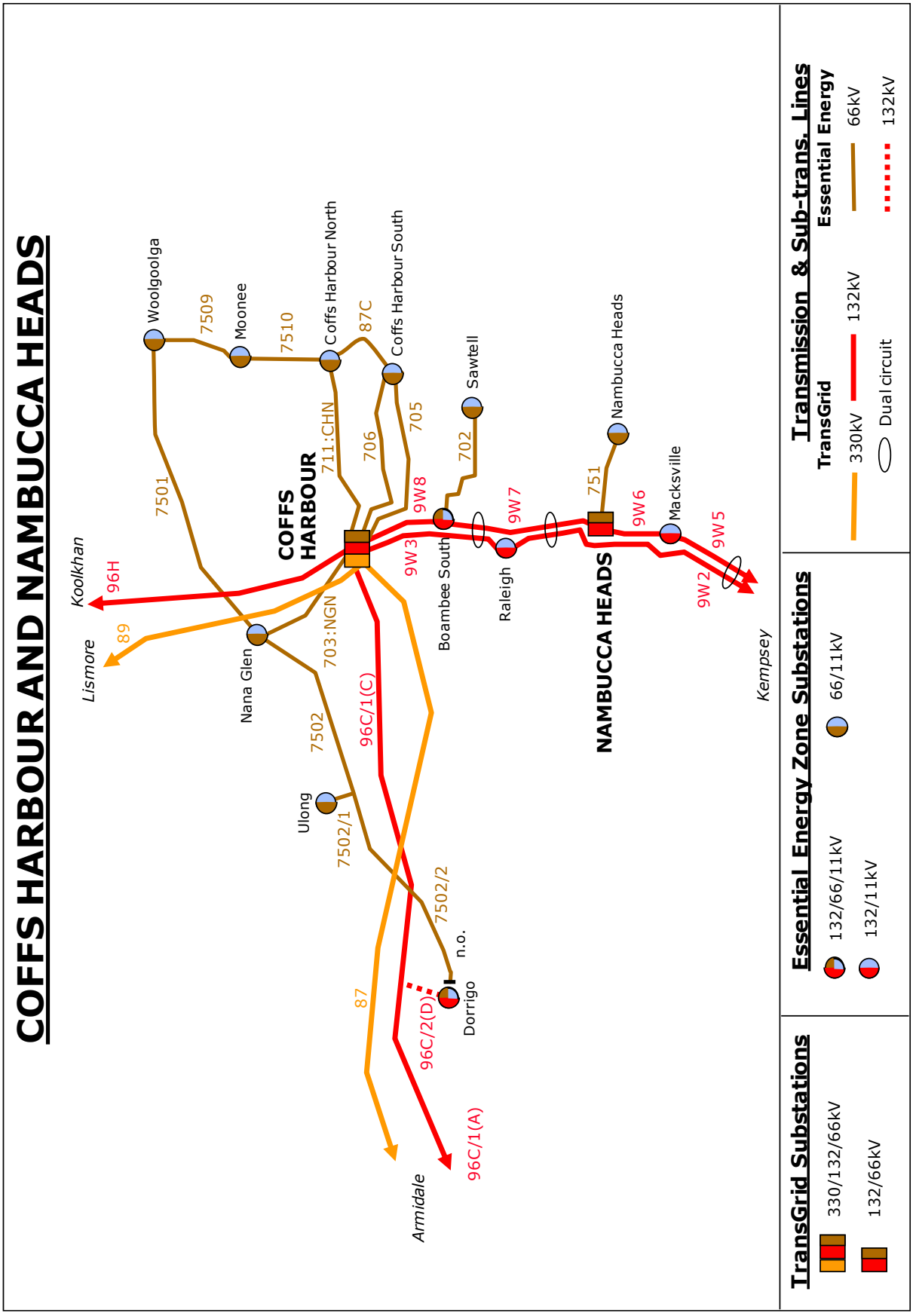
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 96C/2(D) | 132 | TransGrid 96C Armidale Coffs Harbour Dorrigo Tee | Dorrigo ZS | 122 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 137 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| 702 | 66 | Boambee South 132/66kV STS | Sawtell ZS | 61 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 68 | 7.9 | 8.2 | 8.5 | 8.7 | 9.0 |
| 705 | 66 | TransGrid Coffs Harbour 132/66 kV STS | South Coffs ZS | 52 | 14.5 | 14.4 | 14.4 | 14.4 | 14.3 | 58 | 13.3 | 13.3 | 13.4 | 13.5 | 13.6 |
| 706 | 66 | TransGrid Coffs Harbour 132/66 kV STS | South Coffs ZS | 52 | 16.4 | 16.4 | 16.3 | 16.3 | 16.3 | 58 | 15.1 | 15.2 | 15.2 | 15.3 | 15.4 |
| 7501 | 66 | Nana Glen ZS | Woolgoolga ZS | 29 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 33 | 5.0 | 5.0 | 5.0 | 5.0 | 5.1 |
| 7502 | 66 | Nana Glen ZS | Ulong Tee | 9 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 15 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 |
| 7502/1 | 66 | Ulong Tee | Ulong ZS | 9 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 15 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 |
| 7502/2 | 66 | Ulong Tee | Dorrigo ZS | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7509 | 66 | Moonee ZS | Woolgoolga ZS | 30 | 9.2 | 9.2 | 9.3 | 9.4 | 9.5 | 36 | 10.9 | 11.0 | 11.2 | 11.3 | 11.5 |
| 7510 | 66 | North Coffs ZS | Moonee ZS | 61 | 7.0 | 7.0 | 7.0 | 7.0 | 6.9 | 68 | 6.4 | 6.5 | 6.5 | 6.5 | 6.6 |
| 703:NGN | 66 | TransGrid Coffs Harbour 132/66 kV STS | Nana Glen ZS | 62 | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | 69 | 8.1 | 8.2 | 8.2 | 8.2 | 8.3 |
| 711:CHN | 66 | TransGrid Coffs Harbour 132/66 kV STS | North Coffs ZS | 62 | 17.8 | 17.7 | 17.7 | 17.6 | 17.6 | 69 | 16.3 | 16.4 | 16.5 | 16.6 | 16.7 |
| 87C | 66 | North Coffs ZS | South Coffs ZS | 68 | 11.1 | 11.1 | 11.0 | 11.0 | 11.0 | 68 | 10.2 | 10.2 | 10.3 | 10.3 | 10.4 |

## STS and ZS load forecast

| SUMMER | Coffs Harbour Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Boambee South 11kV | 132/66/11 | 60/30/30 | | | 33 | 1.00 | 8.9 | 9.0 | 9.0 | 9.1 | 9.2 | 3.98 | 3.5 |
| Boambee South 66kV | 132/66/11 | | 60/30/30 | | 33 | 1.00 | 8.2 | 8.5 | 8.7 | 8.9 | 9.2 | 0.00 | 10.5 |
| Coffs Harbour North | 66/11 | 15/19/23 | 15/20/25 | 15/19/23 | 50.6 | 1.00 | 24.9 | 24.9 | 24.9 | 24.9 | 24.9 | 5.90 | 3 |
| Coffs Harbour South | 66/11 | 20/30 | 20/30 | | 33 | 0.98 | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 | 3.77 | 5.5 |
| Dorrigo | 132/11, 66/11 | 7.5/10 | 10 | | 11 | 0.98 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.00 | 5 |
| Moonee | 66/11 | 10/16 | 10/16 | | 17.6 | 1.00 | 4.3 | 4.4 | 4.4 | 4.5 | 4.6 | 2.91 | 2.5 |
| Nana Glen | 66/11 | 5/6.25 | 8 | | 6.875 | 0.95 | 2.5 | 2.5 | 2.6 | 2.6 | 2.6 | 1.33 | 1 |
| Sawtell | 66/11 | 15/19/24.5 | 15/19/25 | | 26.95 | 1.00 | 8.0 | 8.2 | 8.4 | 8.6 | 8.8 | 2.82 | 12 |
| Ulong | 66/11 | 2.5 | | | 0 | 0.97 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.15 | 0.5 |
| Woolgoolga | 66/11 | 20/30 | 20/30 | | 33 | 1.00 | 9.2 | 9.2 | 9.3 | 9.4 | 9.5 | 5.32 | 14.5 |

| WINTER | Coffs Harbour Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Boambee South 11kV | 132/66/11 | 60/30/30 | | | 36 | 1.00 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 3.98 | 4 |
| Boambee South 66kV | 132/66/11 | | 60/30/30 | | 36 | 1.00 | 8.8 | 9.0 | 9.3 | 9.5 | 9.8 | 0.00 | 6 |
| Coffs Harbour North | 66/11 | 15/19/23 | 15/20/25 | 15/19/23 | 55.2 | 1.00 | 21.0 | 20.8 | 20.6 | 20.4 | 20.3 | 5.90 | 2.5 |
| Coffs Harbour South | 66/11 | 20/30 | 20/30 | | 36 | 1.00 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 3.77 | 2.5 |
| Dorrigo | 132/11, 66/11 | 7.5/10 | 10 | | 12 | 0.99 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 0.00 | 9 |
| Moonee | 66/11 | 10/16 | 10/16 | | 19.2 | 1.00 | 4.8 | 4.8 | 4.9 | 4.9 | 5.0 | 2.91 | 1.5 |
| Nana Glen | 66/11 | 5/6.25 | 8 | | 7.5 | 0.95 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 1.33 | 3.5 |
| Sawtell | 66/11 | 15/19/24.5 | 15/19/25 | | 29.4 | 0.99 | 7.9 | 8.2 | 8.5 | 8.7 | 9.0 | 2.82 | 5 |
| Ulong | 66/11 | 2.5 | | | 0 | 0.97 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.15 | 3.5 |
| Woolgoolga | 66/11 | 20/30 | 20/30 | | 36 | 1.00 | 10.9 | 11.0 | 11.2 | 11.3 | 11.5 | 5.32 | 5 |

Sub-transmission Single Line Diagram of Coffs Harbour area



### 2.3.6 Nambucca Heads Supply Area

#### Description of Nambucca Heads area

All zone substations in the Nambucca Heads area are in the Mid North Coast region.

The Nambucca Heads area sub-transmission system is supplied from the TransGrid 132kV transmission network. Nambucca Heads is a 66/11kV zone substation supplied via a 66kV line from TransGrid's Nambucca 132/66kV substation, while Raleigh and Macksville are 132/11kV zone substations supplied from the TransGrid 132kV transmission network between Kempsey and Coffs Harbour.

| NAMBUCCA HEADS – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 751 | 66 | TransGrid Nambucca 132/66 kV STS | Nambucca ZS | 15 | 6.4 | 6.4 | 6.5 | 6.5 | 6.6 | 25 | 7.7 | 7.6 | 7.5 | 7.5 | 7.4 |

#### STS and ZS load forecast

| SUMMER | Nambucca Heads Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Macksville | 132/11 | 24/30 | 24/30 | | 33 | 0.99 | 7.6 | 7.7 | 7.9 | 8.0 | 8.2 | 4.07 | 10 |
| Nambucca Heads | 66/11 | 15/19/23 | 17/22/24.5 | | 25.3 | 0.99 | 6.4 | 6.4 | 6.5 | 6.5 | 6.6 | 2.21 | 15 |
| Raleigh | 132/11 | 30 | 30 | | 33 | 0.98 | 10.0 | 10.1 | 10.2 | 10.2 | 10.3 | 4.86 | 9 |

| WINTER | Nambucca Heads Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Macksville | 132/11 | 24/30 | 24/30 | | 36 | 1.00 | 8.0 | 8.1 | 8.1 | 8.2 | 8.3 | 4.07 | 10 |
| Nambucca Heads | 66/11 | 15/19/23 | 17/22/24.5 | | 27.6 | 0.99 | 7.7 | 7.6 | 7.5 | 7.5 | 7.4 | 2.21 | 10.5 |
| Raleigh | 132/11 | 30 | 30 | | 36 | 1.00 | 9.6 | 9.7 | 9.8 | 9.9 | 10.1 | 4.86 | 11 |

#### Sub-transmission Single Line Diagram of Nambucca Heads area

Please refer to the Sub-transmission Single Line Diagram of Coffs Harbour area on Page 34.

### 2.3.7 Kempsey Supply Area

#### Description of Kempsey area

All zone substations in the Kempsey area are in the Mid North Coast region.

The Kempsey area sub-transmission system is supplied from the TransGrid 132/33kV sub-transmission substation at Kempsey.

| KEMPSEY – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

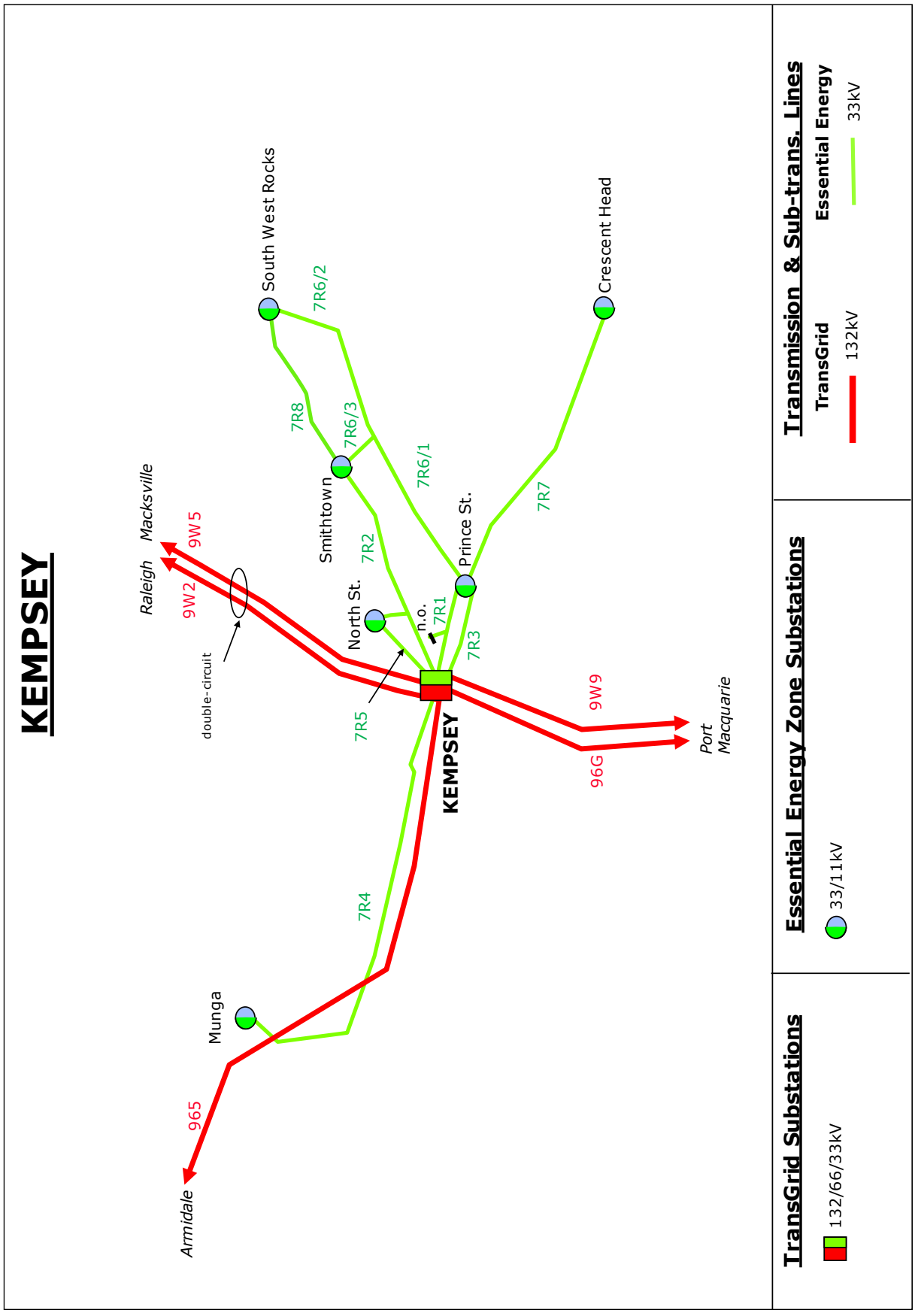
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 7R1 | 33 | TransGrid Kempsey 132/33kV STS | Prince St ZS | 30 | 6.3 | 6.4 | 6.5 | 6.6 | 6.7 | 34 | 7.0 | 7.2 | 7.4 | 7.6 | 7.7 |
| 7R2/1 | 33 | TransGrid Kempsey 132/33kV STS | North St Tee | 26 | 7.3 | 7.4 | 7.5 | 7.6 | 7.7 | 29 | 7.8 | 8.0 | 8.2 | 8.4 | 8.6 |
| 7R2/2 | 33 | North St Tee | Smithtown ZS | 19 | 3.7 | 3.7 | 3.8 | 3.8 | 3.9 | 21 | 4.5 | 4.7 | 4.8 | 4.9 | 5.0 |
| 7R2/3 | 33 | North St Tee | North St ZS | 10 | 3.6 | 3.7 | 3.7 | 3.8 | 3.8 | 19 | 3.2 | 3.2 | 3.3 | 3.4 | 3.5 |
| 7R3 | 33 | TransGrid Kempsey 132/33kV STS | Prince St ZS | 26 | 6.3 | 6.4 | 6.5 | 6.6 | 6.7 | 29 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 |
| 7R4 | 33 | TransGrid Kempsey 132/33kV STS | Munga ZS | 3 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 4 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 7R5 | 33 | TransGrid Kempsey 132/33kV STS | North St ZS | 19 | 5.5 | 5.6 | 5.7 | 5.8 | 5.9 | 21 | 5.9 | 6.0 | 6.2 | 6.4 | 6.5 |
| 7R6/1 | 33 | Prince St ZS | South West Rocks Tee | 15 | 4.6 | 4.7 | 4.8 | 4.8 | 4.9 | 18 | 5.5 | 5.7 | 5.8 | 6.0 | 6.1 |
| 7R6/2 | 33 | South West Rocks Tee | South West Rocks ZS | 19 | 2.3 | 2.4 | 2.4 | 2.4 | 2.5 | 21 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 |
| 7R6/3 | 33 | South West Rocks Tee | Smithtown ZS | 19 | 2.2 | 2.2 | 2.2 | 2.3 | 2.3 | 21 | 2.5 | 2.6 | 2.6 | 2.7 | 2.8 |
| 7R7 | 33 | Prince St ZS | Crescent Head ZS | 5 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 8 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| 7R8 | 33 | Smithtown ZS | South West Rocks ZS | 30 | 2.8 | 2.8 | 2.8 | 2.9 | 2.9 | 34 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 |

## STS and ZS load forecast

| SUMMER | Kempsey Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Crescent Head | 33/11 | 3/4 | 5 | | 4.4 | 0.97 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 0.62 | 2.5 |
| Munga | 33/11 | 2.5/3.25 | 3 | | 3.3 | 0.98 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 | 0.67 | 4.5 |
| North St | 33/11 | 10 | 10 | | 11 | 1.00 | 10.9 | 11.0 | 11.0 | 11.0 | 11.0 | 3.17 | 4 |
| Prince St | 33/11 | 10/15 | 10/15 | | 16.5 | 0.94 | 8.5 | 8.8 | 9.1 | 9.4 | 9.6 | 2.54 | 11 |
| Smithtown | 33/11 | 5/6.5 | 5 | | 5.5 | 0.97 | 4.8 | 4.9 | 5.0 | 5.2 | 5.3 | 1.11 | 2.5 |
| South West Rocks | 33/11 | 10/12.5 | 16 | | 13.75 | 0.99 | 5.9 | 5.9 | 6.0 | 6.0 | 6.0 | 2.63 | 2 |

| WINTER | Kempsey Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Crescent Head | 33/11 | 3/4 | 5 | | 4.8 | 0.99 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 0.62 | 5 |
| Munga | 33/11 | 2.5/3.25 | 3 | | 3.6 | 1.00 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.67 | 3.5 |
| North St | 33/11 | 10 | 10 | | 12 | 0.99 | 9.9 | 10.0 | 10.1 | 10.3 | 10.4 | 3.17 | 2.5 |
| Prince St | 33/11 | 10/15 | 10/15 | | 18 | 0.97 | 8.3 | 8.2 | 8.2 | 8.1 | 8.0 | 2.54 | 2 |
| Smithtown | 33/11 | 5/6.5 | 5 | | 6 | 0.98 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 1.11 | 1.5 |
| South West Rocks | 33/11 | 10/12.5 | 16 | | 15 | 0.98 | 6.0 | 6.1 | 6.1 | 6.2 | 6.3 | 2.63 | 6.5 |

Sub-transmission Single Line Diagram of Kempsey area



### 2.3.8 Port Macquarie Supply Area

#### Description of Port Macquarie area

All zone substations in the Port Macquarie area are in the Mid North Coast region.

The Port Macquarie area sub-transmission system is supplied from the TransGrid 132/33kV sub-transmission substation at Port Macquarie.

| PORT MACQUARIE – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – CPM3B7 Thrumster | 3.3 |

#### Sub-transmission feeder load forecast

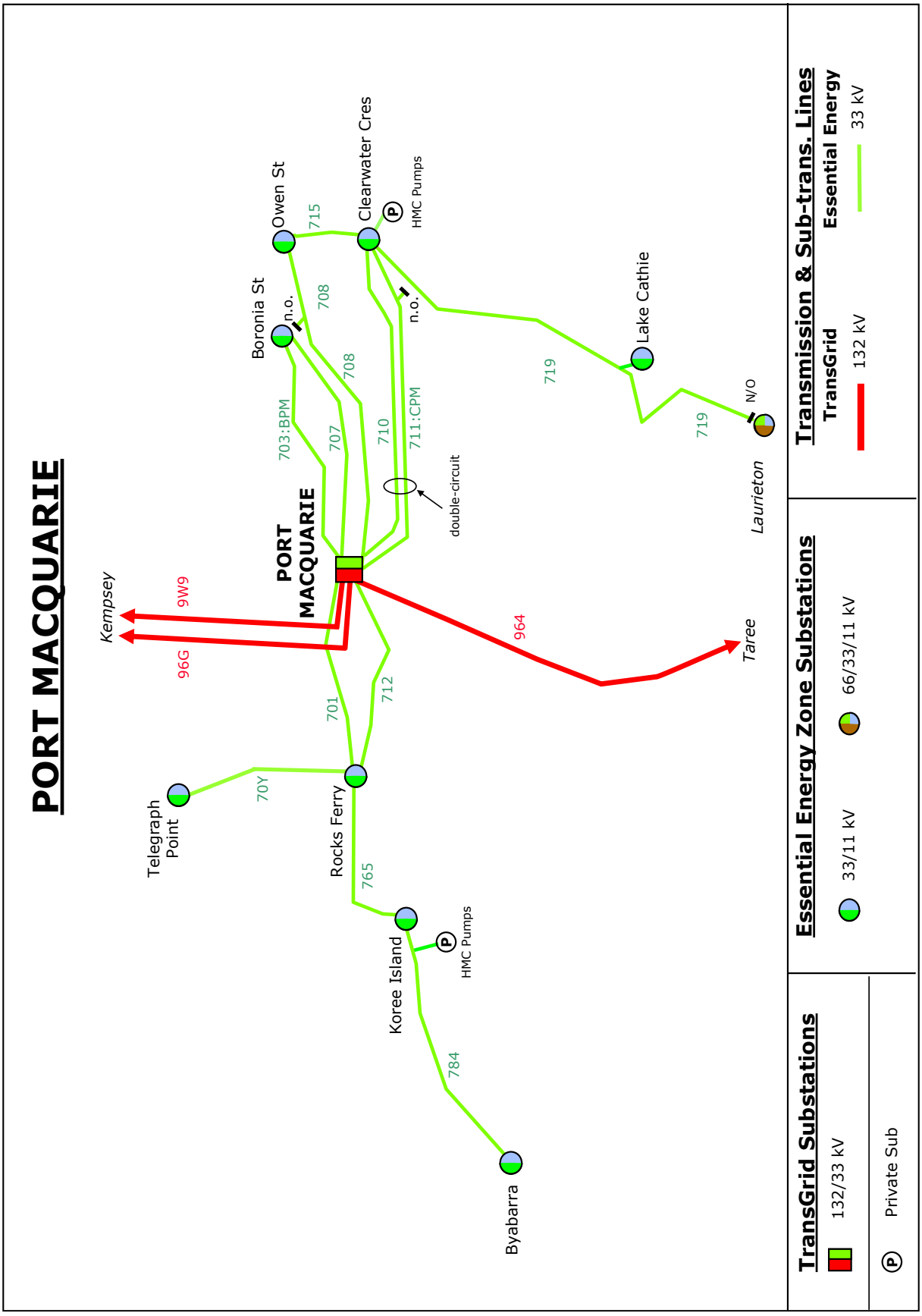
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 70Y | 33 | Rocks Ferry ZS | Telegraph Point ZS | 8 | 1.9 | 2.0 | 2.0 | 2.0 | 2.1 | 12 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| 701 | 33 | TransGrid Port Macquarie 132/33kV STS | Rocks Ferry ZS | 22 | 9.8 | 10.0 | 10.3 | 10.5 | 10.8 | 26 | 9.7 | 10.0 | 10.3 | 10.6 | 10.9 |
| 703:BPM | 33 | TransGrid Port Macquarie 132/33kV STS | Boronia Street ZS | 26 | 8.1 | 8.3 | 8.5 | 8.7 | 8.9 | 29 | 8.3 | 8.5 | 8.8 | 9.0 | 9.3 |
| 707 | 33 | TransGrid Port Macquarie 132/33kV STS | Boronia Street ZS | 26 | 9.1 | 9.4 | 9.6 | 9.9 | 10.1 | 29 | 9.3 | 9.6 | 9.9 | 10.2 | 10.5 |
| 708 | 33 | TransGrid Port Macquarie 132/33kV STS | Owen Street ZS | 26 | 10.6 | 10.9 | 11.2 | 11.4 | 11.7 | 29 | 12.1 | 12.5 | 12.9 | 13.3 | 13.6 |
| 710 | 33 | TransGrid Port Macquarie 132/33kV STS | Clearwater ZS | 31 | 11.5 | 11.8 | 12.1 | 12.4 | 12.7 | 34 | 14.0 | 14.4 | 14.8 | 15.3 | 15.7 |
| 711:CPM | 33 | TransGrid Port Macquarie 132/33kV STS | Clearwater ZS | 20 | 11.5 | 11.8 | 12.1 | 12.4 | 12.7 | 20 | 13.9 | 14.3 | 14.8 | 15.2 | 15.7 |
| 712 | 33 | TransGrid Port Macquarie 132/33kV STS | Rocks Ferry ZS | 12 | 6.4 | 6.6 | 6.8 | 6.9 | 7.1 | 14 | 6.4 | 6.6 | 6.8 | 7.0 | 7.2 |
| 715 | 33 | Clearwater ZS | Owen Street ZS | 31 | 4.8 | 4.9 | 5.1 | 5.2 | 5.3 | 34 | 3.8 | 4.0 | 4.1 | 4.2 | 4.3 |
| 719/1 | 33 | Clearwater ZS | Lake Cathie ZS | 20 | 5.4 | 5.6 | 5.8 | 6.0 | 6.1 | 20 | 5.5 | 5.7 | 5.9 | 6.0 | 6.2 |
| 719/2 | 33 | Lake Cathie ZS | Laurieton ZS | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 765 | 33 | Rocks Ferry ZS | Koree ZS | 9 | 4.3 | 4.4 | 4.6 | 4.7 | 4.8 | 11 | 4.8 | 5.0 | 5.1 | 5.3 | 5.4 |
| 784 | 33 | Koree ZS | Byabarra ZS | 9 | 1.1 | 1.2 | 1.2 | 1.2 | 1.3 | 11 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 |

## STS and ZS load forecast

| SUMMER | Port Macquarie Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Boronia St | 33/11 | 20/30 | 20/30 | | 33 | 0.99 | 20.1 | 20.3 | 20.4 | 20.5 | 20.7 | 5.74 | 6 |
| Byabarra | 33/11 | 2.5/3.25 | 3 | | 3.3 | 0.94 | 1.4 | 1.4 | 1.4 | 1.4 | 1.5 | 0.62 | 2 |
| Clearwater Cr | 33/11 | 20/30 | 20/30 | | 33 | 1.00 | 16.1 | 16.6 | 17.1 | 17.6 | 18.0 | 7.94 | 5.5 |
| Koree Island | 33/11 | 5/8 | 3.5 | | 3.85 | 0.98 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.08 | 3.5 |
| Lake Cathie | 33/11 | 5 | 10/16 | | 5.5 | 0.99 | 5.4 | 5.6 | 5.8 | 6.0 | 6.1 | 2.76 | 0.5 |
| Owen St | 33/11 | 15/20 | 15/20 | | 22 | 0.99 | 15.7 | 15.7 | 15.6 | 15.5 | 15.5 | 2.47 | 1.5 |
| Rocks Ferry | 33/11 | 10/16 | 10/15 | | 16.5 | 0.98 | 11.6 | 11.9 | 12.1 | 12.4 | 12.7 | 4.72 | 2 |
| Telegraph Point | 33/11 | 3/4 | 3/4 | | 4.4 | 0.99 | 1.9 | 2.0 | 2.0 | 2.0 | 2.1 | 0.75 | 3.5 |

| WINTER | Port Macquarie Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Boronia St | 33/11 | 20/30 | 20/30 | | 36 | 1.00 | 17.7 | 17.9 | 18.0 | 18.1 | 18.2 | 5.74 | 1 |
| Byabarra | 33/11 | 2.5/3.25 | 3 | | 3.6 | 0.97 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.62 | 4.5 |
| Clearwater Cr | 33/11 | 20/30 | 20/30 | | 36 | 1.00 | 19.6 | 20.1 | 20.6 | 21.1 | 21.7 | 7.94 | 2.5 |
| Koree Island | 33/11 | 5/8 | 3.5 | | 4.2 | 1.00 | 1.5 | 1.5 | 1.5 | 1.5 | 1.6 | 1.08 | 5 |
| Lake Cathie | 33/11 | 5 | 10/16 | | 6 | 1.00 | 5.5 | 5.7 | 5.9 | 6.0 | 6.2 | 2.76 | 2.5 |
| Owen St | 33/11 | 15/20 | 15/20 | | 24 | 0.97 | 15.5 | 15.7 | 16.0 | 16.2 | 16.4 | 2.47 | 4.5 |
| Rocks Ferry | 33/11 | 10/16 | 10/15 | | 18 | 0.99 | 9.9 | 10.1 | 10.2 | 10.4 | 10.6 | 4.72 | 1.5 |
| Telegraph Point | 33/11 | 3/4 | 3/4 | | 4.8 | 1.00 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 0.75 | 3 |

Sub-transmission Single Line Diagram of Port Macquarie area



### 2.3.9 Herons Creek Supply Area

#### Description of Herons Creek area

All zone substations in the Herons Creek area are in the Mid North Coast region.

The Herons Creek 132/66kV substation is owned by Essential Energy. It receives supply via a tee off TransGrid's Taree – Port Macquarie 132kV line (#964). Johns River, Kew and Laurieton 66/11kV zone substations take normal 66kV supply from Herons Creek, and backup 66kV supply from TransGrid's Taree 132/66/33kV substation via the Essential Energy 66kV line (#862).

| HERONS CREEK – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 866:KEW | 66 | Herons Creek 132/66kV STS | Kew ZS | 16 | 13.6 | 14.1 | 14.6 | 15.2 | 15.7 | 25 | 12.5 | 12.6 | 12.8 | 12.9 | 13.1 |
| 871 | 66 | Kew ZS | Laurieton ZS | 36 | 9.3 | 9.6 | 9.9 | 10.3 | 10.6 | 42 | 8.7 | 8.7 | 8.6 | 8.6 | 8.6 |
| 862/1 | 66 | Kew ZS | Johns River ZS | 16 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 25 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 862/2 | 66 | TransGrid Taree 132/66/33kV STS | Johns River ZS | 16 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### STS and ZS load forecast

| SUMMER | Herons Creek Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Herons Creek | 132/66 | 60 | | | 0 | 0.98 | 13.6 | 14.1 | 14.6 | 15.1 | 15.7 | 0.00 | 1.5 |
| Johns River | 66/11 | 3 | | | 0 | 0.92 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.52 | 1.5 |
| Kew | 66/11 | 3 | 8 | | 3.3 | 0.98 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 1.32 | 1 |
| Laurieton | 66/11, 33/11 | 15/20 | 15/20 | | 22 | 0.99 | 9.3 | 9.6 | 9.9 | 10.3 | 10.6 | 4.48 | 1.5 |

| WINTER | Herons Creek Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Herons Creek | 132/66 | 60 | | | 0 | 0.99 | 12.5 | 12.6 | 12.8 | 13.0 | 13.1 | 0.00 | 1 |
| Johns River | 66/11 | 3 | | | 0 | 0.94 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.52 | 2 |
| Kew | 66/11 | 3 | 8 | | 3.6 | 0.99 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 1.32 | 1 |
| Laurieton | 66/11, 33/11 | 15/20 | 15/20 | | 24 | 1.00 | 8.7 | 8.7 | 8.6 | 8.6 | 8.6 | 4.48 | 0.5 |

#### Sub-transmission Single Line Diagram of Herons Creek area

Please refer to the Sub-transmission Single Line Diagram of Taree area on Page 45.

### 2.3.10 Taree Supply Area

#### Description of Taree area

All zone substations in the Taree area are in the Mid North Coast region.

The Taree area sub-transmission system is supplied from the TransGrid 132/66/33kV sub-transmission substation at Taree.

| TAREE – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – WTE3686 Spence St | 3.3 |
| Feeder – HLP3B2 Failford Rd | 3.3 |

#### Sub-transmission feeder load forecast

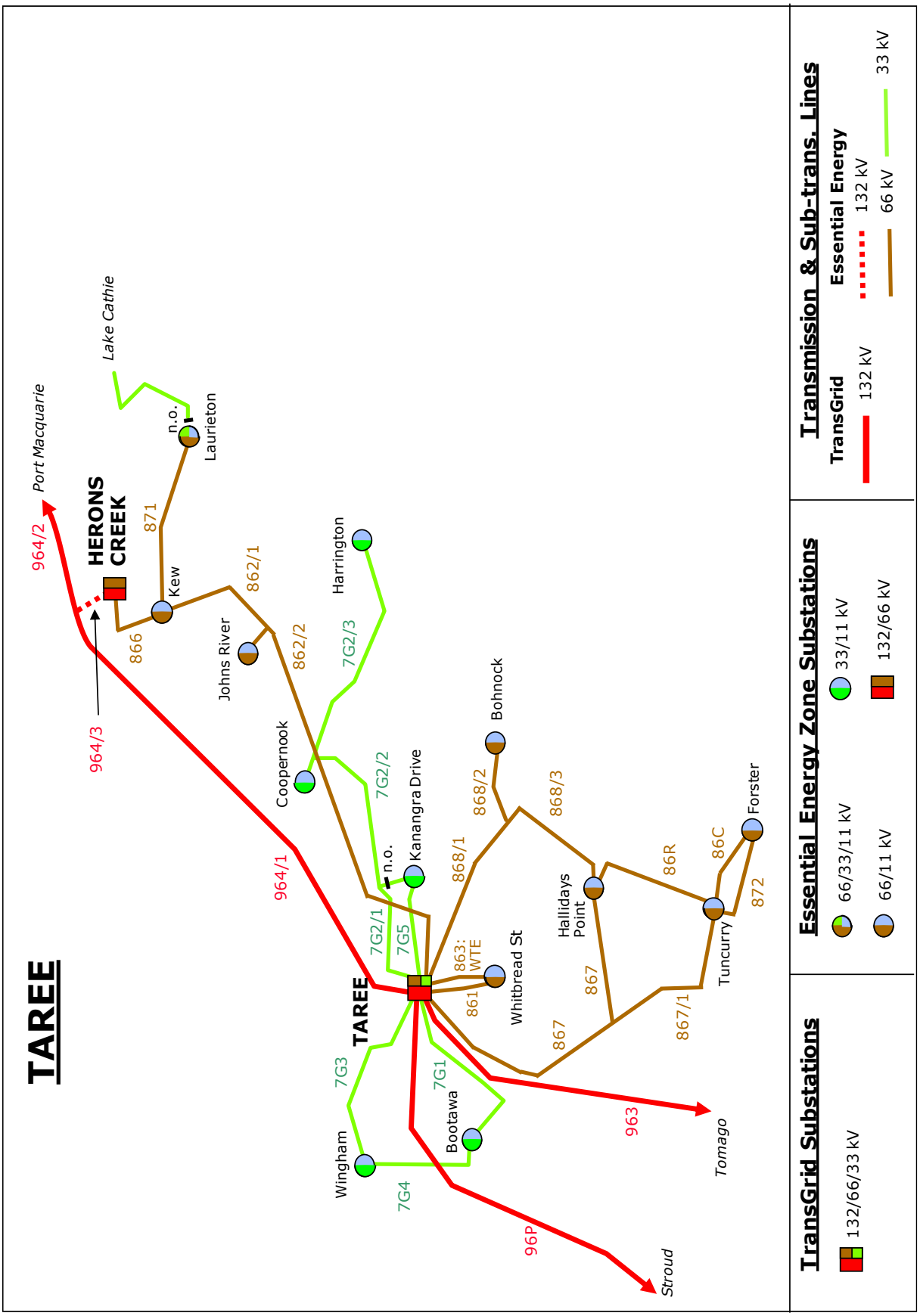
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 861 | 66 | TransGrid Taree 132/66/33kV STS | Whitbread ZS | 62 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 | 69 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 |
| 863:WTE | 66 | TransGrid Taree 132/66/33kV STS | Whitbread ZS | 62 | 10.4 | 10.5 | 10.6 | 10.7 | 10.9 | 69 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 |
| 867 | 66 | TransGrid Taree 132/66/33kV STS | Hallidays Point ZS | 34 | 14.1 | 14.3 | 14.4 | 14.6 | 14.7 | 39 | 16.9 | 16.9 | 17.0 | 17.0 | 17.0 |
| 867/1 | 66 | Hallidays Point Tee | Tuncurry ZS | 39 | 8.5 | 8.6 | 14.4 | 14.6 | 14.7 | 43 | 11.2 | 11.2 | 17.0 | 17.0 | 17.0 |
| 868/1 | 66 | TransGrid Taree 132/66/33kV STS | Bohnock Tee | 36 | 16.6 | 16.8 | 16.9 | 17.1 | 17.3 | 41 | 20.4 | 20.5 | 20.5 | 20.5 | 20.6 |
| 868/2 | 66 | Bohnock Tee | Bohnock ZS | 16 | 5.4 | 5.6 | 5.7 | 5.9 | 6.0 | 26 | 6.3 | 6.3 | 6.4 | 6.4 | 6.5 |
| 868/3 | 66 | Bohnock Tee | Hallidays Point ZS | 38 | 12.1 | 12.2 | 12.4 | 12.5 | 12.6 | 43 | 14.1 | 14.2 | 14.2 | 14.2 | 14.2 |
| 872 | 66 | Tuncurry ZS | Forster ZS | 30 | 7.1 | 7.2 | 7.3 | 7.3 | 7.4 | 37 | 8.9 | 8.9 | 9.0 | 9.0 | 9.0 |
| 86C | 66 | Tuncurry ZS | Forster ZS | 42 | 6.3 | 6.3 | 6.4 | 6.5 | 6.5 | 46 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 86R | 66 | Hallidays Point ZS | Tuncurry ZS | 38 | 11.9 | 12.0 | 12.2 | 12.3 | 12.4 | 43 | 14.8 | 14.8 | 14.8 | 14.9 | 14.9 |
| 7G2/1 | 33 | TransGrid Taree 132/66/33kV STS | Kanangra Tee | 22 | 7.1 | 7.3 | 7.4 | 7.6 | 7.8 | 27 | 5.9 | 6.0 | 6.0 | 6.1 | 6.1 |
| 7G2/2 | 33 | Kanangra Tee | Coopernook ZS | 7 | 6.1 | 6.2 | 6.4 | 6.5 | 6.6 | 12 | 5.3 | 5.4 | 5.4 | 5.5 | 5.5 |
| 7G2/3 | 33 | Coopernook ZS | Harrington ZS | 8 | 3.6 | 3.7 | 3.8 | 3.9 | 4.1 | 13 | 3.5 | 3.6 | 3.6 | 3.7 | 3.8 |
| 7G4 | 33 | Bootaw a ZS | Wingham ZS | 18 | 2.8 | 2.9 | 3.0 | 3.0 | 3.1 | 21 | 2.5 | 2.6 | 2.6 | 2.6 | 2.6 |
| 7G5 | 33 | TransGrid Taree 132/66/33kV STS | Kanangra Dr ZS | 17 | 10.5 | 10.7 | 10.9 | 11.2 | 11.4 | 17 | 8.7 | 8.8 | 8.9 | 9.0 | 9.1 |
| 7G1 | 33 | TransGrid Taree 132/66/33kV STS | Bootaw a ZS | 17 | 7.7 | 7.8 | 8.0 | 8.2 | 8.3 | 19 | 5.9 | 5.9 | 6.0 | 6.0 | 6.1 |
| 7G3 | 33 | TransGrid Taree 132/66/33kV STS | Wingham ZS | 18 | 8.1 | 8.2 | 8.4 | 8.6 | 8.7 | 20 | 6.4 | 6.4 | 6.5 | 6.5 | 6.6 |

## STS and ZS load forecast

| SUMMER | Taree Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bohnock | 66/11 | 5/7 | 5/7 | | 7.7 | 0.98 | 5.4 | 5.6 | 5.7 | 5.9 | 6.0 | 2.72 | 2 |
| Bootawa | 33/11 | 8/11 | 5 | | 5.5 | 0.97 | 4.3 | 4.3 | 4.3 | 4.2 | 4.2 | 0.85 | 0.5 |
| Coopernook | 33/11 | 5/8 | 5/6.5 | | 7.15 | 0.97 | 2.9 | 3.0 | 3.0 | 3.1 | 3.1 | 1.33 | 3 |
| Forster | 66/11 | 15/20/25 | 15/20/25 | | 27.5 | 1.00 | 13.8 | 13.5 | 13.3 | 13.1 | 12.8 | 4.50 | 2.5 |
| Hallidays Point 11kV | 66/11 | 12.5/16 | 10/16 | | 17.6 | 0.99 | 7.2 | 7.7 | 8.2 | 8.7 | 9.2 | 3.35 | 1.5 |
| Harrington | 33/11 | 5/8 | 5/6.25 | | 6.875 | 0.99 | 3.6 | 3.7 | 3.8 | 3.9 | 4.1 | 1.83 | 1.5 |
| Kanangra Dr | 33/11 | 20/30 | 20/25 | | 27.5 | 1.00 | 11.5 | 11.8 | 12.1 | 12.4 | 12.7 | 3.45 | 1.5 |
| Tuncurry | 66/11 | 10/16 | 12.5/16 | | 17.6 | 1.00 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 1.96 | 7 |
| Whitbread St | 66/11 | 20 | 20/30 | | 22 | 0.94 | 19.0 | 18.4 | 17.8 | 17.2 | 16.6 | 0.00 | 0.5 |
| Wingham | 33/11 | 7.5/10 | 7.5/10 | | 11 | 0.95 | 11.6 | 12.0 | 12.3 | 12.6 | 13.0 | 3.09 | 3.5 |

| WINTER | Taree Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bohnock | 66/11 | 5/7 | 5/7 | | 8.4 | 0.99 | 6.3 | 6.3 | 6.4 | 6.4 | 6.5 | 2.72 | 1 |
| Bootawa | 33/11 | 8/11 | 5 | | 6 | 0.98 | 3.6 | 3.5 | 3.4 | 3.3 | 3.2 | 0.85 | 2 |
| Coopernook | 33/11 | 5/8 | 5/6.5 | | 7.8 | 0.99 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 1.33 | 2 |
| Forster | 66/11 | 15/20/25 | 15/20/25 | | 30 | 0.99 | 15.6 | 15.6 | 15.6 | 15.6 | 15.6 | 4.50 | 3 |
| Hallidays Point 11kV | 66/11 | 12.5/16 | 10/16 | | 19.2 | 1.00 | 7.3 | 7.9 | 8.5 | 9.1 | 9.6 | 3.35 | 2.5 |
| Harrington | 33/11 | 5/8 | 5/6.25 | | 7.5 | 1.00 | 3.5 | 3.6 | 3.6 | 3.7 | 3.8 | 1.83 | 1.5 |
| Kanangra Dr | 33/11 | 20/30 | 20/25 | | 30 | 1.00 | 9.4 | 9.4 | 9.5 | 9.5 | 9.5 | 3.45 | 11.5 |
| Tuncurry | 66/11 | 10/16 | 12.5/16 | | 19.2 | 1.00 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 1.96 | 2 |
| Whitbread St | 66/11 | 20 | 20/30 | | 24 | 0.98 | 13.3 | 13.1 | 12.8 | 12.6 | 12.3 | 0.00 | 3 |
| Wingham | 33/11 | 7.5/10 | 7.5/10 | | 12 | 0.98 | 7.9 | 7.9 | 8.0 | 8.0 | 8.0 | 3.09 | 2.5 |

Sub-transmission Single Line Diagram of Taree area



### 2.3.11 Stroud Supply Area

#### Description of Stroud area

All zone substations in the Stroud area are in the Mid North Coast region.

The Stroud 132/33kV sub-transmission substation is owned by Essential Energy. It receives supply via two TransGrid 132kV lines. sub-transmission supply to Martins Creek and Gresford is taken from Stroud, with a secondary supply that emanates from Ausgrid's Network. The 33kV sub-transmission line is partly owned by Essential Energy.

| STROUD – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

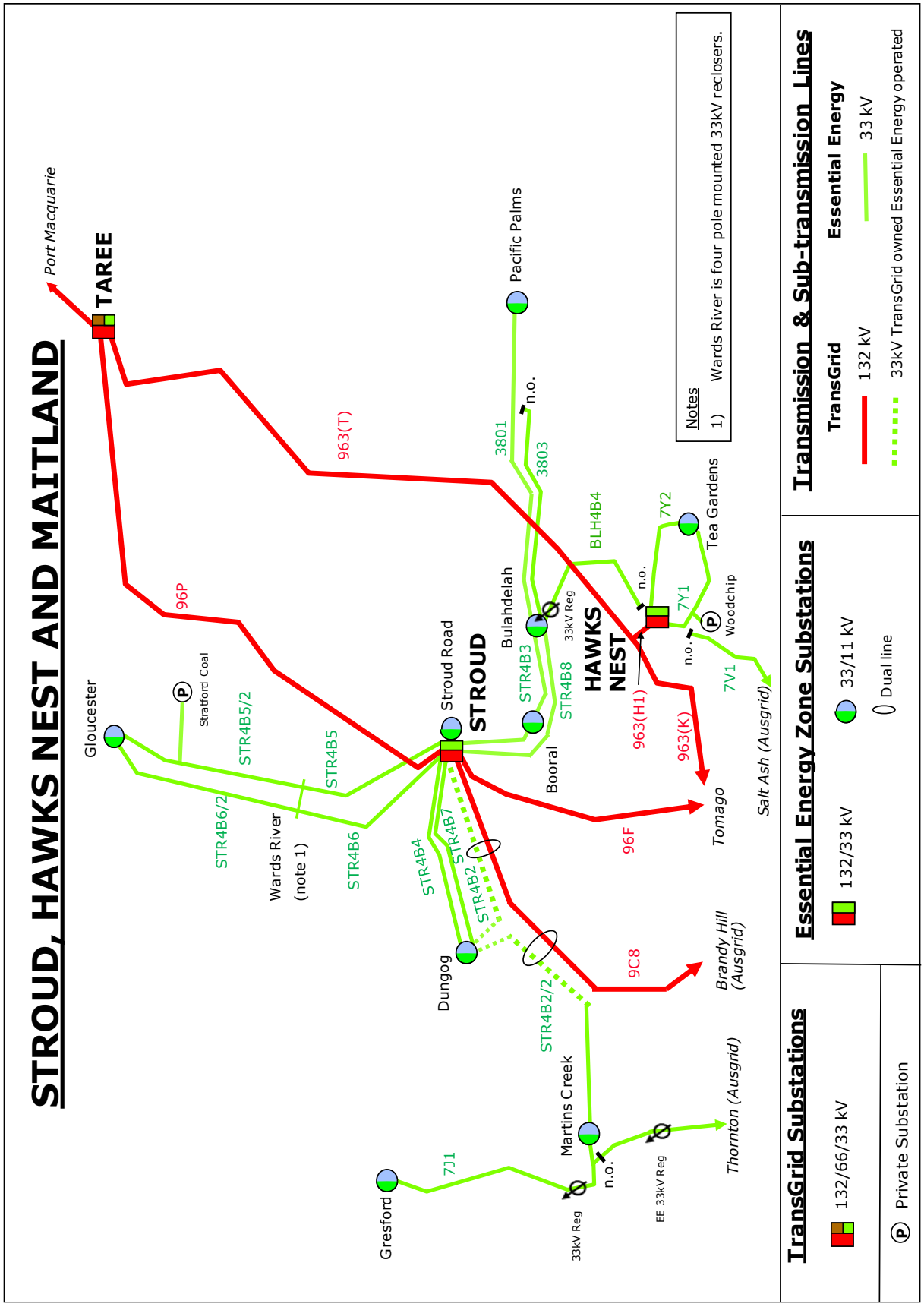
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| STR4B2 | 33 | Stroud 132/33kV STS | Dungog ZS | 27 | 8.3 | 8.4 | 8.4 | 8.4 | 8.4 | 27 | 5.0 | 5.1 | 5.1 | 5.1 | 5.1 |
| STR4B2/2 | 33 | Dungog ZS | Martins Creek ZS | 21 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 27 | 4.2 | 4.2 | 4.3 | 4.3 | 4.3 |
| STR4B3/1 | 33 | Stroud 132/33kV STS | Booral ZS | 7 | 5.1 | 5.3 | 5.4 | 5.6 | 5.7 | 12 | 5.5 | 5.6 | 5.7 | 5.8 | 5.9 |
| STR4B3/2 | 33 | Booral ZS | Bulahdelah ZS | 7 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 12 | 4.0 | 4.1 | 4.1 | 4.2 | 4.3 |
| STR4B4 | 33 | Stroud 132/33kV STS | Dungog ZS | 4 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 6 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| STR4B5/1 | 33 | Stroud 132/33kV STS | Wards River Sw Stn | 17 | 7.3 | 7.5 | 7.7 | 7.9 | 8.1 | 19 | 6.1 | 6.2 | 6.3 | 6.4 | 6.5 |
| STR4B5/2 | 33 | Wards River Sw Stn | Stratford Tee | 19 | 7.6 | 7.4 | 7.3 | 7.2 | 7.0 | 21 | 6.9 | 6.8 | 6.7 | 6.5 | 6.4 |
| STR4B5/2a | 33 | Stratford Tee | Stratford Coal ZS | 7 | 4.3 | 4.1 | 3.9 | 3.7 | 3.5 | 12 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 |
| STR4B5/3 | 33 | Stratford Tee | Gloucester ZS | 19 | 3.1 | 3.2 | 3.2 | 3.3 | 3.3 | 21 | 2.3 | 2.3 | 2.2 | 2.2 | 2.2 |
| STR4B6/1 | 33 | Stroud 132/33kV STS | Wards River Sw Stn | 17 | 8.4 | 8.6 | 8.9 | 9.1 | 9.4 | 19 | 7.1 | 7.2 | 7.3 | 7.4 | 7.5 |
| STR4B6/2 | 33 | Wards River Sw Stn | Gloucester ZS | 17 | 6.0 | 6.1 | 6.2 | 6.4 | 6.5 | 19 | 4.5 | 4.4 | 4.3 | 4.3 | 4.2 |
| STR4B7 | 33 | Stroud 132/33kV STS | Dungog ZS | 7 | 4.3 | 4.3 | 4.3 | 4.3 | 4.4 | 12 | 3.0 | 3.0 | 3.1 | 3.1 | 3.1 |
| STR4B8 | 33 | Stroud 132/33kV STS | Bulahdelah ZS | 7 | 4.7 | 4.8 | 4.9 | 5.1 | 5.2 | 12 | 4.7 | 4.8 | 4.9 | 5.0 | 5.0 |
| 3801 | 33 | Bulahdelah ZS | Pacific Palms ZS | 7 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 12 | 4.8 | 4.9 | 4.9 | 5.0 | 5.0 |
| 3803 | 33 | Bulahdelah ZS | Bungwahl Sw Stn | 7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BLH4B4 | 33 | Bulahdelah ZS | Hawks Nest 132/33kV STS | 7 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 12 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 7J1 | 33 | Ausgrid Recloser 33175 (Patterson) | Martins Creek Tee | 8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7J1/2 | 33 | Martins Creek Tee | Martins Creek ZS | 4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| 7J1/3 | 33 | Martins Creek Tee | Gresford ZS | 4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |

## STS and ZS load forecast

| SUMMER | Stroud Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Booral | 33/11 | 3 | 2.5 | | 2.75 | 0.95 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 0.61 | 2 |
| Bulahdelah | 33/11 | 5/8 | 5/6.5 | | 7.15 | 0.96 | 3.6 | 3.7 | 3.8 | 3.8 | 3.9 | 1.35 | 4.5 |
| Dungog | 33/11 | 10/16 | 10/16 | | 17.6 | 1.00 | 9.0 | 9.0 | 9.1 | 9.1 | 9.1 | 2.10 | 6.5 |
| Gloucester | 33/11 | 10/16 | 10/16 | | 17.6 | 1.00 | 9.1 | 9.3 | 9.5 | 9.7 | 9.8 | 2.60 | 4.5 |
| Gresford | 33/11 | 5/8 | 5/6.5 | | 7.15 | 1.00 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 0.72 | 9.5 |
| Martins Creek | 33/11 | 5/8 | 5/8 | | 8.8 | 0.97 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 1.19 | 1.5 |
| Pacific Palms | 33/11 | 5/8 | 5/8 | | 8.8 | 0.99 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 1.52 | 3 |
| Stroud 132/33kV | 132/33 | 50/60 | 50/60 | | 66 | 1.00 | 34.9 | 35.7 | 36.4 | 37.2 | 38.0 | 0.00 | 5.5 |
| Stroud 33/11kV | 33/11 | 5 | 5/8 | | 5.5 | 1.00 | 2.8 | 2.9 | 2.9 | 2.9 | 2.9 | 0.98 | 5.5 |

| WINTER | Stroud Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Booral | 33/11 | 3 | 2.5 | | 3 | 0.95 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 0.61 | 5 |
| Bulahdelah | 33/11 | 5/8 | 5/6.5 | | 7.8 | 0.95 | 3.2 | 3.2 | 3.2 | 3.3 | 3.3 | 1.35 | 3 |
| Dungog | 33/11 | 10/16 | 10/16 | | 19.2 | 0.99 | 5.5 | 5.6 | 5.6 | 5.6 | 5.7 | 2.10 | 8 |
| Gloucester | 33/11 | 10/16 | 10/16 | | 19.2 | 0.99 | 6.8 | 6.7 | 6.6 | 6.5 | 6.3 | 2.60 | 1.5 |
| Gresford | 33/11 | 5/8 | 5/6.5 | | 7.8 | 0.96 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 0.72 | 9 |
| Martins Creek | 33/11 | 5/8 | 5/8 | | 9.6 | 0.96 | 2.5 | 2.5 | 2.5 | 2.6 | 2.6 | 1.19 | 2.5 |
| Pacific Palms | 33/11 | 5/8 | 5/8 | | 9.6 | 0.96 | 4.8 | 4.9 | 4.9 | 5.0 | 5.0 | 1.52 | 1.5 |
| Stroud 132/33kV | 132/33 | 50/60 | 50/60 | | 72 | 0.98 | 29.7 | 30.1 | 30.6 | 31.0 | 31.5 | 0.00 | 3 |
| Stroud 33/11kV | 33/11 | 5 | 5/8 | | 6 | 0.98 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 0.98 | 2.5 |

Sub-transmission Single Line Diagram of Stroud area



### 2.3.12 Hawks Nest Supply Area

#### Description of Hawks Nest area

All zone substations in the Hawks Nest area are in the Mid North Coast region.

The Hawks Nest 132/33kV sub-transmission substation is owned by Essential Energy. It receives supply via a tee off the TransGrid Tomago to Taree 132kV line (#963). Tea Gardens zone substation takes normal supply from the Hawks Nest 132/33kV substation. Tea Gardens zone substation takes backup supply from a 33kV sub-transmission line that emanates from Ausgrid's Tomago network. A partial backup supply for Tea Gardens is via the 33kV network emanating from the Stroud substation via Bulahdelah.

| HAWKS NEST – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – TEA3B4 Tea Gardens | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 7Y1 | 33 | Hawks Nest 132/33kV STS | Tea Gardens ZS | 7 | 5.1 | 5.2 | 5.2 | 5.3 | 5.3 | 12 | 4.6 | 4.7 | 4.8 | 4.9 | 5.1 |
| 7Y2 | 33 | Hawks Nest 132/33kV STS | Tea Gardens ZS | 7 | 4.7 | 4.8 | 4.8 | 4.9 | 4.9 | 12 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 |
| 7V1 | 33 | Ausgrid Salt Ash ZS | Tee with 7Y1 | 7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### STS and ZS load forecast

| SUMMER | Hawks Nest Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Hawks Nest 132/33kV | 132/33 | 50 | | | 0 | 1.00 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 0.00 | 3.5 |
| Tea Gardens | 33/11 | 10/16 | 10/16 | | 17.6 | 1.00 | 9.7 | 9.9 | 10.1 | 10.3 | 10.5 | 3.23 | 3.5 |

| WINTER | Hawks Nest Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Hawks Nest 132/33kV | 132/33 | 50 | | | 0 | 0.98 | 8.8 | 9.0 | 9.3 | 9.5 | 9.8 | 0.00 | 0.5 |
| Tea Gardens | 33/11 | 10/16 | 10/16 | | 19.2 | 0.99 | 8.3 | 8.4 | 8.6 | 8.7 | 8.9 | 3.23 | 0.5 |

#### Sub-transmission Single Line Diagram of Hawks Nest area

Please refer to the Sub-transmission Single Line Diagram of Stroud area on Page 48.

### 2.3.13 Tenterfield Supply Area

#### Description of Tenterfield area

All zone substations in the Tenterfield area are in the Ranges region.

The Tenterfield area is supplied at 22kV and 11kV from the TransGrid 132/22/11kV sub-transmission substation at Tenterfield. Essential Energy is responsible for the 22/11kV substation area.

| TENTERFIELD – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

There are no sub-transmission feeders in the Tenterfield area.

#### STS and ZS load forecast

| SUMMER | Tenterfield Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| TransGrid 132/22kV Total Tenterfield 22kV Supply | | | | | | 0.99 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 1.34 | 9.5 |
| Tenterfield 11kV | 22/11 | 2.5 | 4 | | 2.75 | 0.98 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 0.86 | 7 |

| WINTER | Tenterfield Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| TransGrid 132/22kV Total Tenterfield 22kV Supply | | | | | | 1.00 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 1.34 | 2 |
| Tenterfield 11kV | 22/11 | 2.5 | 4 | | 3 | 0.99 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 0.86 | 1.5 |

#### Sub-transmission Single Line Diagram of Tenterfield area

Please refer to the Sub-transmission Single Line Diagram of Glen Innes area on Page 55.

### 2.3.14 Armidale Supply Area

#### Description of Armidale area

Zone substations in the Armidale area are spread across both the Ranges and Northern Tablelands regions.

The Armidale area sub-transmission system is supplied from the TransGrid 330/132/66kV sub-transmission substation at Armidale.

| ARMIDALE – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – WLS8B5 Uralla/Walcha Rd/Wollun | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 661/1 | 66 | TransGrid Armidale 330/132/66kV STS | Hillgrove Tee | 20 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 24 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 |
| 661/2 | 66 | Hillgrove Tee | Hillgrove ZS | 16 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 20 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 661/3 | 66 | Hillgrove Tee | Oaky ZS | 20 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 24 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 662/1 | 66 | TransGrid Armidale 330/132/66kV STS | Uralla Tee | 12 | 6.0 | 5.9 | 5.9 | 5.8 | 5.7 | 17 | 6.7 | 6.7 | 6.6 | 6.6 | 6.6 |
| 662/2 | 66 | Uralla Tee | Uralla ZS | 9 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 |
| 662/4 | 66 | Uralla Tee | Walcha South ZS | 9 | 3.6 | 3.5 | 3.5 | 3.5 | 3.4 | 15 | 4.8 | 4.8 | 4.8 | 4.7 | 4.7 |
| 664 | 66 | TransGrid Armidale 330/132/66kV STS | Gallow ay St ZS | 28 | 12.4 | 12.3 | 12.1 | 12.0 | 11.9 | 34 | 19.5 | 19.5 | 19.4 | 19.4 | 19.3 |
| 665 | 66 | TransGrid Armidale 330/132/66kV STS | Madgw ick Dr ZS | 21 | 8.6 | 8.5 | 8.4 | 8.3 | 8.2 | 39 | 12.6 | 12.5 | 12.5 | 12.5 | 12.4 |
| 66C | 66 | Miller St ZS | Madgw ick Dr ZS | 21 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 39 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| 66F | 66 | Gallow ay St ZS | Miller St ZS | 15 | 5.7 | 5.6 | 5.6 | 5.5 | 5.5 | 25 | 7.7 | 7.7 | 7.6 | 7.6 | 7.6 |

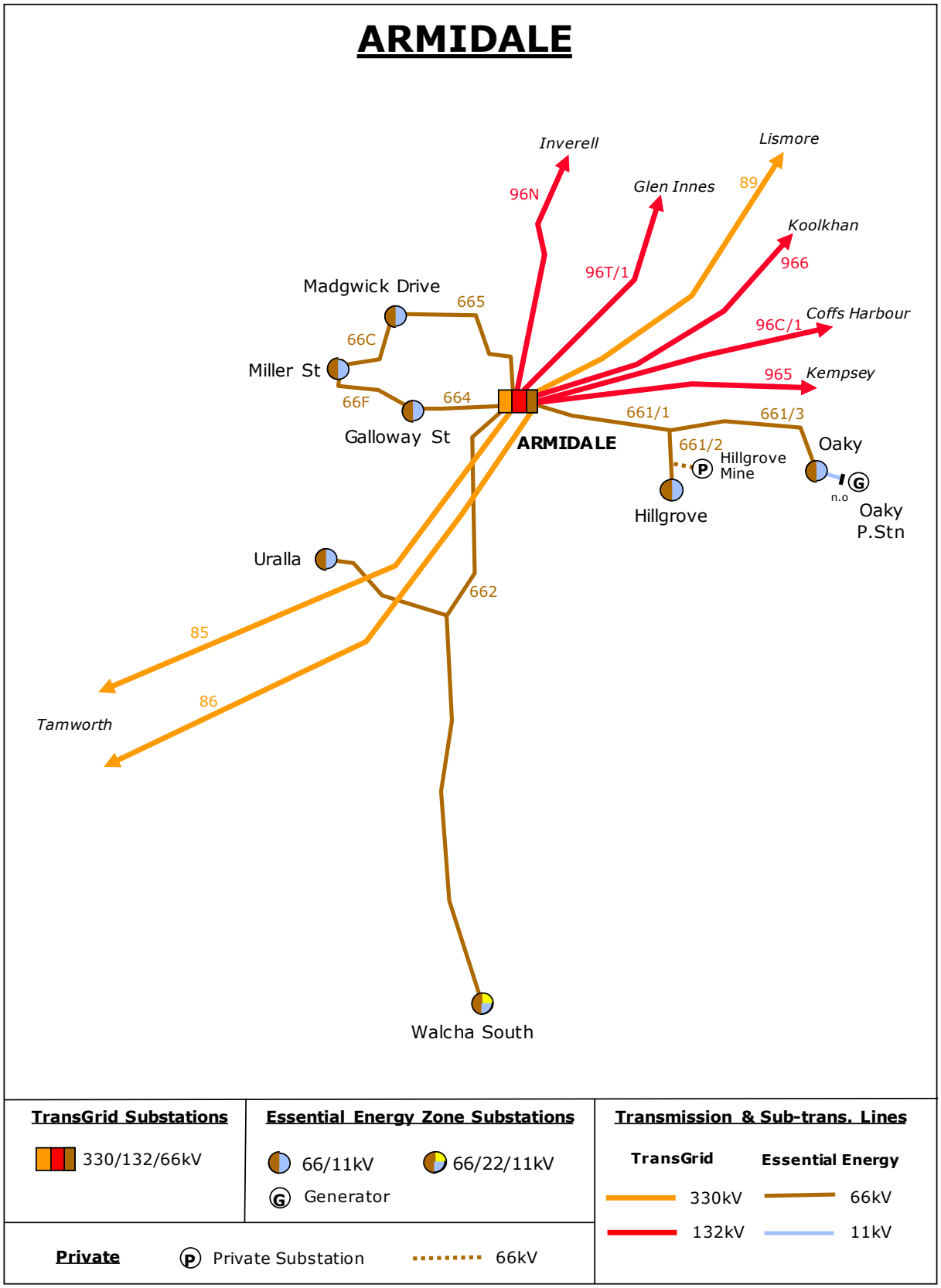
The 5MW hydro generation at Oaky is presently decommissioned after failure of the dam wall.

## STS and ZS load forecast

| SUMMER | Armidale Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Galloway St | 66/11 | 12.5/16 | 10/12.5 | | 13.75 | 1.00 | 8.1 | 8.2 | 8.2 | 8.3 | 8.3 | 3.34 | 6.5 |
| Hillgrove | 66/11 | 5/6.25 | | | 0 | 0.87 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.10 | 2.5 |
| Madgwick Dr | 66/11 | 10/12.5 | 10/16 | | 13.75 | 0.98 | 6.9 | 7.1 | 7.2 | 7.4 | 7.5 | 2.11 | 2.5 |
| Miller St | 66/11 | 12.5/16 | 10/16 | | 17.6 | 0.96 | 9.1 | 9.0 | 8.8 | 8.7 | 8.6 | 2.34 | 1.5 |
| Oaky | 66/11 | 3.5 | 3.5 | | 3.85 | 0.95 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.11 | 1.5 |
| Uralla | 66/11 | 8 | 5 | | 5.5 | 0.95 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 1.45 | 4 |
| Walcha South 66/22kV | 66/22 | 8 | 3 | | 3.3 | 0.78 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 0.58 | 2.5 |
| Walcha South 22/11kV | 22/11 | 3 | 3 | | 3.3 | 0.99 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 0.46 | 7 |

| WINTER | Armidale Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Galloway St | 66/11 | 12.5/16 | 10/12.5 | | 15 | 1.00 | 11.5 | 11.5 | 11.5 | 11.5 | 11.5 | 3.34 | 5.5 |
| Hillgrove | 66/11 | 5/6.25 | | | 0 | 0.98 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.10 | 1 |
| Madgwick Dr | 66/11 | 10/12.5 | 10/16 | | 15 | 0.99 | 9.9 | 10.1 | 10.4 | 10.6 | 10.8 | 2.11 | 1.5 |
| Miller St | 66/11 | 12.5/16 | 10/16 | | 19.2 | 0.99 | 11.1 | 11.0 | 11.0 | 11.0 | 10.9 | 2.34 | 2 |
| Oaky | 66/11 | 3.5 | 3.5 | | 4.2 | 0.95 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.11 | 1.5 |
| Uralla | 66/11 | 8 | 5 | | 6 | 0.95 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 1.45 | 1 |
| Walcha South 66/22kV | 66/22 | 8 | 3 | | 3.6 | 0.76 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 0.58 | 2 |
| Walcha South 22/11kV | 22/11 | 3 | 3 | | 3.6 | 0.99 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 0.46 | 1 |

Sub-transmission Single Line Diagram of Armidale area



### 2.3.15 Glen Innes Supply Area

#### Description of Glen Innes area

Zone substations in the Glen Innes area are spread across both the Ranges and Northern Tablelands regions.

The Glen Innes area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Glen Innes.

| GLEN INNES – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 886 | 66 | TransGrid Glen Innes 132/66kV STS | Glen Innes ZS | 70 | 4.5 | 4.4 | 4.3 | 4.3 | 4.2 | 78 | 6.0 | 6.0 | 6.0 | 6.0 | 5.9 |
| 887 | 66 | TransGrid Glen Innes 132/66kV STS | Glen Innes ZS | 19 | 5.3 | 5.2 | 5.2 | 5.1 | 5.0 | 33 | 7.2 | 7.2 | 7.1 | 7.1 | 7.1 |
| 6NY | 66 | Glen Innes ZS | Guyra ZS | 11 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 19 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 |
| 6NE | 66 | Glen Innes ZS | Emmaville ZS | 17 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 30 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 6AE/A | 66 | Pindari ZS | Ashford ZS | 17 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6AE/E | 66 | Emmaville ZS | Pindari ZS | 17 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 30 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |

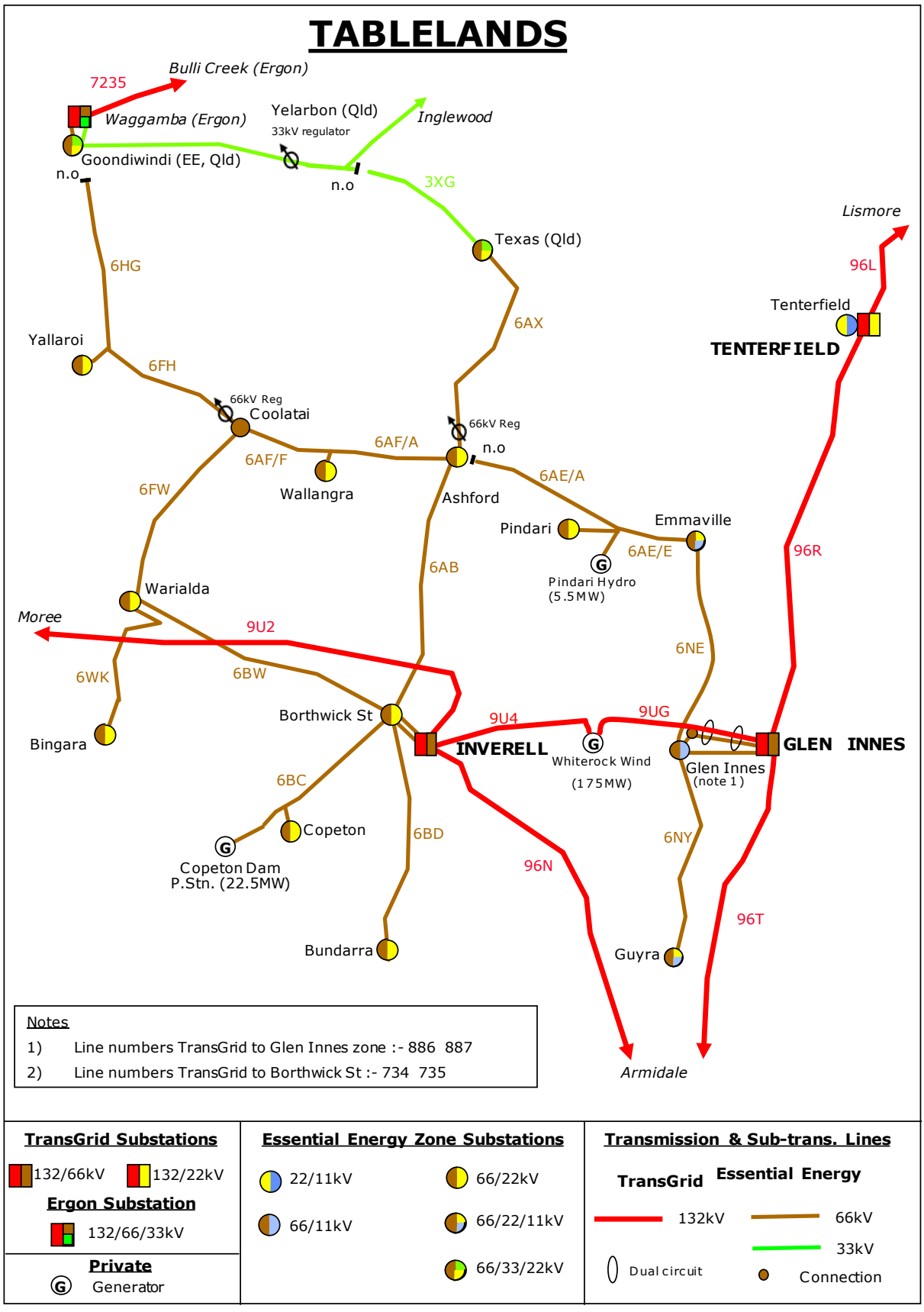
A 5.5MW hydro generator is located at Pindari Dam and is connected to the TransGrid Glen Innes 132/66kV sub-transmission substation at 66kV via feeders 6AE, 6NE, 886 and 887.

#### STS and ZS load forecast

| SUMMER | Glen Innes Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Emmaville 66/11kV | 66/11 | 3 | | | 0 | 0.95 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.61 | 5 |
| Emmaville 66/22kV | 66/22 | 2.5 | | | 0 | 0.95 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.09 | 10.5 |
| Glen Innes | 66/11 | 15/20 | 15/20 | | 22 | 0.99 | 5.7 | 5.7 | 5.6 | 5.5 | 5.5 | 3.32 | 6 |
| Guyra | 66/11/22 | 5 | 5 | | 5.5 | 0.99 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 1.60 | 2 |
| Pindari | 66/22 | 0.3 | | | 0 | 0.98 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.01 | 0 |

| WINTER | Glen Innes Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Emmaville 66/11kV | 66/11 | 3 | | | 0 | 0.95 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.61 | 2.5 |
| Emmaville 66/22kV | 66/22 | 2.5 | | | 0 | 0.95 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.09 | 2 |
| Glen Innes | 66/11 | 15/20 | 15/20 | | 24 | 0.99 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 3.32 | 3 |
| Guyra | 66/11/22 | 5 | 5 | | 6 | 1.00 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 1.60 | 5.5 |
| Pindari | 66/22 | 0.3 | | | 0 | 0.98 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.01 | 0 |

## Sub-transmission Single Line Diagram of Glen Innes area



### 2.3.16 Inverell Supply Area

#### Description of Inverell area

All zone substations in the Inverell area are in the Northern Tablelands region.

The Inverell area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Inverell.

| INVERELL – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – WRA2W08 Northern | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 734 | 66 | TransGrid Inverell 132/66kV STS | Borthwick St ZS | 64 | 16.6 | 16.5 | 16.5 | 16.5 | 16.5 | 71 | 15.2 | 15.3 | 15.4 | 15.5 | 15.5 |
| 735 | 66 | TransGrid Inverell 132/66kV STS | Borthwick St ZS | 64 | 16.8 | 16.8 | 16.8 | 16.8 | 16.8 | 71 | 15.4 | 15.5 | 15.6 | 15.7 | 15.8 |
| 6AB | 66 | Borthwick St ZS | Ashford ZS | 17 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 30 | 4.5 | 4.5 | 4.5 | 4.6 | 4.6 |
| 6AF/A | 66 | Ashford ZS | Wallangra ZS | 11 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 19 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| 6AF/F | 66 | Wallangra ZS | Coolatai Sw Stn | 11 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 19 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| 6AX | 66 | Ashford ZS | Texas ZS | 9 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15 | 3.0 | 3.1 | 3.1 | 3.1 | 3.1 |
| 6BC | 66 | Borthwick St ZS | Copeton ZS | 21 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 41 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| 6BD | 66 | Borthwick St ZS | Bundarra ZS | 14 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 21 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 6BW | 66 | Borthwick St ZS | Warialda ZS | 15 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 25 | 5.3 | 5.3 | 5.4 | 5.4 | 5.4 |
| 6FH | 66 | Coolatai Sw Stn | Yallaroi ZS | 20 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 39 | 1.7 | 1.7 | 1.8 | 1.8 | 1.8 |
| 6FW | 66 | Warialda ZS | Coolatai Sw Stn | 11 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 19 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 6HG | 66 | Yallaroi ZS | Goondiwindi ZS | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6WK | 66 | Warialda ZS | Bingara ZS | 11 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 19 | 2.2 | 2.3 | 2.3 | 2.3 | 2.3 |

A 23MW hydro generator is located at Copeton Dam and is connected to the TransGrid Inverell 132/66kV sub-transmission substation at 66kV via feeders 6BC, 734 and 735.

## STS and ZS load forecast

| SUMMER | Inverell Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Ashford | 66/22 | 3 | | | 0 | 0.95 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 0.44 | 1.5 |
| Bingara | 66/22 | 3 | 7.5 | | 3.3 | 0.95 | 2.5 | 2.6 | 2.6 | 2.6 | 2.7 | 0.88 | 12 |
| Borthwick St | 66/22 | 20/30 | 15/30 | | 33 | 0.99 | 22.4 | 22.7 | 23.0 | 23.3 | 23.6 | 7.24 | 7 |
| Bundarra | 66/22 | 3 | | | 0 | 0.65 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 0.43 | 0.5 |
| Copeton | 66/22 | 3 | 1.5 | | 1.65 | 0.95 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 0.00 | 0.5 |
| Texas 66/22kV | 66/22 | 5 | 5 | | 5.5 | 0.95 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 0.81 | 4.5 |
| Texas 66/33kV | 66/33 | 7.5 | 5 | | 5.5 | 0.95 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.28 | 6 |
| Wallangra | 66/22 | 1 | | | 0 | 0.88 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.07 | 1.5 |
| Warialda | 66/22 | 4 | 8 | | 4.4 | 1.00 | 3.1 | 3.1 | 3.2 | 3.2 | 3.2 | 1.25 | 4 |
| Yallaroi | 66/22 | 5 | | | 0 | 0.95 | 2.2 | 2.2 | 2.2 | 2.2 | 2.3 | 0.65 | 6.5 |

| WINTER | Inverell Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Ashford | 66/22 | 3 | | | 0 | 0.95 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.44 | 3.5 |
| Bingara | 66/22 | 3 | 7.5 | | 3.6 | 0.95 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 0.88 | 10 |
| Borthwick St | 66/22 | 20/30 | 15/30 | | 36 | 1.00 | 21.6 | 22.1 | 22.6 | 23.1 | 23.6 | 7.24 | 2.5 |
| Bundarra | 66/22 | 3 | | | 0 | 0.61 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 0.43 | 8.5 |
| Copeton | 66/22 | 3 | 1.5 | | 1.8 | 0.95 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.00 | 0.5 |
| Texas 66/22kV | 66/22 | 5 | 5 | | 6 | 0.95 | 2.5 | 2.5 | 2.6 | 2.7 | 2.7 | 0.81 | 17 |
| Texas 66/33kV | 66/33 | 7.5 | 5 | | 6 | 0.95 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 0.28 | 3 |
| Wallangra | 66/22 | 1 | | | 0 | 0.81 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.07 | 0.5 |
| Warialda | 66/22 | 4 | 8 | | 4.8 | 0.98 | 2.5 | 2.5 | 2.5 | 2.4 | 2.4 | 1.25 | 1.5 |
| Yallaroi | 66/22 | 5 | | | 0 | 0.95 | 1.8 | 1.8 | 1.9 | 1.9 | 1.9 | 0.65 | 1 |

## Sub-transmission Single Line Diagram of Inverell area

Please refer to the Sub-transmission Single Line Diagram of Glen Innes area on Page 55.

### 2.3.17 Waggamba (Ergon) Supply Area

#### Description of Waggamba area

All zone substations in the Waggamba area are in the Northern Tablelands region.

The Waggamba area sub-transmission system is supplied from the Ergon 132/66/33kV sub-transmission substation at Goondiwindi. The 132/66/33kV substation is supplied by a 132kV network from Powerlink's Bulli Creek substation.

Backup supply to Goondiwindi is limited to a maximum of 20MVA via 66kV from Inverell.

| WAGGAMBA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

There are no sub-transmission feeders in the Waggamba area.

#### STS and ZS load forecast

| SUMMER | Waggamba Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Goondiwindi 22kV | 66/22 | 20 | 20/30 | | 22 | 0.99 | 15.2 | 15.3 | 15.4 | 15.5 | 15.6 | 3.45 | 2 |
| Goondiwindi 33kV | 66/33 | 5 | | | 0 | 1.00 | 6.1 | 6.2 | 6.3 | 6.4 | 6.5 | 1.71 | 12 |

| WINTER | Waggamba Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Goondiwindi 22kV | 66/22 | 20 | 20/30 | | 24 | 0.99 | 15.3 | 15.2 | 15.1 | 14.9 | 14.8 | 3.45 | 9 |
| Goondiwindi 33kV | 66/33 | 5 | | | 0 | 0.98 | 5.0 | 5.1 | 5.2 | 5.4 | 5.5 | 1.71 | 3 |

#### Sub-transmission Single Line Diagram of Waggamba area

Please refer to the Sub-transmission Single Line Diagram of Glen Innes area on Page 55.

### 2.3.18 Moree Supply Area

#### Description of Moree area

All zone substations in the Moree area are in the Northern Tablelands region.

The Moree area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Moree.

| MOREE – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 876 | 66 | TransGrid Moree 132/66kV STS | Moree Solar Farm | 70 | 57.3 | 57.4 | 57.4 | 57.4 | 57.4 | 78 | 56.3 | 56.4 | 56.4 | 56.4 | 56.4 |
| 87J | 66 | Moree Solar Farm | Bellata ZS | 25 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 27 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| 721 | 66 | TransGrid Moree 132/66kV STS | Moree ZS | 64 | 10.0 | 10.0 | 9.9 | 9.9 | 9.9 | 71 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 |
| 722 | 66 | TransGrid Moree 132/66kV STS | Moree ZS | 64 | 10.5 | 10.5 | 10.5 | 10.5 | 10.5 | 71 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 |
| 881/1 | 66 | TransGrid Moree 132/66kV STS | Ashley Tee | 15 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 25 | 10.0 | 10.1 | 10.1 | 10.2 | 10.3 |
| 881/2 | 66 | Ashley Tee | Ashley ZS | 10 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 16 | 5.5 | 5.5 | 5.6 | 5.6 | 5.6 |
| 6PU | 66 | Ashley Tee | Mungindi ZS | 10 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 16 | 4.3 | 4.3 | 4.4 | 4.4 | 4.5 |
| 723:WTR/1 | 66 | TransGrid Moree 132/66kV STS | Wathagar ZS | 12 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 19 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| 723:WTR/2 | 66 | Wathagar ZS | Wenna ZS | 15 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 25 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |

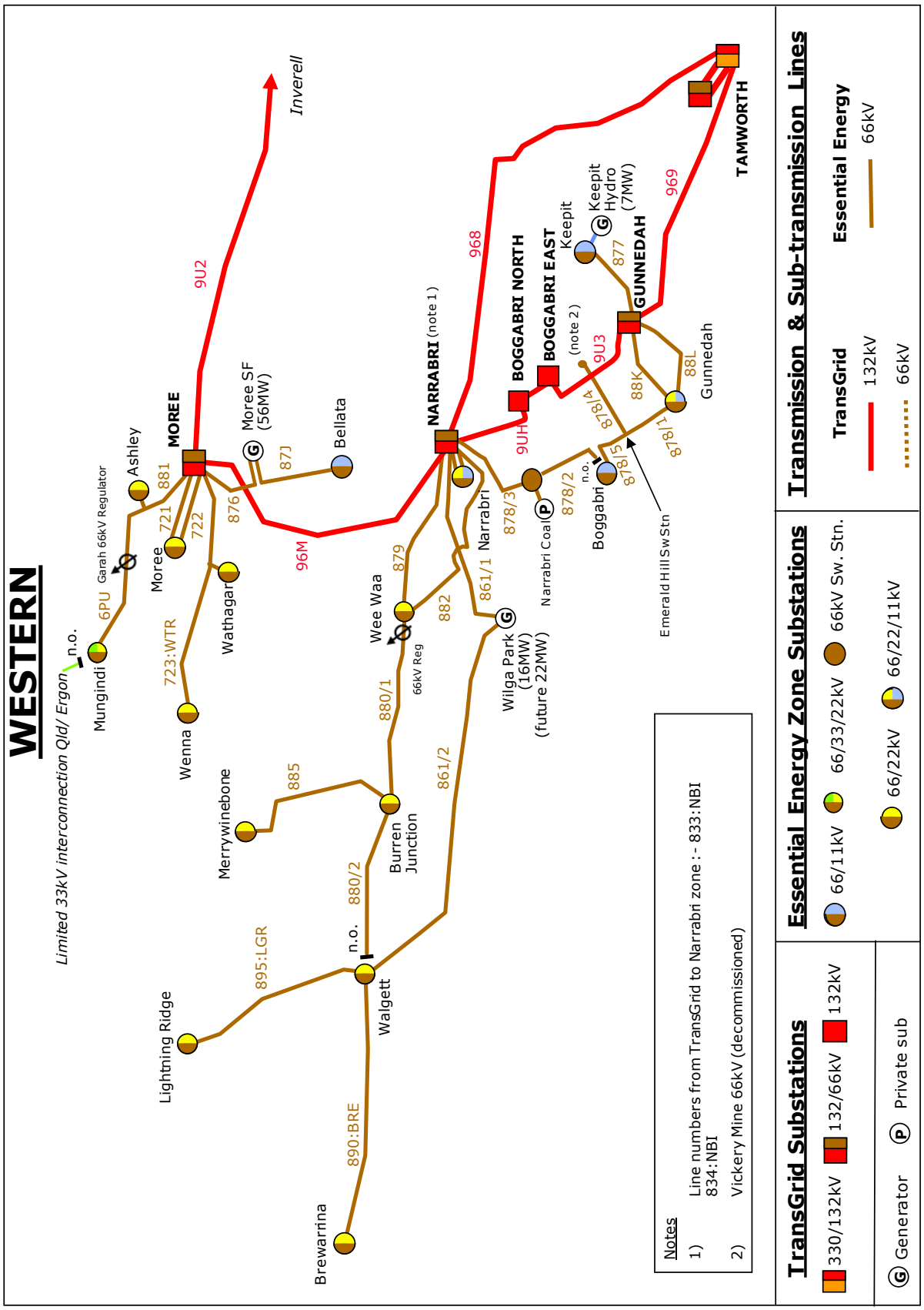
A 56MW solar generator is located at Moree Solar Farm and is connected to TransGrid's Moree 132/66kV sub-transmission substation at 66kV via feeder 876.

## STS and ZS load forecast

| SUMMER | Moree Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Ashley | 66/22 | 8 | | | 0 | 0.98 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.34 | 1.5 |
| Bellata | 66/11 | 2.8 | 2.5 | | 2.75 | 0.98 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.41 | 7 |
| Moree | 66/22 | 15/30 | 24/30 | | 33 | 0.98 | 19.0 | 18.8 | 18.7 | 18.5 | 18.3 | 8.10 | 2 |
| Mungindi | 66/22/33 | 8 | | | 0 | 0.95 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 0.71 | 8 |
| Wathagar | 66/22 | 5 | | | 0 | 0.95 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 0.00 | 8 |
| Wenna | 66/22 | 7.5 | | | 0 | 0.98 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.04 | 4 |

| WINTER | Moree Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Ashley | 66/22 | 8 | | | 0 | 0.98 | 5.5 | 5.5 | 5.6 | 5.6 | 5.6 | 0.34 | 35.5 |
| Bellata | 66/11 | 2.8 | 2.5 | | 3 | 1.00 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.41 | 4 |
| Moree | 66/22 | 15/30 | 24/30 | | 36 | 1.00 | 19.0 | 19.1 | 19.2 | 19.4 | 19.5 | 8.10 | 6 |
| Mungindi | 66/22/33 | 8 | | | 0 | 0.95 | 4.3 | 4.3 | 4.4 | 4.4 | 4.5 | 0.71 | 15.5 |
| Wathagar | 66/22 | 5 | | | 0 | 0.95 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 0.00 | 124 |
| Wenna | 66/22 | 7.5 | | | 0 | 0.98 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.04 | 1 |

Sub-transmission Single Line Diagram of Moree area



### 2.3.19 Narrabri Supply Area

#### Description of Narrabri area

Zone substations in the Narrabri area are spread across both the Northern Tablelands and North Western regions.

The Narrabri area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Narrabri.

| NARRABRI – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 879 | 66 | TransGrid Narrabri 132/66kV STS | Wee Waa ZS | 18 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 22 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |
| 882 | 66 | TransGrid Narrabri 132/66kV STS | Wee Waa ZS | 64 | 8.0 | 8.0 | 8.0 | 8.0 | 8.1 | 71 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 885 | 66 | Burren Junction ZS | Merryw inebone ZS | 15 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 25 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| 833:NBI | 66 | TransGrid Narrabri 132/66kV STS | Narrabri ZS | 38 | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | 43 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 |
| 834:NBI | 66 | TransGrid Narrabri 132/66kV STS | Narrabri ZS | 38 | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 | 43 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 |
| 861/1 | 66 | TransGrid Narrabri 132/66kV STS | Wilga Park ZS | 64 | 10.0 | 10.0 | 10.1 | 10.1 | 10.1 | 71 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 |
| 861/2 | 66 | Wilga Park ZS | Walgett ZS | 64 | 12.0 | 12.0 | 12.1 | 12.1 | 12.1 | 71 | 9.1 | 9.1 | 9.1 | 9.0 | 9.0 |
| 878/2 | 66 | Narrabri Coal Tee | Boggabri ZS | 24 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 29 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 878/3 | 66 | TransGrid Narrabri 132/66kV STS | Narrabri Coal Tee | 61 | 18.5 | 18.5 | 18.5 | 18.5 | 18.5 | 68 | 18.5 | 18.5 | 18.5 | 18.5 | 18.5 |
| 880/1 | 66 | Wee Waa ZS | Burren Junction ZS | 13 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 18 | 4.3 | 4.2 | 4.2 | 4.2 | 4.2 |
| 880/2 | 66 | Burren Junction ZS | Walgett ZS | 13 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 890:BRE | 66 | Walgett ZS | Brew arrina ZS | 15 | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 25 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 |
| 895:LGR | 66 | Walgett ZS | Lightning Ridge ZS | 15 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 25 | 2.6 | 2.6 | 2.6 | 2.5 | 2.5 |

A 10MW and 6MW gas generator located at Wilga Park is connected to the TransGrid Narrabri 132/66kV sub-transmission substation at 66kV via feeder 861.

## STS and ZS load forecast

| SUMMER | Narrabri Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Brewarrina | 66/22 | 6.5/8 | | | 0 | 0.99 | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 0.59 | 12 |
| Burren Junction | 66/22 | 5 | 5 | | 5.5 | 1.00 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 0.46 | 4.5 |
| Lightning Ridge | 66/22 | 8 | 5 | | 5.5 | 1.00 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 1.13 | 9 |
| Merrywinebone | 66/22 | 5 | | | 0 | 0.81 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.39 | 1 |
| Narrabri | 66/22/11 | 18/30 | 18/30 | | 33 | 0.97 | 16.3 | 16.3 | 16.3 | 16.3 | 16.3 | 5.85 | 9 |
| Walgett | 66/22 | 10/16 | 10 | | 11 | 0.99 | 5.0 | 4.9 | 4.9 | 4.8 | 4.8 | 1.46 | 13.5 |
| Wee Waa | 66/22 | 10 | 10 | | 11 | 0.92 | 10.6 | 10.8 | 10.9 | 11.0 | 11.2 | 1.63 | 0.5 |

| WINTER | Narrabri Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Brewarrina | 66/22 | 6.5/8 | | | 0 | 0.92 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 0.59 | 14.5 |
| Burren Junction | 66/22 | 5 | 5 | | 6 | 0.98 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 0.46 | 0.5 |
| Lightning Ridge | 66/22 | 8 | 5 | | 6 | 1.00 | 2.6 | 2.6 | 2.6 | 2.5 | 2.5 | 1.13 | 3.5 |
| Merrywinebone | 66/22 | 5 | | | 0 | 1.00 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 0.39 | 4.5 |
| Narrabri | 66/22/11 | 18/30 | 18/30 | | 36 | 0.98 | 15.8 | 15.8 | 15.8 | 15.8 | 15.8 | 5.85 | 2.5 |
| Walgett | 66/22 | 10/16 | 10 | | 12 | 0.94 | 3.9 | 3.8 | 3.7 | 3.7 | 3.6 | 1.46 | 8.5 |
| Wee Waa | 66/22 | 10 | 10 | | 12 | 0.97 | 8.9 | 8.9 | 8.9 | 8.9 | 8.9 | 1.63 | 5.5 |

## Sub-transmission Single Line Diagram of Narrabri area

Please refer to the Sub-transmission Single Line Diagram of Moree area on Page 61.

### 2.3.20 Gunnedah Supply Area

#### Description of Gunnedah area

All zone substations in the Gunnedah area are in the Northern Tablelands region.

The Gunnedah area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Gunnedah.

| GUNNEDAH – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – GDH6501 M65 Wandobah | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 877 | 66 | TransGrid Gunnedah 132/66kV STS | Keepit Dam ZS | 10 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 16 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 878/1 | 66 | Gunnedah ZS | Emerald Hill Sw Stn | 24 | 15.8 | 15.8 | 15.8 | 15.8 | 15.8 | 29 | 4.7 | 16.7 | 16.7 | 16.7 | 16.7 |
| 878/5 | 66 | Emerald Hill Sw Stn | Boggabri ZS | 24 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 29 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| 88K | 66 | TransGrid Gunnedah 132/66kV STS | Gunnedah ZS | 61 | 20.3 | 20.3 | 20.4 | 20.5 | 20.5 | 68 | 13.6 | 19.8 | 20.1 | 20.3 | 20.5 |
| 88L | 66 | TransGrid Gunnedah 132/66kV STS | Gunnedah ZS | 61 | 20.3 | 20.3 | 20.4 | 20.5 | 20.5 | 68 | 13.6 | 19.8 | 20.1 | 20.3 | 20.5 |

A 7MW hydro generator is located at Lake Keepit and is connected to the TransGrid Gunnedah 132/66kV sub-transmission substation at 66kV via feeder 877.

#### STS and ZS load forecast

| SUMMER | Gunnedah Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Boggabri | 66/11 | 5/6.5 | 10 | | 7.15 | 0.95 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 0.84 | 6.5 |
| Gunnedah 22kV | 66/22/11 | 18/30 | 18/30 | | 33 | 0.97 | 24.7 | 24.8 | 24.9 | 25.1 | 25.2 | 4.81 | 10 |
| Keepit Dam | 66/11 | 1 | | | 0 | 0.94 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.00 | 4.5 |

| WINTER | Gunnedah Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Boggabri | 66/11 | 5/6.5 | 10 | | 7.8 | 0.97 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 0.84 | 28 |
| Gunnedah 22kV | 66/22/11 | 18/30 | 18/30 | | 36 | 1.00 | 22.5 | 23.0 | 23.4 | 23.9 | 24.4 | 4.81 | 2 |
| Keepit Dam | 66/11 | 1 | | | 0 | 0.99 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.00 | 1 |

#### Sub-transmission Single Line Diagram of Gunnedah area

Please refer to the Sub-transmission Single Line Diagram of Moree area on Page 61.

### 2.3.21 Tamworth Supply Area

Description of Tamworth area

All zone substations in the Tamworth area are in the Northern Tablelands region.

The Tamworth area sub-transmission system is supplied from the TransGrid 132/66kV sub-transmission substation at Tamworth.

| TAMWORTH – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – MLA3B3 West/Nth Rural | 3.3 |

## Sub-transmission feeder load forecast

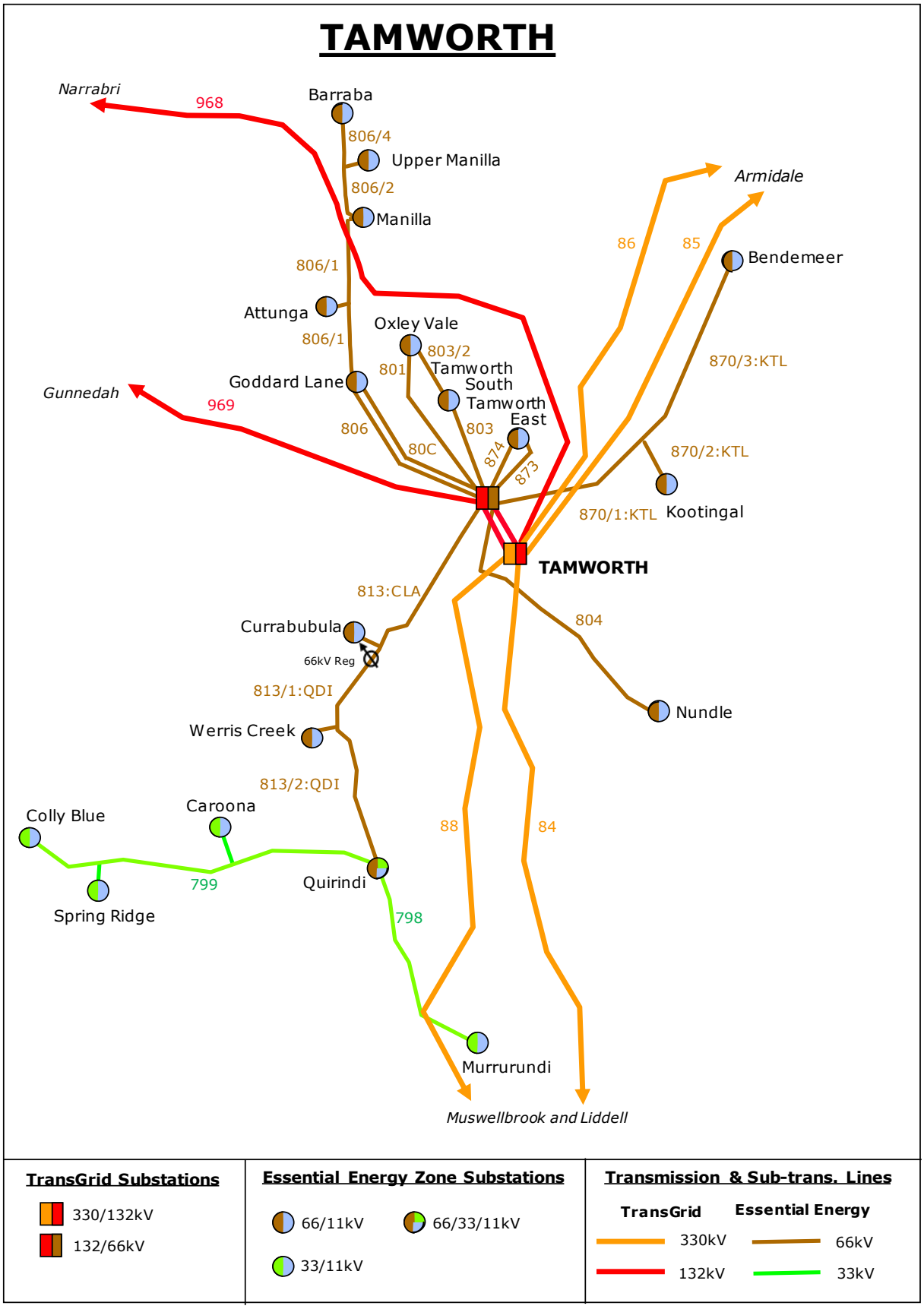
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 801 | 66 | Transgrid Tamworth 132/66kV STS | Oxley Vale ZS | 63 | 13.8 | 14.2 | 14.6 | 15.0 | 15.4 | 70 | 11.4 | 11.6 | 11.8 | 12.0 | 12.2 |
| 803 | 66 | Transgrid Tamworth 132/66kV STS | South Tamworth ZS | 70 | 28.8 | 29.2 | 29.7 | 30.1 | 30.6 | 78 | 24.7 | 24.8 | 25.0 | 25.2 | 25.4 |
| 804 | 66 | Transgrid Tamworth 132/66kV STS | Nundle ZS | 8 | 2.3 | 2.4 | 2.4 | 2.5 | 2.5 | 13 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| 806 | 66 | Transgrid Tamworth 132/66kV STS | Goddard Lane ZS | 38 | 12.4 | 12.6 | 12.8 | 13.0 | 13.2 | 47 | 9.5 | 9.6 | 9.6 | 9.7 | 9.8 |
| 873 | 66 | Transgrid Tamworth 132/66kV STS | East Tamworth ZS | 53 | 18.1 | 18.4 | 18.7 | 18.9 | 19.2 | 61 | 12.9 | 13.0 | 13.1 | 13.2 | 13.3 |
| 874 | 66 | Transgrid Tamworth 132/66kV STS | East Tamworth ZS | 53 | 17.2 | 17.5 | 17.8 | 18.1 | 18.3 | 61 | 12.2 | 12.3 | 12.4 | 12.5 | 12.6 |
| 803/2 | 66 | South Tamworth ZS | Oxley Vale ZS | 63 | 5.2 | 5.3 | 5.4 | 5.5 | 5.6 | 70 | 4.7 | 4.8 | 4.8 | 4.9 | 4.9 |
| 806/1 | 66 | Goddard Lane ZS | Attunga ZS | 18 | 13.4 | 13.6 | 13.9 | 14.1 | 14.3 | 33 | 7.8 | 7.9 | 8.0 | 8.0 | 8.1 |
| 806/1 | 66 | Attunga ZS | Manilla ZS | 18 | 9.4 | 9.6 | 9.7 | 9.9 | 10.0 | 33 | 5.7 | 5.7 | 5.8 | 5.8 | 5.8 |
| 806/2 | 66 | Manilla ZS | Upper Manilla ZS | 18 | 3.4 | 3.4 | 3.5 | 3.5 | 3.6 | 33 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| 806/4 | 66 | Upper Manilla ZS | Barraba ZS | 15 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 25 | 2.2 | 2.2 | 2.3 | 2.3 | 2.3 |
| 80C | 66 | Transgrid Tamworth 132/66kV STS | Goddard Lane ZS | 61 | 11.1 | 11.3 | 11.5 | 11.6 | 11.8 | 68 | 7.9 | 8.0 | 8.1 | 8.1 | 8.2 |
| 813:CLA | 66 | Transgrid Tamworth 132/66kV STS | Currububula ZS | 28 | 18.8 | 19.1 | 19.4 | 19.7 | 20.0 | 34 | 13.5 | 13.6 | 13.7 | 13.8 | 13.9 |
| 813/1:QDI | 66 | Currububula ZS | Werris Creek ZS | 28 | 15.7 | 15.9 | 16.2 | 16.4 | 16.7 | 34 | 11.4 | 11.5 | 11.6 | 11.6 | 11.7 |
| 813/2:QDI | 66 | Werris Creek ZS | Quirindi ZS | 28 | 12.9 | 13.0 | 13.2 | 13.3 | 13.5 | 34 | 9.3 | 9.3 | 9.2 | 9.2 | 9.2 |
| 870/1:KTL | 66 | Transgrid Tamworth 132/66kV STS | Kootingal Tee | 14 | 7.2 | 7.3 | 7.4 | 7.5 | 7.6 | 21 | 4.9 | 5.0 | 5.0 | 5.0 | 5.1 |
| 870/2:KTL | 66 | Kootingal Tee | Kootingal ZS | 12 | 6.9 | 7.1 | 7.3 | 7.5 | 7.8 | 20 | 4.8 | 4.7 | 4.6 | 4.5 | 4.4 |
| 870/3:KTL | 66 | Kootingal Tee | Bendemeer ZS | 13 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 21 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 |
| 798 | 33 | Quirindi ZS | Murrurundi ZS | 4 | 3.0 | 3.0 | 3.1 | 3.1 | 3.1 | 6 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| 799/1 | 33 | Quirindi ZS | Caroona Tee | 6 | 3.4 | 3.4 | 3.5 | 3.5 | 3.6 | 10 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| 799/2 | 33 | Caroona Tee | Caroona ZS | 4 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| 799/3 | 33 | Caroona Tee | Spring Ridge ZS | 3 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 5 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 |
| 799/4 | 33 | Spring Ridge ZS | Colly Blue ZS | 3 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

## STS and ZS load forecast

| SUMMER | Tamworth Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Attunga | 66/11 | 5 | 8 | | 5.5 | 0.95 | 4.0 | 4.0 | 4.1 | 4.1 | 4.2 | 0.82 | 2 |
| Barraba | 66/11 | 5 | 5 | | 5.5 | 0.98 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 0.81 | 4.5 |
| Bendemeer | 66/11 | 3 | 1 | | 1.1 | 1.00 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.30 | 0.5 |
| Caroona | 33/11 | 2 | 3 | | 2.2 | 0.86 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.04 | 3 |
| Colly Blue | 33/11 | 1.5 | 3 | | 1.65 | 0.95 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 0.21 | 3 |
| Currabubula | 66/11 | 3 | | | 0 | 0.95 | 1.5 | 1.6 | 1.6 | 1.6 | 1.7 | 0.34 | 6.5 |
| Goddard Lane | 66/11 | 20/30 | 20/30 | | 33 | 1.00 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 0.98 | 10.5 |
| Kootingal | 66/11 | 10/16 | 10/16 | | 17.6 | 0.97 | 6.9 | 7.1 | 7.3 | 7.5 | 7.8 | 2.13 | 6.5 |
| Manilla | 66/11 | 5/6.25 | 5/6.25 | | 6.875 | 0.90 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 1.22 | 12.5 |
| Murrurundi | 33/11 | 5/8 | 5/8 | | 8.8 | 0.98 | 3.0 | 3.1 | 3.2 | 3.2 | 3.3 | 0.78 | 8 |
| Nundle | 66/11 | 2.5 | 2.5 | | 2.75 | 0.93 | 2.3 | 2.4 | 2.4 | 2.5 | 2.5 | 0.00 | 6 |
| Oxley Vale | 66/11 | 20/30 | 20/30 | | 33 | 1.00 | 19.7 | 20.3 | 20.8 | 21.4 | 22.0 | 4.36 | 6 |
| Quirindi 66/11kV | 66/33/11 | 10/13.3 | 10/13.3 | | 14.63 | 0.98 | 6.6 | 6.8 | 6.9 | 7.1 | 7.3 | 1.53 | 2.5 |
| Quirindi 66/33kV | 66/33/11 | 8/10 | 8/10 | | 11 | 0.98 | 6.3 | 6.2 | 6.2 | 6.2 | 6.2 | 0.00 | 2.5 |
| Spring Ridge | 33/11 | 1 | | | 0 | 0.96 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.13 | 1.5 |
| Tamworth East | 66/11 | 20/30 | 18/23 | 18/23 | 50.6 | 0.99 | 32.3 | 32.4 | 32.6 | 32.7 | 32.9 | 4.35 | 9 |
| Tamworth South | 66/11 | 20/30 | 20/30 | | 33 | 0.97 | 24.3 | 24.5 | 24.8 | 25.0 | 25.3 | 5.21 | 17 |
| Upper Manilla | 66/11 | 1.5 | | | 0 | 0.93 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 0.08 | 4 |
| Werris Creek | 66/11 | 8 | 5/6.25 | | 6.875 | 0.95 | 2.4 | 2.4 | 2.4 | 2.4 | 2.5 | 0.49 | 0.5 |

| WINTER | Tamworth Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Attunga | 66/11 | 5 | 8 | | 6 | 0.95 | 2.0 | 2.0 | 2.0 | 2.0 | 2.1 | 0.82 | 11 |
| Barraba | 66/11 | 5 | 5 | | 6 | 1.00 | 2.2 | 2.2 | 2.3 | 2.3 | 2.3 | 0.81 | 11 |
| Bendemeer | 66/11 | 3 | 1 | | 1.2 | 1.00 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.30 | 2 |
| Caroona | 33/11 | 2 | 3 | | 2.4 | 0.88 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.04 | 1.5 |
| Colly Blue | 33/11 | 1.5 | 3 | | 1.8 | 0.98 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.21 | 3.5 |
| Currabubula | 66/11 | 3 | | | 0 | 0.95 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.34 | 8.5 |
| Goddard Lane | 66/11 | 20/30 | 20/30 | | 36 | 0.97 | 10.5 | 10.6 | 10.7 | 10.8 | 10.9 | 0.98 | 26.5 |
| Kootingal | 66/11 | 10/16 | 10/16 | | 19.2 | 0.99 | 4.8 | 4.7 | 4.6 | 4.5 | 4.4 | 2.13 | 6.5 |
| Manilla | 66/11 | 5/6.25 | 5/6.25 | | 7.5 | 0.90 | 3.2 | 3.3 | 3.3 | 3.4 | 3.4 | 1.22 | 13 |
| Murrurundi | 33/11 | 5/8 | 5/8 | | 9.6 | 1.00 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 0.78 | 4 |
| Nundle | 66/11 | 2.5 | 2.5 | | 3 | 0.97 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.00 | 2 |
| Oxley Vale | 66/11 | 20/30 | 20/30 | | 36 | 0.98 | 16.3 | 16.5 | 16.8 | 17.1 | 17.4 | 4.36 | 2.5 |
| Quirindi 66/11kV | 66/33/11 | 10/13.3 | 10/13.3 | | 15.96 | 0.97 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 1.53 | 6 |
| Quirindi 66/33kV | 66/33/11 | 8/10 | 8/10 | | 12 | 1.00 | 4.1 | 4.1 | 4.0 | 4.0 | 4.0 | 0.00 | 2 |
| Spring Ridge | 33/11 | 1 | | | 0 | 0.97 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.13 | 3.5 |
| Tamworth East | 66/11 | 20/30 | 18/23 | 18/23 | 55.2 | 1.00 | 23.0 | 22.9 | 22.7 | 22.6 | 22.4 | 4.35 | 13 |
| Tamworth South | 66/11 | 20/30 | 20/30 | | 36 | 0.99 | 19.5 | 19.9 | 20.2 | 20.6 | 21.0 | 5.21 | 11.5 |
| Upper Manilla | 66/11 | 1.5 | | | 0 | 0.94 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.08 | 2.5 |
| Werris Creek | 66/11 | 8 | 5/6.25 | | 7.5 | 0.95 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 0.49 | 1 |

Sub-transmission Single Line Diagram of Tamworth area



### 2.3.22 Beryl Supply Area

#### Description of Beryl area

Zone substations in the Beryl area are spread across both the Northern Tablelands and Macquarie regions.

The Beryl area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation. The Mudgee substation is normally connected to the Essential Energy 132kV teed line from the TransGrid Mt Piper to Beryl 132kV transmission line with back up from the Beryl 66kV system via Gulgong.

| BERYL – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

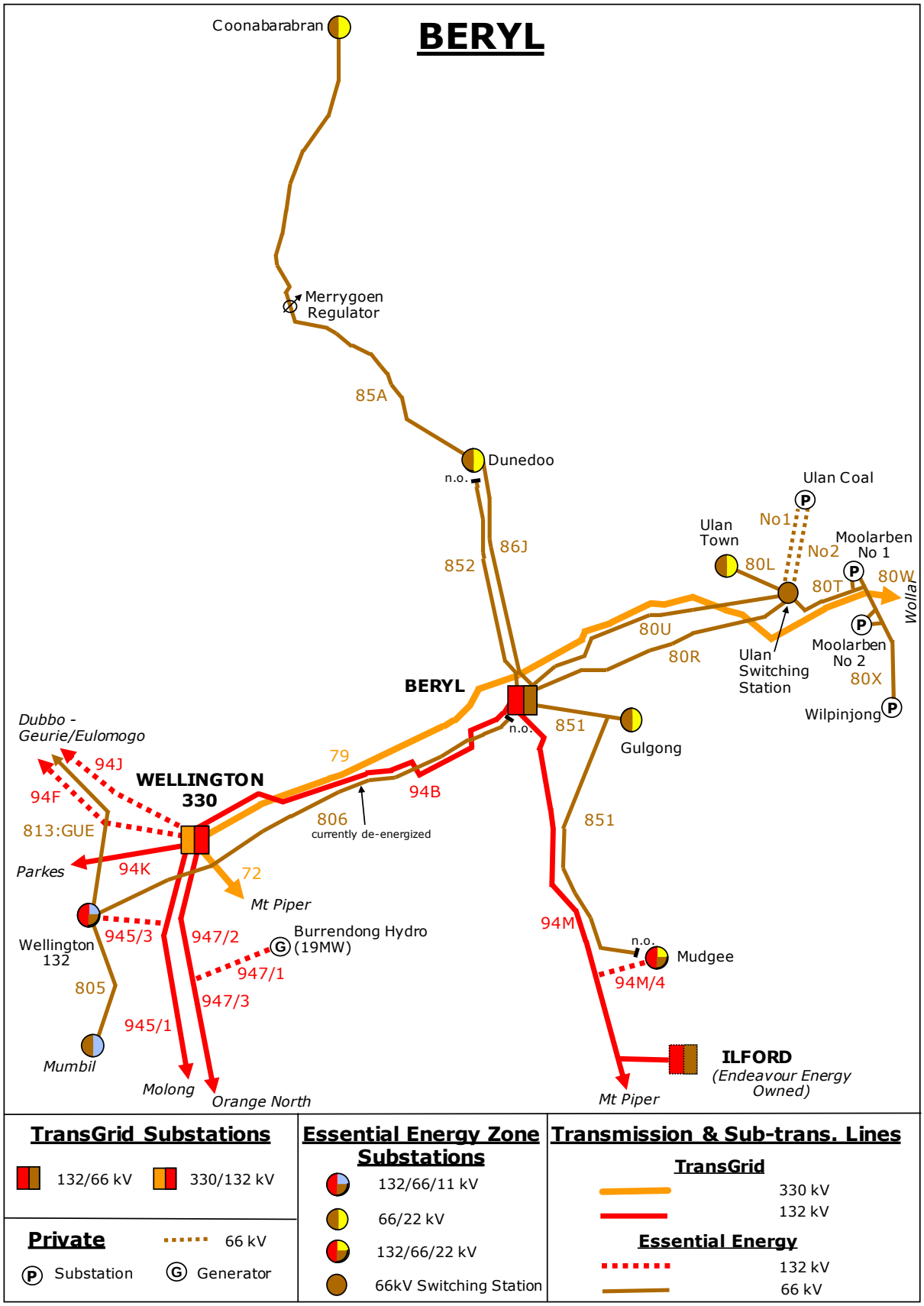
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 94W4 | 132 | TransGrid 94M Mudgee Tee | Mudgee ZS | 128 | 26.6 | 27.0 | 27.4 | 27.8 | 28.2 | 143 | 24.7 | 25.5 | 26.3 | 27.1 | 27.9 |
| 851 | 66 | TransGrid Beryl 132/66kV STS | Gulgong ZS | 28 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 32 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 |
| 851 | 66 | Gulgong ZS | Mudgee ZS | 28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 32 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 852 | 66 | TransGrid Beryl 132/66kV STS | Dunedoo ZS | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 86J | 66 | TransGrid Beryl 132/66kV STS | Dunedoo ZS | 61 | 13.9 | 14.1 | 14.2 | 14.4 | 14.6 | 68 | 13.2 | 13.3 | 13.4 | 13.5 | 13.5 |
| 85A | 66 | Dunedoo ZS | Coonabarabran ZS | 11 | 9.3 | 9.4 | 9.4 | 9.5 | 9.5 | 19 | 9.1 | 9.1 | 9.1 | 9.0 | 9.0 |
| 80L | 66 | Ulan Sw Stn | Ulan Tow n ZS | 15 | 2.1 | 2.7 | 2.7 | 2.8 | 2.8 | 25 | 2.8 | 2.8 | 2.9 | 2.9 | 2.9 |
| 80R | 66 | TransGrid Beryl 132/66kV STS | Ulan Sw Stn | 64 | 34.8 | 36.3 | 37.6 | 37.6 | 37.6 | 71 | 42.5 | 43.8 | 43.8 | 43.8 | 43.8 |
| 80U | 66 | TransGrid Beryl 132/66kV STS | Ulan Sw Stn | 61 | 35.7 | 37.2 | 38.4 | 38.4 | 38.4 | 68 | 34.3 | 35.6 | 35.6 | 35.6 | 35.6 |
| 80T | 66 | Ulan Sw Stn | Moolarben No1 Mine ZS | 43 | 27.0 | 29.5 | 32.0 | 32.0 | 32.0 | 54 | 29.7 | 32.2 | 32.2 | 32.2 | 32.2 |
| 80W | 66 | Moolarben No1 Mine ZS | Moolarben No2 Mine ZS | 43 | 12.3 | 13.6 | 14.8 | 14.8 | 14.8 | 54 | 14.0 | 15.3 | 15.3 | 15.3 | 15.3 |
| 80X | 66 | Moolarben No2 Mine ZS | Wilpinjong Mine ZS | 61 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 68 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 |

## STS and ZS load forecast

| SUMMER | Beryl Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Coonabarabran | 66/22 | 10/13 | 10/13 | | 14.3 | 1.00 | 8.5 | 8.6 | 8.6 | 8.7 | 8.7 | 3.63 | 2 |
| Dunedoo | 66/22 | 7.5/10 | 7.5/10 | | 11 | 1.00 | 5.4 | 5.5 | 5.6 | 5.7 | 5.8 | 1.89 | 3 |
| Gulgong | 66/22 | 5 | | | 0 | 0.98 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 0.75 | 2 |
| Mudgee | 132/22, 66/22 | 30 | 30 | | 33 | 0.99 | 28.2 | 28.9 | 29.5 | 30.2 | 30.8 | 6.40 | 3.5 |
| Ulan Town | 66/22 | 3 | 2.5 | | 2.75 | 0.95 | 2.1 | 2.7 | 2.7 | 2.8 | 2.8 | 0.77 | 2.5 |

| WINTER | Beryl Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Coonabarabran | 66/22 | 10/13 | 10/13 | | 15.6 | 1.00 | 8.3 | 8.3 | 8.3 | 8.2 | 8.2 | 3.63 | 1.5 |
| Dunedoo | 66/22 | 7.5/10 | 7.5/10 | | 12 | 1.00 | 4.9 | 5.0 | 5.1 | 5.3 | 5.4 | 1.89 | 1.5 |
| Gulgong | 66/22 | 5 | | | 0 | 1.00 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 0.75 | 2.5 |
| Mudgee | 132/22, 66/22 | 30 | 30 | | 36 | 1.00 | 24.7 | 25.2 | 25.7 | 26.2 | 26.6 | 6.40 | 1.5 |
| Ulan Town | 66/22 | 3 | 2.5 | | 3 | 0.95 | 2.8 | 2.8 | 2.9 | 2.9 | 2.9 | 0.77 | 1.5 |

## Sub-transmission Single Line Diagram of Beryl area



### 2.3.23 Wellington Supply Area

#### Description of Wellington area

All zone substations in the Wellington area are in the Macquarie region.

The Essential Energy Wellington 132/66/11kV zone substation is normally connected to the Essential Energy 132kV tee line #945/3 from TransGrid's Wellington to Molong 132kV transmission line #945. The 66kV supply for Mumbil is obtained from the Wellington 11kV busbar via a step up 66/11kV transformer. The backup supply for Wellington and Mumbil is via the 66kV powerline #813 from Eulomogo.

| WELLINGTON – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 945/3 | 132 | TransGrid Line 945 Wellington 132kV Tee | Wellington 132kV ZS | 124 | 10.4 | 10.4 | 10.5 | 10.5 | 10.5 | 139 | 8.1 | 8.2 | 8.4 | 8.5 | 8.6 |
| 947/1 | 132 | TransGrid Line 947 Burrendong Tee | Burrendong Hydro | 36 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 64 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| 94F | 132 | TransGrid Wellington 330/132kV STS | Dubbo 132/66kV STS | 173 | 94.7 | 95.3 | 95.8 | 96.3 | 96.9 | 194 | 83.5 | 84.0 | 84.5 | 85.1 | 85.6 |
| 94J | 132 | TransGrid Wellington 330/132kV STS | Dubbo 132/66kV STS | 173 | 87.8 | 88.3 | 88.8 | 89.3 | 89.8 | 194 | 78.2 | 78.7 | 79.2 | 79.7 | 80.2 |
| 805 | 66 | Wellington 132kV ZS | Mumbil ZS | 11 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 19 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 |
| 813:WGN | 66 | Wellington 132kV ZS | Geurie Tee | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### STS and ZS load forecast

| SUMMER | Wellington Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Mumbil | 66/11 | 2.5 | 2.8 | | 2.75 | 0.95 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 0.26 | 7.5 |
| Wellington 11kV | 132/11, 66/11 | 10 | 15 | | 11 | 0.97 | 10.4 | 10.4 | 10.5 | 10.5 | 10.5 | 1.93 | 4.5 |

| WINTER | Wellington Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Mumbil | 66/11 | 2.5 | 2.8 | | 3 | 0.95 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 0.26 | 1.5 |
| Wellington 11kV | 132/11, 66/11 | 10 | 15 | | 12 | 0.99 | 8.1 | 8.2 | 8.4 | 8.5 | 8.6 | 1.93 | 13 |

#### Sub-transmission Single Line Diagram of Wellington area

Please refer to the Sub-transmission Single Line Diagram of Beryl area on Page 71.

### 2.3.24 Dubbo Supply Area

Description of Dubbo area

Zone substations in the Dubbo area are spread across both the Macquarie and North Western regions.

Essential Energy owns two 132kV powerlines emanating from the TransGrid owned Wellington 330/132kV sub-transmission substation that support the Dubbo 132/66kV sub-transmission substation and Nyngan 132/66kV sub-transmission substation supply areas.

The Narromine zone substation is supplied from the Narromine South Switching station connected to the 943 Dubbo to Nyngan 132kV line.

The Nevertire zone substation is normally supplied from the 132kV network via a tee, off the 94W Dubbo to Nyngan 132kV line, with back up supply available from Nyngan 66kV system via Nyngan Town.

| DUBBO – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – CNB32 Coonamble Town No.2 | 3.3 |

## Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 943/1 | 132 | 94F Tee | Dubbo South ZS | 106 | 41.6 | 41.8 | 42.1 | 42.3 | 42.5 | 119 | 37.4 | 37.6 | 37.8 | 38.1 | 38.3 |
| 943/2 | 132 | Dubbo South ZS | Narromine South Sw Stn | 106 | 26.5 | 26.7 | 26.8 | 27.0 | 27.1 | 119 | 24.0 | 24.2 | 24.3 | 24.5 | 24.6 |
| 94W/1 | 132 | Dubbo 132/66kV STS | Nevertire Tee | 128 | 39.4 | 39.6 | 39.9 | 40.1 | 40.3 | 143 | 36.2 | 36.4 | 36.6 | 36.9 | 37.1 |
| 94W/2 | 132 | Nevertire Tee | Nevertire ZS | 124 | 6.8 | 6.9 | 6.9 | 6.9 | 6.9 | 139 | 9.4 | 9.7 | 10.0 | 10.4 | 10.7 |
| 94W/3 | 132 | Nevertire Tee | Nyngan 132/66kV STS | 128 | 31.9 | 32.1 | 32.3 | 32.4 | 32.6 | 143 | 27.8 | 28.0 | 28.1 | 28.3 | 28.5 |
| 9GP | 132 | Narromine South Sw Stn | Narromine ZS | 124 | 13.8 | 14.2 | 14.5 | 14.9 | 15.2 | 139 | 13.3 | 13.4 | 13.5 | 13.6 | 13.8 |
| 9GR | 132 | Narromine South Sw Stn | Narromine ZS | 124 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 139 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9GT | 132 | Dubbo West ZS | Narromine South Sw Stn | 140 | 25.5 | 25.7 | 25.8 | 26.0 | 26.1 | 157 | 22.9 | 23.0 | 23.2 | 23.3 | 23.5 |
| 9GU | 132 | Narromine South Sw Stn | Nyngan 132/66kV STS | 106 | 39.3 | 39.5 | 39.8 | 40.0 | 40.2 | 119 | 35.6 | 35.8 | 36.0 | 36.3 | 36.5 |
| 9GW | 132 | Dubbo 132/66kV STS | Dubbo West ZS | 140 | 36.2 | 36.4 | 36.6 | 36.8 | 37.0 | 157 | 32.9 | 33.2 | 33.4 | 33.6 | 33.8 |
| 812 | 66 | Yarrandale ZS | Gilgandra ZS | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 815 | 66 | Dubbo 132/66kV STS | Phillip St ZS | 24 | 12.4 | 12.2 | 12.0 | 11.8 | 11.6 | 28 | 10.1 | 9.9 | 9.8 | 9.6 | 9.5 |
| 816 | 66 | Dubbo 132/66kV STS | Phillip St ZS | 24 | 12.4 | 12.2 | 12.0 | 11.8 | 11.6 | 28 | 10.1 | 9.9 | 9.8 | 9.6 | 9.5 |
| 813:EUL | 66 | Eulomogo ZS | Geurie Tee | 12 | 1.7 | 1.8 | 1.8 | 1.9 | 1.9 | 18 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 |
| 813/1:GUE | 66 | Geurie Tee | Geurie ZS | 16 | 1.7 | 1.8 | 1.8 | 1.9 | 1.9 | 27 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 |
| 814/1 | 66 | Gilgandra ZS | Gulargambone ZS | 11 | 7.8 | 7.9 | 8.0 | 8.0 | 8.1 | 19 | 6.8 | 6.7 | 6.7 | 6.7 | 6.7 |
| 814/2 | 66 | Gulargambone ZS | Coonamble ZS | 11 | 6.2 | 6.2 | 6.3 | 6.4 | 6.4 | 19 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 |
| 81M | 66 | Dubbo 132/66kV STS | Eulomogo ZS | 20 | 9.9 | 9.9 | 10.0 | 10.1 | 10.1 | 39 | 9.3 | 9.4 | 9.4 | 9.5 | 9.6 |
| 81P | 66 | Dubbo 132/66kV STS | Yarrandale ZS | 61 | 10.6 | 10.6 | 10.7 | 10.7 | 10.8 | 68 | 10.4 | 10.5 | 10.5 | 10.6 | 10.7 |
| 81R | 66 | Dubbo 132/66kV STS | Eulomogo ZS | 20 | 10.3 | 10.4 | 10.4 | 10.5 | 10.6 | 39 | 9.7 | 9.7 | 9.8 | 9.9 | 9.9 |
| 81X | 66 | Dubbo 132/66kV STS | Yarrandale ZS | 28 | 11.6 | 11.6 | 11.7 | 11.8 | 11.8 | 34 | 11.3 | 11.3 | 11.4 | 11.5 | 11.6 |
| 81T | 66 | Yarrandale ZS | Gilgandra ZS | 43 | 15.1 | 15.0 | 15.0 | 14.9 | 14.9 | 54 | 13.1 | 13.2 | 13.2 | 13.2 | 13.2 |

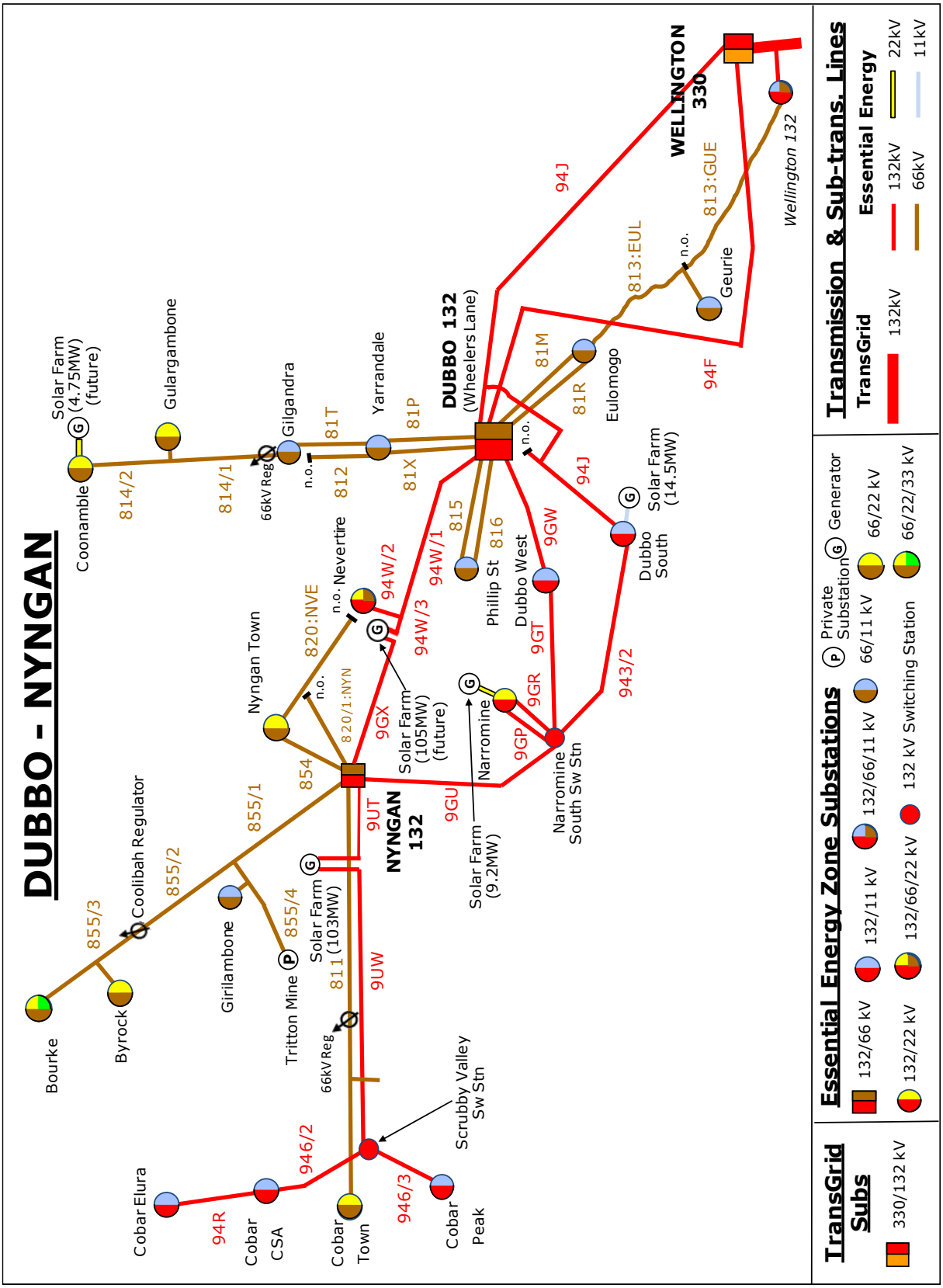
## STS and ZS load forecast

| SUMMER | Dubbo Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Coonamble | 66/22 | 10 | 10 | | 11 | 1.00 | 6.2 | 6.2 | 6.3 | 6.4 | 6.4 | 1.77 | 5.5 |
| Dubbo 132/66kV | 132/66 | 30/45 | 30/45 | 30/45 | 99 | 0.96 | 69.4 | 67.6 | 65.7 | 63.9 | 62.1 | 0.00 | 8 |
| Dubbo Phillip St | 66/11 | 20/30 | 20/30 | | 33 | 0.93 | 24.9 | 24.5 | 24.1 | 23.7 | 23.3 | 2.60 | 9.5 |
| Dubbo South | 132/11 | 30 | 30 | | 33 | 0.98 | 18.7 | 19.3 | 19.9 | 20.5 | 21.1 | 5.06 | 4.5 |
| Dubbo West | 132/11 | 15/23 | 15/23 | | 25.3 | 0.97 | 15.7 | 16.2 | 16.6 | 17.1 | 17.6 | 4.67 | 5 |
| Eulomogo | 66/11 | 15/30 | 20/30 | | 33 | 0.96 | 21.0 | 21.2 | 21.4 | 21.5 | 21.7 | 6.59 | 2.5 |
| Geurie | 66/11 | 5 | | | 0 | 0.97 | 1.7 | 1.8 | 1.8 | 1.9 | 1.9 | 0.51 | 3 |
| Gilgandra | 66/11 | 8/12 | 8/12 | | 13.2 | 0.98 | 7.1 | 7.0 | 6.9 | 6.8 | 6.7 | 2.13 | 7 |
| Gulargambone | 66/22 | 3 | | | 0 | 0.95 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 0.49 | 4.5 |
| Narromine | 132/22 | 17/24 | 24 | | 26.4 | 1.00 | 13.8 | 14.2 | 14.5 | 14.9 | 15.2 | 4.14 | 3.5 |
| Nevertire | 132/22, 66/22 | 17/24 | 10 | | 11 | 0.99 | 6.8 | 6.9 | 6.9 | 6.9 | 6.9 | 2.01 | 9 |
| Yarrandale | 66/11 | 18/25 | 30 | | 27.5 | 0.93 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0.96 | 14 |

| WINTER | Dubbo Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Coonamble | 66/22 | 10 | 10 | | 12 | 0.99 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 1.77 | 1.5 |
| Dubbo 132/66kV | 132/66 | 30/45 | 30/45 | 30/45 | 108 | 0.99 | 57.4 | 56.6 | 55.8 | 55.0 | 54.2 | 0.00 | 1.5 |
| Dubbo Phillip St | 66/11 | 20/30 | 20/30 | | 36 | 0.96 | 20.1 | 19.8 | 19.5 | 19.2 | 18.9 | 2.60 | 2 |
| Dubbo South | 132/11 | 30 | 30 | | 36 | 1.00 | 16.6 | 17.1 | 17.6 | 18.1 | 18.6 | 5.06 | 1.5 |
| Dubbo West | 132/11 | 15/23 | 15/23 | | 27.6 | 0.99 | 13.4 | 13.6 | 13.8 | 14.1 | 14.3 | 4.67 | 2 |
| Eulomogo | 66/11 | 15/30 | 20/30 | | 36 | 0.99 | 19.8 | 19.9 | 20.0 | 20.1 | 20.2 | 6.59 | 1.5 |
| Geurie | 66/11 | 5 | | | 0 | 0.99 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 0.51 | 3 |
| Gilgandra | 66/11 | 8/12 | 8/12 | | 14.4 | 0.99 | 6.3 | 6.3 | 6.3 | 6.3 | 6.4 | 2.13 | 1.5 |
| Gulargambone | 66/22 | 3 | | | 0 | 0.95 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.49 | 1.5 |
| Narromine | 132/22 | 17/24 | 24 | | 28.8 | 1.00 | 13.3 | 13.4 | 13.5 | 13.6 | 13.8 | 4.14 | 8.5 |
| Nevertire | 132/22, 66/22 | 17/24 | 10 | | 12 | 0.99 | 9.4 | 9.7 | 10.0 | 10.4 | 10.7 | 2.01 | 4 |
| Yarrandale | 66/11 | 18/25 | 30 | | 30 | 0.92 | 6.9 | 6.9 | 6.9 | 6.9 | 7.0 | 0.96 | 15.5 |

A 9.2MW solar generator is located at Narromine on the 22kV network, and a 14.5MW solar generator is connected at Dubbo South on the 11kV network.

Sub-transmission Single Line Diagram of Dubbo area



### 2.3.25 Nyngan Supply Area

#### Description of Nyngan area

All zone substations in the Nyngan area are in the North Western region.

Essential Energy's Nyngan 132/66kV substation is supplied from our Dubbo 132/66kV sub-transmission substation via two Essential Energy 132kV transmission lines. The 94W Dubbo to Nyngan 132kV line has a tee connection into Nevertire, with back up supply available from Nyngan 66kV system via Nyngan Town and the 943 Dubbo to Nyngan 132kV line via Narromine South switching station.

| NYNGAN – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 9UT | 132 | Nyngan 132/66kV STS | Nyngan Solar Farm | 106 | 62.7 | 62.7 | 62.7 | 62.7 | 62.6 | 119 | 69.0 | 68.7 | 68.3 | 67.9 | 67.5 |
| 9UW | 132 | Nyngan Solar Farm | Scrubby Valley Sw Stn | 106 | 47.9 | 47.9 | 47.9 | 47.9 | 48.0 | 119 | 43.8 | 44.2 | 44.5 | 44.9 | 45.3 |
| 946/2 | 132 | Scrubby Valley Sw Stn | Cobar CSA ZS | 106 | 28.7 | 28.7 | 28.8 | 28.8 | 28.8 | 119 | 25.6 | 26.0 | 26.4 | 26.8 | 27.2 |
| 946/3 | 132 | Scrubby Valley Sw Stn | Cobar Peak ZS | 102 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 114 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 |
| 94R | 132 | Cobar CSA ZS | Cobar Elura ZS | 128 | 9.2 | 9.2 | 9.2 | 9.2 | 9.3 | 143 | 8.9 | 8.8 | 8.8 | 8.7 | 8.6 |
| 811 | 66 | Nyngan 132/66kV STS | Cobar Town ZS | 10 | 8.0 | 8.1 | 8.2 | 8.3 | 8.4 | 16 | 6.9 | 7.0 | 7.0 | 7.0 | 7.0 |
| 854 | 66 | Nyngan 132/66kV STS | Nyngan Town ZS | 15 | 8.6 | 8.9 | 9.3 | 9.6 | 10.0 | 25 | 6.7 | 6.8 | 6.9 | 6.9 | 7.0 |
| 820/1:NYN | 66 | Nyngan Town ZS | Nevertire Tee | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 820:NVE | 66 | Nyngan 132/66kV STS | Nevertire ZS | 11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 855/1 | 66 | Nyngan 132/66kV STS | Girilambone Tee | 28 | 14.9 | 14.9 | 15.0 | 15.0 | 15.1 | 34 | 16.2 | 16.4 | 16.5 | 16.6 | 16.8 |
| 855/1a | 66 | Girilambone Tee | Girilambone ZS | 24 | 10.1 | 10.2 | 10.2 | 10.2 | 10.3 | 29 | 10.6 | 10.7 | 10.8 | 11.0 | 11.1 |
| 855/2 | 66 | Girilambone Tee | Byrock Tee | 28 | 8.5 | 8.5 | 8.5 | 8.6 | 8.6 | 34 | 9.7 | 9.8 | 9.8 | 9.8 | 9.9 |
| 855/3 | 66 | Byrock Tee | Bourke ZS | 28 | 8.1 | 8.1 | 8.1 | 8.1 | 8.2 | 34 | 9.3 | 9.4 | 9.4 | 9.4 | 9.5 |
| 855/3a | 66 | Byrock Tee | Byrock ZS | 15 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 25 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 855/4 | 66 | Girilambone ZS | Tritton Mine ZS | 24 | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 | 29 | 9.4 | 9.5 | 9.6 | 9.7 | 9.7 |

A 102MW solar generator is located at Nyngan Solar Farm and is connected to the Nyngan 132/66kV sub-transmission substation at 132kV via the feeder 9UT.

## STS and ZS load forecast

| SUMMER | Nyngan Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bourke 22kV | 66/22 | 10 | 10 | | 11 | 0.99 | 5.9 | 5.8 | 5.8 | 5.8 | 5.8 | 1.45 | 4 |
| Bourke 33kV | 66/33 | 5/8 | | | 0 | 0.69 | 3.1 | 3.1 | 3.2 | 3.2 | 3.3 | 0.42 | 7.5 |
| Byrock | 66/22 | 1 | 1 | | 1.1 | 0.85 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.03 | 0.5 |
| Cobar CSA | 132/11 | 15/18 | 15/18 | | 19.8 | 1.00 | 22.0 | 22.0 | 22.0 | 22.0 | 22.0 | 0.00 | 7 |
| Cobar Elura | 132/11 | 15 | 15 | | 16.5 | 0.98 | 9.2 | 9.2 | 9.2 | 9.2 | 9.3 | 0.00 | 42 |
| Cobar Peak | 132/11 | 15/22 | 15/22 | | 24.2 | 0.95 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 0.00 | 127.5 |
| Cobar Town | 66/22 | 8/11 | 10/13 | | 12.1 | 0.95 | 7.0 | 7.1 | 7.2 | 7.3 | 7.4 | 2.24 | 20.5 |
| Girilambone | 66/11 | 10/12.5 | | | 0 | 0.91 | 2.1 | 2.2 | 2.3 | 2.3 | 2.4 | 0.00 | 5.5 |
| Nyngan 132kV | 132/66 | 18/30 | 30/45 | | 33 | 1.00 | 32.0 | 32.4 | 32.9 | 33.4 | 33.9 | 0.00 | 18.5 |
| Nyngan Town | 66/22 | 10 | 10 | | 11 | 1.00 | 8.6 | 8.9 | 9.3 | 9.6 | 10.0 | 1.46 | 15 |

| WINTER | Nyngan Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bourke 22kV | 66/22 | 10 | 10 | | 12 | 0.98 | 7.0 | 7.1 | 7.1 | 7.1 | 7.2 | 1.45 | 3.5 |
| Bourke 33kV | 66/33 | 5/8 | | | 0 | 0.45 | 3.3 | 3.4 | 3.4 | 3.4 | 3.4 | 0.42 | 16 |
| Byrock | 66/22 | 1 | 1 | | 1.2 | 0.73 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.03 | 1 |
| Cobar CSA | 132/11 | 15/18 | 15/18 | | 21.6 | 0.99 | 18.9 | 19.4 | 19.9 | 20.4 | 21.0 | 0.00 | 2 |
| Cobar Elura | 132/11 | 15 | 15 | | 18 | 0.99 | 8.9 | 8.8 | 8.8 | 8.7 | 8.6 | 0.00 | 27.5 |
| Cobar Peak | 132/11 | 15/22 | 15/22 | | 26.4 | 0.95 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 0.00 | 23 |
| Cobar Town | 66/22 | 8/11 | 10/13 | | 13.2 | 0.95 | 5.9 | 6.0 | 6.0 | 6.0 | 6.0 | 2.24 | 2.5 |
| Girilambone | 66/11 | 10/12.5 | | | 0 | 0.89 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 0.00 | 24.5 |
| Nyngan 132kV | 132/66 | 18/30 | 30/45 | | 36 | 1.00 | 29.7 | 30.1 | 30.4 | 30.8 | 31.1 | 0.00 | 5 |
| Nyngan Town | 66/22 | 10 | 10 | | 12 | 0.98 | 6.7 | 6.8 | 6.9 | 6.9 | 7.0 | 1.46 | 6.5 |

## Sub-transmission Single Line Diagram of Nyngan area

Please refer to the Sub-transmission Single Line Diagram of Dubbo area on Page 76.

### 2.3.26 Broken Hill Supply Area

#### Description of Broken Hill area

All zone substations in the Broken Hill area are in the North Western region.

The Broken Hill area is supplied from TransGrid's 220/22kV substation. Essential Energy utilises two 22kV lines and steps them up to 66kV for supply to Mt Gipps and Sunset Strip from which 33kV and other voltage levels are derived for specific purposes.

| BROKEN HILL – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Multiple Feeders – TransGrid's Broken Hill 220/22kV substation | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| X4 | 220 | TransGrid Broken Hill 220/22kV STS | Perilya Mine | 213 | 24.2 | 24.4 | 24.7 | 25.0 | 25.3 | 238 | 25.0 | 25.2 | 25.5 | 25.8 | 26.0 |
| 5B1:PPL | 66 | Pinnacles Place ZS | Mt Gipps ZS | 19 | 8.9 | 9.0 | 9.2 | 9.3 | 9.4 | 33 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 |
| 5B1:MTG | 66 | Mt Gipps ZS | Sunset Strip ZS | 19 | 6.8 | 6.9 | 7.0 | 7.1 | 7.2 | 33 | 5.4 | 5.4 | 5.4 | 5.4 | 5.5 |
| 5B1:SUN | 66 | Sunset Strip ZS | Menindee ZS | 6 | 2.1 | 2.1 | 2.1 | 2.1 | 2.2 | 9 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |

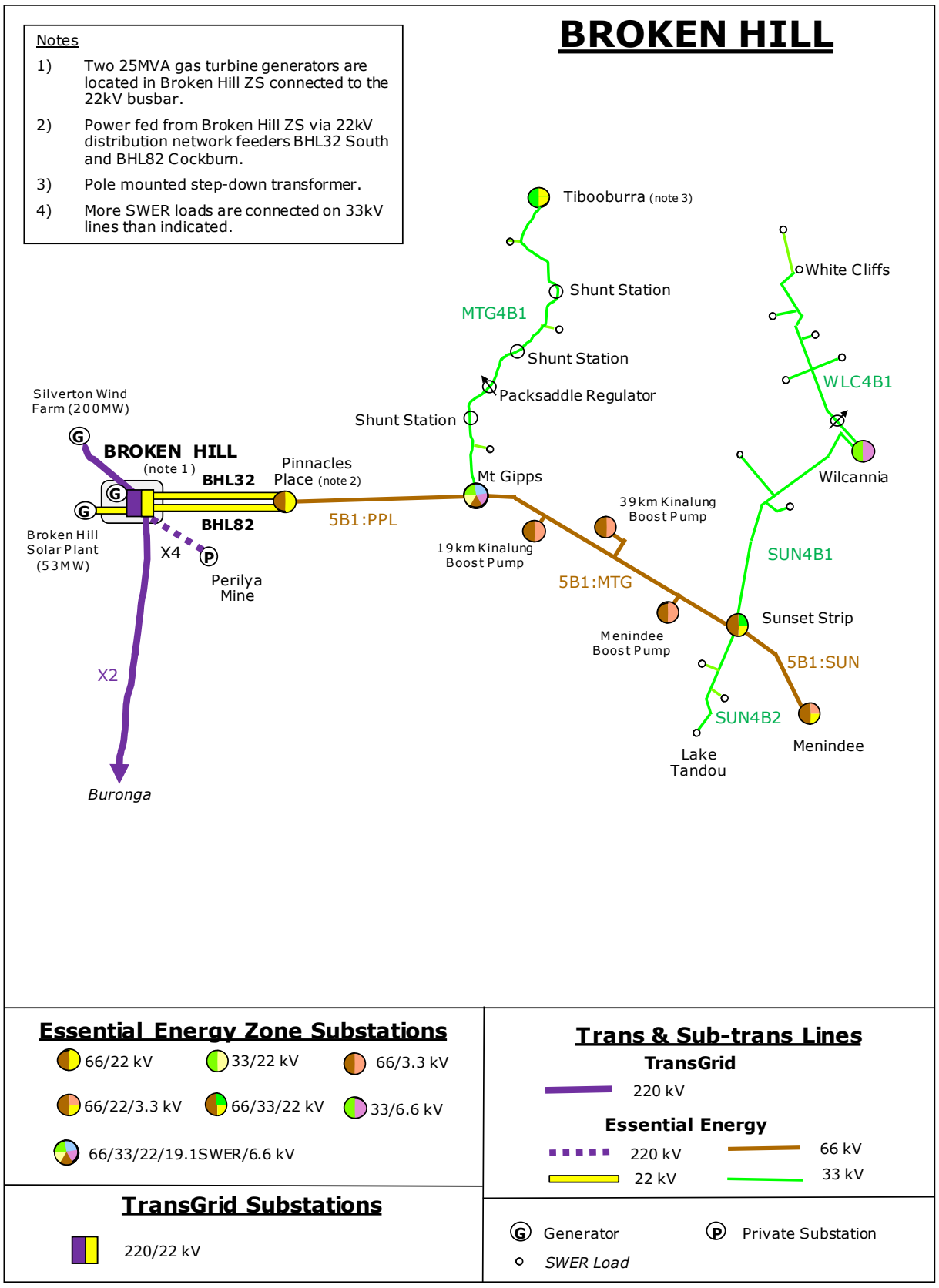
A 53MW solar generator is located at Broken Hill and is connected to the TransGrid Broken Hill 220/22kV sub-transmission substation at 22kV.

## STS and ZS load forecast

| SUMMER | Broken Hill Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| TransGrid 220/22kV Total Broken Hill 22kV Supply | | | | | | 0.97 | 42.2 | 42.7 | 43.3 | 43.8 | 44.3 | 9.07 | 13.5 |
| Wilcannia 33kV | | | | | | 0.87 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.16 | 8 |
| Menindee | 66/22 | 5 | 5 | | 5.5 | 0.96 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.43 | 2.5 |
| Mt Gipps 33kV | 66/33 | 1.5 | 1.5 | | 1.65 | 0.95 | 1.2 | 1.3 | 1.3 | 1.3 | 1.4 | 0.47 | 5 |
| Mt Gipps 6.6kV | 66/6.6 | 1.5 | 1.5/2 | | 1.65 | 0.99 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 0.03 | 1016.5 |
| Pinnacles Place | 22/66 | 15 | 15 | | 16.5 | 1.00 | 7.9 | 7.9 | 8.0 | 8.0 | 8.1 | 0.00 | 9.5 |
| Sunset Strip 22kV | 66/22 | 5 | | | 0 | 0.94 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 0.06 | 4 |
| Sunset Strip 33kV | 66/33 | 4 | 4 | | 4.4 | 0.92 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 0.16 | 3 |
| Wilcannia 6.6kV | 33/6.6 | 3.5 | 3.5 | | 3.85 | 0.94 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.24 | 10.5 |

| WINTER | Broken Hill Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| TransGrid 220/22kV Total Broken Hill 22kV Supply | | | | | | 1.00 | 33.4 | 33.5 | 33.5 | 33.6 | 33.7 | 9.07 | 8 |
| Wilcannia 33kV | | | | | | 0.76 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.16 | 1 |
| Menindee | 66/22 | 5 | 5 | | 6 | 1.00 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.43 | 1.5 |
| Mt Gipps 33kV | 66/33 | 1.5 | 1.5 | | 1.8 | 0.81 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.47 | 5.5 |
| Mt Gipps 6.6kV | 66/6.6 | 1.5 | 1.5/2 | | 1.8 | 0.99 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.03 | 16 |
| Pinnacles Place | 22/66 | 15 | 15 | | 18 | 0.94 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 0.00 | 2.5 |
| Sunset Strip 22kV | 66/22 | 5 | | | 0 | 0.98 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.06 | 15.5 |
| Sunset Strip 33kV | 66/33 | 4 | 4 | | 4.8 | 0.88 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.16 | 18 |
| Wilcannia 6.6kV | 33/6.6 | 3.5 | 3.5 | | 4.2 | 0.98 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.24 | 2 |

## Sub-transmission Single Line Diagram of Broken Hill area



### 2.3.27 Orange Supply Area

#### Description of Orange area

All zone substations in the Orange area are in the Macquarie region.

The Orange area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation, with the Orange town substations (Industrial, North, South and West) being supplied via a 66kV ring network. The Orange area provides a back-up 66kV supply to Molong via Orange West which supplies Cumnock and Molong via a 66/11kV transformer.

| ORANGE – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

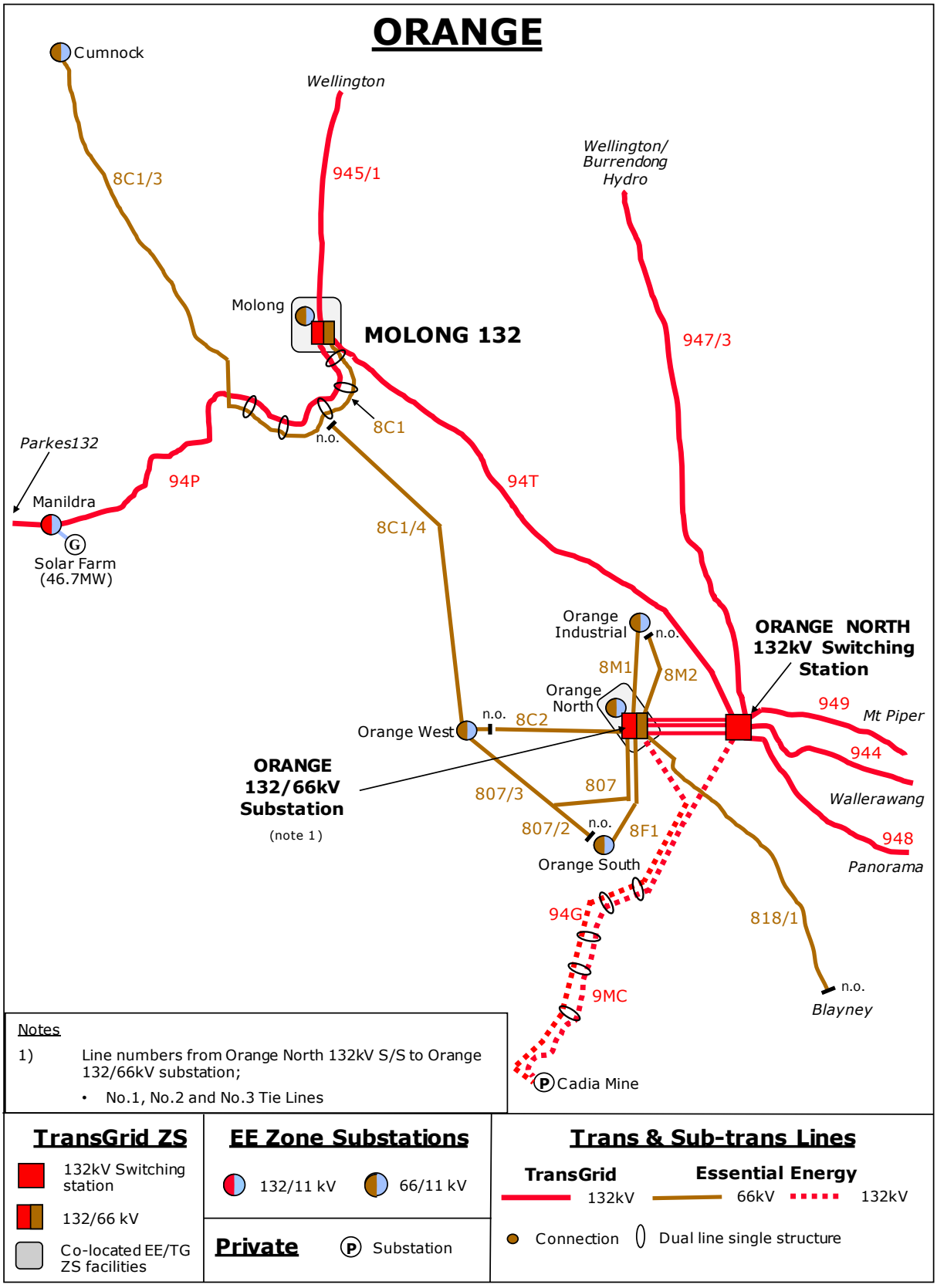
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 94G | 132 | TransGrid Orange North 132kV Sw Stn | Cadia ZS | 142 | 75.9 | 83.9 | 92.4 | 91.2 | 90.7 | 142 | 75.4 | 83.5 | 92.0 | 90.8 | 90.3 |
| 9MC | 132 | TransGrid Orange North 132kV Sw Stn | Cadia ZS | 142 | 75.9 | 83.9 | 92.4 | 91.2 | 90.7 | 142 | 75.4 | 83.5 | 92.0 | 90.8 | 90.3 |
| 807 | 66 | TransGrid Orange 132/66kV STS | Orange West & South Tee | 61 | 13.6 | 14.1 | 14.5 | 15.0 | 15.4 | 68 | 16.0 | 16.1 | 16.3 | 16.5 | 16.6 |
| 807/2 | 66 | Orange West & South Tee | Orange South ZS | 63 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 70 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 807/3 | 66 | Orange West & South Tee | Orange West ZS | 62 | 13.6 | 14.1 | 14.5 | 15.0 | 15.4 | 69 | 16.0 | 16.1 | 16.3 | 16.5 | 16.6 |
| 818/1 | 66 | TransGrid Orange 132/66kV STS | Blayney ZS | 11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8C2 | 66 | TransGrid Orange 132/66kV STS | Orange West ZS | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8F1 | 66 | TransGrid Orange 132/66kV STS | Orange South ZS | 63 | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 | 70 | 22.5 | 22.5 | 22.5 | 22.5 | 22.5 |
| 8M1 | 66 | TransGrid Orange 132/66kV STS | Orange Industrial ZS | 11 | 11.5 | 11.8 | 12.1 | 12.4 | 12.7 | 19 | 10.9 | 10.8 | 10.8 | 10.8 | 10.8 |
| 8M2 | 66 | TransGrid Orange 132/66kV STS | Orange Industrial ZS | 21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## STS and ZS load forecast

| SUMMER | Orange Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Orange Industrial | 66/11 | 15 | 10 | | 11 | 0.99 | 11.5 | 11.8 | 12.1 | 12.4 | 12.7 | 3.05 | 4 |
| Orange North | 66/11 | 20 | 15 | | 16.5 | 0.97 | 14.4 | 14.6 | 14.8 | 15.0 | 15.2 | 2.64 | 5 |
| Orange South | 66/11 | 20/30 | 30 | | 33 | 0.96 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 4.13 | 8 |
| Orange West | 66/11 | 30 | 30 | | 33 | 0.98 | 13.6 | 14.1 | 14.5 | 15.0 | 15.4 | 3.93 | 3.5 |

| WINTER | Orange Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Orange Industrial | 66/11 | 15 | 10 | | 12 | 1.00 | 10.9 | 10.8 | 10.8 | 10.8 | 10.8 | 3.05 | 4.5 |
| Orange North | 66/11 | 20 | 15 | | 18 | 0.99 | 15.4 | 15.5 | 15.6 | 15.7 | 15.7 | 2.64 | 9.5 |
| Orange South | 66/11 | 20/30 | 30 | | 36 | 0.98 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 4.13 | 16.5 |
| Orange West | 66/11 | 30 | 30 | | 36 | 1.00 | 16.0 | 16.1 | 16.3 | 16.5 | 16.6 | 3.93 | 2.5 |

Sub-transmission Single Line Diagram of Orange area



### 2.3.28 Molong Supply Area

#### Description of Molong area

All zone substations in the Molong area are in the Macquarie region.

The Molong 132/66/11kV substation is a shared asset with TransGrid, whereby Essential Energy takes supply at 66kV which supplies Cumnock and Molong via a 66/11kV transformer, with back up supply from the Orange 66kV network via Orange West. Manildra zone substation is also a shared asset with TransGrid and is supplied from TransGrid's Molong substation at 132kV.

| MOLONG – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – MDA3B6 Monument | 3.3 |
| Feeder – MLO22 East | 3.3 |
| Feeder – CMK4022 Yeoval | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 8C1 | 66 | TransGrid Molong 132/66kV STS | Cumnock / Orange West Tee | 61 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 68 | 1.7 | 1.7 | 1.7 | 1.7 | 1.8 |
| 8C1/3 | 66 | Cumnock / Orange West Tee | Cumnock ZS | 9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 15 | 1.7 | 1.7 | 1.7 | 1.7 | 1.8 |
| 8C1/4 | 66 | Cumnock / Orange West Tee | Orange West ZS | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### STS and ZS load forecast

| SUMMER | Molong Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Cumnock | 66/11 | 2.5 | 2.5 | | 2.75 | 0.98 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 0.76 | 2 |
| Manildra | 132/11 | 18/24 | 18/24 | | 26.4 | 0.96 | 10.0 | 10.0 | 10.1 | 10.1 | 10.1 | 1.21 | 4.5 |
| Molong 11kV | 66/11 | 5/7.5 | 3/4 | | 4.4 | 0.99 | 4.3 | 4.5 | 4.6 | 4.7 | 4.9 | 1.08 | 4.5 |

| WINTER | Molong Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Cumnock | 66/11 | 2.5 | 2.5 | | 3 | 0.98 | 1.7 | 1.7 | 1.7 | 1.7 | 1.8 | 0.76 | 2.5 |
| Manildra | 132/11 | 18/24 | 18/24 | | 28.8 | 0.97 | 10.2 | 10.2 | 10.2 | 10.1 | 10.1 | 1.21 | 71 |
| Molong 11kV | 66/11 | 5/7.5 | 3/4 | | 4.8 | 1.00 | 3.4 | 3.5 | 3.5 | 3.6 | 3.7 | 1.08 | 1.5 |

A 46.7MW solar generator is located at Manildra on the 11kV network.

#### Sub-transmission Single Line Diagram of Molong area

Please refer to the Sub-transmission Single Line Diagram of Orange area on Page 84.

### 2.3.29 Bathurst Supply Area

#### Description of Bathurst area

All zone substations in the Bathurst area are in the Macquarie region.

The Bathurst area sub-transmission system is supplied from TransGrid's Panorama 132/66kV sub-transmission substation with the Bathurst town substations (Russell St, Raglan and Stewart) being supplied via 66kV ring network.

The Blayney and Mandurama substations are supplied by a radial 66kV line from Panorama with a 66kV back up supply from Orange if required.

| BATHURST – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – RAG3B5 OConnell | 3.3 |
| Multiple Feeders – BNY3B4 Millthorpe | 3.3 |
| Feeder – MUA5005 East | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 81H | 66 | TransGrid Panorama 132/66kV STS | Stew art ZS | 62 | 7.3 | 7.4 | 7.4 | 7.5 | 7.5 | 69 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 |
| 81G | 66 | TransGrid Panorama 132/66kV STS | Stew art ZS | 64 | 12.2 | 12.3 | 12.3 | 12.4 | 12.5 | 71 | 10.5 | 10.5 | 10.5 | 10.5 | 10.5 |
| 81F | 66 | TransGrid Panorama 132/66kV STS | Russell St ZS | 64 | 29.0 | 29.2 | 29.3 | 29.5 | 29.6 | 71 | 25.7 | 25.8 | 25.9 | 25.9 | 26.0 |
| 81J | 66 | Raglan ZS | Russell St ZS | 64 | 5.6 | 5.6 | 5.7 | 5.7 | 5.7 | 71 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 |
| 81L | 66 | TransGrid Panorama 132/66kV STS | Raglan ZS | 64 | 17.1 | 17.2 | 17.3 | 17.4 | 17.4 | 71 | 15.5 | 15.5 | 15.5 | 15.6 | 15.6 |
| 81C | 66 | TransGrid Panorama 132/66kV STS | Blayney ZS | 19 | 12.7 | 12.7 | 12.8 | 12.9 | 12.9 | 22 | 10.5 | 10.5 | 10.6 | 10.6 | 10.6 |
| 66:MAN | 66 | Blayney ZS | Mandurama ZS | 9 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 15 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |

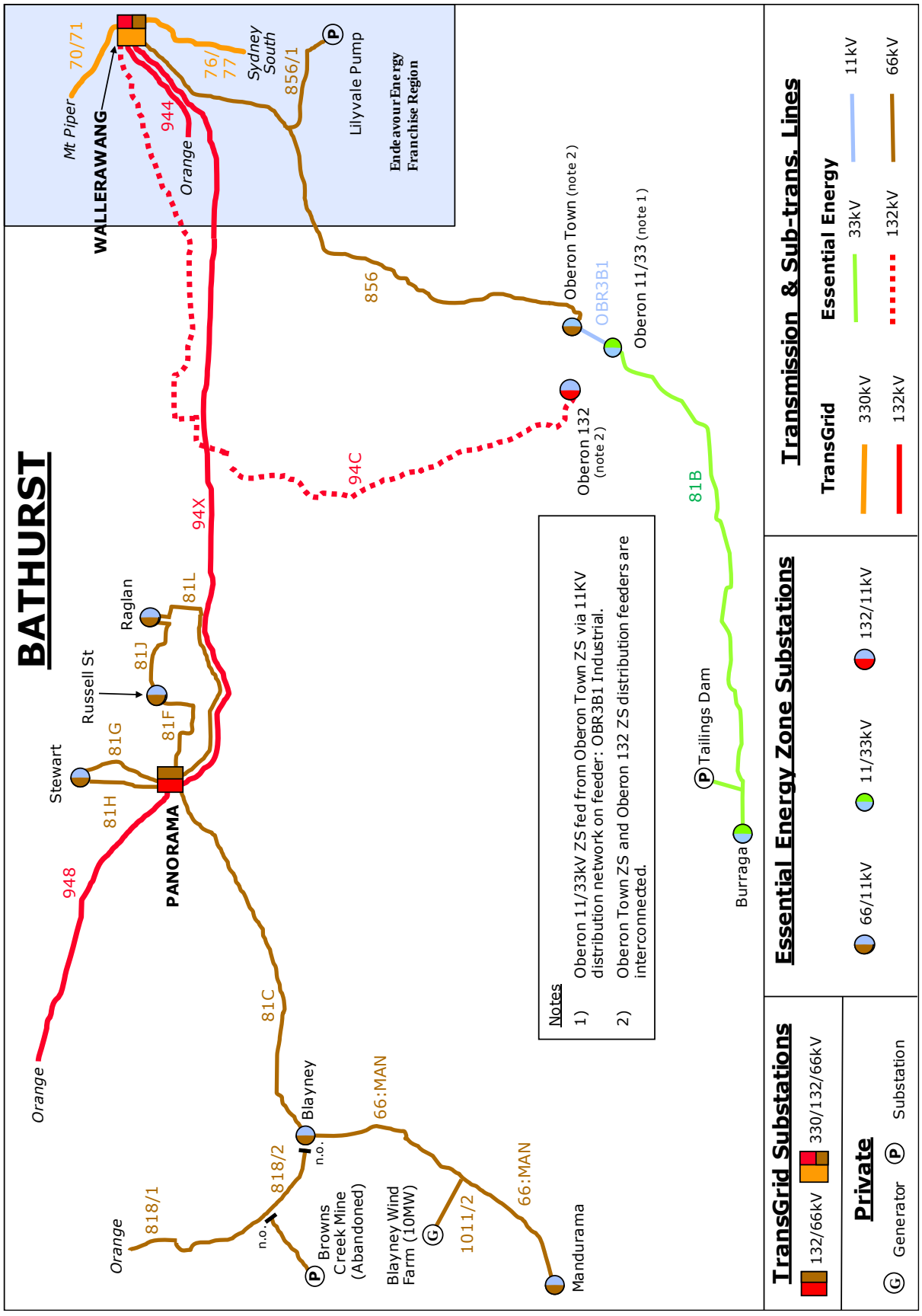
A 10MW wind generator is located at Blayney wind farm and is connected to the TransGrid Panorama 132/66kV sub-transmission substation at 66kV via feeders 66:MAN and 81C.

## STS and ZS load forecast

| SUMMER | Bathurst Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Blayney | 66/11 | 14/20 | 14/20 | | 22 | 0.98 | 9.9 | 9.9 | 9.9 | 9.8 | 9.8 | 1.93 | 2 |
| Mandurama | 66/11 | 2.5 | 3/4 | | 2.75 | 0.98 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 0.77 | 3 |
| Raglan | 66/11 | 18/30 | 18/30 | | 33 | 1.00 | 20.9 | 21.1 | 21.3 | 21.5 | 21.6 | 4.82 | 7 |
| Russell Street | 66/11 | 20/30 | 15/30 | 20/30 | 66 | 0.95 | 24.5 | 25.1 | 25.6 | 26.2 | 26.7 | 3.15 | 7.5 |
| Stewart | 66/11 | 15/25 | 15/18/25 | | 27.5 | 1.00 | 21.0 | 21.0 | 21.0 | 21.0 | 21.0 | 4.85 | 8.5 |

| WINTER | Bathurst Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Blayney | 66/11 | 14/20 | 14/20 | | 24 | 0.99 | 10.4 | 10.3 | 10.2 | 10.1 | 10.0 | 1.93 | 21 |
| Mandurama | 66/11 | 2.5 | 3/4 | | 3 | 0.99 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 0.77 | 3 |
| Raglan | 66/11 | 18/30 | 18/30 | | 36 | 1.00 | 18.5 | 18.1 | 17.6 | 17.2 | 16.7 | 4.82 | 2.5 |
| Russell Street | 66/11 | 20/30 | 15/30 | 20/30 | 72 | 0.98 | 23.1 | 23.6 | 24.1 | 24.6 | 25.1 | 3.15 | 9.5 |
| Stewart | 66/11 | 15/25 | 15/18/25 | | 30 | 1.00 | 18.3 | 18.3 | 18.3 | 18.3 | 18.3 | 4.85 | 4.5 |

## Sub-transmission Single Line Diagram of Bathurst area



### 2.3.30 Oberon Supply Area

#### Description of Oberon area

All zone substations in the Oberon area are in the Macquarie region.

The zone substations at Oberon are supplied directly from Wallerawang via Essential Energy's 66kV and 132kV sub-transmission lines respectively.

| OBERON – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 94C | 132 | TransGrid Wallerawang 330/132/66kV STS | Oberon 132 ZS | 128 | 29.7 | 29.8 | 30.0 | 30.1 | 30.3 | 143 | 29.8 | 30.2 | 30.7 | 31.1 | 31.6 |
| 856 | 66 | TransGrid Wallerawang 330/132/66kV STS | Oberon Town ZS | 28 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 32 | 6.5 | 6.6 | 6.6 | 6.6 | 6.7 |
| 81B | 33 | Oberon Town ZS | Burraga ZS | 8 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 13 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |

#### STS and ZS load forecast

| SUMMER | Oberon Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Burraga | 33/11 | 2.5 | | | 0 | 0.85 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.00 | 1.5 |
| Oberon 132kV | 132/11 | 25/45 | 25/45 | | 49.5 | 0.88 | 29.7 | 29.8 | 30.0 | 30.1 | 30.3 | 0.00 | 9 |
| Oberon Town | 66/11 | 10/15 | 10/15 | | 16.5 | 0.97 | 4.2 | 4.2 | 4.2 | 4.2 | 4.3 | 1.66 | 3.5 |

| WINTER | Oberon Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Burraga | 33/11 | 2.5 | | | 0 | 0.90 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.00 | 0.5 |
| Oberon 132kV | 132/11 | 25/45 | 25/45 | | 54 | 0.88 | 29.8 | 30.2 | 30.7 | 31.1 | 31.6 | 0.00 | 4.5 |
| Oberon Town | 66/11 | 10/15 | 10/15 | | 18 | 0.98 | 5.9 | 5.9 | 6.0 | 6.0 | 6.0 | 1.66 | 2.5 |

#### Sub-transmission Single Line Diagram of Oberon area

Please refer to the Sub-transmission Single Line Diagram of Bathurst area on Page 88.

### 2.3.31 Parkes Supply Area

#### Description of Parkes area

All zone substations in the Parkes area are in the Central region.

The Parkes area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation via a 66kV 89L/89G ring to the Parkes Town zone substation with a feed to Peak Hill and Tomingley Mine Substations.

| PARKES – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

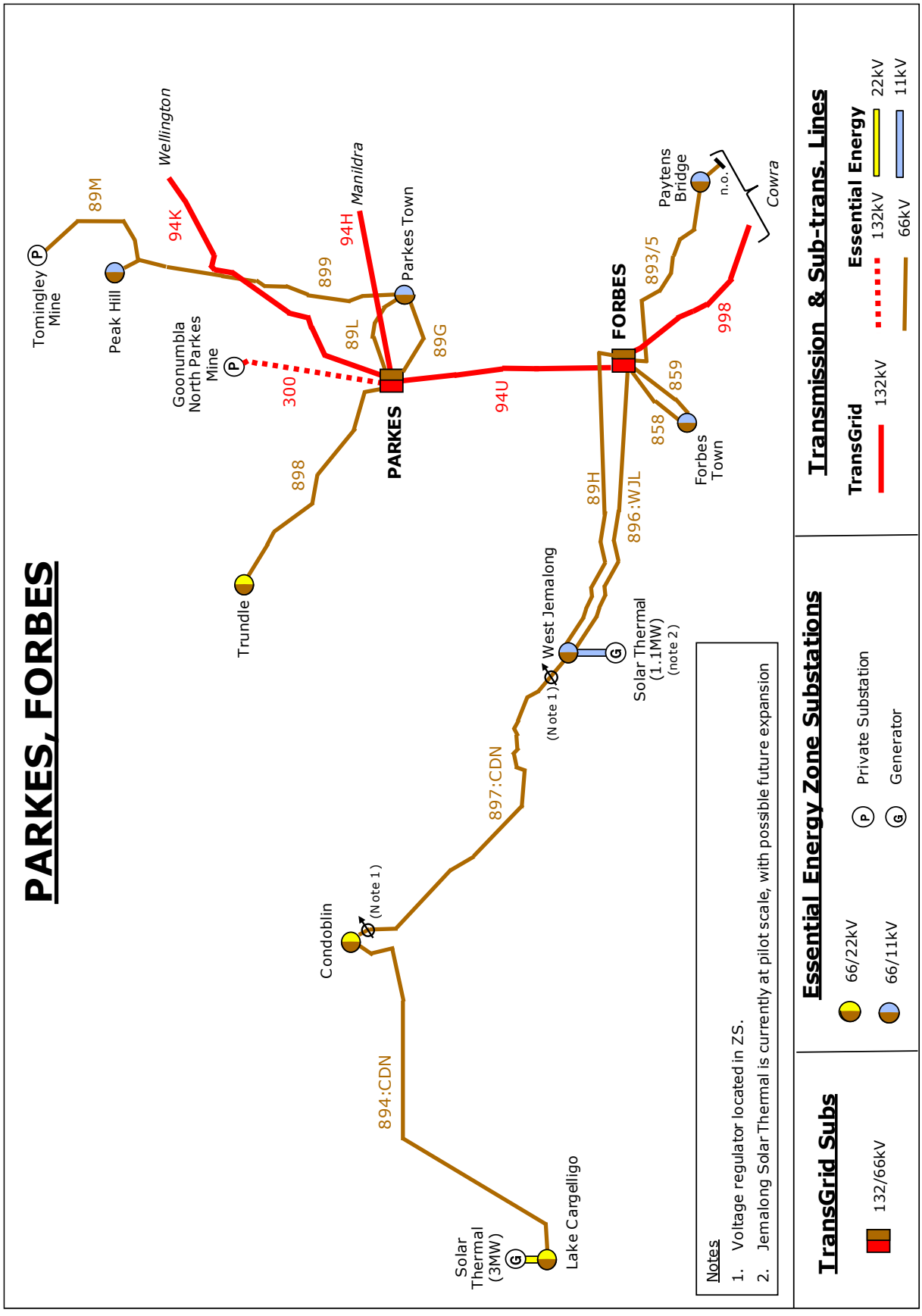
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 300 | 132 | TransGrid Parkes 132/66kV STS | North Parkes Mine ZS | 87 | 52.8 | 53.6 | 54.4 | 55.2 | 56.0 | 108 | 53.8 | 54.4 | 55.0 | 55.6 | 56.2 |
| 898 | 66 | TransGrid Parkes 132/66kV STS | Trundle ZS | 11 | 2.9 | 2.8 | 2.7 | 2.7 | 2.6 | 17 | 2.3 | 2.3 | 2.2 | 2.2 | 2.2 |
| 899 | 66 | Parkes Town ZS | Peak Hill ZS | 13 | 7.3 | 7.6 | 7.7 | 7.8 | 7.9 | 20 | 7.3 | 7.7 | 7.8 | 7.9 | 8.0 |
| 89G | 66 | TransGrid Parkes 132/66kV STS | Parkes Town ZS | 68 | 14.9 | 15.7 | 16.1 | 16.4 | 16.7 | 76 | 11.6 | 12.4 | 12.6 | 12.8 | 13.0 |
| 89L | 66 | TransGrid Parkes 132/66kV STS | Parkes Town ZS | 38 | 11.2 | 11.9 | 12.1 | 12.4 | 12.6 | 43 | 8.8 | 9.4 | 9.5 | 9.7 | 9.8 |
| 89M | 66 | Peak Hill ZS | Tomingley Mine ZS | 17 | 5.1 | 6.3 | 6.4 | 6.5 | 6.7 | 28 | 5.4 | 6.5 | 6.7 | 6.8 | 7.0 |

#### STS and ZS load forecast

| SUMMER | Parkes Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Parkes Town | 66/11 | 30 | 30 | | 33 | 0.97 | 19.2 | 19.6 | 20.1 | 20.5 | 20.9 | 5.69 | 4 |
| Peak Hill | 66/11 | 5 | 5 | | 5.5 | 0.98 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 0.84 | 7.5 |
| Trundle | 66/22 | 5 | 5 | | 5.5 | 0.99 | 2.9 | 2.8 | 2.7 | 2.7 | 2.6 | 1.24 | 1.5 |

| WINTER | Parkes Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Parkes Town | 66/11 | 30 | 30 | | 36 | 0.99 | 13.3 | 13.6 | 13.8 | 14.0 | 14.2 | 5.69 | 1.5 |
| Peak Hill | 66/11 | 5 | 5 | | 6 | 1.00 | 1.7 | 1.7 | 1.7 | 1.7 | 1.6 | 0.84 | 2 |
| Trundle | 66/22 | 5 | 5 | | 6 | 0.99 | 2.3 | 2.3 | 2.2 | 2.2 | 2.2 | 1.24 | 1.5 |

Sub-transmission Single Line Diagram of Parkes area



### 2.3.32 Forbes Supply Area

#### Description of Forbes area

Zone substations in the Forbes area are spread across both the Riverina Slopes and Central regions.

The Forbes area sub-transmission system is supplied from TransGrid's Forbes 132/66kV sub-transmission substation.

| FORBES – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – PYB3B1 Eugowra | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 858 | 66 | TransGrid Forbes 132/66kV STS | Forbes Town ZS | 28 | 14.8 | 14.8 | 14.8 | 14.7 | 14.7 | 34 | 11.2 | 11.2 | 11.3 | 11.3 | 11.3 |
| 859 | 66 | TransGrid Forbes 132/66kV STS | Forbes Town ZS | 28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 893/5 | 66 | TransGrid Forbes 132/66kV STS | Payten's Bridge ZS | 12 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 18 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| 894:CDN | 66 | Condobolin ZS | Lake Cargelligo ZS | 15 | 4.1 | 4.1 | 4.2 | 4.2 | 4.2 | 25 | 3.3 | 3.3 | 3.3 | 3.2 | 3.2 |
| 896:WJL | 66 | TransGrid Forbes 132/66kV STS | West Jemalong ZS | 20 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 24 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |
| 897:CDN | 66 | West Jemalong ZS | Condobolin ZS | 20 | 14.1 | 14.1 | 14.1 | 14.1 | 14.1 | 24 | 11.8 | 11.8 | 11.8 | 11.8 | 11.8 |
| 89H | 66 | TransGrid Forbes 132/66kV STS | West Jemalong ZS | 43 | 11.2 | 11.2 | 11.2 | 11.2 | 11.2 | 54 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 |

#### STS and ZS load forecast

| SUMMER | Forbes Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Condobolin | 66/22 | 16 | 10 | | 11 | 0.99 | 8.5 | 8.5 | 8.4 | 8.3 | 8.3 | 2.53 | 6 |
| Forbes Town | 66/11 | 18/30 | 15/30 | | 33 | 0.96 | 14.8 | 14.8 | 14.8 | 14.7 | 14.7 | 3.31 | 10.5 |
| Lake Cargelligo | 66/22 | 8 | 5 | | 5.5 | 0.98 | 4.1 | 4.1 | 4.2 | 4.2 | 4.2 | 1.57 | 5 |
| Paytens Bridge | 66/11 | 5 | 5/6.25 | | 5.5 | 0.94 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 0.63 | 22 |
| West Jemalong | 66/11 | 3/4 | 3/4 | | 4.4 | 0.95 | 2.4 | 2.4 | 2.4 | 2.4 | 2.5 | 0.18 | 3.5 |

| WINTER | Forbes Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Condobolin | 66/22 | 16 | 10 | | 12 | 0.99 | 6.1 | 5.9 | 5.8 | 5.6 | 5.5 | 2.53 | 4.5 |
| Forbes Town | 66/11 | 18/30 | 15/30 | | 36 | 0.99 | 11.2 | 11.2 | 11.3 | 11.3 | 11.3 | 3.31 | 4 |
| Lake Cargelligo | 66/22 | 8 | 5 | | 6 | 0.88 | 3.3 | 3.3 | 3.3 | 3.2 | 3.2 | 1.57 | 1 |
| Paytens Bridge | 66/11 | 5 | 5/6.25 | | 6 | 0.94 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 0.63 | 7.5 |
| West Jemalong | 66/11 | 3/4 | 3/4 | | 4.8 | 0.97 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 0.18 | 4 |

A 3MW solar thermal generator is located at Lake Cargelligo on the 22kV network, and a 1.1MW solar thermal generator is located at West Jemalong on the 11kV network.

### Sub-transmission Single Line Diagram of Forbes area

Please refer to the Sub-transmission Single Line Diagram of Parkes area on Page 91.

### 2.3.33 Moruya North Supply Area

#### Description of Moruya North area

All zone substations in the Moruya North area are in the South Eastern region.

Essential Energy's Moruya North sub-transmission substation is supplied via 2 x 132kV transmission lines from Endeavour Energy's 132kV transmission system that emanate from the Evans Lane switching station near Ulladulla. Essential Energy partly owns with Endeavour Energy both 132kV transmission lines from Evans Lane switching station.

| MORUYA NORTH – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

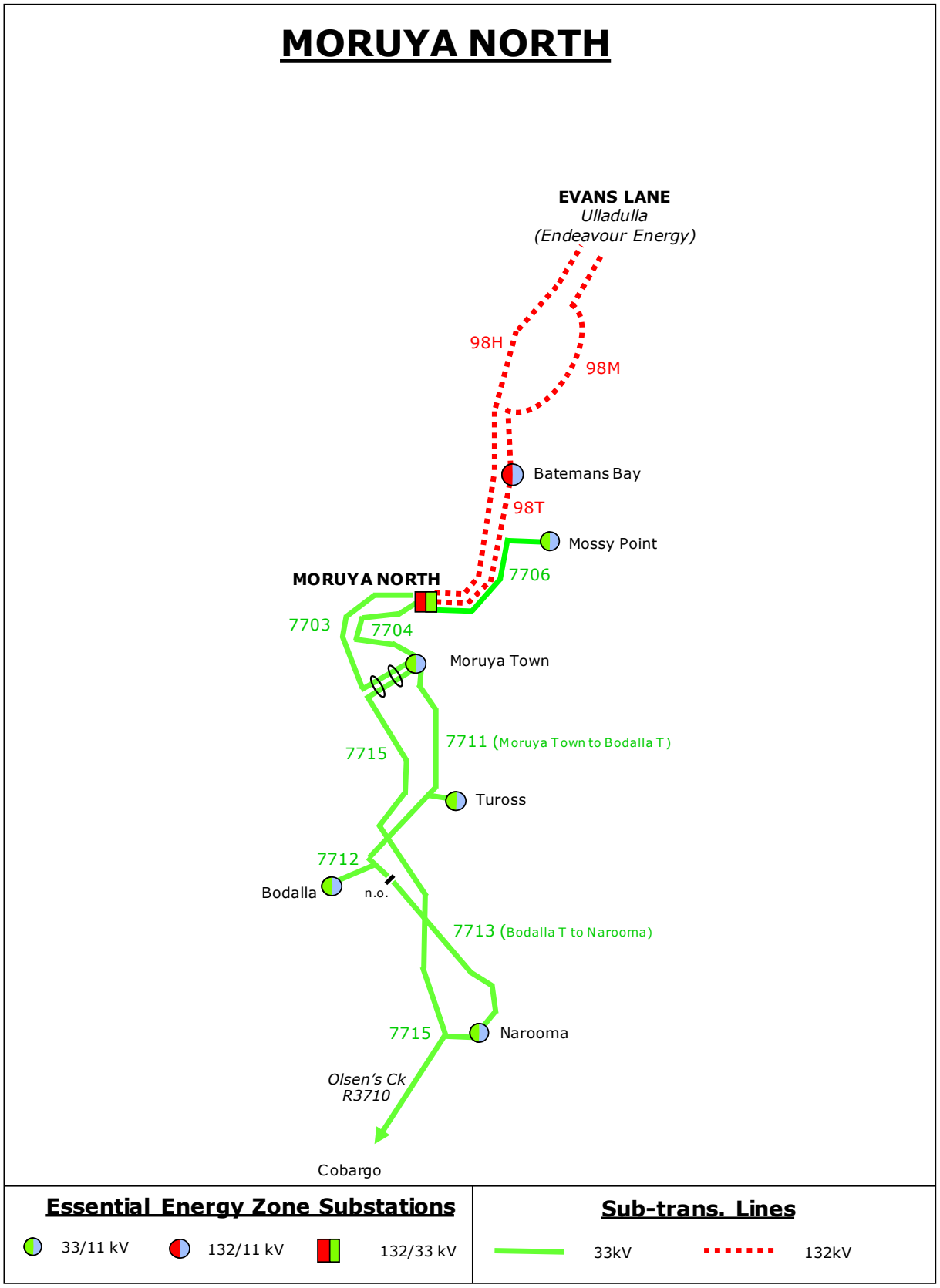
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 98H | 132 | Endeavour Energy Evans Lane Sw Stn | Moruya North 132/33kV STS | 180 | 18.9 | 19.3 | 19.6 | 20.0 | 20.4 | 202 | 22.3 | 22.4 | 22.6 | 22.8 | 23.0 |
| 98M | 132 | Endeavour Energy Evans Lane Sw Stn | Batemans Bay ZS | 50 | 23.8 | 24.3 | 24.7 | 25.2 | 25.7 | 62 | 27.8 | 28.1 | 28.3 | 28.6 | 28.8 |
| 98T | 132 | Batemans Bay ZS | Moruya North 132/33kV STS | 61 | 4.3 | 4.4 | 4.4 | 4.5 | 4.6 | 70 | 5.5 | 5.6 | 5.6 | 5.7 | 5.7 |
| 7703 | 33 | Moruya North 132/33kV STS | Moruya Town ZS | 30 | 7.2 | 7.3 | 7.4 | 7.6 | 7.7 | 34 | 8.6 | 8.7 | 8.7 | 8.8 | 8.9 |
| 7704 | 33 | Moruya North 132/33kV STS | Moruya Town ZS | 26 | 9.1 | 9.3 | 9.5 | 9.6 | 9.8 | 30 | 10.9 | 11.0 | 11.1 | 11.2 | 11.3 |
| 7706 | 33 | Moruya North 132/33kV STS | Mossy Point ZS | 25 | 6.2 | 6.3 | 6.4 | 6.5 | 6.7 | 28 | 7.4 | 7.5 | 7.5 | 7.6 | 7.7 |
| 7712 | 33 | Bodalla Tee | Bodalla ZS | 10 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 19 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| 7713 | 33 | Bodalla Tee | Narooma ZS | 21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7817 | 33 | Narooma Tee | Cobargo ZS | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7711/1 | 33 | Moruya Town ZS | Tuross Tee | 17 | 3.1 | 3.2 | 3.2 | 3.3 | 3.4 | 19 | 4.2 | 4.3 | 4.3 | 4.3 | 4.4 |
| 7711/2 | 33 | Tuross Tee | Tuross ZS | 7 | 1.8 | 1.9 | 1.9 | 1.9 | 2.0 | 12 | 2.7 | 2.8 | 2.8 | 2.8 | 2.8 |
| 7711/3 | 33 | Tuross Tee | Bodalla Tee | 21 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 27 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 |
| 7715/1 | 33 | Moruya Town ZS | Narooma Tee | 30 | 6.1 | 6.2 | 6.3 | 6.5 | 6.6 | 34 | 7.8 | 7.9 | 8.0 | 8.0 | 8.1 |
| 7715/2 | 33 | Narooma Tee | Narooma ZS | 10 | 5.8 | 5.9 | 6.0 | 6.1 | 6.2 | 19 | 7.4 | 7.4 | 7.5 | 7.6 | 7.6 |

## STS and ZS load forecast

| SUMMER | Moruya North Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Batemans Bay | 132/11 | 30/45 | 30/45 | | 49.5 | 1.00 | 19.1 | 19.3 | 19.5 | 19.6 | 19.8 | 5.06 | 5 |
| Bodalla | 33/11 | 3/4 | 3 | | 3.3 | 0.97 | 1.3 | 1.4 | 1.4 | 1.4 | 1.5 | 0.64 | 3 |
| Moruya North | 132/33 | 40 | 30/45 | | 44 | 0.98 | 21.9 | 22.2 | 22.5 | 22.8 | 23.0 | 0.00 | 2 |
| Moruya Town | 33/11 | 16 | 16 | | 17.6 | 0.97 | 6.6 | 6.7 | 6.8 | 6.9 | 7.1 | 2.47 | 0.5 |
| Mossy Point | 33/11 | 12.5 | 12.5 | | 13.75 | 0.99 | 6.7 | 6.9 | 7.0 | 7.1 | 7.2 | 2.21 | 6 |
| Narooma | 33/11 | 10/16 | 10/12.5 | | 13.75 | 0.98 | 5.4 | 5.4 | 5.5 | 5.5 | 5.6 | 2.33 | 12 |
| Tuross | 33/11 | 5/8 | | | 0 | 0.98 | 2.2 | 2.3 | 2.3 | 2.3 | 2.4 | 0.97 | 1 |

| WINTER | Moruya North Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Batemans Bay | 132/11 | 30/45 | 30/45 | | 54 | 1.00 | 18.5 | 18.6 | 18.8 | 18.9 | 19.0 | 5.06 | 13 |
| Bodalla | 33/11 | 3/4 | 3 | | 3.6 | 0.99 | 1.6 | 1.6 | 1.7 | 1.7 | 1.8 | 0.64 | 0.5 |
| Moruya North | 132/33 | 40 | 30/45 | | 48 | 1.00 | 28.2 | 28.6 | 29.0 | 29.4 | 29.8 | 0.00 | 1.5 |
| Moruya Town | 33/11 | 16 | 16 | | 19.2 | 0.99 | 8.1 | 8.2 | 8.2 | 8.3 | 8.4 | 2.47 | 1.5 |
| Mossy Point | 33/11 | 12.5 | 12.5 | | 15 | 0.99 | 7.8 | 8.0 | 8.3 | 8.5 | 8.8 | 2.21 | 1 |
| Narooma | 33/11 | 10/16 | 10/12.5 | | 15 | 0.99 | 6.9 | 6.9 | 6.9 | 6.9 | 6.9 | 2.33 | 8 |
| Tuross | 33/11 | 5/8 | | | 0 | 1.00 | 2.5 | 2.5 | 2.6 | 2.6 | 2.6 | 0.97 | 1 |

Sub-transmission Single Line Diagram of Moruya North area



### 2.3.34 Cooma Supply Area

#### Description of Cooma area

All zone substations in the Cooma area are in the South Eastern region.

The Cooma area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation at Cooma.

| COOMA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 974 | 132 | TransGrid Cooma 132/66kV STS | Bega 132/66kV STS | 128 | 16.8 | 16.8 | 16.8 | 16.8 | 16.8 | 143 | 22.1 | 22.1 | 22.1 | 22.1 | 22.1 |
| 97R | 132 | TransGrid Cooma 132/66kV STS | Steeple Flat 132/66kV STS | 140 | 81.0 | 81.0 | 81.0 | 81.0 | 81.0 | 157 | 74.6 | 74.6 | 74.6 | 74.6 | 74.6 |
| 82D | 66 | TransGrid Cooma 132/66kV STS | Jindabyne East ZS | 20 | 9.7 | 9.7 | 9.7 | 9.7 | 9.7 | 39 | 20.6 | 20.6 | 20.6 | 20.6 | 20.6 |
| 84J | 66 | TransGrid Cooma 132/66kV STS | Cooma 66/11kV ZS | 70 | 5.3 | 5.3 | 5.4 | 5.4 | 5.5 | 78 | 6.4 | 6.4 | 6.4 | 6.4 | 6.4 |
| 84L | 66 | TransGrid Cooma 132/66kV STS | Cooma 66/11kV ZS | 64 | 5.3 | 5.3 | 5.4 | 5.4 | 5.5 | 71 | 6.4 | 6.4 | 6.4 | 6.4 | 6.4 |
| 82J/1 | 66 | Snowy Adit 132/66/11kV ZS | Snowy Lookout Sw Stn | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 82J/2 | 66 | Jindabyne ZS | Snowy Lookout Sw Stn | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 82R | 66 | Jindabyne East ZS | Jindabyne ZS | 20 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 39 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 888/1 | 66 | TransGrid Cooma 132/66kV STS | Rhine Falls Sw Stn | 16 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 25 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 |
| 888/3 | 66 | Rhine Falls Sw Stn | Adaminaby ZS | 16 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 25 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 |
| 888/4 | 66 | Rhine Falls Sw Stn | Eucumbene Tee | 15 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 25 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 888/6 | 66 | Eucumbene Tee | Eucumbene ZS | 15 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 25 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 888/7 | 66 | Eucumbene Tee | Snowy Adit 132/66/11kV ZS | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 849/1 | 33 | Adaminaby ZS | Providence Portal ZS | 7 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 12 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| 849/2 | 33 | Providence Portal ZS | Mt Selwyn Tee | 7 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 12 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| 849/3 | 33 | Mt Selwyn Tee | Cabramurra ZS | 8 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 12 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |

A 5MW hydro generator is located at Brown Mountain Hydro and is connected to Steeple Flat 132/66kV sub-transmission substation at 66kV via feeder 810.

A 114MW wind generator is located at Boco Rock wind farm and is connected to the Steeple Flat 132/66kV sub-transmission substation which is connected to TransGrid's Cooma 132/66kV sub-transmission substation at 132kV via the feeder 97R.

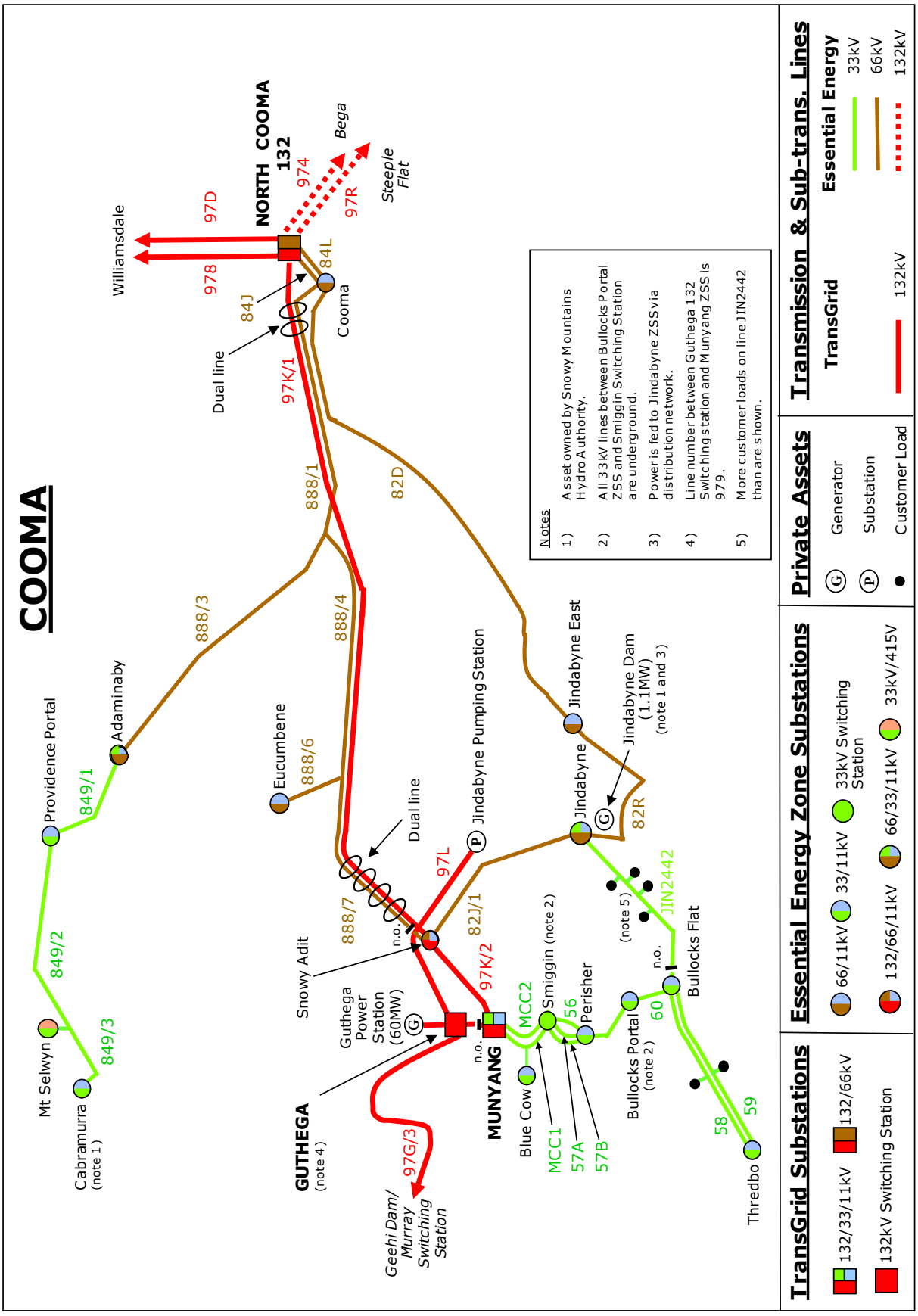
A 1MW hydro generator is located at Jindabyne Dam and is connected to the Jindabyne zone substation 11kV busbar via feeder JIN22.

## STS and ZS load forecast

| SUMMER | Cooma Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Adaminaby 11kV | 66/33/11 | 8/10 | | 5 | 5.5 | 0.98 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.26 | 4 |
| Adaminaby 33kV | 66/33/11 | | 5 | | 5.5 | 1.00 | 1.4 | 1.4 | 1.5 | 1.5 | 1.5 | 0.00 | 3 |
| Cooma 66/11kV | 66/11 | 15/20 | 15/20 | | 22 | 0.96 | 10.6 | 10.7 | 10.8 | 10.9 | 11.0 | 3.00 | 2 |
| Eucumbene | 66/11 | 0.6 | | | 0 | 0.95 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.03 | 1.5 |
| Jindabyne 11kV | 66/33/11 | 15/30 | 15/30 | | 33 | 0.97 | 4.2 | 4.2 | 4.1 | 4.1 | 4.1 | 1.14 | 2 |
| Jindabyne 33kV | 66/33/11 | 15 | | | 0 | 1.00 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.07 | 2 |
| Jindabyne East | 66/11 | 8/10 | 8/10 | | 11 | 0.98 | 1.9 | 1.9 | 2.0 | 2.0 | 2.0 | 0.69 | 2 |
| Providence Portal | 33/11 | 0.5 | | | 0 | 0.83 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.00 | 0.5 |

| WINTER | Cooma Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Adaminaby 11kV | 66/33/11 | 8/10 | | 5 | 6 | 0.99 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.26 | 2.5 |
| Adaminaby 33kV | 66/33/11 | | 5 | | 6 | 1.00 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 0.00 | 6.5 |
| Cooma 66/11kV | 66/11 | 15/20 | 15/20 | | 24 | 0.99 | 12.9 | 12.9 | 12.9 | 12.9 | 12.9 | 3.00 | 15 |
| Eucumbene | 66/11 | 0.6 | | | 0 | 0.95 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.03 | 2 |
| Jindabyne 11kV | 66/33/11 | 15/30 | 15/30 | | 36 | 0.99 | 13.4 | 13.4 | 13.5 | 13.6 | 13.7 | 1.14 | 2.5 |
| Jindabyne 33kV | 66/33/11 | 15 | | | 0 | 1.00 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 0.07 | 1 |
| Jindabyne East | 66/11 | 8/10 | 8/10 | | 12 | 0.99 | 4.4 | 4.5 | 4.6 | 4.6 | 4.7 | 0.69 | 5 |
| Providence Portal | 33/11 | 0.5 | | | 0 | 0.89 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.00 | 0.5 |

## Sub-transmission Single Line Diagram of Cooma area



### 2.3.35 Munyang Supply Area

#### Description of Munyang area

All zone substations in the Munyang area are in the South Eastern region.

The Munyang area sub-transmission system is supplied from TransGrid's sub-transmission substation at Munyang. The majority of the Snowy Mountains winter ski resorts are supplied from the Munyang sub-transmission substation.

Essential Energy takes supply at 11kV from Snowy Mountains Hydro at the Murray transmission substation to supply the Khancoban township.

| MUNYANG – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 56 | 33 | Smiggin Sw Stn | Perisher ZS | 20 | 1.3 | 1.4 | 1.4 | 1.4 | 1.4 | 23 | 16.0 | 18.4 | 18.2 | 17.9 | 17.8 |
| 57A | 33 | Smiggin Sw Stn | Perisher ZS | 20 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 23 | 6.8 | 6.8 | 6.8 | 6.8 | 7.0 |
| 57B | 33 | Smiggin Sw Stn | Perisher ZS | 20 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 23 | 4.5 | 4.5 | 4.5 | 4.5 | 4.7 |
| No.1 Perisher | 33 | TransGrid Munyang 132/33kV STS | Smiggin Sw Stn | 38 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 41 | 16.0 | 18.4 | 18.2 | 17.9 | 17.8 |
| No.2 Perisher | 33 | TransGrid Munyang 132/33kV STS | Blue Cow Tee | 38 | 1.7 | 1.8 | 1.8 | 1.8 | 1.8 | 49 | 13.9 | 16.0 | 15.7 | 15.5 | 15.4 |
| No.2 Perisher | 33 | Blue Cow Tee | Smiggin Sw Stn | 38 | 1.6 | 1.7 | 1.7 | 1.7 | 1.7 | 49 | 14.3 | 16.5 | 16.3 | 16.1 | 16.0 |
| 60/2 | 33 | Bullocks Portal ZS | Bullocks Flat ZS | 19 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 23 | 15.5 | 16.4 | 16.1 | 15.8 | 15.5 |
| 58 | 33 | Bullocks Flat ZS | Thredbo ZS | 6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 14 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| 59 | 33 | Bullocks Flat ZS | Thredbo ZS | 6 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 14 | 6.7 | 7.2 | 7.0 | 6.8 | 6.7 |
| Bullocks Portal Line | 33 | Perisher ZS | Bullocks Portal ZS | 20 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 23 | 15.5 | 16.4 | 16.1 | 15.8 | 15.5 |

## STS and ZS load forecast

| SUMMER | Munyang Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Blue Cow | 33/11 | 5/8 | | | 0 | 0.81 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.00 | 0.5 |
| Bullocks Flat | 33/11 | 5/6.25 | | | 0 | 0.99 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.00 | 0.5 |
| Bullocks Portal | 33/11 | 5/6.25 | | | 0 | 1.00 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.00 | 0.5 |
| Perisher | 33/11 | 8/10 | 8/10 | | 11 | 0.95 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.02 | 0.5 |
| Snowy Adit 11kV | 132/66/11 | | 10 | | 0 | 0.89 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.00 | 3.5 |
| Snowy Adit 66kV | 132/66/11 | 30 | | | 0 | 0.98 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 0.00 | 8 |
| Thredbo | 33/11 | 10/16 | 10/16 | | 17.6 | 0.99 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 0.02 | 0.5 |

| WINTER | Munyang Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Blue Cow | 33/11 | 5/8 | | | 0 | 0.85 | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 0.00 | 4 |
| Bullocks Flat | 33/11 | 5/6.25 | | | 0 | 1.00 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 0.00 | 10.5 |
| Bullocks Portal | 33/11 | 5/6.25 | | | 0 | 1.00 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.00 | 2 |
| Perisher | 33/11 | 8/10 | 8/10 | | 12 | 0.95 | 11.3 | 11.3 | 11.3 | 11.3 | 11.6 | 0.02 | 4 |
| Snowy Adit 11kV | 132/66/11 | | 10 | | 0 | 0.89 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 7 |
| Snowy Adit 66kV | 132/66/11 | 30 | | | 0 | 0.98 | 12.3 | 12.3 | 12.3 | 12.3 | 12.3 | 0.00 | 2 |
| Thredbo | 33/11 | 10/16 | 10/16 | | 19.2 | 0.97 | 13.4 | 14.3 | 14.0 | 13.7 | 13.4 | 0.02 | 6.5 |

## Sub-transmission Single Line Diagram of Munyang area

Please refer to the Sub-transmission Single Line Diagram of Cooma area on Page 99.

### 2.3.36 Bega Supply Area

#### Description of Bega area

All zone substations in the Bega area are in the South Eastern region.

Essential Energy's Bega sub-transmission substation is supplied from TransGrid's Cooma 132/66kV sub-transmission substation via two Essential Energy 132kV transmission lines.

| BEGA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – PAM3B1 Bald Hills No.3 | 3.3 |
| Feeder – PAM3B5 Merimbula No.7 | 3.3 |

#### Sub-transmission feeder load forecast

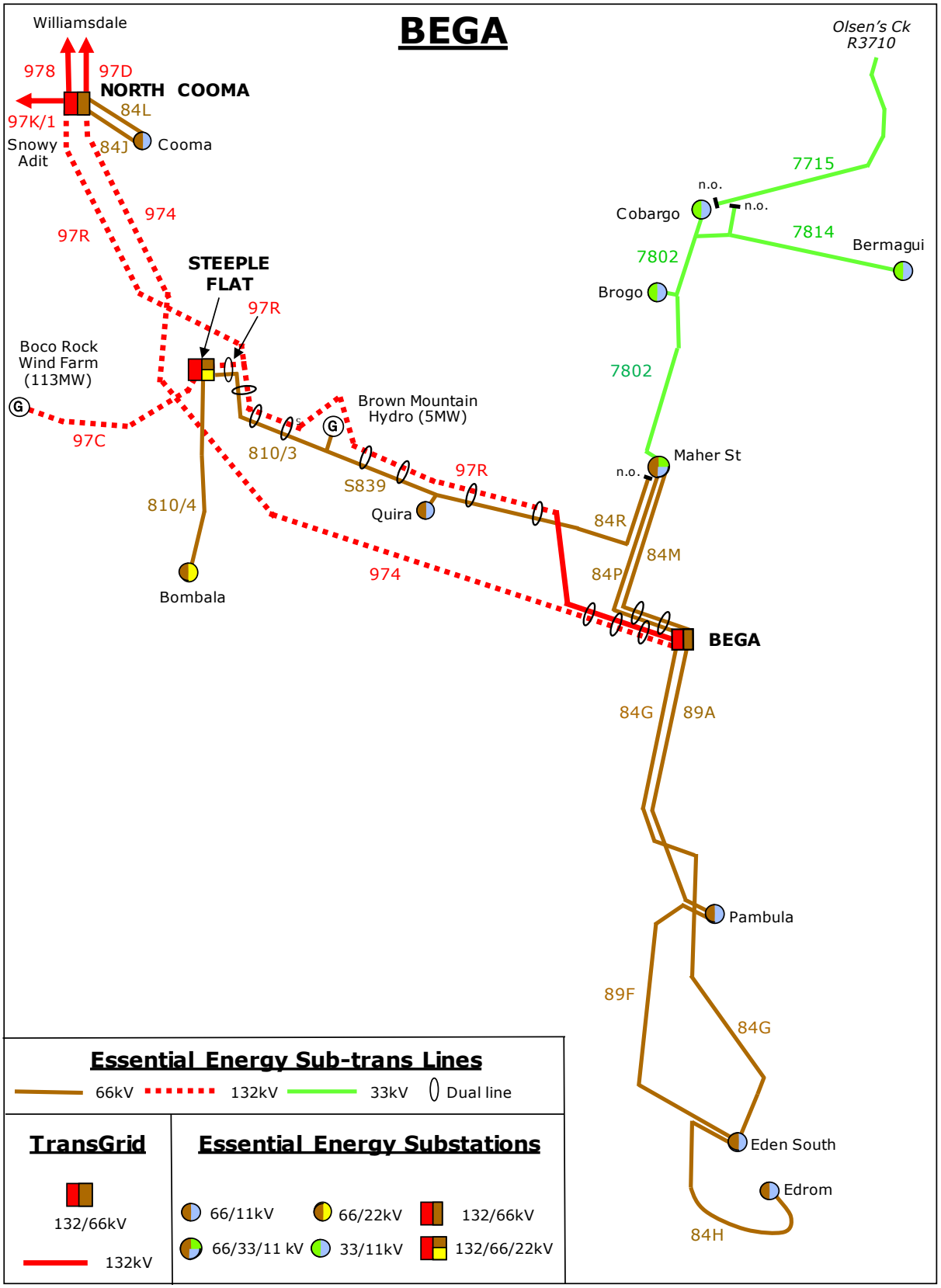
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 84G | 66 | Bega 132/66kV STS | Eden South ZS | 61 | 6.4 | 6.4 | 6.4 | 6.4 | 6.4 | 68 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 |
| 84H | 66 | Eden South ZS | Edrom ZS | 38 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 43 | 2.3 | 2.4 | 2.5 | 2.6 | 2.6 |
| 84M | 66 | Bega 132/66kV STS | Maher St ZS | 61 | 10.0 | 9.9 | 9.8 | 9.8 | 9.7 | 68 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 |
| 89A | 66 | Bega 132/66 | Pambula ZS | 38 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 43 | 14.4 | 14.4 | 14.4 | 14.4 | 14.4 |
| 84P | 66 | Bega 132/66kV STS | Maher St ZS | 38 | 10.0 | 9.9 | 9.8 | 9.8 | 9.7 | 43 | 10.1 | 10.2 | 10.3 | 10.4 | 10.5 |
| 89F | 66 | Pambula ZS | Eden South ZS | 16 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 26 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| 7802/1 | 33 | Maher St ZS | Brogo ZS | 12 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 24 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 |
| 7802/2 | 33 | Brogo ZS | Cobargo ZS | 10 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 19 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 |
| 84R | 33 | Maher St ZS | Quira ZS | 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7814 | 33 | Cobargo ZS | Bermagui ZS | 5 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 9 | 3.1 | 3.2 | 3.2 | 3.2 | 3.3 |

## STS and ZS load forecast

| SUMMER | Bega Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bega 132kV | 132/66 | 35/60 | 35/60 | | 66 | 1.00 | 35.0 | 35.1 | 35.1 | 35.1 | 35.2 | 0.00 | 4 |
| Bermagui | 33/11 | 5 | 5 | | 5.5 | 0.98 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 1.10 | 2.5 |
| Brogo | 33/11 | 3 | | | 0 | 0.96 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.28 | 4 |
| Cobargo | 33/11 | 3 | 2.5 | | 2.75 | 0.97 | 1.3 | 1.3 | 1.4 | 1.4 | 1.4 | 0.94 | 3.5 |
| Eden South | 66/11 | 10/16 | 10/16 | | 17.6 | 0.98 | 4.1 | 4.1 | 4.1 | 4.1 | 4.2 | 1.39 | 4.5 |
| Edrom | 66/11 | 5 | 5 | | 5.5 | 0.86 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 0.00 | 2.5 |
| Maher Street 66/33kV | 66/33 | 8 | | | 0 | 0.95 | 4.4 | 4.3 | 4.3 | 4.2 | 4.2 | 0.00 | 4 |
| Maher Street 66/11kV | 66/11 | 24/30 | 24/30 | | 33 | 0.99 | 15.0 | 15.0 | 14.9 | 14.9 | 14.8 | 4.07 | 7.5 |
| Pambula | 66/11 | 10/13/16 | 10/13/16 | | 17.6 | 0.99 | 12.2 | 12.4 | 12.6 | 12.8 | 13.0 | 4.68 | 5 |
| Quira | 66/11 | 5 | | | 0 | 0.95 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 0.44 | 2.5 |

| WINTER | Bega Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bega 132kV | 132/66 | 35/60 | 35/60 | | 72 | 0.99 | 39.7 | 39.6 | 39.5 | 39.4 | 39.3 | 0.00 | 12.5 |
| Bermagui | 33/11 | 5 | 5 | | 6 | 1.00 | 3.1 | 3.2 | 3.2 | 3.2 | 3.3 | 1.10 | 1.5 |
| Brogo | 33/11 | 3 | | | 0 | 0.99 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.28 | 2.5 |
| Cobargo | 33/11 | 3 | 2.5 | | 3 | 0.99 | 1.3 | 1.4 | 1.4 | 1.4 | 1.4 | 0.94 | 7 |
| Eden South | 66/11 | 10/16 | 10/16 | | 19.2 | 0.98 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 1.39 | 2.5 |
| Edrom | 66/11 | 5 | 5 | | 6 | 0.87 | 2.3 | 2.4 | 2.5 | 2.6 | 2.6 | 0.00 | 5.5 |
| Maher Street 66/33kV | 66/33 | 8 | | | 0 | 0.99 | 5.0 | 5.0 | 5.1 | 5.1 | 5.1 | 0.00 | 4.5 |
| Maher Street 66/11kV | 66/11 | 24/30 | 24/30 | | 36 | 0.99 | 14.7 | 14.9 | 15.0 | 15.2 | 15.3 | 4.07 | 7 |
| Pambula | 66/11 | 10/13/16 | 10/13/16 | | 19.2 | 1.00 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 4.68 | 11.5 |
| Quira | 66/11 | 5 | | | 0 | 0.99 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 0.44 | 4.5 |

Sub-transmission Single Line Diagram of Bega area



### 2.3.37 Steeple Flat Supply Area

#### Description of Steeple Flat area

All zone substations in the Steeple Flat area are in the South Eastern region.

The Steeple Flat 132/66/22kV substation is owned by Essential Energy. It receives supply via a tee off the Essential Energy Cooma – Bega 132kV line (#97R). The 132/66/11kV transformer provides supply for the 66kV network to Bombala 66/22kV zone substation and connection for the Brown Mountain Generation. An 11/22kV transformer at Steeple Flat provides 22kV supply for local distribution load. Steeple Flat also provides connection for the Boco Rock wind farm to the 132kV network.

| STEEPLE FLAT – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 97C | 132 | Steeple Flat 132/66kV STS | Boco Rock Wind Farm | 140 | 112.5 | 112.5 | 112.5 | 112.5 | 112.5 | 157 | 112.6 | 112.6 | 112.6 | 112.6 | 112.6 |
| 97R | 132 | Steeple Flat 132/66kV STS | Bega 132/66kV STS | 140 | 17.3 | 17.3 | 17.3 | 17.3 | 17.3 | 157 | 22.9 | 22.9 | 22.9 | 22.9 | 22.9 |
| 810/3 | 66 | Steeple Flat 132/66kV STS | Brown Mountain Hydro | 70 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 810/4 | 66 | Steeple Flat 132/66kV STS | Bombala ZS | 21 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 25 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| S839 | 66 | Brown Mountain Hydro | Quira ZS | 70 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 78 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |

#### STS and ZS load forecast

| SUMMER | Steeple Flat Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bombala | 66/22 | 10/16 | 10/13 | | 14.3 | 1.00 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 0.62 | 1 |
| Steeple Flat 132/66kV | 132/66 | 30 | | | 0 | 0.98 | 5.1 | 5.1 | 5.2 | 5.2 | 5.2 | 0.00 | 3.5 |
| Steeple Flat 22kV | 11/22 | 5 | | | 0 | 0.94 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.24 | 12.5 |

| WINTER | Steeple Flat Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bombala | 66/22 | 10/16 | 10/13 | | 15.6 | 1.00 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 0.62 | 5 |
| Steeple Flat 132/66kV | 132/66 | 30 | | | 0 | 0.99 | 6.0 | 6.0 | 6.0 | 6.0 | 6.1 | 0.00 | 9 |
| Steeple Flat 22kV | 11/22 | 5 | | | 0 | 0.98 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.24 | 14.5 |

#### Sub-transmission Single Line Diagram of Steeple Flat area

Please refer to the Sub-transmission Single Line Diagram of Bega area on Page 104.

### 2.3.38 Tumut Supply Area

#### Description of Tumut area

All zone substations in the Tumut area are in the Riverina Slopes region.

The Tumut area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation.

| TUMUT – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 827 | 66 | TransGrid Tumut 132/66kV STS | Tumut ZS | 28 | 16.7 | 16.8 | 16.9 | 17.0 | 17.1 | 34 | 14.4 | 14.3 | 14.2 | 14.2 | 14.1 |
| 828 | 66 | TransGrid Tumut 132/66kV STS | Gundagai South ZS | 11 | 7.2 | 7.2 | 7.3 | 7.3 | 7.4 | 19 | 5.3 | 5.3 | 5.2 | 5.2 | 5.2 |
| 829 | 66 | TransGrid Tumut 132/66kV STS | Tumut ZS | 28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 831 | 66 | Gundagai South ZS | Nangus ZS | 11 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 19 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 848 | 66 | Adelong Tee | Adelong ZS | 12 | 1.6 | 1.6 | 1.6 | 1.6 | 1.7 | 19 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 |
| 830/2:GUN | 66 | Gundagai South ZS | Parsons Creek ZS | 11 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 19 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 848/1 | 66 | Adelong Tee | Batlow ZS | 21 | 9.7 | 9.8 | 9.8 | 9.9 | 9.9 | 25 | 9.7 | 9.7 | 9.6 | 9.6 | 9.6 |
| 848/2 | 66 | Batlow ZS | Tumbarumba ZS | 22 | 7.7 | 7.8 | 7.8 | 7.9 | 7.9 | 26 | 7.6 | 7.6 | 7.6 | 7.5 | 7.5 |
| 848/3 | 66 | TransGrid Tumut 132/66kV STS | Adelong Tee | 21 | 11.3 | 11.4 | 11.4 | 11.5 | 11.5 | 25 | 11.0 | 11.0 | 10.9 | 10.9 | 10.8 |
| 850:TAL | 66 | TransGrid Tumut 132/66kV STS | Talbingo ZS | 18 | 1.3 | 1.3 | 1.4 | 1.4 | 1.4 | 22 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |

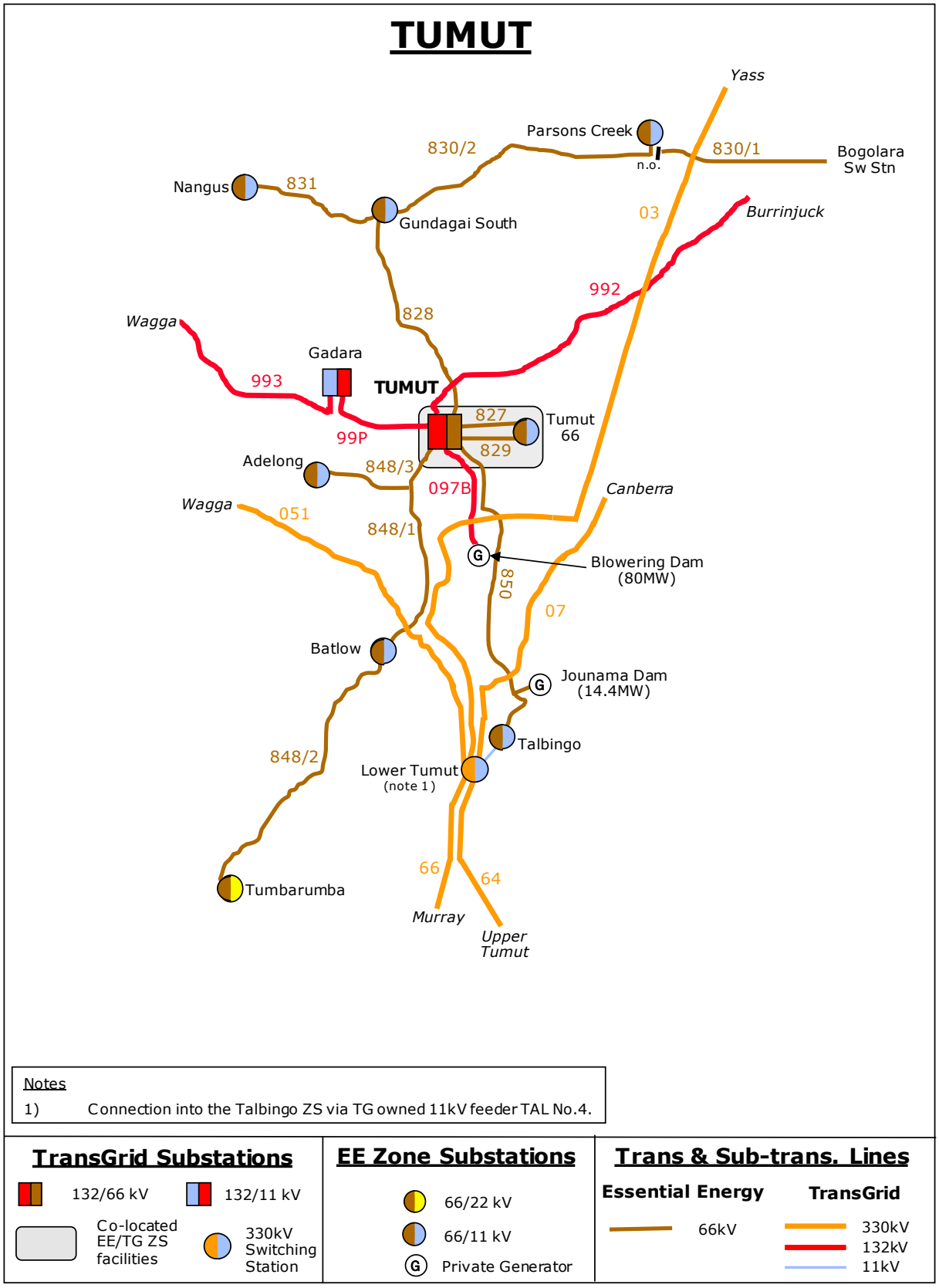
A 15MW hydro generator is located at Jounama Dam and is connected to the TransGrid Tumut 132/66kV sub-transmission substation at 66kV via feeder 850:TAL.

## STS and ZS load forecast

| SUMMER | Tumut Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Adelong | 66/11 | 3 | 2.5 | | 2.75 | 0.99 | 1.6 | 1.6 | 1.6 | 1.6 | 1.7 | 0.73 | 5.5 |
| Batlow | 66/11 | 5 | 5 | | 5.5 | 0.96 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 0.60 | 2 |
| Gundagai South | 66/11 | 8 | 8 | | 8.8 | 0.98 | 6.2 | 6.2 | 6.3 | 6.4 | 6.4 | 1.79 | 11.5 |
| Nangus | 66/11 | 1 | 2.8 | | 1.1 | 0.92 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.21 | 2.5 |
| Parsons Creek | 66/11 | 3 | | | 0 | 1.00 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.04 | 2.5 |
| Talbingo | 66/11 | 3.5 | | | 0 | 1.00 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.18 | 0.5 |
| Tumbarumba | 66/22 | 10/12.5 | 10/12.5 | | 13.75 | 1.00 | 7.9 | 7.9 | 7.8 | 7.8 | 7.8 | 1.80 | 8.5 |
| Tumut | 66/11 | 30 | 18/30 | | 33 | 0.94 | 18.4 | 18.9 | 19.3 | 19.8 | 20.3 | 0.00 | 10 |

| WINTER | Tumut Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Adelong | 66/11 | 3 | 2.5 | | 3 | 1.00 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.73 | 1 |
| Batlow | 66/11 | 5 | 5 | | 6 | 0.98 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.60 | 8 |
| Gundagai South | 66/11 | 8 | 8 | | 9.6 | 1.00 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 1.79 | 24 |
| Nangus | 66/11 | 1 | 2.8 | | 1.2 | 0.98 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.21 | 3 |
| Parsons Creek | 66/11 | 3 | | | 0 | 1.00 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.04 | 1.5 |
| Talbingo | 66/11 | 3.5 | | | 0 | 1.00 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.18 | 1 |
| Tumbarumba | 66/22 | 10/12.5 | 10/12.5 | | 15 | 0.99 | 8.7 | 8.7 | 8.8 | 8.8 | 8.9 | 1.80 | 29.5 |
| Tumut | 66/11 | 30 | 18/30 | | 36 | 0.96 | 14.3 | 14.4 | 14.5 | 14.5 | 14.6 | 0.00 | 10 |

## Sub-transmission Single Line Diagram of Tumut area



### 2.3.39 Queanbeyan Supply Area

#### Description of Queanbeyan area

All zone substations in the Queanbeyan area are in the South Eastern region.

The Queanbeyan area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation.

| QUEANBEYAN – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

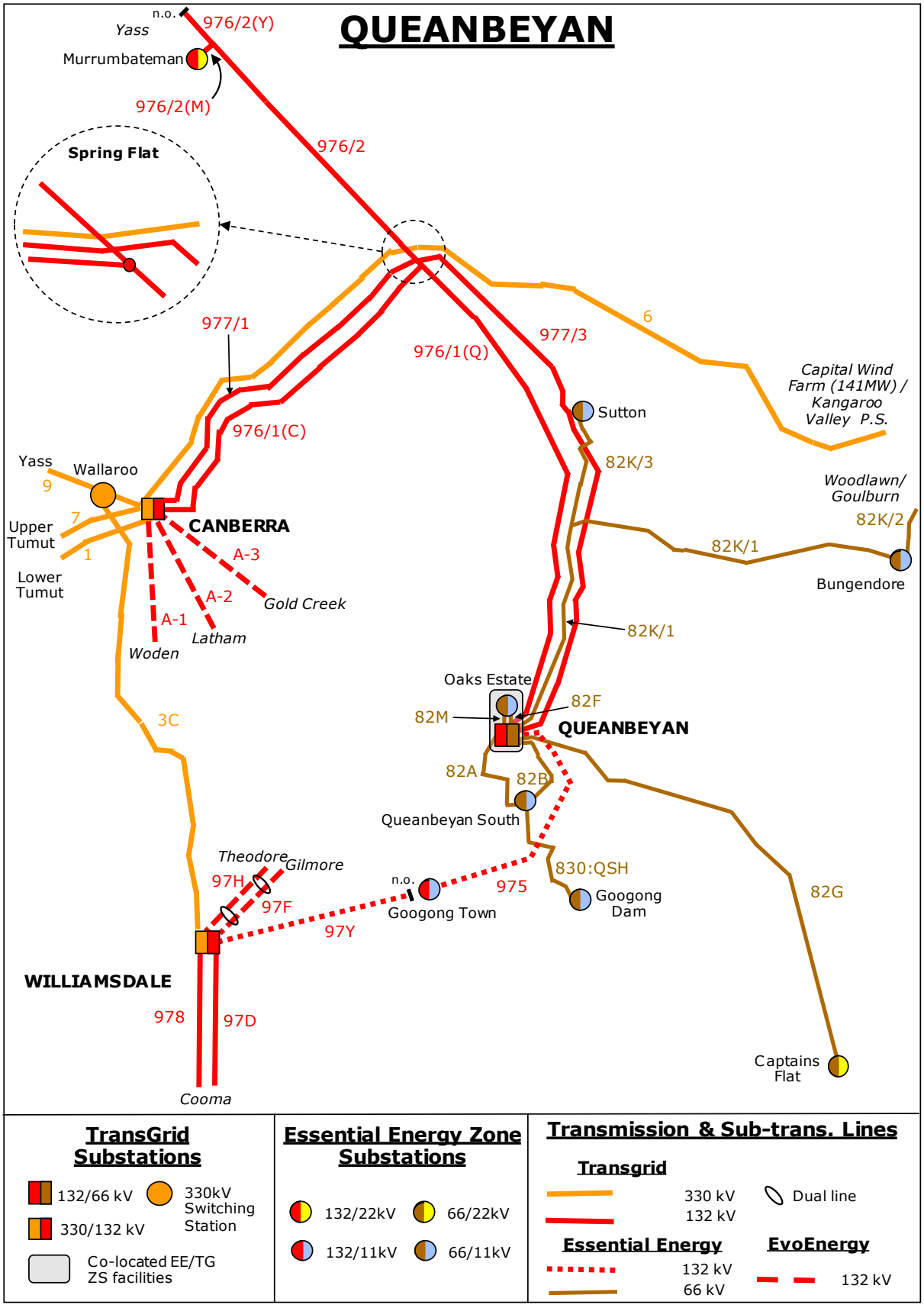
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 97Y | 132 | TransGrid Williamsdale 330/132kV STS | Googong Town ZS | 91 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 112 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 975 | 132 | TransGrid Queanbeyan 132/66kV STS | Googong Town ZS | 41 | 7.3 | 8.2 | 9.2 | 10.2 | 14.0 | 79 | 8.3 | 9.4 | 10.5 | 11.6 | 15.6 |
| 82A | 66 | TransGrid Queanbeyan 132/66kV STS | Queanbeyan South ZS | 30 | 15.6 | 15.7 | 15.8 | 15.9 | 16.0 | 37 | 14.9 | 14.9 | 14.9 | 14.9 | 14.8 |
| 82B | 66 | TransGrid Queanbeyan 132/66kV STS | Queanbeyan South ZS | 30 | 11.7 | 11.8 | 11.8 | 11.9 | 12.0 | 37 | 11.2 | 11.2 | 11.2 | 11.2 | 11.1 |
| 82F | 66 | TransGrid Queanbeyan 132/66kV STS | Oaks Estate ZS | 49 | 15.6 | 16.1 | 16.9 | 17.7 | 15.6 | 49 | 17.1 | 17.5 | 18.3 | 19.1 | 17.0 |
| 82G | 66 | TransGrid Queanbeyan 132/66kV STS | Captains Flat ZS | 12 | 7.4 | 7.5 | 7.5 | 7.5 | 7.5 | 19 | 8.4 | 8.5 | 8.5 | 8.6 | 8.7 |
| 82K/1 | 66 | TransGrid Queanbeyan 132/66kV STS | Sutton / Bungendore Tee | 28 | 12.2 | 12.5 | 12.8 | 13.1 | 13.4 | 34 | 13.9 | 14.1 | 14.3 | 14.5 | 14.7 |
| 82K/1 | 66 | Sutton / Bungendore Tee | Bungendore ZS | 28 | 8.4 | 8.6 | 8.7 | 8.9 | 9.0 | 34 | 9.3 | 9.4 | 9.5 | 9.6 | 9.7 |
| 82K/3 | 66 | Sutton / Bungendore Tee | Sutton ZS | 28 | 3.8 | 3.9 | 4.1 | 4.3 | 4.4 | 34 | 4.6 | 4.7 | 4.8 | 4.9 | 5.0 |
| 82M | 66 | TransGrid Queanbeyan 132/66kV STS | Oaks Estate ZS | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 830:QSH | 66 | Queanbeyan South ZS | Googong Dam ZS | 15 | 4.0 | 4.2 | 4.4 | 4.5 | 4.5 | 25 | 3.2 | 3.4 | 3.6 | 3.7 | 3.7 |

## STS and ZS load forecast

| SUMMER | Queanbeyan Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bungendore | 66/11 | 7.5/10 | 7.5/10 | | 11 | 1.00 | 8.1 | 8.3 | 8.4 | 8.6 | 8.7 | 3.57 | 5 |
| Captains Flat | 66/22 | 5 | 5 | | 5.5 | 1.00 | 7.1 | 7.2 | 7.2 | 7.2 | 7.2 | 1.22 | 3.5 |
| Googong Dam | 66/11 | 8/10 | 7.5/10 | | 11 | 1.00 | 3.8 | 4.0 | 4.2 | 4.3 | 4.3 | 0.00 | 1.5 |
| Googong Town | 132/11 | 30 | | | 0 | 1.00 | 7.3 | 8.2 | 9.2 | 10.2 | 14.0 | 2.89 | 1 |
| Oaks Estate | 66/11 | 30 | 20/30 | | 33 | 0.96 | 15.6 | 16.1 | 16.9 | 17.7 | 15.6 | 3.06 | 7.5 |
| Queanbeyan South | 66/11 | 20/25/30 | 20/25/30 | | 33 | 0.98 | 26.0 | 26.2 | 26.3 | 26.5 | 26.7 | 0.00 | 4.5 |
| Sutton | 66/11 | 8 | 6.5/8 | | 8.8 | 0.99 | 3.7 | 3.8 | 4.0 | 4.2 | 4.3 | 2.07 | 3 |

| WINTER | Queanbeyan Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bungendore | 66/11 | 7.5/10 | 7.5/10 | | 12 | 1.00 | 9.0 | 9.1 | 9.2 | 9.3 | 9.4 | 3.57 | 4.5 |
| Captains Flat | 66/22 | 5 | 5 | | 6 | 1.00 | 8.1 | 8.2 | 8.2 | 8.3 | 8.4 | 1.22 | 4.5 |
| Googong Dam | 66/11 | 8/10 | 7.5/10 | | 12 | 1.00 | 3.0 | 3.2 | 3.4 | 3.5 | 3.5 | 0.00 | 13 |
| Googong Town | 132/11 | 30 | | | 0 | 1.00 | 8.3 | 9.4 | 10.5 | 11.6 | 15.6 | 2.89 | 6.5 |
| Oaks Estate | 66/11 | 30 | 20/30 | | 36 | 0.98 | 17.1 | 17.5 | 18.3 | 19.1 | 17.0 | 3.06 | 6.5 |
| Queanbeyan South | 66/11 | 20/25/30 | 20/25/30 | | 36 | 1.00 | 24.9 | 24.9 | 24.8 | 24.8 | 24.7 | 0.00 | 16 |
| Sutton | 66/11 | 8 | 6.5/8 | | 9.6 | 0.99 | 4.5 | 4.6 | 4.7 | 4.8 | 4.9 | 2.07 | 20.5 |

Sub-transmission Single Line Diagram of Queanbeyan area



### 2.3.40 Goulburn Supply Area

#### Description of Goulburn area

All zone substations in the Goulburn area are in the South Eastern region.

Essential Energy's Goulburn (Rocky Hill) 132/66/33kV substation is supplied via Essential Energy's 132kV transmission lines from TransGrid's sub-transmission substations at Marulan and Yass respectively.

| GOULBURN – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 972 | 132 | TransGrid Marulan 330/132kV STS | Goulburn 132/66/33kV STS | 180 | 41.1 | 38.6 | 37.9 | 37.2 | 36.5 | 202 | 49.2 | 46.8 | 46.2 | 45.6 | 45.0 |
| 9UR | 132 | TransGrid Marulan 330/132kV STS | Taralga Wind Farm | 140 | 97.7 | 97.7 | 97.7 | 97.7 | 97.7 | 157 | 104.9 | 104.9 | 104.9 | 104.9 | 104.9 |
| 843 | 66 | Clinton St ZS | Goulburn North ZS | 46 | 4.4 | 4.4 | 4.5 | 4.5 | 4.5 | 52 | 4.7 | 4.7 | 4.8 | 4.8 | 4.8 |
| 82K/2 | 66 | Woodlawn ZS | Bungendore ZS | 28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 840:GOU | 66 | Goulburn 132/66/33kV STS | Goulburn North ZS | 61 | 7.5 | 7.6 | 7.7 | 7.8 | 7.9 | 68 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 |
| 841:GBN | 66 | Goulburn North ZS | Crookwell ZS | 9 | 4.3 | 4.4 | 4.4 | 4.5 | 4.5 | 13 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| 850:GOU | 66 | Goulburn 132/66/33kV STS | Woodlawn ZS | 28 | 19.5 | 19.5 | 19.5 | 19.5 | 19.5 | 34 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 86M/1 | 66 | Goulburn 132/66/33kV STS | Marulan North Tee | 25 | 11.8 | 14.4 | 15.3 | 16.1 | 16.9 | 29 | 12.6 | 15.2 | 16.0 | 16.8 | 17.6 |
| 86M/2 | 66 | Marulan North Tee | Marulan South ZS | 25 | 7.4 | 9.6 | 9.7 | 9.9 | 10.1 | 29 | 8.0 | 10.2 | 10.4 | 10.6 | 10.8 |
| 86L | 66 | Marulan North Tee | Marulan North ZS | 12 | 5.7 | 6.5 | 7.2 | 8.0 | 8.7 | 19 | 6.0 | 6.7 | 7.4 | 8.1 | 8.7 |
| 870:GOU | 66 | Goulburn 132/66/33kV STS | Clinton St ZS | 34 | 18.7 | 18.9 | 19.0 | 19.1 | 19.3 | 41 | 19.9 | 19.9 | 20.0 | 20.1 | 20.1 |
| GOU12 | 33 | Goulburn 132/66/33kV STS | Brisbane Grove ZS | 7 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 12 | 2.4 | 2.5 | 2.6 | 2.7 | 2.7 |

A 7MW biomass generator is located at Woodlawn Bioreactor and is connected to the Woodlawn 66/11kV zone substation at 11kV via feeder WOO8642.

A 5MW wind generator is located at Crookwell wind farm and is connected to the Goulburn 132/66kV sub-transmission substation at 66kV via feeders 841:GBN and 840:GOU.

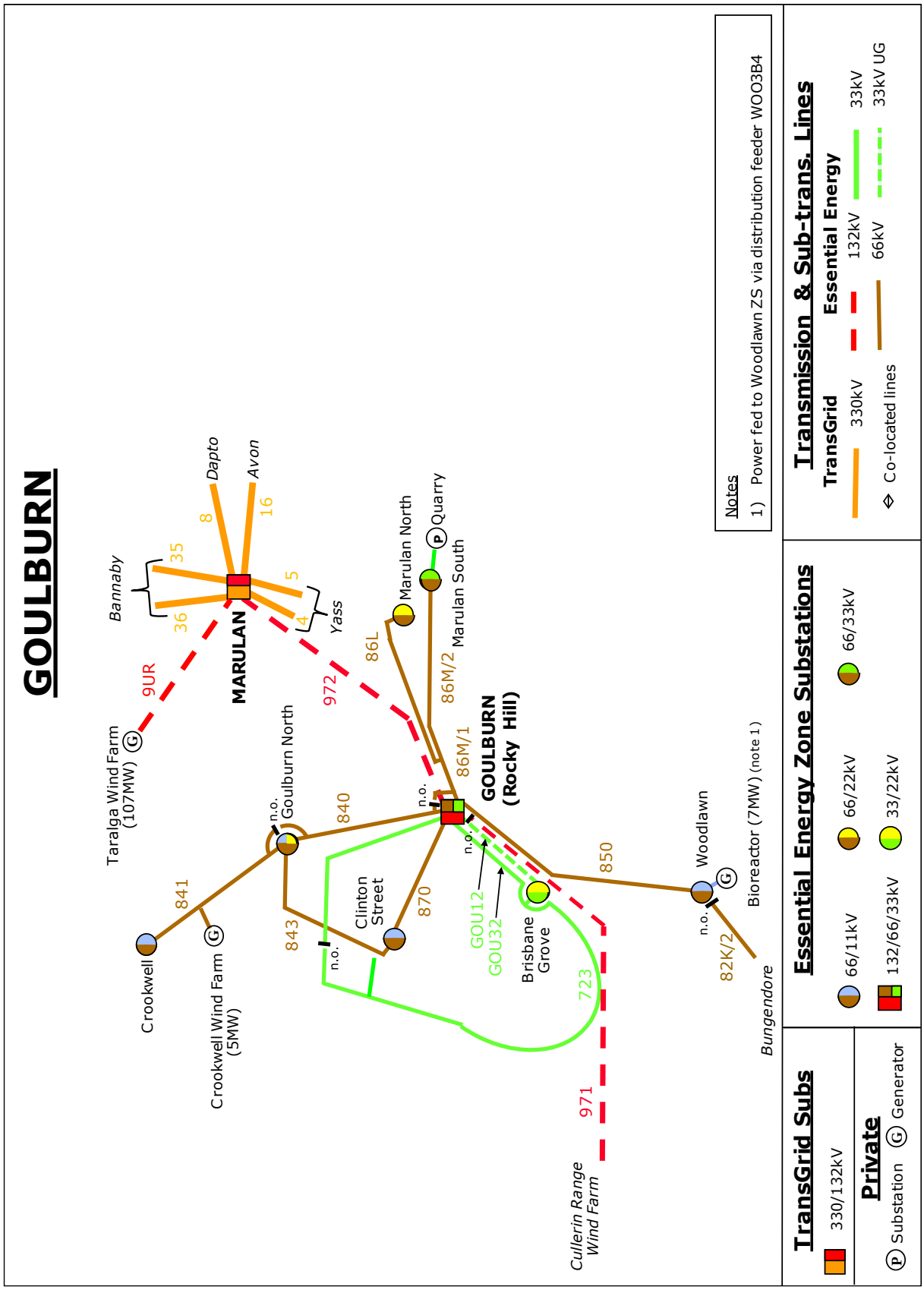
A 107MW wind generator is located at Taralga wind farm and is connected to the TransGrid Marulan 330/132kV sub-transmission substation at 132kV via feeder 9UR.

## STS and ZS load forecast

| SUMMER | Goulburn Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Brisbane Grove | 33/22 | 2.5 | 2.5 | | 2.75 | 0.98 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 1.11 | 4.5 |
| Clinton Street | 66/11 | 15/19 | 20/23/30 | | 20.9 | 0.96 | 13.1 | 13.1 | 13.1 | 13.1 | 13.2 | 2.97 | 2 |
| Crookwell | 66/11 | 7.5/10 | 7.5/10 | | 11 | 0.99 | 4.3 | 4.4 | 4.4 | 4.5 | 4.5 | 2.09 | 3 |
| Goulburn 132/33kV | 132/33 | 15/22.5/30 | 30/36 | | 33 | 1.00 | 8.9 | 9.0 | 9.0 | 9.0 | 9.0 | 1.58 | 11 |
| Goulburn 132/66kV | 132/66 | 35/60 | 35/60 | | 66 | 0.97 | 50.4 | 53.8 | 55.3 | 56.8 | 58.2 | 0.00 | 2.5 |
| Goulburn North | 66/11 | 15 | 12.5/16 | | 16.5 | 1.00 | 7.9 | 8.0 | 8.1 | 8.2 | 8.4 | 2.42 | 0.5 |
| Marulan North | 66/22 | 12.5/15 | 12.5/15 | | 16.5 | 1.00 | 5.7 | 6.5 | 7.2 | 8.0 | 8.7 | 1.25 | 1 |
| Marulan South | 66/33 | 10/16 | | | 0 | 0.96 | 7.4 | 9.6 | 9.7 | 9.9 | 10.1 | 0.00 | 2 |
| Woodlawn | 66/11 | 10/14 | 24/30 | | 15.4 | 1.00 | 19.5 | 19.5 | 19.5 | 19.5 | 19.5 | 0.47 | 26.5 |

| WINTER | Goulburn Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Brisbane Grove | 33/22 | 2.5 | 2.5 | | 3 | 0.97 | 2.4 | 2.5 | 2.6 | 2.7 | 2.7 | 1.11 | 3.5 |
| Clinton Street | 66/11 | 15/19 | 20/23/30 | | 22.8 | 0.99 | 13.9 | 14.0 | 14.0 | 14.1 | 14.2 | 2.97 | 14.5 |
| Crookwell | 66/11 | 7.5/10 | 7.5/10 | | 12 | 1.00 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 2.09 | 8 |
| Goulburn 132/33kV | 132/33 | 15/22.5/30 | 30/36 | | 36 | 1.00 | 8.5 | 8.5 | 8.5 | 8.4 | 8.4 | 1.58 | 23 |
| Goulburn 132/66kV | 132/66 | 35/60 | 35/60 | | 72 | 0.98 | 53.7 | 57.6 | 59.5 | 61.4 | 63.3 | 0.00 | 5 |
| Goulburn North | 66/11 | 15 | 12.5/16 | | 18 | 1.00 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 2.42 | 7.5 |
| Marulan North | 66/22 | 12.5/15 | 12.5/15 | | 18 | 1.00 | 6.0 | 6.7 | 7.4 | 8.1 | 8.7 | 1.25 | 8.5 |
| Marulan South | 66/33 | 10/16 | | | 0 | 0.96 | 8.0 | 10.2 | 10.4 | 10.6 | 10.8 | 0.00 | 1.5 |
| Woodlawn | 66/11 | 10/14 | 24/30 | | 16.8 | 1.00 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 0.47 | 5 |

Sub-transmission Single Line Diagram of Goulburn area



### 2.3.41 Cowra Supply Area

#### Description of Cowra area

Zone substations in the Cowra area are spread across both the Macquarie and Riverina Slopes regions.

The Cowra area sub-transmission system is supplied from TransGrid's Cowra 132/66kV sub-transmission substation. Normal 66kV system operation supplies from Cowra to Young open point and includes Bendick Murrell, Monteagle and connection to Wyangala Power Station.

| COWRA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – CWD33 Eugowra | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 865 | 66 | TransGrid Cowra 132/66kV STS | Cowra Town ZS | 15 | 10.9 | 10.8 | 10.7 | 10.6 | 10.5 | 25 | 7.5 | 7.7 | 7.9 | 8.1 | 8.2 |
| 863:CWD | 66 | TransGrid Cowra 132/66kV STS | Canowindra ZS | 9 | 6.8 | 6.9 | 6.9 | 7.0 | 7.1 | 15 | 4.9 | 5.1 | 5.2 | 5.3 | 5.5 |
| 866:COW | 66 | TransGrid Cowra 132/66kV STS | Cowra Town ZS | 15 | 10.9 | 10.8 | 10.7 | 10.6 | 10.5 | 25 | 7.5 | 7.7 | 7.9 | 8.1 | 8.2 |
| 891/1 | 66 | TransGrid Cowra 132/66kV STS | Wyangala Dam Tee | 20 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 | 24 | 2.0 | 2.1 | 2.1 | 2.1 | 2.1 |
| 891/2 | 66 | Wyangala Dam Tee | Wyangala Dam | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 891/5 | 66 | Monteagle Tee | Monteagle ZS | 13 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 22 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| 891/6 | 66 | Monteagle Tee | Young ZS | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 891/7 | 66 | Bendick Murrell Tee | Bendick Murrell ZS | 19 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 33 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| 891:BMU | 66 | Wyangala Dam Tee | Bendick Murrell Tee | 19 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 33 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| 891:BMU | 66 | Bendick Murrell Tee | Monteagle Tee | 19 | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 33 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| 893/1 | 66 | TransGrid Cowra 132/66kV STS | Grenfell Tee | 12 | 3.8 | 3.8 | 3.7 | 3.6 | 3.5 | 18 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 |
| 893/4 | 66 | Grenfell Tee | Payten's Bridge ZS | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 893/6 | 66 | Grenfell Tee | Grenfell ZS | 12 | 3.9 | 3.8 | 3.8 | 3.7 | 3.6 | 18 | 4.5 | 4.5 | 4.5 | 4.6 | 4.6 |

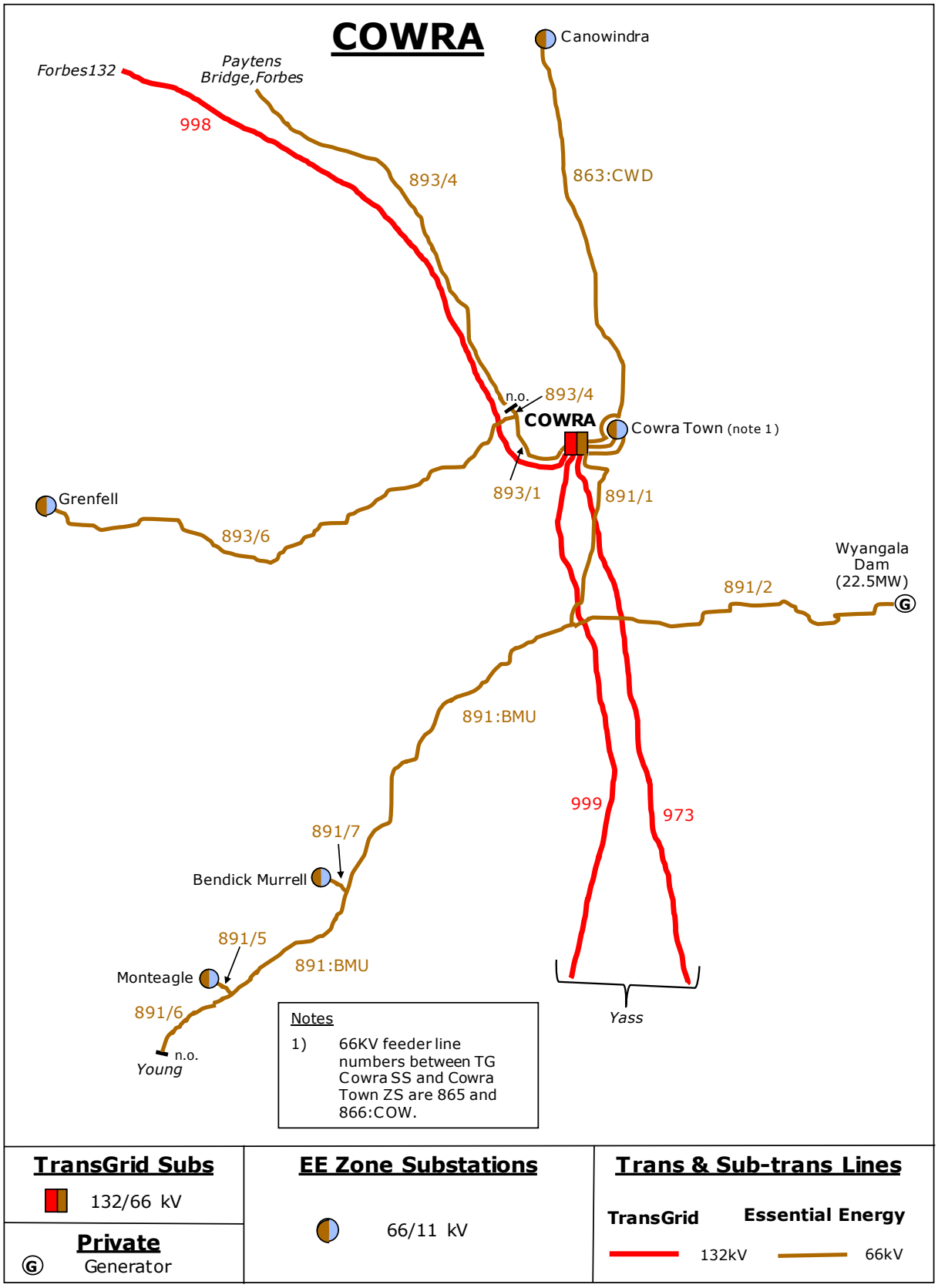
A 22.5MW hydro generator is located at Wyangala Dam and is connected to the TransGrid Cowra 132/66kV sub-transmission substation at 66kV via feeder 891.

## STS and ZS load forecast

| SUMMER | Cowra Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bendick Murrell | 66/11 | 2.8 | | | 0 | 0.93 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 0.59 | 1.5 |
| Canowindra | 66/11 | 5 | 8 | | 5.5 | 0.96 | 6.8 | 6.9 | 6.9 | 7.0 | 7.1 | 1.53 | 5 |
| Cowra | 66/11 | 15/30 | 15/30 | | 33 | 1.00 | 21.7 | 21.5 | 21.3 | 21.1 | 20.9 | 4.17 | 6 |
| Grenfell | 66/11 | 8 | 5 | | 5.5 | 0.95 | 5.2 | 5.1 | 5.1 | 5.0 | 5.0 | 1.71 | 6 |
| Monteagle | 66/11 | 1 | | | 0 | 0.95 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.38 | 3 |

| WINTER | Cowra Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bendick Murrell | 66/11 | 2.8 | | | 0 | 0.98 | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 0.59 | 2.5 |
| Canowindra | 66/11 | 5 | 8 | | 6 | 0.99 | 4.9 | 5.1 | 5.2 | 5.3 | 5.5 | 1.53 | 8.5 |
| Cowra | 66/11 | 15/30 | 15/30 | | 36 | 1.00 | 15.1 | 15.4 | 15.8 | 16.1 | 16.5 | 4.17 | 15.5 |
| Grenfell | 66/11 | 8 | 5 | | 6 | 0.95 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 1.71 | 4 |
| Monteagle | 66/11 | 1 | | | 0 | 0.95 | 0.9 | 0.9 | 0.9 | 1.0 | 1.0 | 0.38 | 4 |

Sub-transmission Single Line Diagram of Cowra area



### 2.3.42 Murrumburrah Supply Area

#### Description of Murrumburrah area

All zone substations in the Murrumburrah area are in the Riverina Slopes region.

The Harden-Murrumburrah area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation at Murrumburrah.

| MURRUMBURRAH – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

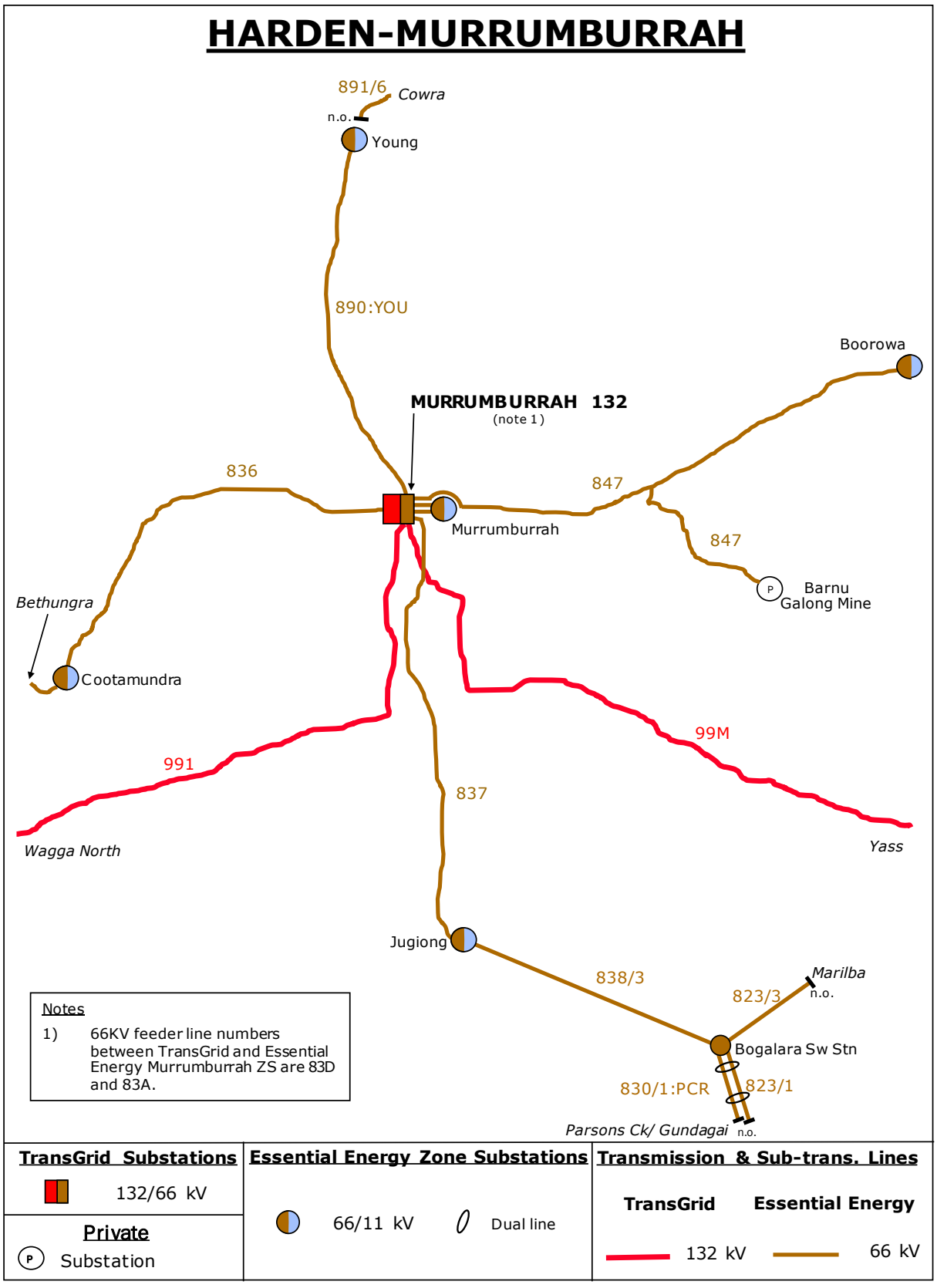
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 836 | 66 | TransGrid Murrumburrah 132/66kV STS | Cootamundra ZS | 12 | 10.6 | 10.6 | 10.5 | 10.5 | 10.5 | 18 | 7.7 | 7.8 | 7.8 | 7.9 | 8.0 |
| 837 | 66 | TransGrid Murrumburrah 132/66kV STS | Jugiong ZS | 12 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 18 | 1.6 | 1.7 | 1.7 | 1.7 | 1.7 |
| 847 | 66 | TransGrid Murrumburrah 132/66kV STS | Boorowa ZS | 10 | 4.9 | 4.8 | 4.8 | 4.7 | 4.7 | 16 | 4.7 | 4.7 | 4.8 | 4.8 | 4.9 |
| 823/3 | 66 | Bogalara Sw Stn | Marilba ZS | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 830/1:PCR | 66 | Bogalara Sw Stn | Parsons Creek ZS | 11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 838/3 | 66 | Jugiong ZS | Bogalara Sw Stn | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 83A | 66 | TransGrid Murrumburrah 132/66kV STS | Murrumburrah ZS | 15 | 5.3 | 5.2 | 5.2 | 5.1 | 5.0 | 25 | 4.3 | 4.3 | 4.4 | 4.4 | 4.4 |
| 83D | 66 | TransGrid Murrumburrah 132/66kV STS | Murrumburrah ZS | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 890:YOU | 66 | TransGrid Murrumburrah 132/66kV STS | Young ZS | 24 | 18.6 | 18.3 | 18.0 | 17.7 | 17.4 | 28 | 14.8 | 14.9 | 15.0 | 15.1 | 15.3 |

## STS and ZS load forecast

| SUMMER | Harden - Murrumburrah Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Boorowa | 66/11 | 8 | 5 | | 5.5 | 0.97 | 3.7 | 3.7 | 3.6 | 3.6 | 3.5 | 1.50 | 4.5 |
| Cootamundra | 66/11 | 15/19 | 15/19 | | 20.9 | 0.97 | 10.6 | 10.6 | 10.5 | 10.5 | 10.5 | 2.87 | 7.5 |
| Jugiong | 66/11 | 5.9/6.5 | 5.9/6.5 | | 7.15 | 0.91 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.22 | 13.5 |
| Murrumburrah | 66/11 | 8/10 | 8/10 | | 11 | 0.96 | 5.3 | 5.2 | 5.2 | 5.1 | 5.0 | 1.53 | 6.5 |
| Young | 66/11 | 24/30 | 18/30 | | 33 | 0.96 | 18.6 | 18.3 | 18.0 | 17.7 | 17.4 | 4.27 | 9 |

| WINTER | Harden - Murrumburrah Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Boorowa | 66/11 | 8 | 5 | | 6 | 0.98 | 3.3 | 3.4 | 3.4 | 3.5 | 3.6 | 1.50 | 7.5 |
| Cootamundra | 66/11 | 15/19 | 15/19 | | 22.8 | 1.00 | 7.7 | 7.8 | 7.8 | 7.9 | 8.0 | 2.87 | 14 |
| Jugiong | 66/11 | 5.9/6.5 | 5.9/6.5 | | 7.8 | 0.93 | 1.6 | 1.7 | 1.7 | 1.7 | 1.7 | 0.22 | 15 |
| Murrumburrah | 66/11 | 8/10 | 8/10 | | 12 | 0.99 | 4.3 | 4.3 | 4.4 | 4.4 | 4.4 | 1.53 | 7.5 |
| Young | 66/11 | 24/30 | 18/30 | | 36 | 1.00 | 14.8 | 14.9 | 15.0 | 15.1 | 15.3 | 4.27 | 16.5 |

Sub-transmission Single Line Diagram of Murrumburrah area



### 2.3.43 Yass Supply Area

#### Description of Yass area

All zone substations in the Yass area are in the South Eastern region.

The Yass area sub-transmission system is supplied from TransGrid's 330/132/66kV sub-transmission substation.

| YASS – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating MVA | Line Forecast MVA | | | | | Line Rating MVA | Line Forecast MVA | | | | |
| | | | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 |
| 971(1) | 132 | TransGrid Yass 330/132/66kV STS | Cullerin Range Wind Farm | 106 | 78.8 | 78.8 | 78.8 | 78.8 | 78.8 | 119 | 78.5 | 78.5 | 78.5 | 78.5 | 78.5 |
| 971(2) | 132 | Cullerin Range Wind Farm | Gunning Wind Farm | 140 | 48.4 | 48.4 | 48.4 | 48.4 | 48.4 | 157 | 48.3 | 48.3 | 48.3 | 48.3 | 48.3 |
| 971(3) | 132 | Cullerin Range Wind Farm | Goulburn 132/66/33kV STS | 106 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 119 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 976/2 (M) | 132 | TransGrid 132kV Line 976/2(Y) / Murrumbateman Tee | Murrumbateman ZS | 42 | 6.3 | 6.5 | 6.6 | 6.7 | 6.8 | 82 | 6.7 | 6.8 | 7.0 | 7.2 | 7.3 |
| 824 | 66 | TransGrid Yass 330/132/66kV STS | Yass ZS | 12 | 14.5 | 14.5 | 14.5 | 14.6 | 14.6 | 18 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 |
| 823/5 | 66 | Yass ZS | Marilba ZS | 12 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 18 | 1.7 | 1.8 | 1.8 | 1.8 | 1.8 |

A 30MW wind generator is located at Cullerin Range wind farm and is connected to the TransGrid Yass 330/132/66kV sub-transmission substation at 132kV via feeder 971.

A 47MW wind generator is located at Gunning wind farm and is also connected to the TransGrid Yass 330/132/66kV sub-transmission substation at 132kV via feeder 971.

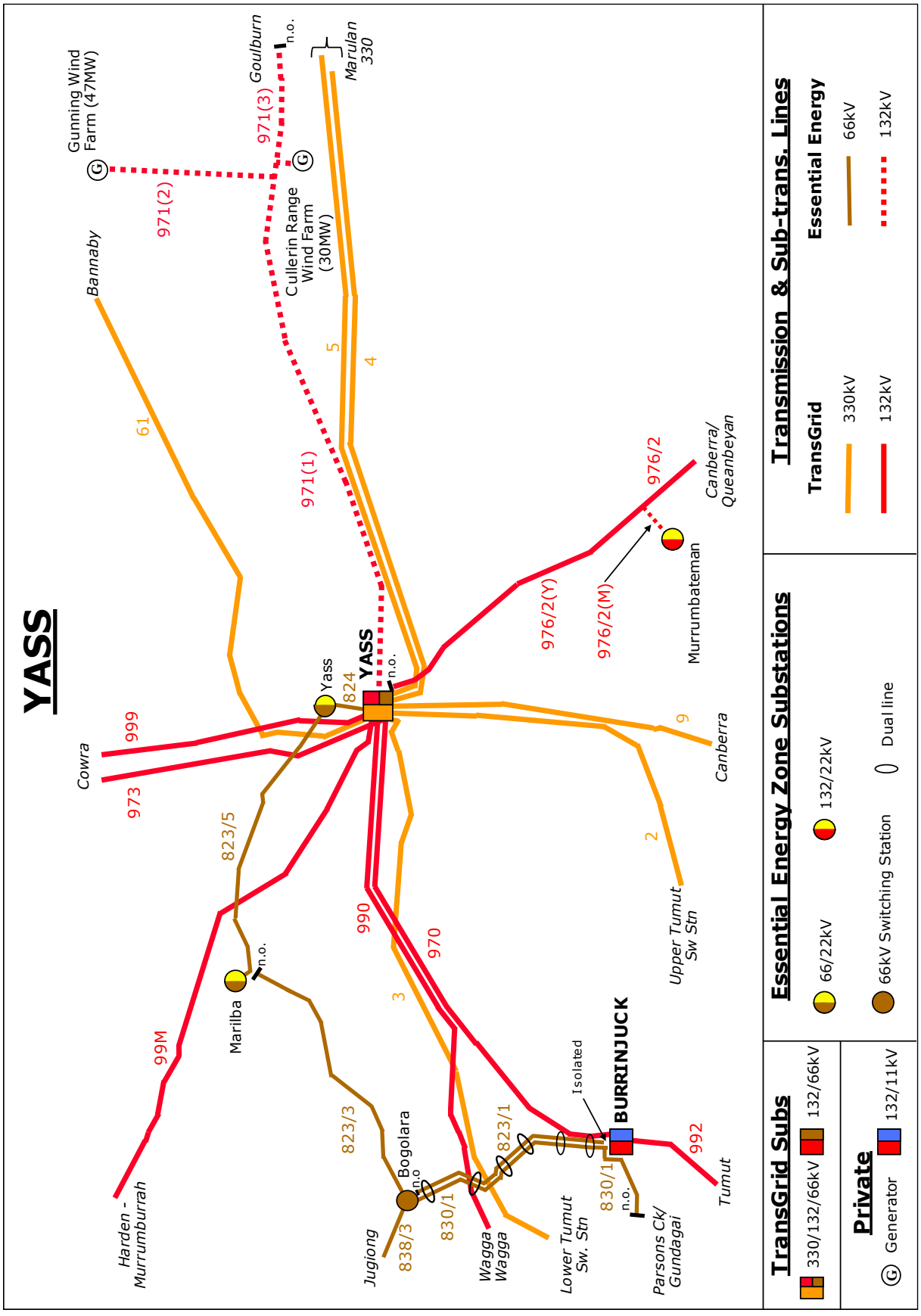
#### STS and ZS load forecast

| SUMMER | Yass Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Gunning | 22/11 | 2.5 | 2.5 | | 2.75 | 0.99 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 0.63 | 2.5 |
| Marilba | 66/11 | 3 | 1 | | 1.1 | 0.99 | 1.5 | 1.5 | 1.6 | 1.6 | 1.6 | 0.57 | 3.5 |
| Murrumbateman | 132/22 | 10/12.5 | | | 0 | 1.00 | 6.2 | 6.3 | 6.4 | 6.6 | 6.7 | 3.16 | 3.5 |
| Yass | 66/22 | 10/12 | 10/12 | | 13.2 | 0.96 | 13.0 | 13.1 | 13.2 | 13.3 | 13.4 | 3.76 | 4 |

| WINTER | Yass Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Gunning | 22/11 | 2.5 | 2.5 | | 3 | 1.00 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 0.63 | 1 |
| Marilba | 66/11 | 3 | 1 | | 1.2 | 1.00 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 0.57 | 18 |
| Murrumbateman | 132/22 | 10/12.5 | | | 0 | 1.00 | 6.7 | 6.8 | 7.0 | 7.2 | 7.3 | 3.16 | 6.5 |
| Yass | 66/22 | 10/12 | 10/12 | | 14.4 | 0.95 | 12.6 | 12.8 | 12.9 | 13.1 | 13.3 | 3.76 | 5.5 |

There are multiple load transfer points in the Yass area to other zone substations that can be utilised with the loss of a single Yass transformer.

Sub-transmission Single Line Diagram of Yass area



### 2.3.44 Temora Supply Area

#### Description of Temora area

Zone substations in the Temora area are spread across both the Riverina Slopes and Central regions.

Essential Energy's Temora 132/66kV sub-transmission substation is supplied from TransGrid's Wagga Wagga North 132/66kV sub-transmission substation via two Essential Energy 132kV transmission lines.

| TEMORA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

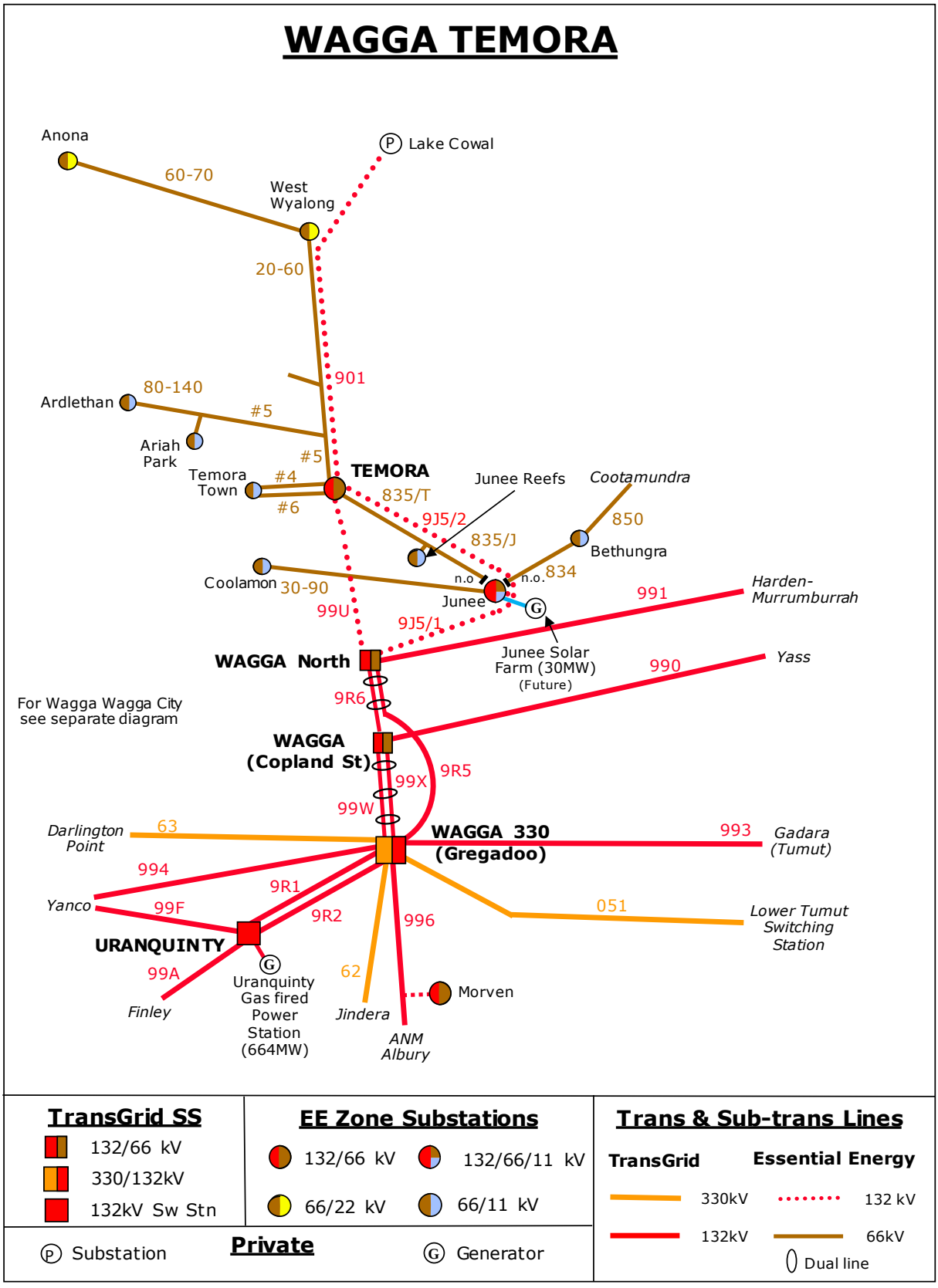
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 901 | 132 | Temora 132/66 STS | Lake Cowal | 108 | 32.5 | 32.5 | 50.5 | 50.5 | 50.5 | 135 | 32.4 | 32.4 | 50.4 | 50.4 | 50.4 |
| 4 | 66 | Temora 132/66 STS | Temora Town ZS | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 66 | Temora 132/66 STS | Ariah Park Tee | 21 | 12.3 | 12.3 | 12.3 | 12.3 | 12.3 | 25 | 8.9 | 8.9 | 8.9 | 8.9 | 8.9 |
| 6 | 66 | Temora 132/66 STS | Temora Town ZS | 15 | 8.3 | 8.1 | 8.0 | 7.9 | 7.8 | 25 | 6.5 | 6.5 | 6.5 | 6.5 | 6.6 |
| 20-60 | 66 | Ariah Park Tee | West Wyalong ZS | 21 | 10.2 | 10.2 | 10.2 | 10.2 | 10.2 | 25 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| 60-70 | 66 | West Wyalong ZS | Anona ZS | 7 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 12 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 80-140 | 66 | Ariah Park Tee | Ariah Park ZS | 15 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 25 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| 80-140 | 66 | Ariah Park ZS | Ardlethan ZS | 11 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 19 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 835/J | 66 | Junee Reefs ZS | Junee ZS | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 835/T | 66 | Temora 132/66 STS | Junee Reefs ZS | 12 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 18 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |

## STS and ZS load forecast

| SUMMER | Temora Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Anona | 66/22 | 3 | 2.5 | | 2.75 | 1.00 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.50 | 4 |
| Ardlethan | 66/11 | 2.5 | 3 | | 2.75 | 0.98 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.27 | 2.5 |
| Ariah Park | 66/11 | 3 | 3 | | 3.3 | 0.99 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.36 | 8.5 |
| Junee Reefs | 66/11 | 3 | | | 0 | 0.95 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.05 | 4 |
| Temora 132/66kV | 132/66 | 35/60 | 35/60 | | 66 | 1.00 | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 | 0.00 | 11 |
| Temora 66/11kV | 66/11 | 6.75/10 | 10/12.5 | | 11 | 0.97 | 8.3 | 8.1 | 8.0 | 7.9 | 7.8 | 2.41 | 9.5 |
| West Wyalong | 66/22 | 8 | 10/12.5 | | 8.8 | 0.97 | 9.1 | 9.1 | 9.1 | 9.1 | 9.2 | 2.38 | 6.5 |

| WINTER | Temora Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Anona | 66/22 | 3 | 2.5 | | 3 | 0.94 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.50 | 2.5 |
| Ardlethan | 66/11 | 2.5 | 3 | | 3 | 1.00 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.27 | 5.5 |
| Ariah Park | 66/11 | 3 | 3 | | 3.6 | 1.00 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.36 | 5.5 |
| Junee Reefs | 66/11 | 3 | | | 0 | 0.98 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.05 | 0.5 |
| Temora 132/66kV | 132/66 | 35/60 | 35/60 | | 72 | 0.99 | 15.5 | 15.7 | 15.8 | 16.0 | 16.1 | 0.00 | 5 |
| Temora 66/11kV | 66/11 | 6.75/10 | 10/12.5 | | 12 | 1.00 | 6.5 | 6.5 | 6.5 | 6.5 | 6.6 | 2.41 | 5.5 |
| West Wyalong | 66/22 | 8 | 10/12.5 | | 9.6 | 0.97 | 6.5 | 6.6 | 6.7 | 6.8 | 6.9 | 2.38 | 4.5 |

Sub-transmission Single Line Diagram of Temora area



### 2.3.45 Wagga North Supply Area

#### Description of Wagga North area

All zone substations in the Wagga North area are in the Riverina Slopes region.

The Wagga Wagga area sub-transmission system is supplied from two separate TransGrid 132/66kV sub-transmission substations at Wagga Wagga (Copland St) and Wagga North.

The transmission system emanating from Wagga North supplies many smaller outlying areas.

| WAGGA NORTH – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

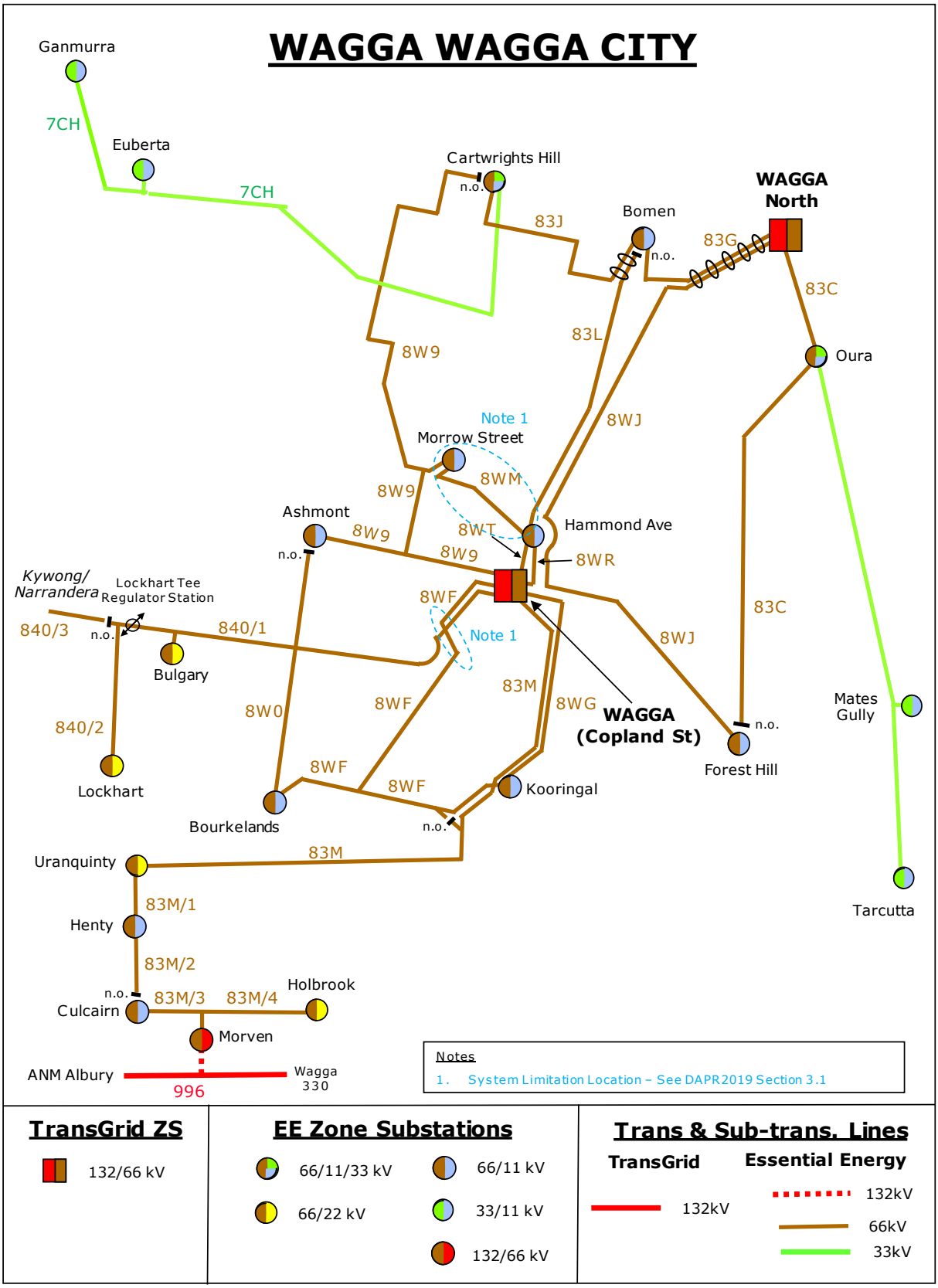
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 99U | 132 | TransGrid Wagga North 132/66kV STS | Temora 132/66 STS | 128 | 29.3 | 29.3 | 37.2 | 37.2 | 37.2 | 143 | 24.6 | 24.6 | 32.3 | 32.3 | 32.3 |
| 9J5/1 | 132 | TransGrid Wagga North 132/66kV STS | Junee 132/66/11kV ZS | 140 | 37.3 | 37.3 | 47.4 | 47.4 | 47.4 | 157 | 32.6 | 32.6 | 42.8 | 42.8 | 42.8 |
| 9J5/2 | 132 | Junee 132/66/11kV ZS | Temora 132/66 STS | 140 | 25.6 | 25.4 | 34.2 | 34.0 | 33.8 | 157 | 21.4 | 21.3 | 29.4 | 29.3 | 29.2 |
| 30-90 | 66 | Junee ZS | Coolamon ZS | 6 | 5.3 | 5.4 | 5.4 | 5.5 | 5.5 | 9 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 |
| 834:JUN | 66 | Junee ZS | Bethungra ZS | 11 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 19 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 |
| 83C | 66 | TransGrid Wagga North 132/66kV STS | Oura ZS | 24 | 4.0 | 3.9 | 3.8 | 6.9 | 6.8 | 28 | 2.9 | 2.9 | 2.8 | 5.9 | 5.9 |
| 83C | 66 | Oura ZS | Forest Hill ZS | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 83G | 66 | TransGrid Wagga North 132/66kV STS | Bomen ZS | 34 | 17.6 | 17.8 | 18.1 | 18.3 | 18.5 | 39 | 15.0 | 15.2 | 15.4 | 15.6 | 15.8 |
| 83J | 66 | Bomen ZS | Cartwrights Hill ZS | 34 | 8.8 | 9.0 | 9.2 | 9.3 | 9.5 | 39 | 6.6 | 6.8 | 7.0 | 7.2 | 7.3 |
| 850:BET | 66 | Bethungra ZS | Cootamundra ZS | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CHI2527 | 33 | Cartwrights Hill ZS | Euberta ZS | 4 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 6 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| CHI2527 | 33 | Euberta ZS | Ganmurra ZS | 4 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| Mates Gully | 33 | Oura ZS | Mates Gully ZS | 3 | 2.0 | 2.1 | 2.1 | 2.1 | 2.1 | 6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| Mates Gully | 33 | Mates Gully ZS | Tarcutta ZS | 4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 8WJ | 66 | TransGrid Wagga North 132/66kV STS | Forest Hill ZS | 34 | 6.4 | 6.3 | 6.1 | 6.0 | 5.8 | 39 | 5.8 | 5.9 | 5.9 | 5.9 | 5.9 |

## STS and ZS load forecast

| SUMMER | Wagga North Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Bethungra | 66/11 | 3 | 3 | | 3.3 | 0.96 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.12 | 8.5 |
| Bomen | 66/11 | 20/30 | 20/30 | | 33 | 0.99 | 10.9 | 11.0 | 11.1 | 11.2 | 11.3 | 0.24 | 45 |
| Cartwrights Hill 11kV | 66/11 | 6.75/10 | 6.75/10 | | 11 | 0.98 | 8.6 | 8.8 | 9.0 | 9.1 | 9.3 | 1.08 | 5.5 |
| Cartwrights Hill 33kV | 11/33 | 5 | 4 | | 4.4 | 0.96 | 2.0 | 1.9 | 1.9 | 1.9 | 1.9 | 0.00 | 8.5 |
| Coolamon | 66/11 | 8 | 8 | | 8.8 | 0.98 | 5.0 | 5.1 | 5.1 | 5.2 | 5.2 | 1.72 | 6 |
| Euberta | 33/11 | 4 | 3 | | 3.3 | 0.94 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.36 | 4 |
| Forest Hill | 66/11 | 12.5/16 | 10/14 | | 15.4 | 0.94 | 6.2 | 6.1 | 5.9 | 5.8 | 5.6 | 0.86 | 3 |
| Ganmurra | 33/11 | 2.5 | | | 0 | 0.96 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.11 | 10 |
| Junee 11kV | 66/11 | 10/18 | 15 | | 16.5 | 0.97 | 7.1 | 7.1 | 7.2 | 7.2 | 7.3 | 1.74 | 11.5 |
| Junee 66kV | 132/66 | 30 | | | 0 | 0.97 | 15.4 | 15.8 | 16.2 | 16.6 | 17.0 | 0.00 | 1.5 |
| Mates Gully | 33/11 | 2 | | | 0 | 0.95 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.19 | 6.5 |
| Oura 11/33kV | 11/33 | 4 | 2 | | 2.2 | 0.92 | 1.8 | 1.8 | 1.8 | 1.9 | 1.9 | 0.00 | 8 |
| Oura 66/11kV | 66/11 | 5/6.9 | 5/6.9 | | 7.59 | 0.94 | 3.9 | 3.8 | 3.7 | 6.8 | 6.7 | 0.25 | 8 |
| Tarcutta | 33/11 | 1 | 3 | | 1.1 | 0.90 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.43 | 1 |

| WINTER | Wagga North Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Bethungra | 66/11 | 3 | 3 | | 3.6 | 0.98 | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 0.12 | 36 |
| Bomen | 66/11 | 20/30 | 20/30 | | 36 | 0.99 | 10.3 | 10.3 | 10.3 | 10.4 | 10.4 | 0.24 | 71 |
| Cartwrights Hill 11kV | 66/11 | 6.75/10 | 6.75/10 | | 12 | 1.00 | 6.4 | 6.6 | 6.8 | 7.0 | 7.1 | 1.08 | 11.5 |
| Cartwrights Hill 33kV | 11/33 | 5 | 4 | | 4.8 | 0.98 | 1.5 | 1.6 | 1.6 | 1.7 | 1.7 | 0.00 | 3 |
| Coolamon | 66/11 | 8 | 8 | | 9.6 | 1.00 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 1.72 | 7.5 |
| Euberta | 33/11 | 4 | 3 | | 3.6 | 0.95 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.36 | 4.5 |
| Forest Hill | 66/11 | 12.5/16 | 10/14 | | 16.8 | 0.96 | 5.6 | 5.7 | 5.7 | 5.7 | 5.7 | 0.86 | 5.5 |
| Ganmurra | 33/11 | 2.5 | | | 0 | 0.97 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.11 | 0.5 |
| Junee 11kV | 66/11 | 10/18 | 15 | | 18 | 0.99 | 6.2 | 6.3 | 6.5 | 6.6 | 6.8 | 1.74 | 17 |
| Junee 66kV | 132/66 | 30 | | | 0 | 1.00 | 10.6 | 10.9 | 11.1 | 11.4 | 11.7 | 0.00 | 3.5 |
| Mates Gully | 33/11 | 2 | | | 0 | 0.98 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.19 | 2 |
| Oura 11/33kV | 11/33 | 4 | 2 | | 2.4 | 0.93 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.00 | 13 |
| Oura 66/11kV | 66/11 | 5/6.9 | 5/6.9 | | 8.28 | 0.97 | 2.8 | 2.8 | 2.7 | 5.8 | 5.8 | 0.25 | 3 |
| Tarcutta | 33/11 | 1 | 3 | | 1.2 | 0.90 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.43 | 7 |

Sub-transmission Single Line Diagram of Wagga North area



### 2.3.46 Wagga Wagga (Copland St) Supply Area

#### Description of Wagga Wagga area

Zone substations in the Wagga Wagga area are spread across both the Riverina Slopes and Murray regions.

The Wagga Wagga area sub-transmission system is supplied from two separate TransGrid 132/66kV sub-transmission substations at Wagga Wagga (Copland St) and Wagga North.

The transmission system emanating from Wagga Wagga (Copland St) supplies the majority of the Wagga Wagga city load as well as supplying the areas as far south as Holbrook and as far west as Lockhart.

| **WAGGA WAGGA – Identified System Limitations** | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Thermal limitation on 8WF Copland St to Bourkelands ZS line | 3.1 |
| Total loss of supply at Morrow ZS for loss of feeder 8WM | 3.1 |
| Feeder – BOU3B2 Bourke St | 3.3 |
| Feeder – KOO3B4 Red Hill Rd | 3.3 |
| Feeder – LOC3786 Urana | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 83L | 66 | Hammond Ave ZS | Bomen ZS | 54 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 62 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 83M | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Uranquinty ZS | 28 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 34 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 |
| 840/1 | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Bulgary ZS | 15 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 25 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 |
| 840/2 | 66 | Bulgary ZS | Lockhart ZS | 15 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 24 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |
| 840/3 | 66 | Lockhart Tee | Kywong ZS | 16 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 83M/1 | 66 | Uranquinty ZS | Henty ZS | 15 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 25 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 83M/2 | 66 | Henty ZS | Culcairn ZS | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8W9 | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Ashmont ZS | 34 | 19.3 | 19.3 | 19.3 | 19.3 | 19.3 | 39 | 15.6 | 15.6 | 15.6 | 15.6 | 15.6 |
| 8WF/1 | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Bourkelands ZS | 34 | 21.3 | 21.2 | 21.1 | 21.1 | 21.0 | 39 | 16.9 | 17.0 | 17.0 | 17.0 | 17.0 |
| 8WM | 66 | Hammond Ave ZS | Morrow St ZS | 34 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 39 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 |
| 8WO | 66 | Ashmont ZS | Bourkelands ZS | 34 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 39 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| 8WP | 66 | Morrow St ZS | Cartwrights Hill ZS | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8WR | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Hammond Ave ZS | 52 | 14.4 | 14.4 | 14.4 | 14.4 | 14.4 | 60 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 8WT | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Hammond Ave ZS | 52 | 14.3 | 14.3 | 14.3 | 14.3 | 14.3 | 60 | 11.8 | 11.8 | 11.8 | 11.8 | 11.8 |
| 8WG | 66 | TransGrid Wagga 132/66kV STS (Copland St) | Kooringal ZS | 34 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 39 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 |
| 8WF/2 | 66 | Bourkelands ZS | Kooringal ZS | 34 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 39 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |

## STS and ZS load forecast

| SUMMER | Wagga (Copland St) Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Ashmont | 66/11 | 20/30 | 20/30 | | 33 | 0.96 | 21.2 | 21.3 | 21.5 | 21.6 | 21.8 | 3.10 | 19.5 |
| Bourkelands | 66/11 | 10/13.333 | 10/13 | | 14.3 | 0.98 | 12.0 | 11.9 | 11.8 | 11.7 | 11.7 | 3.15 | 6 |
| Bulgary | 66/22 | 2.5 | | | 0 | 0.99 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.00 | 2 |
| Hammond Ave | 66/11 | 24/30 | 24/30 | | 33 | 0.94 | 17.5 | 17.0 | 16.6 | 16.1 | 15.7 | 2.22 | 14 |
| Henty | 66/11 | 5 | 5 | | 5.5 | 0.98 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 1.11 | 1 |
| Kooringal | 66/11 | 18/25 | 18/25 | | 27.5 | 1.00 | 18.6 | 18.6 | 18.6 | 18.6 | 18.6 | 4.32 | 6.5 |
| Lockhart | 66/22 | 8 | 5 | | 5.5 | 1.00 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 1.30 | 5 |
| Morrow St | 66/11 | 20 | 20 | | 22 | 0.95 | 13.5 | 13.5 | 13.5 | 13.4 | 13.4 | 0.91 | 30 |
| Uranquinty | 66/22 | 10/16 | 10/16 | | 17.6 | 0.98 | 5.7 | 5.8 | 5.9 | 6.0 | 6.1 | 1.50 | 7 |

| WINTER | Wagga (Copland St) Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Ashmont | 66/11 | 20/30 | 20/30 | | 36 | 0.98 | 16.3 | 16.8 | 17.4 | 17.9 | 18.4 | 3.10 | 14.5 |
| Bourkelands | 66/11 | 10/13.333 | 10/13 | | 15.6 | 1.00 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 3.15 | 10.5 |
| Bulgary | 66/22 | 2.5 | | | 0 | 1.00 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.00 | 6.5 |
| Hammond Ave | 66/11 | 24/30 | 24/30 | | 36 | 1.00 | 13.6 | 13.6 | 13.7 | 13.7 | 13.8 | 2.22 | 13.5 |
| Henty | 66/11 | 5 | 5 | | 6 | 1.00 | 2.2 | 2.1 | 2.1 | 2.0 | 2.0 | 1.11 | 4 |
| Kooringal | 66/11 | 18/25 | 18/25 | | 30 | 0.99 | 14.7 | 14.8 | 14.8 | 14.9 | 14.9 | 4.32 | 6 |
| Lockhart | 66/22 | 8 | 5 | | 6 | 0.97 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 1.30 | 3.5 |
| Morrow St | 66/11 | 20 | 20 | | 24 | 0.97 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 0.91 | 14.5 |
| Uranquinty | 66/22 | 10/16 | 10/16 | | 19.2 | 1.00 | 4.4 | 4.4 | 4.5 | 4.5 | 4.6 | 1.50 | 8.5 |

## Sub-transmission Single Line Diagram of Wagga Wagga area

Please refer to the Sub-transmission Single Line Diagram of Wagga North area on Page 129.

### 2.3.47 Morven Supply Area

#### Description of Morven area

All zone substations in the Morven area are in the Murray region.

The Morven 132/66kV substation is owned by Essential Energy. It receives supply via a tee off the TransGrid Wagga Wagga 330kV (Gregadoo) – Albury (ANM) 132kV line (#996). Culcairn 66/11kV and Holbrook 66/22kV zone substations take normal 66kV supply from Morven and backup 66kV supply from TransGrid's Wagga Wagga 132/66kV substation (Copland St) on the Essential Energy 66kV line (#83M) via Uranquinty and Holbrook.

| MORVEN – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 996/1 | 132 | TransGrid 132kV Line 996 Tee | Morven 132/66kV STS | 45 | 8.2 | 8.1 | 8.0 | 7.9 | 7.8 | 86 | 6.7 | 6.7 | 6.7 | 6.6 | 6.6 |
| 83M/3 | 66 | Morven 132/66kV STS | Culcairn ZS | 15 | 4.2 | 4.2 | 4.1 | 4.0 | 3.9 | 25 | 3.6 | 3.6 | 3.6 | 3.6 | 3.5 |
| 83M/4 | 66 | Morven 132/66kV STS | Holbrook ZS | 15 | 3.8 | 3.7 | 3.7 | 3.7 | 3.7 | 25 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 |

#### STS and ZS load forecast

| SUMMER | Morven Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Culcairn | 66/11 | 5/7 | 8 | | 7.7 | 0.96 | 4.2 | 4.2 | 4.1 | 4.0 | 3.9 | 1.91 | 14 |
| Holbrook | 66/22 | 5/7 | 5/7 | | 7.7 | 0.99 | 3.8 | 3.7 | 3.7 | 3.7 | 3.7 | 1.52 | 8 |
| Morven | 132/66 | 30 | | | 0 | 0.98 | 8.2 | 8.1 | 8.0 | 7.9 | 7.8 | 0.00 | 6.5 |

| WINTER | Morven Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Culcairn | 66/11 | 5/7 | 8 | | 8.4 | 0.98 | 3.6 | 3.6 | 3.6 | 3.6 | 3.5 | 1.91 | 9.5 |
| Holbrook | 66/22 | 5/7 | 5/7 | | 8.4 | 1.00 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 | 1.52 | 0.5 |
| Morven | 132/66 | 30 | | | 0 | 1.00 | 6.7 | 6.7 | 6.7 | 6.6 | 6.6 | 0.00 | 6 |

#### Sub-transmission Single Line Diagram of Morven area

Please refer to the Sub-transmission Single Line Diagram of Wagga North area on Page 129.

### 2.3.48 Albury Supply Area

#### Description of Albury area

All zone substations in the Albury area are in the Murray region.

The Albury area 132kV sub-transmission system is supplied from TransGrid's Jindera 330/132kV sub-transmission substation with backup via TransGrid's 132kV line from ANM substation Ettamogah.

The Essential Energy substation of Corowa and Mulwala are supplied at 132kV from the Essential Energy 132kV powerlines connecting the Union Road substation to TransGrid's Finley 132/66kV sub-transmission substation.

| ALBURY – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

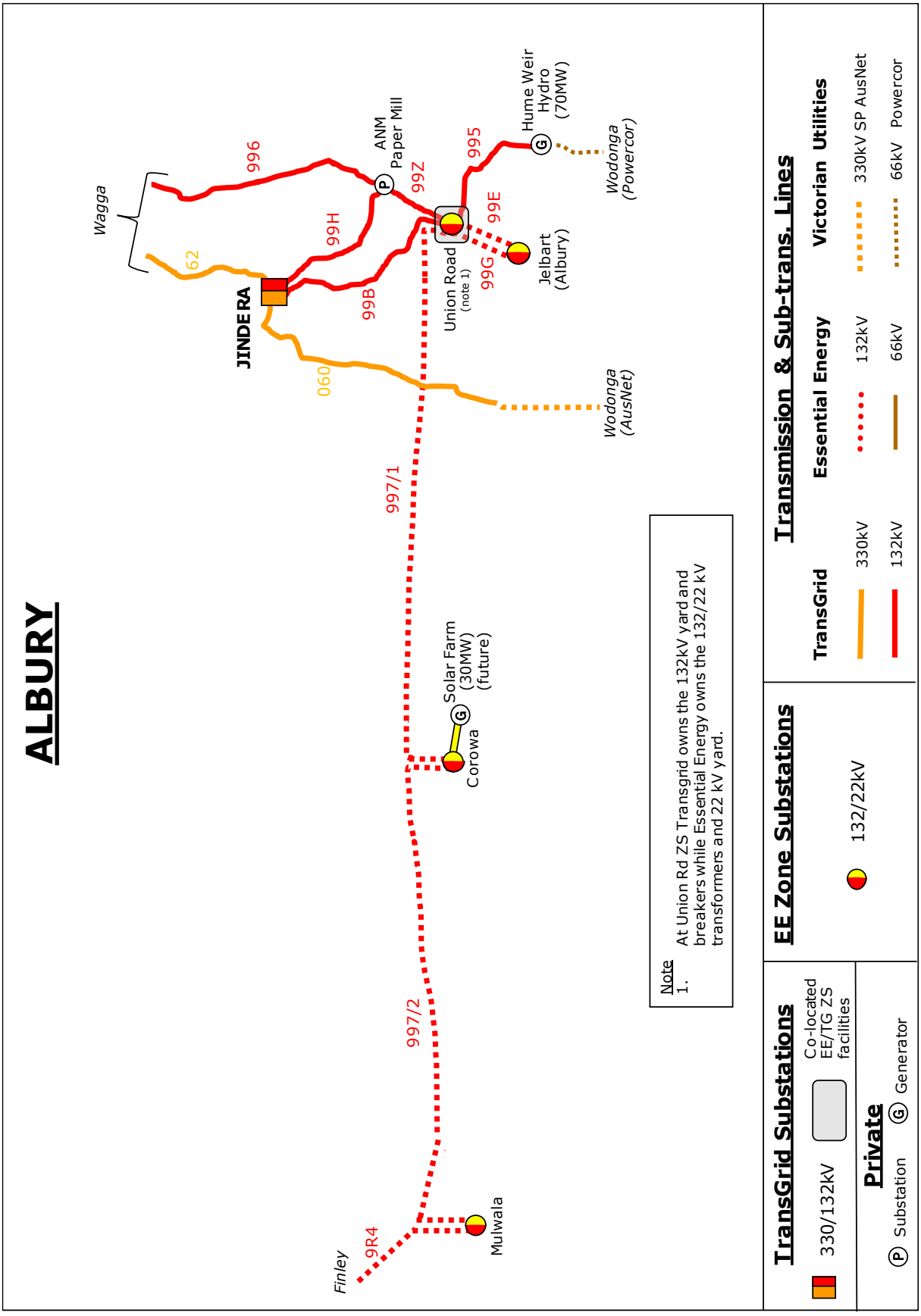
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 997/1 | 132 | Union Rd ZS | Corowa ZS | 128 | 33.5 | 33.7 | 33.9 | 34.0 | 34.2 | 143 | 23.2 | 23.5 | 23.8 | 24.1 | 24.3 |
| 997/2 | 132 | Corowa ZS | Mulwala ZS | 128 | 14.1 | 14.1 | 14.0 | 13.9 | 13.8 | 143 | 9.7 | 9.9 | 10.1 | 10.3 | 10.6 |
| 99E | 132 | Union Rd ZS | Jelbart ZS | 148 | 22.1 | 22.1 | 22.1 | 22.1 | 22.1 | 164 | 17.1 | 17.1 | 17.1 | 17.0 | 17.0 |
| 99G | 132 | Union Rd ZS | Jelbart ZS | 148 | 22.1 | 22.1 | 22.1 | 22.1 | 22.1 | 164 | 17.1 | 17.1 | 17.1 | 17.0 | 17.0 |

#### STS and ZS load forecast

| SUMMER | Albury Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Corowa | 132/22 | 30 | 27/30 | | 33 | 0.97 | 19.4 | 19.6 | 19.9 | 20.1 | 20.3 | 6.65 | 3.5 |
| Jelbart | 132/22 | 30/44 | 30/44 | | 48.4 | 1.00 | 44.1 | 44.1 | 44.1 | 44.1 | 44.1 | 6.10 | 12 |
| Mulwala | 132/22 | 30 | 30 | | 33 | 0.98 | 14.1 | 14.1 | 14.0 | 13.9 | 13.8 | 2.98 | 12.5 |
| Union Rd | 132/22 | 15/35 | 30/44 | 30/44 | 86.9 | 0.97 | 53.6 | 54.5 | 55.3 | 56.1 | 57.0 | 24.88 | 12.5 |

| WINTER | Albury Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Corowa | 132/22 | 30 | 27/30 | | 36 | 0.99 | 13.5 | 13.6 | 13.7 | 13.7 | 13.8 | 6.65 | 10.5 |
| Jelbart | 132/22 | 30/44 | 30/44 | | 52.8 | 1.00 | 34.3 | 34.2 | 34.1 | 34.1 | 34.0 | 6.10 | 5 |
| Mulwala | 132/22 | 30 | 30 | | 36 | 0.99 | 9.7 | 9.9 | 10.1 | 10.3 | 10.6 | 2.98 | 25 |
| Union Rd | 132/22 | 15/35 | 30/44 | 30/44 | 94.8 | 0.99 | 40.3 | 40.8 | 41.3 | 41.8 | 42.3 | 24.88 | 9 |

Sub-transmission Single Line Diagram of Albury area



### 2.3.49 Finley Supply Area

#### Description of Finley area

All zone substations in the Finley area are in the Murray region.

The Finley area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation.

| FINLEY – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 9R4 | 132 | TransGrid Finley 132/66kV STS | Mulwala ZS | 140 | 14.6 | 14.6 | 14.6 | 14.6 | 14.6 | 157 | 11.4 | 11.4 | 11.4 | 11.4 | 11.4 |
| 84A | 66 | TransGrid Finley 132/66kV STS | Jerilderie ZS | 15 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 25 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 84B | 66 | TransGrid Finley 132/66kV STS | Finley ZS | 61 | 8.6 | 8.7 | 8.7 | 8.7 | 8.7 | 70 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 |
| 84C | 66 | TransGrid Finley 132/66kV STS | Finley ZS | 61 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 70 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 |

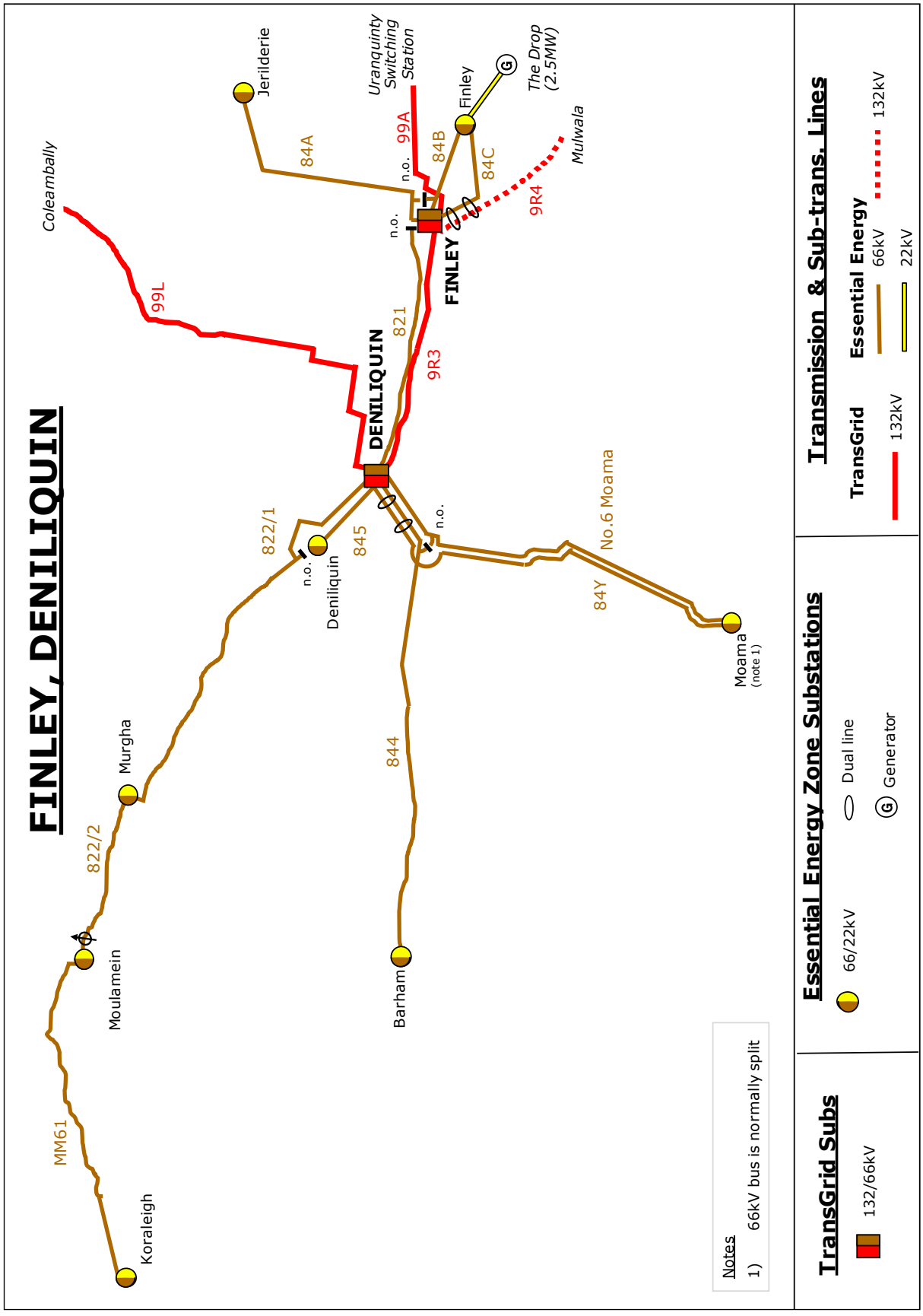
#### STS and ZS load forecast

| SUMMER | Finley Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Finley Town | 66/22 | 24/30 | 24/30 | | 33 | 0.99 | 14.0 | 14.0 | 14.0 | 14.0 | 13.9 | 5.04 | 3 |
| Jerilderie | 66/22 | 8.8/10 | 8.8/10 | | 11 | 1.00 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 1.14 | 8 |

| WINTER | Finley Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Finley Town | 66/22 | 24/30 | 24/30 | | 36 | 1.00 | 10.2 | 10.0 | 9.7 | 9.5 | 9.2 | 5.04 | 18.5 |
| Jerilderie | 66/22 | 8.8/10 | 8.8/10 | | 12 | 1.00 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 1.14 | 5.5 |

A 2.5MW hydro generator is located at The Drop and is connected to the Finley 66/22kV zone substation at 22kV via feeder FIN42.

Sub-transmission Single Line Diagram of Finley area



### 2.3.50 Deniliquin Supply Area

#### Description of Deniliquin area

All zone substations in the Deniliquin area are in the Murray region.

The Deniliquin area sub-transmission system is supplied from TransGrid's 132/66kV sub-transmission substation.

| DENILIQUIN – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 844 | 66 | TransGrid Deniliquin 132/66kV STS | Barham ZS | 11 | 6.4 | 6.5 | 6.5 | 6.6 | 6.6 | 19 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 |
| 845 | 66 | TransGrid Deniliquin 132/66kV STS | Deniliquin ZS | 38 | 24.5 | 24.7 | 24.8 | 25.0 | 25.2 | 43 | 15.3 | 15.3 | 15.3 | 15.3 | 15.3 |
| 822/1 | 66 | TransGrid Deniliquin 132/66kV STS | Murgha ZS | 11 | 8.4 | 8.4 | 8.5 | 8.6 | 8.6 | 19 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 |
| 822/2 | 66 | Murgha ZS | Moulamein ZS | 11 | 7.0 | 7.1 | 7.1 | 7.2 | 7.3 | 19 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 |
| 84Y | 66 | TransGrid Deniliquin 132/66kV STS | Moama ZS | 66 | 9.5 | 9.5 | 9.6 | 9.7 | 9.8 | 66 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 |
| MM61 | 66 | Moulamein ZS | Koraleigh ZS | 15 | 4.7 | 4.7 | 4.7 | 4.8 | 4.8 | 25 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| No.6 Moama | 66 | TransGrid Deniliquin 132/66kV STS | Moama ZS | 34 | 6.6 | 6.7 | 6.7 | 6.8 | 6.8 | 39 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |

#### STS and ZS load forecast

| SUMMER | Deniliquin Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Barham | 66/22 | 10/16 | 10 | | 11 | 0.98 | 5.9 | 5.9 | 5.9 | 5.9 | 5.8 | 2.23 | 5 |
| Deniliquin | 66/22 | 18/30 | 18/30 | | 33 | 0.97 | 23.3 | 23.2 | 23.0 | 22.9 | 22.8 | 4.72 | 10 |
| Koraleigh | 66/22 | 8/11 | 5 | | 5.5 | 0.98 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 1.25 | 8 |
| Moama | 66/22 | 24/30 | 24/30 | | 33 | 0.99 | 15.4 | 15.3 | 15.2 | 15.2 | 15.1 | 3.33 | 3 |
| Moulamein | 66/22 | 8/11 | 5 | | 5.5 | 0.99 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 0.67 | 1 |
| Murgha | 66/22 | 1 | | | 0 | 0.87 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.00 | 2 |

| WINTER | Deniliquin Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Barham | 66/22 | 10/16 | 10 | | 12 | 1.00 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 2.23 | 9 |
| Deniliquin | 66/22 | 18/30 | 18/30 | | 36 | 0.99 | 17.1 | 16.7 | 16.3 | 15.9 | 15.5 | 4.72 | 7.5 |
| Koraleigh | 66/22 | 8/11 | 5 | | 6 | 1.00 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 1.25 | 2.5 |
| Moama | 66/22 | 24/30 | 24/30 | | 36 | 1.00 | 8.2 | 8.4 | 8.6 | 8.8 | 9.0 | 3.33 | 27 |
| Moulamein | 66/22 | 8/11 | 5 | | 6 | 0.95 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 0.67 | 2.5 |
| Murgha | 66/22 | 1 | | | 0 | 0.90 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.00 | 1 |

## Sub-transmission Single Line Diagram of Deniliquin area

Please refer to the Sub-transmission Single Line Diagram of Finley area on Page 136.

### 2.3.51 Coleambally Supply Area

#### Description of Coleambally area

All zone substations in the Coleambally area are in the Central region.

Essential Energy's Coleambally 132/33kV sub-transmission substation is supplied from TransGrid's 132kV transmission powerlines #99L from Deniliquin and #99T from Darlington Point system.

| COLEAMBALLY – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – DPT934 Darlington Point Town | 3.3 |

#### Sub-transmission feeder load forecast

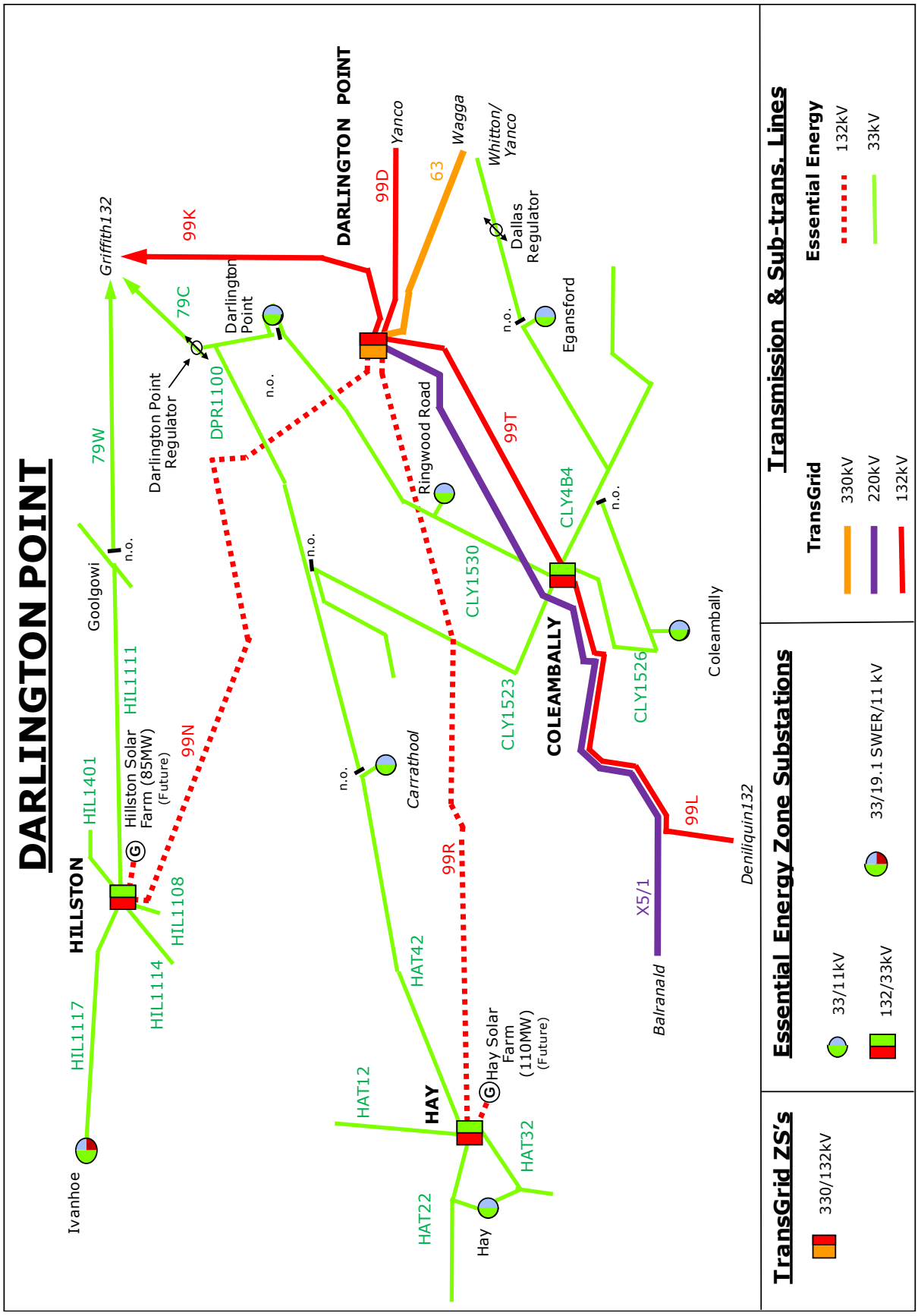
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| CLY1526 | 33 | Coleambally 132/33kV STS | Coleambally Tee | 10 | 4.5 | 4.6 | 4.7 | 4.8 | 4.9 | 19 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| CLY1526 | 33 | Coleambally Tee | Coleambally ZS | 10 | 2.6 | 2.6 | 2.7 | 2.7 | 2.8 | 19 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| CLY1526 | 33 | Coleambally Tee | Egansford ZS | 8 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 13 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| CLY1530 | 33 | Coleambally 132/33kV STS | Ringw ood Rd ZS | 8 | 6.7 | 6.9 | 7.0 | 7.1 | 7.3 | 13 | 3.8 | 3.8 | 3.8 | 3.9 | 3.9 |
| CLY1530 | 33 | Ringw ood Rd ZS | Darlington Point ZS | 8 | 3.1 | 3.2 | 3.2 | 3.3 | 3.4 | 13 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |

#### STS and ZS load forecast

| SUMMER | Coleambally Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Coleambally 132kV | 132/33 | 17.5/25 | 25 | | 27.5 | 0.92 | 14.2 | 14.5 | 14.8 | 15.1 | 15.5 | 0.40 | 5 |
| Coleambally 33/11kV | 33/11 | 7.5 | 7.5 | | 8.25 | 0.91 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.49 | 6.5 |
| Darlington Point | 33/11 | 10/12.5 | 10/14 | | 13.75 | 0.81 | 4.0 | 4.1 | 4.1 | 4.1 | 4.1 | 0.57 | 8 |
| Egansford | 33/11 | 2.5 | 5 | | 2.75 | 0.88 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.05 | 7 |
| Ringwood Road | 33/11 | 5 | | | 0 | 0.75 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 0.35 | 4 |

| WINTER | Coleambally Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Coleambally 132kV | 132/33 | 17.5/25 | 25 | | 30 | 0.96 | 8.2 | 8.2 | 8.2 | 8.3 | 8.3 | 0.40 | 4.5 |
| Coleambally 33/11kV | 33/11 | 7.5 | 7.5 | | 9 | 0.94 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 0.49 | 1 |
| Darlington Point | 33/11 | 10/12.5 | 10/14 | | 15 | 0.86 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 0.57 | 4.5 |
| Egansford | 33/11 | 2.5 | 5 | | 3 | 0.89 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.05 | 2 |
| Ringwood Road | 33/11 | 5 | | | 0 | 0.77 | 2.1 | 2.1 | 2.2 | 2.3 | 2.3 | 0.35 | 3 |

Sub-transmission Single Line Diagram of Coleambally area



### 2.3.52 Darlington Point Supply Area

#### Description of Darlington Point area

All zone substations in the Darlington Point area are in the Central region.

The Darlington Point area 132kV sub-transmission system is supplied from TransGrid's 330/132kV sub-transmission substation. Essential Energy owns the 132kV transmission lines supplying Hay and Hillston substations. The 33kV sub-transmission originates from these substations.

| DARLINGTON POINT – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 99N | 132 | TransGrid Darlington Point 330/132kV STS | Hillston ZS | 128 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 143 | 14.4 | 14.4 | 14.4 | 14.4 | 14.4 |
| 99R | 132 | TransGrid Darlington Point 330/132kV STS | Hay 132 ZS | 128 | 10.6 | 10.8 | 11.0 | 11.2 | 11.4 | 143 | 13.7 | 13.7 | 13.7 | 13.7 | 13.7 |
| HAT 22 | 33 | Hay 132 ZS | Hay ZS | 8 | 7.8 | 7.8 | 7.8 | 7.8 | 7.8 | 14 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| HAT 32 | 33 | Hay 132 ZS | Hay ZS | 8 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 14 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| HAT 42 | 33 | Hay 132 ZS | Carrathool ZS | 7 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 12 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 |
| HIL1117 | 33 | Hillston ZS | Ivanhoe ZS | 8 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 14 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |

#### STS and ZS load forecast

| SUMMER | Darlington Point Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Carathool | 33/11 | 1.5 | 1.5 | | 1.65 | 0.90 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.09 | 5 |
| Hay 132kV | 132/33 | 24/30 | 30/36 | | 33 | 0.98 | 10.1 | 10.4 | 10.6 | 10.9 | 11.1 | 0.79 | 16 |
| Hay Town | 33/11 | 8/11 | 8/10 | | 11 | 0.96 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 1.37 | 4 |
| Hillston | 132/33 | 30 | 12/16 | | 17.6 | 1.00 | 12.9 | 13.3 | 13.7 | 14.0 | 14.4 | 1.54 | 12.5 |
| Ivanhoe | 33/11 | 1 | 1 | | 1.1 | 0.98 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.14 | 11 |

| WINTER | Darlington Point Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Carathool | 33/11 | 1.5 | 1.5 | | 1.8 | 0.96 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.09 | 9 |
| Hay 132kV | 132/33 | 24/30 | 30/36 | | 36 | 0.99 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 0.79 | 12 |
| Hay Town | 33/11 | 8/11 | 8/10 | | 12 | 0.99 | 6.4 | 6.4 | 6.4 | 6.3 | 6.3 | 1.37 | 12 |
| Hillston | 132/33 | 30 | 12/16 | | 19.2 | 0.99 | 7.9 | 8.1 | 8.2 | 8.3 | 8.4 | 1.54 | 7 |
| Ivanhoe | 33/11 | 1 | 1 | | 1.2 | 0.98 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.14 | 2.5 |

## Sub-transmission Single Line Diagram of Darlington Point area

Please refer to the Sub-transmission Single Line Diagram of Coleambally area on Page 140.

### 2.3.53 Griffith Supply Area

#### Description of Griffith area

All zone substations in the Griffith area are in the Central region.

The Griffith area sub-transmission system is supplied from TransGrid's 132/33kV sub-transmission substation.

| GRIFFITH – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Voltage and thermal limitations under contingent conditions on Feeder 79W | 3.1 |
| Feeder – GFH3B6 Illilliwa | 3.3 |
| Feeder – THA2225 Hillston Rd | 3.3 |
| Multiple Feeders – Willbriggie 33/11kV Zone Substation | 3.3 |

#### Sub-transmission feeder load forecast

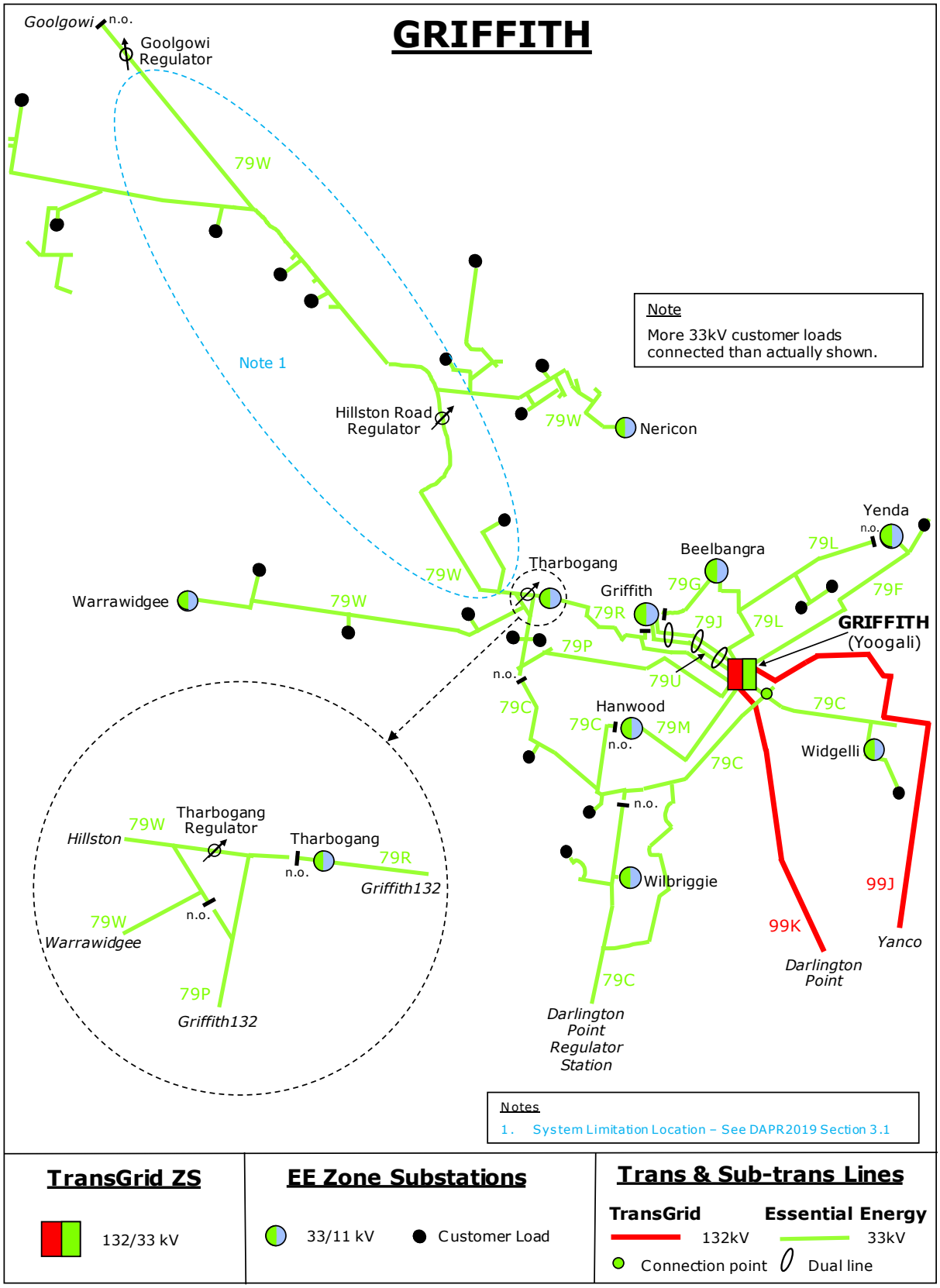
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 79C/1 | 33 | TransGrid Griffith 132/33kV STS | Widgelli / Willbriggie Tee | 10 | 6.1 | 6.4 | 6.5 | 6.5 | 6.5 | 19 | 5.4 | 5.8 | 5.8 | 5.9 | 5.9 |
| 79C/2 | 33 | Widgelli / Willbriggie Tee | Widgelli ZS | 10 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 19 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 |
| 79C/3 | 33 | Widgelli / Willbriggie Tee | Willbriggie Tee | 10 | 4.9 | 5.2 | 5.2 | 5.3 | 5.3 | 19 | 4.4 | 4.8 | 4.8 | 4.9 | 4.9 |
| 79C/4 | 33 | Willbriggie Tee | Willbriggie ZS | 10 | 4.3 | 4.6 | 4.6 | 4.6 | 4.7 | 19 | 3.9 | 4.2 | 4.2 | 4.3 | 4.3 |
| 79C/5 | 33 | Willbriggie Tee | 79C / 79P Tee | 10 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 19 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 79F | 33 | TransGrid Griffith 132/33kV STS | Yenda ZS | 22 | 11.9 | 12.5 | 12.6 | 12.7 | 12.8 | 27 | 7.9 | 8.5 | 8.6 | 8.6 | 8.7 |
| 79G | 33 | Beelbangera ZS | Griffith ZS | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 79J | 33 | TransGrid Griffith 132/33kV STS | Griffith ZS | 51 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 79L | 33 | TransGrid Griffith 132/33kV STS | Beelbangera ZS | 10 | 13.3 | 14.0 | 14.1 | 14.1 | 14.2 | 19 | 7.5 | 8.1 | 8.2 | 8.2 | 8.3 |
| 79M | 33 | TransGrid Griffith 132/33kV STS | Hanwood ZS | 22 | 14.8 | 14.9 | 15.0 | 15.0 | 15.1 | 27 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 |
| 79P | 33 | TransGrid Griffith 132/33kV STS | Warrawidgee Tee | 22 | 9.4 | 9.9 | 9.9 | 10.0 | 10.1 | 27 | 7.0 | 7.6 | 7.6 | 7.7 | 7.8 |
| 79W | 33 | Warrawidgee Tee | Warrawidgee ZS | 6 | 2.2 | 2.3 | 2.3 | 2.3 | 2.3 | 9 | 1.6 | 1.7 | 1.7 | 1.8 | 1.8 |
| 79W | 33 | Warrawidgee Tee | Nericon Tee | 21 | 6.6 | 6.9 | 6.9 | 7.0 | 7.0 | 27 | 5.0 | 5.3 | 5.4 | 5.4 | 5.5 |
| 79W | 33 | Nericon Tee | Nericon ZS | 6 | 2.9 | 3.0 | 3.1 | 3.1 | 3.1 | 9 | 1.7 | 1.9 | 1.9 | 1.9 | 1.9 |
| 79R | 33 | TransGrid Griffith 132/33kV STS | Tharbogang ZS | 31 | 14.7 | 14.6 | 14.4 | 14.2 | 14.1 | 34 | 9.5 | 9.6 | 9.7 | 9.8 | 9.9 |
| 79U | 33 | TransGrid Griffith 132/33kV STS | Griffith ZS | 51 | 27.4 | 27.5 | 27.6 | 27.7 | 27.8 | 56 | 20.0 | 20.1 | 20.2 | 20.3 | 20.4 |

## STS and ZS load forecast

| SUMMER | Griffith Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Beelbangera | 33/11 | 10/12.5 | 10/12.5 | | 13.75 | 0.95 | 10.5 | 10.6 | 10.7 | 10.8 | 10.9 | 2.05 | 11.5 |
| Griffith | 33/11 | 40/50 | 40/50 | | 55 | 1.00 | 27.4 | 27.5 | 27.6 | 27.7 | 27.8 | 4.77 | 17.5 |
| Hanwood | 33/11 | 25 | 25 | | 27.5 | 1.00 | 14.8 | 14.9 | 15.0 | 15.0 | 15.1 | 0.85 | 4.5 |
| Nericon | 33/11 | 5/8 | | | 0 | 0.94 | 2.3 | 2.4 | 2.4 | 2.4 | 2.5 | 0.34 | 7 |
| Tharbogang | 33/11 | 15/20/25 | 15/20/25 | | 27.5 | 0.95 | 14.7 | 14.6 | 14.4 | 14.2 | 14.1 | 3.09 | 6 |
| Warrawidgee | 33/11 | 2.5 | 3 | | 2.75 | 0.84 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 0.11 | 9.5 |
| Widgelli | 33/11 | 1 | | | 0 | 0.90 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.00 | 5.5 |
| Willbriggie | 33/11 | 5/8 | | | 0 | 0.92 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 0.12 | 4 |
| Yenda | 33/11 | 7.5/9.5 | 7.5/9.5 | | 10.45 | 0.99 | 8.0 | 8.1 | 8.3 | 8.4 | 8.5 | 1.28 | 6 |

| WINTER | Griffith Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Beelbangera | 33/11 | 10/12.5 | 10/12.5 | | 15 | 0.98 | 6.2 | 6.3 | 6.4 | 6.5 | 6.5 | 2.05 | 4.5 |
| Griffith | 33/11 | 40/50 | 40/50 | | 60 | 0.99 | 20.0 | 20.1 | 20.2 | 20.3 | 20.4 | 4.77 | 3.5 |
| Hanwood | 33/11 | 25 | 25 | | 30 | 0.97 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 0.85 | 34 |
| Nericon | 33/11 | 5/8 | | | 0 | 0.96 | 1.3 | 1.3 | 1.4 | 1.4 | 1.4 | 0.34 | 2.5 |
| Tharbogang | 33/11 | 15/20/25 | 15/20/25 | | 30 | 1.00 | 9.5 | 9.6 | 9.7 | 9.8 | 9.9 | 3.09 | 1 |
| Warrawidgee | 33/11 | 2.5 | 3 | | 3 | 0.87 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.11 | 5.5 |
| Widgelli | 33/11 | 1 | | | 0 | 0.95 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.00 | 8 |
| Willbriggie | 33/11 | 5/8 | | | 0 | 0.97 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.12 | 12 |
| Yenda | 33/11 | 7.5/9.5 | 7.5/9.5 | | 11.4 | 0.99 | 4.4 | 4.5 | 4.5 | 4.5 | 4.6 | 1.28 | 9 |

Sub-transmission Single Line Diagram of Griffith area



### 2.3.54 Yanco Supply Area

#### Description of Yanco area

All zone substations in the Yanco area are in the Central region.

The Yanco area sub-transmission system is supplied from TransGrid's 132/33/66kV sub-transmission substation. The 66kV sub-transmission system originates from TransGrid's 132/33/66kV sub-transmission substation via an Essential Energy 33/66kV transformer.

| YANCO – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Nil | |

#### Sub-transmission feeder load forecast

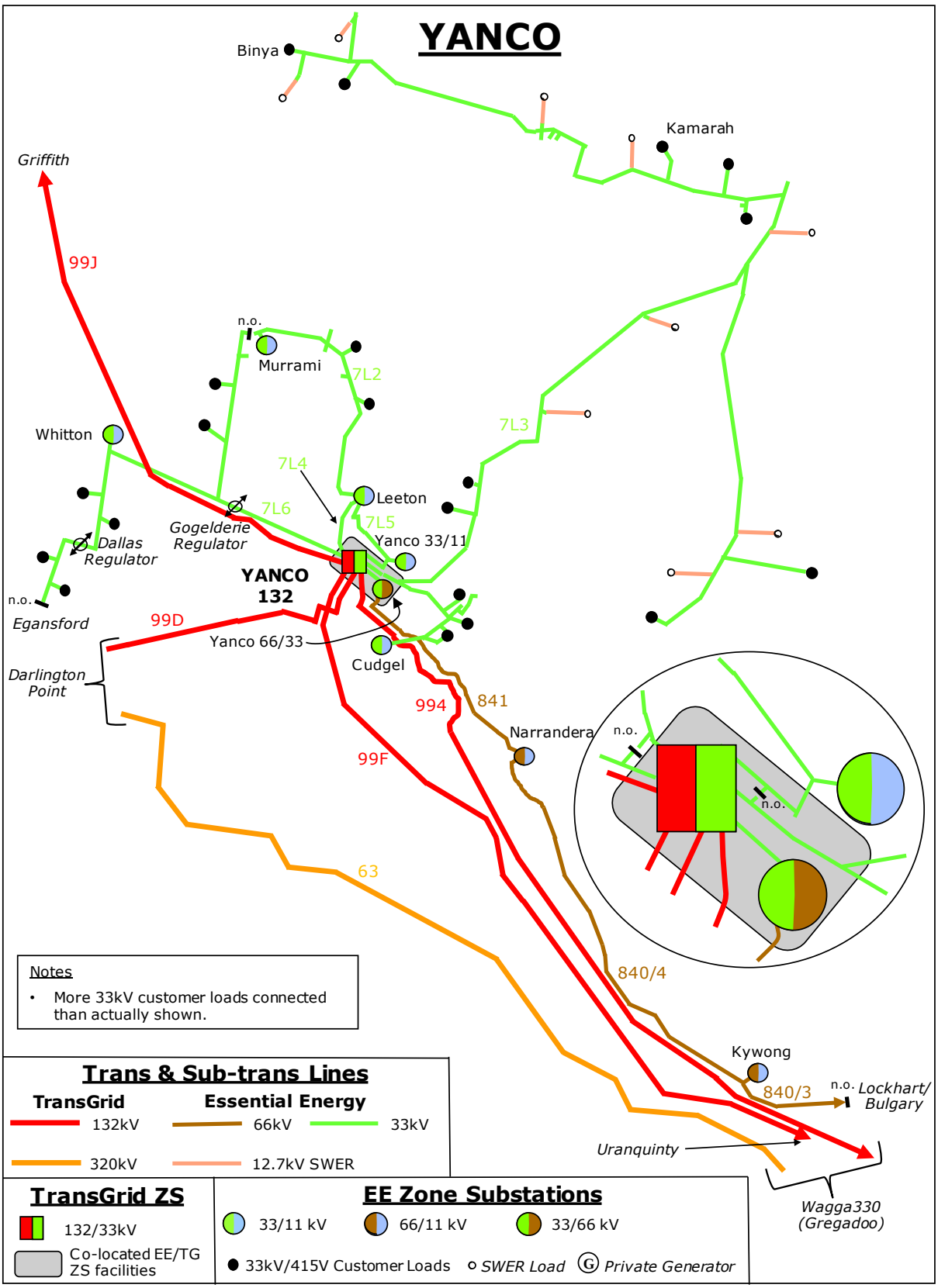
| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 840/4 | 66 | Narrandra ZS | Kyw ong ZS | 16 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 25 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 841:YNC | 66 | TransGrid Yanco 132/33/66kV STS | Narrandera ZS | 15 | 13.9 | 13.9 | 13.9 | 13.9 | 13.8 | 25 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 |
| 7L3 | 33 | TransGrid Yanco 132/33/66kV STS | Cudgel ZS | 8 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 13 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 7L6 | 33 | TransGrid Yanco 132/33/66kV STS | Whitton / Murrami Tee | 15 | 7.4 | 7.5 | 7.6 | 7.7 | 7.8 | 18 | 5.8 | 5.8 | 5.8 | 5.8 | 5.9 |
| 7L6 | 33 | Whitton / Murrami Tee | Whitton ZS | 8 | 5.3 | 5.4 | 5.6 | 5.8 | 5.9 | 13 | 3.1 | 3.3 | 3.4 | 3.5 | 3.6 |
| 7L6 | 33 | Whitton / Murrami Tee | Murrami ZS | 8 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 13 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 7L5 | 33 | TransGrid Yanco 132/33/66kV STS | Yanco ZS | 8 | 12.5 | 12.7 | 12.8 | 12.9 | 13.0 | 13 | 9.9 | 9.9 | 9.8 | 9.8 | 9.7 |
| 7L5 | 33 | Yanco ZS | Leeton ZS | 6 | 10.0 | 10.1 | 10.2 | 10.2 | 10.3 | 9 | 9.0 | 8.9 | 8.8 | 8.7 | 8.6 |
| 7L4 | 33 | TransGrid Yanco 132/33/66kV STS | Leeton ZS | 31 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 34 | 9.0 | 8.9 | 8.8 | 8.7 | 8.6 |

## STS and ZS load forecast

| SUMMER | Yanco Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Kywong | 66/11 | 3 | | | 0 | 0.96 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.05 | 7.5 |
| Leeton | 33/11 | 15/20/25 | 15/20/25 | | 27.5 | 0.94 | 19.9 | 20.1 | 20.3 | 20.5 | 20.7 | 3.41 | 9 |
| Murrami | 33/11 | 5 | 5 | | 5.5 | 0.91 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.34 | 2.5 |
| Narrandera | 66/11 | 10/16 | 10/16 | | 17.6 | 0.98 | 14.1 | 14.0 | 14.0 | 14.0 | 14.0 | 2.28 | 9 |
| Whitton | 33/11 | 5/6.25 | 5/6.25 | | 6.875 | 0.93 | 5.3 | 5.4 | 5.6 | 5.8 | 5.9 | 0.54 | 15.5 |
| Yanco 33/11kV | 33/11 | 5 | | | 0 | 0.95 | 2.6 | 2.6 | 2.6 | 2.7 | 2.7 | 0.56 | 16 |
| Yanco 33/66kV | 33/66 | 15 | | | 0 | 1.00 | 14.9 | 15.1 | 15.2 | 15.4 | 15.6 | 0.00 | 3.5 |

| WINTER | Yanco Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Kywong | 66/11 | 3 | | | 0 | 0.96 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.05 | 6.5 |
| Leeton | 33/11 | 15/20/25 | 15/20/25 | | 30 | 0.98 | 18.1 | 17.9 | 17.7 | 17.5 | 17.3 | 3.41 | 26.5 |
| Murrami | 33/11 | 5 | 5 | | 6 | 0.93 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.34 | 0.5 |
| Narrandera | 66/11 | 10/16 | 10/16 | | 19.2 | 1.00 | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 2.28 | 2.5 |
| Whitton | 33/11 | 5/6.25 | 5/6.25 | | 7.5 | 0.92 | 3.1 | 3.3 | 3.4 | 3.5 | 3.6 | 0.54 | 3.5 |
| Yanco 33/11kV | 33/11 | 5 | | | 0 | 0.97 | 2.0 | 2.0 | 2.1 | 2.1 | 2.1 | 0.56 | 7 |
| Yanco 33/66kV | 33/66 | 15 | | | 0 | 0.99 | 11.1 | 11.0 | 10.8 | 10.7 | 10.6 | 0.00 | 2.5 |

Sub-transmission Single Line Diagram of Yanco area



### 2.3.55 Buronga Supply Area

#### Description of Buronga area

All zone substations in the Buronga area are in the Murray region.

Supply to the Dareton, Wentworth and Buronga areas originates from the Powercor 66kV sub-transmission substations at Merbein and Mildura in Victoria, which is in turn supplied from the Red Cliffs Victoria 220/66kV sub-transmission substation south east of Mildura.

The Balranald area is supplied from TransGrid's 220/22kV substation. Backup supply is seasonal limited via Moulamein 22kV system.

| BURONGA – Identified System Limitations | |
|---|---|
| SYSTEM LIMITATION | Refer to DAPR Section |
| Feeder – ELL8B2 Pooncarie | 3.3 |

#### Sub-transmission feeder load forecast

| Feeder # | Feeder Voltage kV | Feeder Origin | Feeder Destination | Summer | | | | | | Winter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Line Rating | Line Forecast MVA | | | | | Line Rating | Line Forecast MVA | | | | |
| | | | | MVA | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | MVA | 2020 | 2021 | 2022 | 2023 | 2024 |
| 87G | 66 | Dareton ZS | Ellerslie ZS | 67 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 | 78 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| 87H/1 | 66 | Ellerslie ZS | Ginkgo Snapper Tee | 45 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 56 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 |
| 87H/2 | 66 | Ginkgo Snapper Tee | Ginkgo ZS | 20 | 6.1 | 6.0 | 6.0 | 5.9 | 5.8 | 39 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 |
| 87H/3 | 66 | Ginkgo Snapper Tee | Snapper ZS | 12 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 19 | 5.3 | 5.3 | 5.4 | 5.5 | 5.6 |
| 83U | 66 | Powercor Mildura ZS (NSW Border) | Buronga ZS | 22 | 20.9 | 20.9 | 20.9 | 20.9 | 20.9 | 43 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 |
| 83W | 66 | Buronga ZS | Dareton ZS | 22 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 43 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Merbein - Dareton Line | 66 | Powercor Mildura ZS (NSW Border) | Dareton ZS | 49 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 61 | 11.4 | 11.4 | 11.4 | 11.4 | 11.4 |

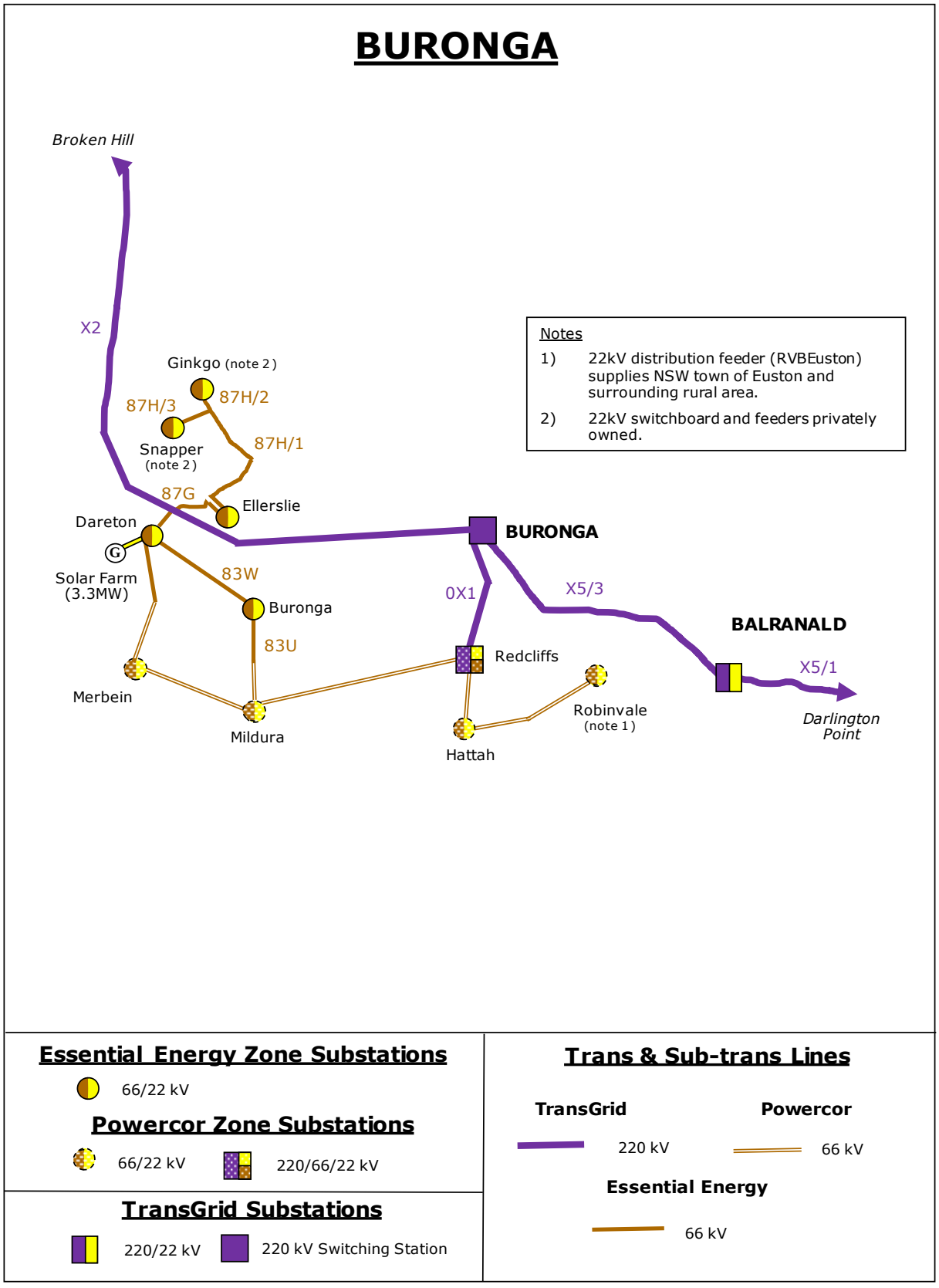
## STS and ZS load forecast

| SUMMER | Buronga Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | |
| Powercor Robinvale 22kV Euston Distribution Supply | | | | | | 0.96 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 0.45 | 28.5 |
| TransGrid 220/22kV Total Balranald 22kV Supply | | | | | | 1.00 | 3.9 | 3.9 | 4.0 | 4.0 | 4.0 | 0.73 | 14 |
| Buronga Town | 66/22 | 20/30 | 20/30 | | 33 | 0.95 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 1.80 | 5 |
| Dareton | 66/22 | 24/30 | 24/30 | | 33 | 0.97 | 12.3 | 12.3 | 12.3 | 12.3 | 12.3 | 1.61 | 4 |
| Ellerslie | 66/22 | 5/8 | | | 0 | 0.99 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 0.33 | 2 |
| Ginkgo | 66/22 | 12.5/16 | | | 0 | 0.93 | 6.1 | 6.0 | 6.0 | 5.9 | 5.8 | 0.00 | 23 |
| Snapper | 66/22 | 10/16 | | | 0 | 0.97 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 0.00 | 37 |

| WINTER | Buronga Supply Area POE50 Indicative Demand Forecast | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Substation | kV | Transformer Rating (MVA) | | | Firm Normal Cyclic Rating (MVA) | Forecast PF | Forecast (MVA) | | | | | Embedded Generation (MW) | 95% Peak Load Exceeded (Hrs) |
| | | Tx.1 | Tx.2 | Tx.3 | | | 2020 | 2021 | 2022 | 2023 | 2024 | | |
| Powercor Robinvale 22kV Euston Distribution Supply | | | | | | 0.97 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 0.45 | 1 |
| TransGrid 220/22kV Total Balranald 22kV Supply | | | | | | 0.98 | 2.8 | 2.8 | 2.8 | 2.9 | 2.9 | 0.73 | 11 |
| Buronga Town | 66/22 | 20/30 | 20/30 | | 36 | 0.99 | 7.6 | 7.8 | 8.0 | 8.1 | 8.3 | 1.80 | 2.5 |
| Dareton | 66/22 | 24/30 | 24/30 | | 36 | 1.00 | 6.9 | 6.9 | 6.9 | 6.9 | 6.9 | 1.61 | 7 |
| Ellerslie | 66/22 | 5/8 | | | 0 | 1.00 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 0.33 | 3.5 |
| Ginkgo | 66/22 | 12.5/16 | | | 0 | 0.93 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 0.00 | 73 |
| Snapper | 66/22 | 10/16 | | | 0 | 0.97 | 5.3 | 5.3 | 5.4 | 5.5 | 5.6 | 0.00 | 33 |

A 3.3MW solar generator is located at Dareton on the 22kV network.

Sub-transmission Single Line Diagram of Buronga area



## 2.4 Future Connection Points

There are no Future Connection Points that have been identified for Essential Energy.

## 2.5 Transmission – Distribution Connection Point Load Forecast

The embedded generation includes all major generation capacity but excludes the rooftop PV generation (which is shown against the individual zone substation forecasts).

### 2.5.1 Transmission – Distribution Connection Point load forecast

| Transmission Distribution Connection Point POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connection Point | Forecast PF | Summer Forecast (MVA) | | | | | Forecast PF | Winter Forecast (MVA) | | | | | Major Embedded Generation (MW) |
| | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 | |
| Albury (Corowa) | 0.97 | 19.4 | 19.6 | 19.9 | 20.1 | 20.3 | 0.99 | 13.5 | 13.6 | 13.7 | 13.7 | 13.8 | 0 |
| Albury (Mulwala) | 0.98 | 14.1 | 14.1 | 14.0 | 13.9 | 13.8 | 0.99 | 9.7 | 9.9 | 10.1 | 10.3 | 10.6 | 0 |
| Albury (Union Rd + Jelbart) | 0.97 | 97.3 | 97.8 | 98.4 | 98.9 | 99.5 | 0.99 | 69.2 | 69.5 | 69.8 | 70.1 | 70.5 | 0 |
| Armidale | 1.00 | 26.8 | 26.6 | 26.3 | 26.0 | 25.8 | 1.00 | 39.0 | 38.9 | 38.8 | 38.7 | 38.6 | 5 |
| Balranald | 1.00 | 3.9 | 3.9 | 4.0 | 4.0 | 4.0 | 0.98 | 2.8 | 2.8 | 2.8 | 2.9 | 2.9 | 0 |
| Beryl | 0.99 | 69.7 | 74.9 | 79.6 | 81.8 | 84.0 | 1.00 | 82.4 | 87.4 | 89.9 | 92.5 | 95.0 | 0 |
| Boambee South | 1.00 | 22.0 | 22.3 | 22.6 | 22.8 | 23.1 | 1.00 | 18.8 | 19.2 | 19.6 | 20.0 | 20.5 | 0 |
| Broken Hill 22kV | 0.97 | 42.2 | 42.7 | 43.3 | 43.8 | 44.3 | 1.00 | 33.4 | 33.5 | 33.5 | 33.6 | 33.7 | 50 |
| Casino | 0.95 | 30.0 | 30.8 | 31.6 | 32.4 | 33.2 | 1.00 | 23.7 | 24.0 | 24.3 | 24.7 | 25.0 | 0 |
| Coffs Harbour | 0.99 | 57.3 | 57.2 | 57.0 | 56.9 | 56.7 | 1.00 | 52.6 | 52.9 | 53.2 | 53.5 | 53.7 | 0 |
| Coleambally | 0.92 | 14.4 | 14.7 | 15.0 | 15.3 | 15.6 | 0.96 | 8.2 | 8.2 | 8.3 | 8.3 | 8.3 | 0 |
| Cooma 132kV | 0.85 | 37.5 | 37.5 | 37.5 | 37.5 | 37.5 | 0.85 | 50.2 | 50.2 | 50.2 | 50.2 | 50.2 | 118 |
| Cooma 66kV (Includes Generation) | 1.00 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 1.00 | 25.3 | 25.3 | 25.3 | 25.3 | 25.3 | 1.1 |
| Cowra (Includes Generation) | 0.99 | 27.8 | 27.2 | 26.6 | 26.0 | 25.4 | 1.00 | 27.8 | 27.9 | 28.1 | 28.2 | 28.3 | 22.5 |
| Darlington Point | 0.91 | 25.9 | 25.9 | 25.9 | 25.9 | 25.9 | 0.82 | 24.7 | 24.7 | 24.7 | 24.7 | 24.7 | 0 |
| Deniliquin | 0.98 | 55.0 | 55.4 | 55.8 | 56.2 | 56.6 | 1.00 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 0 |
| Dorrigo | 0.98 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.99 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 0 |
| Dunoon | 0.99 | 6.8 | 7.0 | 7.2 | 7.4 | 7.6 | 1.00 | 6.6 | 6.7 | 6.8 | 6.8 | 6.9 | 0 |
| Evans Lane | 1.00 | 41.2 | 42.0 | 42.8 | 43.6 | 44.4 | 1.00 | 48.5 | 49.0 | 49.4 | 49.8 | 50.3 | 0 |
| Finley 132kV | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 |
| Finley 66kV (Includes Generation) | 0.99 | 18.2 | 18.2 | 18.2 | 18.2 | 18.3 | 1.00 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 2.5 |
| Forbes | 1.00 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 | 0.99 | 25.6 | 25.6 | 25.6 | 25.6 | 25.6 | 4.1 |
| Glen Innes | 0.97 | 9.8 | 9.6 | 9.5 | 9.4 | 9.2 | 0.99 | 13.2 | 13.2 | 13.1 | 13.0 | 13.0 | 5.5 |
| Griffith | 1.00 | 90.9 | 95.5 | 96.1 | 96.7 | 97.3 | 0.99 | 57.8 | 62.2 | 62.7 | 63.2 | 63.6 | 0 |
| Gunnedah 66kV | 0.99 | 26.8 | 39.2 | 39.5 | 39.9 | 40.2 | 0.99 | 23.2 | 35.1 | 35.1 | 35.1 | 35.1 | 7 |
| Hawks Nest | 1.00 | 9.9 | 10.0 | 10.1 | 10.2 | 10.3 | 0.98 | 8.8 | 9.0 | 9.3 | 9.5 | 9.8 | 0 |
| Herons Ck | 0.98 | 13.6 | 14.1 | 14.6 | 15.2 | 15.7 | 0.99 | 12.5 | 12.6 | 12.8 | 12.9 | 13.1 | 0 |
| Inverell | 0.99 | 33.4 | 33.4 | 33.4 | 33.3 | 33.3 | 0.96 | 30.6 | 30.8 | 31.0 | 31.2 | 31.3 | 22.5 |
| Kempsey 33kV | 0.99 | 26.8 | 27.2 | 27.6 | 28.0 | 28.4 | 1.00 | 28.8 | 29.6 | 30.4 | 31.1 | 31.9 | 0 |
| Koolkhan | 1.00 | 57.5 | 58.2 | 58.9 | 59.6 | 60.3 | 0.99 | 53.4 | 54.2 | 54.9 | 55.7 | 56.4 | 0 |
| Lismore 132kV | 0.99 | 93.7 | 94.2 | 94.8 | 95.3 | 95.9 | 1.00 | 73.9 | 73.0 | 72.0 | 71.1 | 70.2 | 37.5 |
| Macksville | 0.99 | 9.2 | 9.3 | 9.4 | 9.5 | 9.6 | 1.00 | 9.3 | 9.3 | 9.4 | 9.5 | 9.5 | 0 |
| Manildra | 0.94 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 0.97 | 9.8 | 9.8 | 9.8 | 9.8 | 9.7 | 48.5 |
| Marulan (Includes Generation) | 0.98 | 62.8 | 65.6 | 66.4 | 67.2 | 68.1 | 0.99 | 61.9 | 64.6 | 65.2 | 65.9 | 66.5 | 118 |
| Merbein | 0.96 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 0.98 | 11.4 | 11.4 | 11.4 | 11.4 | 11.4 | 0 |
| Mildura | 0.96 | 20.9 | 20.9 | 20.9 | 20.9 | 20.9 | 0.99 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 3.3 |
| Molong | 1.00 | 5.4 | 5.5 | 5.6 | 5.8 | 5.9 | 0.99 | 5.0 | 5.0 | 5.0 | 5.0 | 5.1 | 0 |

## 2.5.2 Transmission – Distribution Connection Point load forecast – Continued

| Transmission Distribution Connection Point POE50 Indicative Demand Forecast | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connection Point | Forecast PF | Summer Forecast (MVA) | | | | | Forecast PF | Winter Forecast (MVA) | | | | | Major Embedded Generation (MW) |
| | | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | | 2020 | 2021 | 2022 | 2023 | 2024 | |
| Moree | 1.00 | 25.9 | 25.9 | 25.9 | 25.8 | 25.8 | 1.00 | 31.6 | 31.6 | 31.6 | 31.6 | 31.6 | 61 |
| Morven | 0.98 | 8.2 | 8.1 | 8.0 | 7.9 | 7.8 | 1.00 | 6.7 | 6.7 | 6.7 | 6.6 | 6.6 | 0 |
| Mudgee | 0.99 | 26.6 | 27.0 | 27.4 | 27.8 | 28.2 | 1.00 | 24.7 | 25.5 | 26.3 | 27.1 | 27.9 | 0 |
| Mullumbimby | 1.00 | 49.7 | 51.1 | 52.6 | 54.1 | 55.6 | 1.00 | 57.8 | 57.9 | 58.1 | 58.2 | 58.3 | 0 |
| Munyang | 0.94 | 3.4 | 3.5 | 3.5 | 3.5 | 3.5 | 0.95 | 30.8 | 35.5 | 35.0 | 34.5 | 34.3 | 0 |
| Murrumbateman | 1.00 | 6.3 | 6.5 | 6.6 | 6.7 | 6.8 | 1.00 | 6.7 | 6.8 | 7.0 | 7.2 | 7.3 | 0 |
| Murrumburrah | 0.97 | 42.2 | 41.7 | 41.3 | 40.9 | 40.4 | 1.00 | 37.6 | 38.0 | 38.3 | 38.7 | 39.0 | 0 |
| Nambucca | 0.99 | 6.4 | 6.3 | 6.3 | 6.2 | 6.2 | 0.99 | 8.2 | 8.2 | 8.1 | 8.1 | 8.0 | 0 |
| Narrabri | 0.98 | 45.1 | 45.3 | 45.4 | 45.5 | 45.7 | 0.99 | 47.8 | 47.7 | 47.7 | 47.6 | 47.5 | 16 |
| Orange 132kV | 0.99 | 151.7 | 167.8 | 184.8 | 182.4 | 181.4 | 0.99 | 150.8 | 166.9 | 183.9 | 181.5 | 180.5 | 0 |
| Orange 66kV | 0.99 | 55.7 | 56.3 | 57.0 | 57.7 | 58.3 | 0.99 | 61.9 | 61.9 | 61.9 | 61.9 | 61.8 | 0 |
| Panorama (Includes Generation) | 0.99 | 78.5 | 78.9 | 79.3 | 79.7 | 80.1 | 0.99 | 68.7 | 68.8 | 68.9 | 69.1 | 69.2 | 10 |
| Parkes 132kV | 0.93 | 52.8 | 53.6 | 54.4 | 55.2 | 56.0 | 0.92 | 53.8 | 54.4 | 55.0 | 55.6 | 56.2 | 0 |
| Parkes 66kV | 0.98 | 30.8 | 32.2 | 32.7 | 33.1 | 33.5 | 0.99 | 26.4 | 27.9 | 28.3 | 28.8 | 29.2 | 0 |
| Port Macquarie | 0.99 | 66.7 | 68.4 | 70.2 | 71.9 | 73.7 | 0.99 | 73.3 | 75.6 | 77.9 | 80.2 | 82.5 | 0 |
| Queanbeyan 132kV | 0.96 | 8.5 | 9.7 | 11.0 | 12.2 | 16.4 | 0.97 | 9.7 | 10.9 | 12.0 | 13.2 | 17.3 | 0 |
| Queanbeyan 66kV | 0.99 | 58.3 | 59.4 | 60.7 | 62.0 | 60.2 | 1.00 | 62.1 | 62.7 | 63.7 | 64.5 | 62.4 | 0 |
| Raleigh | 0.98 | 10.0 | 10.1 | 10.2 | 10.3 | 10.4 | 1.00 | 9.5 | 9.6 | 9.8 | 9.9 | 10.0 | 0 |
| Robinvale | 0.96 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 0.97 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 0 |
| Snowy Adit | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 |
| Stroud | 1.00 | 37.1 | 38.2 | 39.3 | 40.4 | 41.5 | 0.99 | 31.0 | 31.5 | 31.9 | 32.4 | 32.9 | 0 |
| Tamworth | 0.98 | 130.8 | 132.8 | 134.9 | 136.9 | 139.0 | 1.00 | 94.8 | 95.5 | 96.3 | 97.0 | 97.7 | 0 |
| Taree 33kV | 0.99 | 33.3 | 34.0 | 34.7 | 35.5 | 36.2 | 0.99 | 27.6 | 27.9 | 28.2 | 28.4 | 28.7 | 0 |
| Taree 66kV | 0.99 | 51.7 | 52.2 | 52.8 | 53.3 | 53.8 | 1.00 | 54.1 | 54.2 | 54.3 | 54.4 | 54.5 | 0 |
| Tenterfield | 0.99 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 1.00 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 0 |
| Terranora | 1.00 | 91.0 | 91.5 | 92.4 | 98.4 | 98.8 | 1.00 | 90.9 | 91.9 | 93.4 | 99.9 | 100.9 | 0 |
| Tumut (Includes Generation) | 0.96 | 35.2 | 35.4 | 35.6 | 35.8 | 36.0 | 0.99 | 31.0 | 30.8 | 30.7 | 30.6 | 30.4 | 14.4 |
| Wagga 66kV | 0.97 | 92.2 | 92.2 | 92.2 | 92.2 | 92.2 | 1.00 | 77.1 | 77.1 | 77.1 | 77.1 | 77.1 | 0 |
| Wagga North 132kV | 1.00 | 66.6 | 66.6 | 84.6 | 84.6 | 84.6 | 0.98 | 57.2 | 57.2 | 75.2 | 75.2 | 75.2 | 0 |
| Wagga North 66kV | 0.93 | 28.1 | 28.2 | 28.2 | 31.5 | 31.6 | 0.99 | 23.4 | 23.4 | 23.4 | 26.6 | 26.6 | 0 |
| Wallerawang 132kV | 0.86 | 31.0 | 31.2 | 31.4 | 31.6 | 31.8 | 0.86 | 31.0 | 31.6 | 32.2 | 32.8 | 33.3 | 0 |
| Wallerawang 66kV | 0.98 | 4.3 | 4.3 | 4.4 | 4.4 | 4.4 | 0.96 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 0 |
| Wellington 132kV | 1.00 | 182.6 | 183.7 | 184.7 | 185.7 | 186.7 | 1.00 | 161.4 | 162.4 | 163.4 | 164.5 | 165.5 | 146.3 |
| Yanco | 1.00 | 49.1 | 49.8 | 50.5 | 51.2 | 51.9 | 0.99 | 38.5 | 38.7 | 38.8 | 39.0 | 39.1 | 0 |
| Yass 132kV | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 |
| Yass 66kV | 0.99 | 14.5 | 14.5 | 14.5 | 14.6 | 14.6 | 0.98 | 15.6 | 15.8 | 16.0 | 16.2 | 16.4 | 0 |

## 2.6 Forecast of Reliability Target Performance

The 2018/19 financial year is the fourth year since the introduction of the Service Target Performance Incentive Scheme (STPIS) to Essential Energy. The STPIS provides incentives for improved normalised reliability performance and penalises reduced normalised reliability performance against System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) targets.

The following targets have been set by the AER for the network performance component of STPIS for the period 2015/16 - 2018/19. These targets are based on the average performance level of Essential Energy's network over the period 2008/09 - 2013/14.

**Table 4 – STPIS targets 2015/16 to 2018/19**

| Feeder Category | Unplanned SAIDI (minutes) | Unplanned SAIFI (interruptions) |
|---|---|---|
| **Urban** | 68.47 | 0.863 |
| **Short Rural** | 212.94 | 1.923 |
| **Long Rural** | 419.43 | 2.803 |

In addition to the targets listed in Table 4, are the Reliability and Performance licence conditions set out by IPART that impose reliability performance standards on electricity distributors. These are categorised by different feeder lengths and load densities. Reliability performance standards were met for all feeder categories in 2018/19. Essential Energy uses this data to make efficient investment decisions for the sub-transmission and distribution networks.

According to the normalised index that covers the average number of interruptions (SAIFI) and the average time customers are without electricity (SAIDI) during the year, Essential Energy's network reliability in the reporting period increased compared to the previous period.

Customers were without electricity for an average of 236 minutes in 2018/19 (SAIDI), compared to 212 minutes in 2017/18. The average frequency of interruptions per customer (SAIFI) was 1.88 in 2018/19, compared to 1.78 in the previous year. The restoration of performance to atypical levels can be attributed to poor weather conditions over the course of the year.

# 3. IDENTIFIED SYSTEM LIMITATIONS

A major part of the planning process involves performing network analysis using the latest demand forecast to establish network performance under different loading and network configurations that relate to the planning criteria outlined in Essential Energy's licence conditions and internal guidelines.

The process identifies whether the network performance obligations are satisfied within the forward planning period or if corrective action is required to address a network limitation. It should be noted that limitations identified in this report have been assessed under the network conditions and licence requirements pertaining at the time of assembly, and are subject to review in the event of any significant change to either. Essential Energy defines the normal cyclic ratings for zone substation transformers as 110 per cent of nameplate rating in summer and 120 per cent of nameplate rating in winter.

Only primary distribution feeder limitations where network proposals have been developed are included in this section. A distribution feeder strategic review is underway to provide more comprehensive advice in subsequent reports.

The NER requires distribution network service providers to investigate non-network options by utilising a thorough consultation process to facilitate input into the planning of major network upgrades. This provides opportunity for interested parties and the community to submit options and ideas allowing for the development of cost effective demand management and other system support options.

The NER calls for a 'screening test' to be performed for all capital projects above $5M to determine if a non-network option is credible and should be investigated further. If a non-network option is deemed to be feasible, Essential Energy will conduct a detailed investigation to determine the objective and targets for a non-network option to be successful and publish this information in a Non-Network Options Report. Alternatively, a notice must be published if it is determined on reasonable grounds there are no feasible non-network options to address the project.

The AER published a distribution system limitation template in June 2017 to enable the delivery of useable and consistent information to non-network service providers for addressing identified network needs. The template is designed to improve the quality of the information provided, and enable rapid evaluation of alternative solutions. All projects provided within this template have not yet been assessed for internal or external non-network solutions.

This section outlines the identified network limitations and provides an indication of the potential network solutions against which the credible non-network alternatives will be assessed.

The detailed list of identified limitations, asset ratings and whole feeder historical load traces are published in separate files to this report. These supplementary files are available for download on the Essential Energy website https://www.essentialenergy.com.au/our-network/network-pricing-and-regulatory-reporting/regulatory-reports-and-network-information.

## 3.1 Sub-transmission Feeder Limitations

| IDENTIFIED SUBTRANSMISSION FEEDER LIMITATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operations Area | Feeder Number and Name | System Limitation | | | Potential Load Transfer | Load reduction required for 1 year deferral (MW) | Impact on Transmission-Distribution Connection Point | Potential Credible Solutions |
| | | Details | Driver | Timing | | | | |
| Riverina Slopes Wagga | 8WF Kooringal Tees to Kooringal | Network limitations associated with tee connection | Capacity/ Growth | Existing | 0 | 10.8 | Nil | Install high speed protection (fibre) between TransGrid BSP and Kooringal ZS |
| Riverina Slopes Wagga | 8WM Morrow St | Total loss of supply at Morrow St ZS for loss of feeder 8WM | Capacity/ Growth | Existing | 0 | 12.2 | Nil | Construct 66 kV bus bar at Morrow St ZS |
| Central Griffith | 79W Goolgowi | Voltage and thermal limitations under contingent conditions | Capacity/ Growth | Jun-20 | 0 | 2 | Nil | 1. Install 2nd 33kV line from Tharbogang to Nericon tee<br>2. Demand Management Alternative |

## 3.2 Sub-transmission and Zone Substation Limitations

There have been no Sub-transmission Substation or Zone Substation limitations identified outside of the projects listed in section 3.5 Network Asset Retirements and De-ratings – Zone Substation.

## 3.3 Primary Distribution Feeder Limitations

Essential Energy primary distribution feeder projects have been included within the latest limitation template provided by ISF, and a summary of these identified limitations are included below. The detailed information for these limitations are included in supplementary documents available for download on the Essential Energy website https://www.essentialenergy.com.au/our-network/network-pricing-and-regulatory-reporting/regulatory-reports-and-network-information.

| SUMMARY OF IDENTIFIED DISTRIBUTION FEEDER LIMITATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operations Area | Zone Substation Name | Feeder | Primary Driver | Preferred Network Solution | Estimated Captial Cost | Demand Reduction Required for 1 Year Deferral | Segment Asset Rating | Load At Risk |
| Mid North Coast | Dorrigo | DOR3B3 Mt Moombil | Asset Condition | OH - Reconduct 7/2.00 SC/GZ - 4.6km - Breakwalls Rd, Megan | $ 202,400 | 0.06 MVA | 2020 - 0.8 MVA;<br>2021 - 0.8 MVA;<br>2022 - 0.8 MVA;<br>2023 - 0.8 MVA;<br>2024 - 0.8 MVA | 2020 - 0.06 MW;<br>2021 - 0.06 MW;<br>2022 - 0.06 MW;<br>2023 - 0.06 MW;<br>2024 - 0.06 MW |
| Mid North Coast | Moonee | MNE3B6 Emerald Beach | Reliability | UG- Establish 11kV tie - 680m, Heritage Dve, Moonee Beach | $ 240,000 | 0.22 MVA | 2020 - 6.4 MVA;<br>2021 - 6.4 MVA;<br>2022 - 6.4 MVA;<br>2023 - 6.4 MVA;<br>2024 - 6.4 MVA | 2020 - 0.22 MW;<br>2021 - 0.22 MW;<br>2022 - 0.22 MW;<br>2023 - 0.22 MW;<br>2024 - 0.22 MW |
| Mid North Coast | Woolgoolga | WGA3B3 Wooli | Reliability | OH Feeder backup Pacific Highway, Halfway Creek | $ 376,000 | 1.2 MVA | 2020 - 5 MVA;<br>2021 - 5 MVA;<br>2022 - 5 MVA;<br>2023 - 5 MVA;<br>2024 - 5 MVA | 2020 - 1.2 MW;<br>2021 - 1.2 MW;<br>2022 - 1.2 MW;<br>2023 - 1.2 MW;<br>2024 - 1.2 MW |
| Mid North Coast | Whitbread St | WTE3B7 Spence St | Asset Condition | UG - Replace LV consac cable Tristania Cr Taree 2-21416, 400m | $ 300,000 | 0 MVA | 2020 - 0.19 MVA;<br>2021 - 0.19 MVA;<br>2022 - 0.19 MVA;<br>2023 - 0.19 MVA;<br>2024 - 0.19 MVA | 2020 - 0.162 MW;<br>2021 - 0.163 MW;<br>2022 - 0.165 MW;<br>2023 - 0.166 MW;<br>2024 - 0.166 MW |
| Mid North Coast | Hallidays Point 11kV | HLP3B2 Failford Rd | Reliability | OH - Network Augmentation second supply to Nabiac | $ 1,055,000 | 0 MVA | 2020 - 5.18 MVA;<br>2021 - 5.18 MVA;<br>2022 - 5.18 MVA;<br>2023 - 5.18 MVA;<br>2024 - 5.18 MVA | 2020 - 2.6 MW;<br>2021 - 2.626 MW;<br>2022 - 2.652 MW;<br>2023 - 2.679 MW;<br>2024 - 2.706 MW |
| Mid North Coast | Tea Gardens | TEA3B4 Tea Gardens | Reliability | UG - Create 11 kV link Spinifex Ave Tea Gardens 88-82432, 1600 m | $ 592,073 | 0 MVA | 2020 - 3.3 MVA;<br>2021 - 3.3 MVA;<br>2022 - 3.3 MVA;<br>2023 - 3.3 MVA;<br>2024 - 3.3 MVA | 2020 - 1.7 MW;<br>2021 - 1.9 MW;<br>2022 - 2.1 MW;<br>2023 - 2.3 MW;<br>2024 - 2.5 MW |

| SUMMARY OF IDENTIFIED DISTRIBUTION FEEDER LIMITATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operations Area | Zone Substation Name | Feeder | Primary Driver | Preferred Network Solution | Estimated Captial Cost | Demand Reduction Required for 1 Year Deferral | Segment Asset Rating | Load At Risk |
| Mid North Coast | Clearwater Cr | CPM3B7 Thrumster | Reliability | UGOH install 1200m cable & recond fdr tie College Rise Sovereign Hills | $ 247,688 | 1.4 MVA | 2020 - 4 MVA;<br>2021 - 4 MVA;<br>2022 - 4.5 MVA;<br>2023 - 4.5 MVA;<br>2024 - 4.5 MVA | 2020 - 1.4 MW;<br>2021 - 1.6 MW;<br>2022 - 1.7 MW;<br>2023 - 1.9 MW;<br>2024 - 2.1 MW |
| Coastal | Grafton North | GRN3B7 Grafton West | Safety | Replacement of 3 cast iron potheads and 2 ABS with two 4 way RMU's -Duke Street Grafton | $ 223,496 | 0 MVA | 2020 - 4.7 MVA;<br>2021 - 4.7 MVA;<br>2022 - 4.7 MVA;<br>2023 - 4.7 MVA;<br>2024 - 4.7 MVA | 2020 - 1.9 MW;<br>2021 - 1.9 MW;<br>2022 - 1.9 MW;<br>2023 - 1.9 MW;<br>2024 - 1.9 MW |
| Coastal | Lennox Head | LHD3B5 Lennox West | Capacity | UG-11kV - replace 95mm cable - 360m - Hutley Dve, Lennox Hd | $ 350,000 | 0 MVA | 2020 - 3.8 MVA;<br>2021 - 3.8 MVA;<br>2022 - 3.8 MVA;<br>2023 - 3.8 MVA;<br>2024 - 3.8 MVA | 2020 - 2.4 MW;<br>2021 - 2.4 MW;<br>2022 - 2.4 MW;<br>2023 - 2.4 MW;<br>2024 - 2.4 MW |
| Coastal | Maclean 66/11kV | MLN3B2 Maclean Town | Capacity | Augement L.V. Feeders and upgrade sub 51-1851 CBD Maclean | $ 335,489 | 0.5 MVA | 2020 - 1.2 MVA;<br>2021 - 1.2 MVA;<br>2022 - 1.6 MVA;<br>2023 - 1.6 MVA;<br>2024 - 1.6 MVA | 2020 - 1.2 MW;<br>2021 - 1.2 MW;<br>2022 - 1.3 MW;<br>2023 - 1.4 MW;<br>2024 - 1.5 MW |
| Ranges | Dunoon | DUN3B3 Nimbin | Asset Condition | OH - Reconduct 5500m HV - Stoney Chute Rd, Nimbin | $ 230,000 | 0.3 MVA | 2020 - 2.1 MVA;<br>2021 - 2.1 MVA;<br>2022 - 2.1 MVA;<br>2023 - 2.1 MVA;<br>2024 - 2.1 MVA | 2020 - 0.2 MW;<br>2021 - 0.2 MW;<br>2022 - 0.2 MW;<br>2023 - 0.2 MW;<br>2024 - 0.2 MW |
| Northern Tablelands | Manilla | MLA3B3 West/Nth Rural | Capacity | Replace approximately 4.4 km of 7/.064 HDBC and 7/16 SC/GZ between 11 kV feeder breaker 3B3 and first-line recloser 18-R790 | $ 225,000 | 1.909 MVA | 2020 - 2.13 MVA;<br>2021 - 2.13 MVA;<br>2022 - 2.13 MVA;<br>2023 - 2.13 MVA;<br>2024 - 2.13 MVA | 2020 - 1.9 MW;<br>2021 - 1.9 MW;<br>2022 - 1.9 MW;<br>2023 - 1.9 MW;<br>2024 - 1.9 MW |
| Northern Tablelands | Gunnedah 22kV | GDH6501 M65 Wandobah | Voltage | HV Reconductor 7.70 km of 7/16 SC/GZ with 7/3.00 AAAC, 75-L501421 Gunnedah | $ 270,000 | 0.476 MVA | 2020 - 2.036 MVA;<br>2021 - 2.036 MVA;<br>2022 - 2.036 MVA;<br>2023 - 2.036 MVA;<br>2024 - 2.036 MVA | 2020 - 0.428 MW;<br>2021 - 0.428 MW;<br>2022 - 0.428 MW;<br>2023 - 0.428 MW;<br>2024 - 0.428 MW |
| Northern Tablelands | Warialda | WRA2W08 Northern | Asset Condition | Reconductor 8.50 km of 3/4/.0661 ACSR with 3/4/2.50 ACSR between Pole 110200858 (82-A2010) and Pole 110200987 (82-R27) | $ 320,000 | 0.6 MVA | 2020 - 4.788 MVA;<br>2021 - 4.788 MVA;<br>2022 - 4.788 MVA;<br>2023 - 4.788 MVA;<br>2024 - 4.788 MVA | 2020 - 0.5 MW;<br>2021 - 0.5 MW;<br>2022 - 0.5 MW;<br>2023 - 0.5 MW;<br>2024 - 0.5 MW |

| SUMMARY OF IDENTIFIED DISTRIBUTION FEEDER LIMITATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operations Area | Zone Substation Name | Feeder | Primary Driver | Preferred Network Solution | Estimated Captial Cost | Demand Reduction Required for 1 Year Deferral | Segment Asset Rating | Load At Risk |
| Northern Tablelands | Walcha South 66/22kV | WLS8B5 Uralla/Walcha Rd/Wollun | Asset Condition | Reconductor 11.7km of 7/.064 copper identifed to ne at the end of its serviceable life | $ 450,000 | 0.26 MVA | 2020 - 5.553 MVA;<br>2021 - 5.553 MVA;<br>2022 - 5.553 MVA;<br>2023 - 5.553 MVA;<br>2024 - 5.553 MVA | 2020 - 0.216 MW;<br>2021 - 0.216 MW;<br>2022 - 0.216 MW;<br>2023 - 0.216 MW;<br>2024 - 0.216 MW |
| North Western | Coonamble | CNB32 Coonamble Town No.2 | Safety | Replace LV mains attached to the Facia of buildings in Castlereagh St between Tooloon St and Skillmans Lane | $ 347,587 | 0.3 MVA | 2020 - 5.452 MVA;<br>2021 - 5.452 MVA;<br>2022 - 5.452 MVA;<br>2023 - 5.452 MVA;<br>2024 - 5.452 MVA | 2020 - 0.3 MW;<br>2021 - 0.3 MW;<br>2022 - 0.3 MW;<br>2023 - 0.3 MW;<br>2024 - 0.3 MW |
| North Western | TransGrid 220/22kV Total Broken Hill 22kV Supply | BROKEN HILL TG BSP 220/22 - BHL-MULTI - # MULTI FDRS - BROKEN HILL | Reliability | Install a new recloser on each of the 6 Broken Hill Feeders to provide real time monitoring and remote operation and control of BH network | $ 300,000 | 38.7 MVA | 2020 - 88.2 MVA;<br>2021 - 88.2 MVA;<br>2022 - 88.2 MVA;<br>2023 - 88.2 MVA;<br>2024 - 88.2 MVA | 2020 - 37.4 MW;<br>2021 - 37.5 MW;<br>2022 - 38.9 MW;<br>2023 - 39.1 MW;<br>2024 - 39.2 MW |
| Macquarie | Manildra | MDA3B6 Monument | Capacity | Reconductor a 6.4km section of single phase steel conductor to three phase 7/3.00AAAC | $ 250,000 | 0.953 MVA | 2020 - 12.232 MVA;<br>2021 - 12.232 MVA;<br>2022 - 12.232 MVA;<br>2023 - 12.232 MVA;<br>2024 - 12.232 MVA | 2020 - 0.897 MW;<br>2021 - 0.897 MW;<br>2022 - 0.897 MW;<br>2023 - 0.897 MW;<br>2024 - 0.897 MW |
| Macquarie | Raglan | RAG3B5 OConnell | Asset Condition | Reconductor existing 6.5km section of HDBC conductor to 7/4.50AAAC | $ 250,000 | 1.5 MVA | 2020 - 7.24 MVA;<br>2021 - 7.24 MVA;<br>2022 - 7.24 MVA;<br>2023 - 7.24 MVA;<br>2024 - 7.24 MVA | 2020 - 1.48 MW;<br>2021 - 1.48 MW;<br>2022 - 1.48 MW;<br>2023 - 1.48 MW;<br>2024 - 1.48 MW |
| Macquarie | Blayney | BNY3B4 Millthorpe | Asset Condition | Upgrade existing HDBC conductor with 7/4.50AAAC between poles 12I4.1 and 11I17.2 | $ 275,000 | 0.381 MVA | 2020 - 5.239 MVA;<br>2021 - 5.239 MVA;<br>2022 - 5.239 MVA;<br>2023 - 5.239 MVA;<br>2024 - 5.239 MVA | 2020 - 0.373 MW;<br>2021 - 0.373 MW;<br>2022 - 0.373 MW;<br>2023 - 0.373 MW;<br>2024 - 0.373 MW |
| Macquarie | Blayney | BNY3B4 Millthorpe | Asset Condition | Replace 7.14km of HDBC conductor with 7/4.50AAAC between 10-G13075 and 11I69.6 | $ 300,000 | 0.191 MVA | 2020 - 5.239 MVA;<br>2021 - 5.239 MVA;<br>2022 - 5.239 MVA;<br>2023 - 5.239 MVA;<br>2024 - 5.239 MVA | 2020 - 0.187 MW;<br>2021 - 0.187 MW;<br>2022 - 0.187 MW;<br>2023 - 0.187 MW;<br>2024 - 0.187 MW |
| Macquarie | Molong 11kV | MLO22 East | Capacity | Reconductor 6.65kms of Wagtail and steel conductor Belgravia Rd, Molong | $ 300,000 | 0.095 MVA | 2020 - 4.153 MVA;<br>2021 - 4.153 MVA;<br>2022 - 4.153 MVA;<br>2023 - 4.153 MVA;<br>2024 - 4.153 MVA | 2020 - 0.094 MW;<br>2021 - 0.094 MW;<br>2022 - 0.094 MW;<br>2023 - 0.094 MW;<br>2024 - 0.094 MW |

| SUMMARY OF IDENTIFIED DISTRIBUTION FEEDER LIMITATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operations Area | Zone Substation Name | Feeder | Primary Driver | Preferred Network Solution | Estimated Captial Cost | Demand Reduction Required for 1 Year Deferral | Segment Asset Rating | Load At Risk |
| Macquarie | Cumnock | CMK4022 Yeoval | Asset Condition | Replace 7.8km section of HDBC conductor with 7/4.50AAAC | $ 350,000 | 0.108 MVA | 2020 - 2.13 MVA;<br>2021 - 2.13 MVA;<br>2022 - 2.13 MVA;<br>2023 - 2.13 MVA;<br>2024 - 2.13 MVA | 2020 - 0.107 MW;<br>2021 - 0.107 MW;<br>2022 - 0.107 MW;<br>2023 - 0.107 MW;<br>2024 - 0.107 MW |
| Macquarie | Canowindra | CWD33 Eugowra | Reliability | Replace existing 7/64HDBC conductor from Links 70-L884 to 70-L891 | $ 400,000 | 0.191 MVA | 2020 - 2.726 MVA;<br>2021 - 2.726 MVA;<br>2022 - 2.726 MVA;<br>2023 - 2.726 MVA;<br>2024 - 2.726 MVA | 2020 - 0.171 MW;<br>2021 - 0.171 MW;<br>2022 - 0.171 MW;<br>2023 - 0.171 MW;<br>2024 - 0.171 MW |
| Macquarie | Mandurama | MUA5005 East | Asset Condition | Upgrade existing 11.3km section of HDBC conductor from Recloser 10-R5190 to 10-L1335 | $ 400,000 | 0.609 MVA | 2020 - 2.777 MVA;<br>2021 - 2.777 MVA;<br>2022 - 2.777 MVA;<br>2023 - 2.777 MVA;<br>2024 - 2.777 MVA | 2020 - 0.606 MW;<br>2021 - 0.606 MW;<br>2022 - 0.606 MW;<br>2023 - 0.606 MW;<br>2024 - 0.606 MW |
| Riverina Slopes | Bourkelands | BOU3B2 Bourke St | Asset Condition | Replace ageing street light columnns with current standard - Replacement due to asset condition | $ 200,096 | 0 MVA | 2020 - 0.3 MVA;<br>2021 - 0.3 MVA;<br>2022 - 0.3 MVA;<br>2023 - 0.3 MVA;<br>2024 - 0.3 MVA | 2020 - 0.098 MW;<br>2021 - 0.098 MW;<br>2022 - 0.098 MW;<br>2023 - 0.098 MW;<br>2024 - 0.098 MW |
| Riverina Slopes | Kooringal | KOO3B4 Red Hill Rd | Asset Condition | Replace ageing street light columnns with current standard - Replacement due to asset condition | $ 230,000 | 0 MVA | 2020 - 0.28 MVA;<br>2021 - 0.28 MVA;<br>2022 - 0.28 MVA;<br>2023 - 0.28 MVA;<br>2024 - 0.28 MVA | 2020 - 0.2 MW;<br>2021 - 0.2 MW;<br>2022 - 0.2 MW;<br>2023 - 0.2 MW;<br>2024 - 0.2 MW |
| Riverina Slopes | Lockhart | LOC3786 Urana | Asset Condition | Reconductor Lockhart Urana Main line 3Ø 22kV 11 000M | $ 623,266 | 0 MVA | 2020 - 4.888 MVA;<br>2021 - 4.888 MVA;<br>2022 - 4.888 MVA;<br>2023 - 4.888 MVA;<br>2024 - 4.888 MVA | 2020 - 1.2 MW;<br>2021 - 1.2 MW;<br>2022 - 1.2 MW;<br>2023 - 1.2 MW;<br>2024 - 1.2 MW |
| Riverina Slopes | Paytens Bridge | PYB3B1 Eugowra | Asset Condition | Reconductor existing copper conductor from L901 to L891 on the Paytens Bridge Eugowra Feeder | $ 600,000 | 0.154 MVA | 2020 - 2.777 MVA;<br>2021 - 2.777 MVA;<br>2022 - 2.777 MVA;<br>2023 - 2.777 MVA;<br>2024 - 2.777 MVA | 2020 - 0.152 MW;<br>2021 - 0.152 MW;<br>2022 - 0.152 MW;<br>2023 - 0.152 MW;<br>2024 - 0.152 MW |
| South Eastern | Pambula | PAM3B5 Merimbula No.7 | Asset Condition | Replace 640m of direct buried HV 70mm Al UG cable @ Tura Beach Dr | $ 295,000 | 1.5 MVA | 2020 - 3.516 MVA;<br>2021 - 3.516 MVA;<br>2022 - 3.516 MVA;<br>2023 - 3.516 MVA;<br>2024 - 3.516 MVA | 2020 - 0.9 MW;<br>2021 - 1 MW;<br>2022 - 1 MW;<br>2023 - 1.1 MW;<br>2024 - 1.1 MW |

| SUMMARY OF IDENTIFIED DISTRIBUTION FEEDER LIMITATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operations Area | Zone Substation Name | Feeder | Primary Driver | Preferred Network Solution | Estimated Captial Cost | Demand Reduction Required for 1 Year Deferral | Segment Asset Rating | Load At Risk |
| South Eastern | Pambula | PAM3B1 Bald Hills No.3 | Asset Condition | Reconductor 8145m of 11kV steel conductor along Towridgee Ln to Myrtle Mtn | $ 352,000 | 0 MVA | 2020 - 0.42 MVA;<br>2021 - 0.42 MVA;<br>2022 - 0.42 MVA;<br>2023 - 0.42 MVA;<br>2024 - 0.42 MVA | 2020 - 0.2 MW;<br>2021 - 0.2 MW;<br>2022 - 0.2 MW;<br>2023 - 0.2 MW;<br>2024 - 0.2 MW |
| Murray | Ellerslie | ELL8B2 Pooncarie | Safety | Reconductor approximately 24KM of SWER 3/2.75 SCGZ with 7/3.00 Fluorine from Woodlands T Off to Popio shearing shed, install an additional SWER recloser load side of Popio T Off pole 4531 | $ 350,000 | 0.15 MVA | 2020 - 0.275 MVA;<br>2021 - 0.275 MVA;<br>2022 - 0.275 MVA;<br>2023 - 0.275 MVA;<br>2024 - 0.275 MVA | 2020 - 0.3 MW;<br>2021 - 0.3 MW;<br>2022 - 0.3 MW;<br>2023 - 0.3 MW;<br>2024 - 0.3 MW |
| Central | Griffith | GFH3B6 Illilliwa | Asset Condition | Backyard ABC 96-2537 Illilliwa st curtin cedar mcnabb 1000mtrs Griffith | $ 220,000 | 0 MVA | 2020 - 0.14 MVA;<br>2021 - 0.14 MVA;<br>2022 - 0.14 MVA;<br>2023 - 0.14 MVA;<br>2024 - 0.14 MVA | 2020 - 0.176 MW;<br>2021 - 0.176 MW;<br>2022 - 0.176 MW;<br>2023 - 0.176 MW;<br>2024 - 0.176 MW |
| Central | Tharbogang | THA2225 Hillston Rd | Asset Condition | Reconductor 4km of 7/.064Cu with 7/4.50AAAC on Whites Rd from G255 to L14186 Old Well Rd | $ 299,500 | 0 MVA | 2020 - 1.2 MVA;<br>2021 - 1.2 MVA;<br>2022 - 1.2 MVA;<br>2023 - 1.2 MVA;<br>2024 - 1.2 MVA | 2020 - 1.386 MW;<br>2021 - 1.386 MW;<br>2022 - 1.386 MW;<br>2023 - 1.386 MW;<br>2024 - 1.386 MW |
| Central | Darlington Point | DPT934 Darlington Point Town | Asset Condition | Reconductor 2.7km to 7/4.50AAAC_ICW OH_ Carrington St Darlington Point Town | $ 285,000 | 0 MVA | 2020 - 1.4 MVA;<br>2021 - 1.4 MVA;<br>2022 - 1.4 MVA;<br>2023 - 1.4 MVA;<br>2024 - 1.4 MVA | 2020 - 1.25 MW;<br>2021 - 1.25 MW;<br>2022 - 1.25 MW;<br>2023 - 1.25 MW;<br>2024 - 1.25 MW |
| Central | Willbriggie | WILLBRIGGIE 33/11 - WBG-MULTI - # MULTI FDRS - WILLBRIGGIE | Reliability | Darlington Point 33kV via Kidman Way OH Upgrade of 33kV & 11kV network - 6.75km | $ 548,272 | 0 MVA | 2020 - 5.7 MVA;<br>2021 - 5.7 MVA;<br>2022 - 5.7 MVA;<br>2023 - 5.7 MVA;<br>2024 - 5.7 MVA | 2020 - 5.326 MW;<br>2021 - 5.421 MW;<br>2022 - 5.611 MW;<br>2023 - 5.706 MW;<br>2024 - 5.801 MW |

## 3.4 Network Asset Retirements and De-ratings – Sub-transmission

### 3.4.1 Casino to Mallanganee 33kV Feeder

#### Asset Description

The 8401 sub-transmission feeder from Casino to Mallanganee consists of 15km and 21km sections of radial 7/.080 copper conductor, supplying around 2,000 customers in total between Mallanganee, Bonalbo and Urbenville zone substations.

The feeder was constructed in 1950, consisting of 239 spans with single pole, predominantly delta pin pole top construction and 7/.080 copper conductor. It has 11kV underslung for the entire length, except for a short section near Casino, the underslung 11kV is also mostly copper conductor of same era. The average pole age is 37 years, with 80 of the 239 poles over 50 years old.

The feeder transverses from the relatively flat areas at Casino rising into the hills and into the Great Dividing Range near Mallanganee. Located in a small area of NSW that has the highest average lightning ground flash density, the feeder is susceptible to thunder storms and lightning strikes, particularly in the higher area near Mallanganee. Having delta pin pole top construction, the feeder has no overhead earthwire protection, other than small sections (<1km) at the exit of Casino and entry to Mallanganee zone substations.

#### Assessment

The 67-year-old 7/.080 copper conductor on this feeder is reaching end of serviceable life and is subject to regular failure, resulting in poor reliability for customers and an increasing public safety risk.

Being in an area susceptible to lightning strikes, the conductor is struck excessively, producing fault currents that overheat the conductor, leading to annealing of the copper strands. The copper hardens over the long term and combined with pitting, strands begin to fracture and the conductor breaks.

The original design of the feeder has inherent problems. The spans lengths are relatively long in areas traversing hills. The chance of inter-circuit conductor clash is increased as conductor swings are exacerbated in the areas with longer spans, leading to further conductor failure.

The conductor can be joined with short sections of new conductor, splices and compression sleeves but over time the rate of failure increases exponentially as the conductor reaches end of life. The Casino – Mallanganee feeder has over 200 joints/splices.

#### Date of retirement

Replacement of an initial 15km section of copper conductor is planned for 2019/20.
Replacement of the next 21km section of copper conductor is planned for 2022/23.

#### Changes since previous DAPR

The first 15km section is currently being replaced. There have been no changes to the project plan since the 2018 DAPR.

## 3.5 Network Asset Retirements and De-ratings – Zone Substation

### 3.5.1 Indoor Switchboard Replacement, Refurbishment and Conversion

| Zone Substation Indoor Switchboards (Replacement, Refurbishment & Conversion) | | |
|---|---|---|
| Asset Description and Location | Timing | Reason Identified |
| Cartwrights Hill ZS 11kV Switchboard Replacement | Dec-20 | ECONOMIC END OF LIFE, SAFETY |
| Forster ZS 11kV Switchboard Replacement | Dec-22 | ECONOMIC END OF LIFE, SAFETY |
| Googong Dam ZS 11kV Switchboard Replacement | Jun-23 | ECONOMIC END OF LIFE, SAFETY |
| Laurieton ZS 11kV Switchboard Replacement | Jun-23 | ECONOMIC END OF LIFE, SAFETY |
| Narooma ZS 11kV Refurbishment / Replacement | Jun-22 | ECONOMIC END OF LIFE, SAFETY |
| Narrandera ZS 11kV Switchboard Refurbishment / Replacement | Jan-21 | ECONOMIC END OF LIFE, SAFETY |
| Owen St ZS 11kV Switchboard Replacement | Jun-22 | ECONOMIC END OF LIFE, SAFETY |
| Perisher ZS 33kV and 11kV Switchgear Replacement | Sep-22 | ECONOMIC END OF LIFE, SAFETY |
| Wingham ZS 11kV Switchboard Replacement | Jun-20 | ECONOMIC END OF LIFE, SAFETY, LOAD RESTRICTION |
| Woolgoolga ZS 11kV Switchboard Replacement | Jan-21 | ECONOMIC END OF LIFE, SAFETY |

### 3.5.2 Power Transformer Replacement

| Zone Substation Power Transformer Replacement | | |
|---|---|---|
| Asset Description and Location | Timing | Reason Identified |
| Blayney ZS Replace Tx1 | Jan-21 | ECONOMIC END OF LIFE |
| Bourke ZS Replace Tx1 Refurb Tx2 | Jun-20 | ECONOMIC END OF LIFE |
| Burren Junction ZS Replace Tx1 | Dec-22 | ECONOMIC END OF LIFE |
| Cartwrights Hill ZS Replace Tx1 | Jan-21 | ECONOMIC END OF LIFE |
| Eucumbene ZS Replace Tx1 | Jun-21 | ECONOMIC END OF LIFE |
| Geurie ZS Replace Tx1 | Jun-21 | ECONOMIC END OF LIFE |
| Gulgong ZS Replace Tx1 | Jun-23 | ECONOMIC END OF LIFE |
| Kempsey North St Replace Tx2 | Jun-21 | ECONOMIC END OF LIFE |
| Oura ZS Replace Tx4 | Jun-22 | ECONOMIC END OF LIFE |
| Peak Hill ZS Replace Tx2 | Dec-22 | ECONOMIC END OF LIFE |
| Trundle ZS 22/11kV Tx4 Replace | Jun-21 | ECONOMIC END OF LIFE |
| Wee Waa ZS Replace 66kV Regulator | Jun-21 | ECONOMIC END OF LIFE |
| Wee Waa ZS Replace Tx2 | Jun-21 | ECONOMIC END OF LIFE |
| Wingham ZS Replace Tx 2 | Dec-20 | ECONOMIC END OF LIFE |
| Yallaroi ZS Replace Tx1 | Jun-21 | ECONOMIC END OF LIFE |
| Yenda ZS Replace Tx1 | Jun-21 | ECONOMIC END OF LIFE |

### 3.5.3 Combined Asset Retirements and De-Ratings

| Combined Asset Replacements | | | |
|---|---|---|---|
| Asset Description | Region | Timing | Reason Identified |
| Zone Substation Circuit Breaker replacement | Macquarie, Mid North Coast, North Western, | Jun-20 | Economic End Of Life, Safety |
| Zone Substation Circuit Breaker replacement | Central, Coastal, Mid North Coast | Jun-21 | Economic End Of Life, Safety |
| Zone Substation Circuit Breaker replacement | North Western, South Eastern | Jun-22 | Economic End Of Life, Safety |
| Zone Substation Current Transformer Replacement | North Western | Jun-22 | Economic End Of Life, Safety |
| Zone Substation Outdoor Bus and Isolator Refurbishment and Replacement | Riverina Slopes, South Eastern | Jun-21 | Economic End Of Life, Safety |
| Zone Substation Outdoor Bus and Isolator Refurbishment and Replacement | Central, Murray | Jun-22 | Economic End Of Life, Safety |
| Zone Substation Power Transformer Refurbishment | Northern Tablelands, Riverina Slopes | Jun-20 | Economic Life Extension |
| Zone Substation Power Transformer Refurbishment | Macquarie, North Western | Jun-21 | Economic Life Extension |
| Zone Substation Power Transformer Refurbishment | Macquarie, North Western, Riverina | Jun-22 | Economic Life Extension |
| Zone Substation Voltage Transformer Replacement | Coastal | Jun-20 | Economic End Of Life, Safety |
| Zone Substation Voltage Transformer Replacement | Macquarie, North Western | Jun-21 | Economic End Of Life, Safety |
| Zone Substation Voltage Transformer Replacement | Riverina Slopes | Jun-22 | Economic End Of Life, Safety |
| Wooden Pole Staking and Replacement | All Regions | Jun-19 | Asset Age, Asset Failure |
| Wooden Pole Staking and Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Wooden Pole Staking and Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Wooden Pole Staking and Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Wooden Pole Staking and Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Concrete/Steel/Other Pole Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Concrete/Steel/Other Pole Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Concrete/Steel/Other Pole Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Concrete/Steel/Other Pole Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Concrete/Steel/Other Pole Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| Pole Top Structure Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Pole Top Structure Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Pole Top Structure Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Pole Top Structure Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Pole Top Structure Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |

| Combined Asset Replacements | | | |
|---|---|---|---|
| Asset Description | Region | Timing | Reason Identified |
| Overhead Conductor Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Overhead Conductor Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Overhead Conductor Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Overhead Conductor Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Overhead Conductor Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| Underground Cable Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Underground Cable Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Underground Cable Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Underground Cable Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Underground Cable Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| Service Line Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Service Line Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Service Line Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Service Line Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Service Line Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| Pole Mounted Transformer Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Pole Mounted Transformer Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Pole Mounted Transformer Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Pole Mounted Transformer Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Pole Mounted Transformer Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| Kiosk/Chamber/Other Transformer Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Kiosk/Chamber/Other Transformer Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Kiosk/Chamber/Other Transformer Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Kiosk/Chamber/Other Transformer Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Kiosk/Chamber/Other Transformer Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |

| Combined Asset Replacements | | | |
|---|---|---|---|
| Asset Description | Region | Timing | Reason Identified |
| Network Switchgear Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Network Switchgear Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Network Switchgear Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Network Switchgear Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Network Switchgear Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| Public Lighting Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| Public Lighting Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| Public Lighting Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| Public Lighting Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| Public Lighting Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |
| SCADA, Network Control and Protection Systems Replacement | All Regions | Jun-20 | Asset Age, Asset Failure |
| SCADA, Network Control and Protection Systems Replacement | All Regions | Jun-21 | Asset Age, Asset Failure |
| SCADA, Network Control and Protection Systems Replacement | All Regions | Jun-22 | Asset Age, Asset Failure |
| SCADA, Network Control and Protection Systems Replacement | All Regions | Jun-23 | Asset Age, Asset Failure |
| SCADA, Network Control and Protection Systems Replacement | All Regions | Jun-24 | Asset Age, Asset Failure |

# 4. NETWORK INVESTMENTS

## 4.1 Regulatory Test / RIT-Ds Completed or in Progress

There are no RIT-Ds that have been completed or were in progress in 2019.

## 4.2 Potential RIT-Ds for Identified System Limitations

Essential Energy has not identified any network system limitations that may require the publication of a RIT-D.

## 4.3 Urgent and Unforeseen Investments

There have been no urgent or unforeseen investments identified in 2019.

# 5. JOINT PLANNING

Joint Planning is a requirement under Clause 5.14 of the NER, which requires Essential Energy to carry out Joint Planning with each Network Service Provider (NSP) to which its networks are connected. Consequently, Essential Energy conducts Joint Planning activities with TNSPs – TransGrid and Powerlink Queensland. At a DNSP level, it conducts such activities with Energex and Ergon Energy (of parent company Energy Queensland formed as of 1 July 2016), Ausgrid, Endeavour Energy, Evoenergy (formerly ActewAGL) and Powercor Australia.

The frequency, process and methodology of such Joint Planning depends on the timing of emerging network constraints due to growth, reliability and refurbishment needs, as well as other external drivers such as third-party connection requests to service new or augmented major loads and generators.

Joint Planning aims to identify the most efficient network or non-network option to address the need in a prudent manner, regardless of ownership, jurisdiction or boundary.

In general, the process and methodology establishes a formal Joint Planning committee between the relevant parties (Essential Energy and the NSP or in some cases multiple NSPs) which, depending upon the emerging limitation(s), severity and impact, will then meet to jointly confirm, quantify, review, recommend and resolve the matter(s).

This is undertaken using agreed technical, unit cost, fiscal, risk and sensitivity assessment assumptions and criterion to compare and evaluate the credible non-network and network alternatives in order to select, plan and deliver the most prudent investment(s) in accordance with NER requirements and objectives.

In the case of shared investments over a combined total cost threshold of $5M, regulatory consultation documentation and notifications are prepared and published jointly in accordance with the NER process requirements.

For investments below this threshold value, the appropriate investment case documentation is shared and held by the joint parties. In both instances, where necessary, a Joint Planning Report (JPR) is executed to define the high level responsibilities of all parties in delivering, funding and owning the investment or parts thereof.

## 5.1 Results of Joint Planning with the TNSP TransGrid

### 5.1.1 Summary of the Process and Methodology

An existing Joint Planning committee, made up of network planning staff from Essential Energy and TransGrid, met regularly (approximately every quarter) throughout the past year. A Joint Planning Charter, detailing a formally structured approach and guiding principles, sets the basis. Issues and outcomes were minuted with actions, and where necessary, issues were referred to an overseeing Joint Executive Steering Committee which met at least once within the period.

TransGrid has a Transmission Reliability Standard (enforced from 1 July 2018), and as an ongoing consequence TransGrid and Essential Energy have consulted with each other via Joint Planning, and where cost effective, are initiating works to reduce expected unserved energy supplied from TransGrid Bulk Supply Points.

### 5.1.2 Investments Jointly Planned

Joint Planning between Essential Energy and TransGrid has commenced regarding the apparent and emerging 132kV network constraints in the Orange, Parkes/Forbes, Beryl/Wellington and Gunnedah/Narrabri areas of NSW. This is presently ongoing due to the uncertainty of spot load developments and small to large embedded generation proposals.

The only TransGrid jointly planned project to be completed in 2019, was the remaining minor (< $1m) shared yet deferred Orange 132/66kV substation refurbishment works as originally jointly planned circa 2014.

### 5.1.3 Additional Information

Additional detailed information regarding the above considerations may be obtained from the Essential Energy and TransGrid websites, and as published in the preceding and latest TransGrid Transmission Annual Planning Reports.

## 5.2 Results of Joint Planning with the TNSP Powerlink

### 5.2.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Powerlink Queensland as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

This is facilitated through face-to-face meetings or teleconferencing between Joint Planning representatives from both organisations. These interactions have formal agendas and minuted outcomes with assigned responsibilities. The Joint Planning representatives from Powerlink and Essential Energy are from the respective Joint Planning teams and may from time-to-time consist of representatives from specialist technical teams outside of network planning.

### 5.2.2 Investments Jointly Planned

There has been continued Joint Planning with Powerlink (and Energex) regarding the network in the Gold Coast zone, particularly the ongoing emerging condition risks arising from the condition of one of the three existing Powerlink Mudgeeraba substation 275/110kV power transformers.

Joint Planning studies have confirmed the potential to subsequently retire this transformer given the current flat demand forecast. It is proposed to retire this transformer by 2020 and it is suggested that the proposed network solution will not have a material inter-network impact or a material impact to network users.

Also, through 2019, several other Joint Planning interactions with both Powerlink (and Energex) were held. The primary reason was to jointly review and plan for the emerging condition risks arising from the condition of the dual circuit 110kV powerline (circuits 757 & 758) single steel-tower structures, between the Powerlink Mudgeeraba substation (on the Queensland Gold Coast), and the Terranora Bulk Supply Point substation owned by Essential Energy in the Tweed region of Northern NSW.

Joint Planning consideration (with both Powerlink & Energex) is presently ongoing regarding the restoration options for contingent emergency supply to this Northern NSW region should both these 110kV (757 & 758) circuits incur a sustained unplanned outage due to the single steel-tower structures.

The most obvious option would be to reinstate at least one of the 110kV circuit/s (757 or 758), however this may not provide a suitable response time for part or progressive restoration depending upon the severity of the outage.

Provision of limited alternate 66kV supply from the Energex Kirra substation via the substation 11kV busbar is being considered as another viable option.

### 5.2.3 Additional Information

Additional information on the above project investments may be obtained from the Essential Energy and Powerlink websites[5], and as published in the recent 2019 Powerlink Transmission Annual Planning Report.

## 5.3 Results of Joint Planning with the DNSP Energex

### 5.3.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Energex as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

[5] Powerlink TAPR 2019, Section 3.2 page 51 & Section 5.7.11 page 127, Gold Coast zone.

This is facilitated through face-to-face meetings or teleconferencing between Joint Planning representatives from both organisations. These interactions have formal agendas and minuted outcomes with assigned responsibilities. The Joint Planning representatives from Powerlink and Essential Energy are from the respective Joint Planning teams and may from time-to-time consist of representatives from specialist technical teams outside of network planning.

### 5.3.2 Investments Jointly Planned

In 2019, several Joint Planning interactions with both Energex (and Powerlink Queensland) were held. (Please refer to Section 5.2.2 above for the specific project detail as it is the same for both Energex and Powerlink Queensland).

### 5.3.3 Additional Information

Additional information on the above project investments may be obtained from the Essential Energy and Energex websites[6], and as published in the 2019 Energex Distribution Annual Planning Report.

## 5.4 Results of Joint Planning with the DNSP Ergon

### 5.4.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Ergon as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

However, in 2019, there has been no material need to conduct formal Joint Planning with Ergon Energy. This is mainly due to the past and sustained decline in peak demand forecasts and the fact that no limitations on the interconnecting 132kV sub-transmission and 33kV distribution networks are imminent. Joint Planning has therefore been limited to a few telephone/email discussions between the respective network planning and customer connection teams.

### 5.4.2 Investments Jointly Planned

Nil.

### 5.4.3 Additional Information

Nil.

## 5.5 Results of Joint Planning with the DNSP Ausgrid

### 5.5.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Ausgrid as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

This is facilitated through face-to-face meetings or teleconferencing between Joint Planning representatives from both organisations. These interactions have formal agendas and minuted outcomes with assigned responsibilities. The Joint Planning representatives from Ausgrid and Essential Energy are from the respective Joint Planning teams and may from time-to-time consist of representatives from specialist technical teams outside of network planning.

In 2019, there has been one formal Joint Planning meeting with Ausgrid. This was to inform each other regarding any significant developments and emerging constraints within the respective supply jurisdictions. It concluded that no network related actions are required, which is mainly due to the past decline and continued flat trend in peak demand forecasts and the fact that no limitations on the interconnecting 33kV and 11kV networks are imminent.

[6] Energex DAPR 2019

### 5.5.2 Investments Jointly Planned

Nil.

### 5.5.3 Additional Information

Nil.

## 5.6 Results of Joint Planning with the DNSP Endeavour Energy

### 5.6.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Endeavour Energy as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

This is facilitated through face-to-face meetings or teleconferencing between Joint Planning representatives from both organisations. These interactions have formal agendas and minuted outcomes with assigned responsibilities. The Joint Planning representatives from Endeavour Energy and Essential Energy are from the respective Joint Planning teams and may from time-to-time consist of representatives from specialist technical teams outside of network planning.

In 2019, there has been no material need to conduct formal Joint Planning with Endeavour Energy. This is mainly due to the past decline and now flat trend in peak demand forecasts and the fact that no limitations on the interconnecting 132kV sub-transmission network is imminent. Joint planning has therefore been limited to a few telephone/email discussions between the respective network planning and customer connection teams.

### 5.6.2 Investments Jointly Planned

Nil.

### 5.6.3 Additional Information

Nil.

## 5.7 Results of Joint Planning with the DNSP Evoenergy

### 5.7.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Evoenergy as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

This is facilitated through face-to-face meetings or teleconferencing between Joint Planning representatives from both organisations. These interactions have formal agendas and minuted outcomes with assigned responsibilities. The Joint Planning representatives from Evoenergy and Essential Energy are from the respective Joint Planning teams and may from time-to-time consist of representatives from specialist technical teams outside of network planning.

In 2019, there has been no material need to conduct formal Joint Planning meetings with Evoenergy. This is mainly due to the fact that no limitations on the neighbouring networks are imminent. Joint Planning has therefore been limited to a few telephone/email discussions between the respective network planning and customer connection teams.

### 5.7.2 Investments jointly planned

Nil.

### 5.7.3 Additional Information

Nil.

## 5.8 Results of Joint Planning with the DNSP Powercor Australia

### 5.8.1 Summary of the Process and Methodology

For the purpose of effective network planning, Essential Energy has collaborated in regular Joint Planning with Powercor Australia as part of an established continual process. Necessary collaboration regarding network matters such as emerging constraints and planned developments have and are undertaken regularly, as required based on project need.

This is facilitated through face-to-face meetings or teleconferencing between Joint Planning representatives from both organisations. These interactions have formal agendas and minuted outcomes with assigned responsibilities. The Joint Planning representatives from Powercor and Essential Energy are from the respective Joint Planning teams and may from time-to-time consist of representatives from specialist technical teams outside of network planning.

In 2019, there has been no material need to conduct formal Joint Planning meetings with Powercor Australia. This is mainly due to the fact that no limitations on the interconnecting 66kV and 22kV networks are imminent. Joint Planning has therefore been limited to a few telephone/email discussions between the respective network planning, system operations and customer connection teams.

### 5.8.2 Investments jointly planned

Nil.

### 5.8.3 Additional Information

Nil.

# 6. NETWORK PERFORMANCE

## 6.1 Reliability Performance

The AER STPIS was applied to Essential Energy from the 2015/16 financial year. Reporting is in accordance with the excluded interruption conditions of the STPIS, which include the removal of days where the distribution network exceeds the defined major event day boundary. The reliability measures used are SAIDI, average minutes without supply per customer, and SAIFI, average number of interruptions experienced per customer. Performance is monitored at distribution feeder level for unplanned interruptions.

Distribution feeders are categorised as Urban, Short Rural or Long Rural, based on feeder length and load density. Essential Energy's distribution network consists of 296 Urban Feeders, 926 Short Rural Feeders and 243 Long Rural Feeders, with over 60 per cent of customers on Short Rural Feeders.

### 6.1.1 Feeder Category Performance against STPIS Targets

Reliability outcomes by feeder category for the 2018/19 financial year fell outside STPIS targets for urban and long rural feeders.

**Table 5 – Feeder Performance by Category**

| Feeder Category | SAIDI (minutes) | | SAIFI (no of interruptions) | |
|---|---|---|---|---|
| | Target | Actual | Target | Actual |
| Urban | 68 | 80 | 0.86 | 1.00 |
| Short Rural | 213 | 214 | 1.92 | 1.82 |
| Long Rural | 419 | 554 | 2.80 | 3.35 |

### 6.1.2 Performance against Individual Feeder Standards

The performance objectives for organisational average performances by feeder category are not sufficient to identify when customers on a particular feeder experience unsatisfactory reliability performance. For this reason, SAIDI and SAIFI criteria (after 'excluded interruptions' are disregarded) act as a trigger for investigation and exception reporting purposes. The figures contained in the licence conditions are shown in Table 6 and Table 7.

**Table 6 – Individual feeder standards specified in the Licence Conditions applicable to Essential Energy**

| | Feeder Category | | |
|---|---|---|---|
| | Urban | Short Rural | Long Rural |
| SAIDI | 400 | 1,000 | 1,400 |
| SAIFI | 6 | 8 | 10 |

Performance outside this range results in the following actions:

- Immediate investigation of the causes for each feeder exceeding the individual feeder standards
- By the end of the quarter following the quarter in which the feeder first exceeded the individual feeder standard, complete an investigation report identifying the causes and action required to improve the performance
- Complete any operational actions identified in the investigation report by the end of the third quarter following the quarter in which the feeder first exceeded the standard
- Where the investigation report identifies actions, other than operational actions, that are required to improve the performance of a feeder to the individual feeder standards, a project plan is developed. The project plan includes an implementation timetable of required capital works. This timetable details the commencement of

implementation by the end of the second quarter following the quarter in which the feeder first exceeded the individual feeder standards.

**Table 7 – Individual Feeder Performance against the Standard Summary**

| Feeder Category | Urban | Short Rural | Long Rural |
|---|---|---|---|
| Feeders (Total Number each Type) | 296 | 926 | 243 |
| Feeders that Exceeded the Standard During the Year (Total Number) | 7 | 41 | 18 |

## 6.2 Quality of Supply Performance

The Electricity Supply Standards adopted by Essential Energy are set out in the document *CEOP8026 Electricity Supply Standard,* in accordance with the *Code of Practice – Electricity Service Standards.* A copy of *CEOP8026* can be downloaded from https://www.essentialenergy.com.au/.
*CEOP8026* also outlines Essential Energy's adoption of the Australian Standard AS 61000.3.100 – 2011 (Amendment No.1 -2016) and Australian Standard *AS 60038 – 2012 Standard Voltages.*

The main areas addressed include:

- Voltage fluctuations (LV) managed in accordance with Australian Standards AS/NZS 61000.3.3:2012, SA/SNZ TS IEC 61000.3.5: 2013 and SA/SNZ TR IEC 61000.3.5: 2013
- Switching transients (voltage waveform distortion) limited where possible to less than twice normal supply voltage
- Frequency variation and Essential Energy's role in notifying AEMO of any sustained fluctuations
- Voltage swells and voltage dips (sags) managed through best practice network improvement and augmentation (Recommended voltage swell and dip thresholds given in Australian Standard AS 61000.3.100 – 2011 (Amendment No.1 -2016)
- Steady state voltage differences between neutral and earth limited to less than 10 volts at the customer's point of supply
- Lightning strikes limited in their impact on supply where possible by adherence to industry best practice system design and maintenance principles
- Limitation of 'step and touch' voltage differentials managed in accordance with industry standards, namely ENA EG-0 Power System Earthing Guide – ENA DOC 025-2010
- Essential Energy's objective is to limit voltage unbalance to levels as required by the National Electricity Rules. This is generally 2% on the high voltage network and up to 6% on the LV network using 10min average values. This level may be exceeded occasionally in some rural areas. However, Voltage Unbalance allocations for new customer connections are managed through the latest Australian Standard for Voltage Unbalance (AS/NZS TR IEC 61000.3.13: 2012 and ENA Guideline for Power Quality – Voltage Unbalance)
- Harmonic content of voltage and current waveforms managed in accordance with Australian Standards AS/NZS TR IEC 61000.3.6:2012. Harmonic emission allocation process for new customer connections are managed through the Australian Standard and ENA Guideline for Power Quality – Harmonics
- Voltage fluctuations, flicker, and rapid voltage changes in HV network are managed in accordance with AS/NZS TR IEC 61000.3.7: 2012 Standard. Like the harmonics and unbalance, all the new HV customer connections and emissions allocations are managed through the latest Australian standard and the ENA Guideline for Power Quality – Flicker
- Mains signalling reliability set at a target of 99.5 per cent failsafe to ensure correct switching and metering functions.

Quality of supply is monitored through power quality enquiries received from customers and also through participation in the Power Quality Compliance Audit conducted by the University of Wollongong and a number of other distributors throughout Australia. This survey studies parameters such as steady state voltage, voltage total harmonic distortion (THD), voltage sags and voltage unbalance on three phase sites.

All valid complaints assessed as being network related, or issues identified via network monitoring are addressed to ensure the situation is rectified and maintained within standards.

Remedial actions could include but are not limited to adjusting tap settings on transformers, adjusting voltage regulation levels, installing additional or larger transformers, augmenting network capacity, repairing network faults and balancing network loads.

**Table 8 – Completed Investigations from Network Complaints**

| Network Complaint Investigations Completed | | 2018/19 | |
|---|---|---|---|
| **Category** | **Nature of Complaint** | **Number** | **Number Valid** |
| Voltage | Sustained over voltage | 178 | 142 |
| | Sustained under voltage | 76 | 39 |
| | Voltage fluctuations | 175 | 80 |
| | Voltage dips | 50 | 23 |
| | Voltage swell | 1 | 0 |
| | Switching transients | 0 | 0 |
| | N-E voltage difference | 127 | 59 |
| | Ground fault voltage | 3 | 2 |
| | Voltage unbalance | 18 | 15 |
| | Mains signalling voltages (Outside defined range) | 0 | 0 |
| | HV injection (HV/LV Intermix) | 0 | 0 |
| | Notching | 0 | 0 |
| | Invalid (268 confirmed invalid) | | |
| **Subtotal (Supply Voltage Complaints)** | | **628** | **360** |
| Current | Direct current | 0 | 0 |
| | Harmonic content | 0 | 0 |
| | Inter Harmonics | 1 | 0 |
| | Invalid (1 confirmed invalid) | | |
| **Subtotal (Supply Current Complaints)** | | **1** | **0** |
| Other Quality | Mains signalling reliability | 0 | 0 |
| | Noise & Interference | 32 | 9 |
| | Level of supply capacity | 33 | 19 |
| | Embedded Generation (Solar) | 593 | 523 |

| Category | Nature of Complaint | Number | Number Valid |
|---|---|---|---|
| Other Quality Continued | Embedded Generation (Wind) | 0 | 0 |
| | Supply frequency | 0 | 0 |
| | Level of EMF | 4 | 1 |
| | Customer Equipment Failure | 74 | 22 |
| | Invalid (162 confirmed invalid) | | |
| **Subtotal (Other Quality of Supply Complaints)** | | **736** | **574** |
| | | | |
| **Subtotal (All Quality of Supply Complaints)** | | **1365** | **934** |
| | | | |
| Reliability | No. of supply failures | 52 | 19 |
| | Duration of supply failures | 2 | 1 |
| | Outages Miscellaneous | 26 | 8 |
| | No. of <1 min. interruptions | 30 | 4 |
| | Invalid (78 confirmed invalid) | | |
| **Subtotal (Reliability of Supply)** | | **110** | **32** |
| | | | |
| **Total Completed** | | **1475** | **966** |
| | | | |
| Other | IN Communities | 0 | 0 |
| | Under Investigation (not validated) | 55 | 0 |
| **Totals** | | **1530** | **966** |

The total number of Network Complaints increased by 25% in the 18/19 FY compared to last financial years total which continues the trend of the last 4 years where the total number of complaints has increased by 60% (959 vs 1530). The total number of Voltage Complaints increased by 22% and Embedded Generation Solar continued to be the leading complaint with a total of 593 complaints and an increase of 34% overall compared to last FY.

Sustained Over Voltage (+14%) and Sustained Undervoltage (+13%) also increased compared to last FY with over voltage accounting for 134% more jobs than undervoltage.

Generally, most categories increased by varying margin's, however Voltage Dips (-21%), Noise and Interference (-27%) and Number of <1-minute interruptions all decreased (-6%).

Overall, the number of valid complaints was 966 of 1530 reported jobs in the 2018/19 FY.

# 7. ASSET MANAGEMENT

## 7.1 Essential Energy's Asset Management Approach

### 7.1.1 Introduction

Essential Energy is undertaking significant development in the asset management area with the aim to align to ISO55001:2014 and licence condition requirement to achieve certification by February 2022. Further, Essential Energy is continually improving its asset management capabilities by keeping abreast of asset management developments domestically and abroad. This includes undertaking external reviews to benchmark our capability against ISO55001 and inform our processes. The present format of Essential Energy's asset management system includes:

- The SAMP, the overarching document that defines the asset management framework and defines the key processes associated with Essential Energy's asset management system. Its purpose is to translate the Business Plan strategic objectives and priority actions to specific, measurable, achievable, realistic and timely asset management objectives which are used for line-of-sight through the entire asset management system
- Network and Asset Class strategies. These strategies perform Asset Lifecycle analysis in order for Essential Energy to understand and better manage our assets in support of achieving the defined asset management objectives. These strategies set direction for us as a business in establishing programs of work to manage the network we are accountable for, creating linkages with business objectives, expected levels of service and asset management plans
- Asset Management Plans detail targeted actions to deliver on network and asset class strategies. These plans identify needs and develop options that feed a strategic network portfolio optimisation process that achieves the asset management objectives through an appropriate balance of performance, cost and risk.

The following sections detail the specifics of Essential Energy's network and asset lifecycle management strategies to provide an overview of the high-level direction used to manage network performance.

### 7.1.2 Distribution Growth Strategy

Essential Energy has developed this strategy to instil a systematic and consistent approach to the management of demand and load growth throughout the asset management functions.

The Distribution Growth Strategy defines the components that constitute distribution network demand and load growth, the impacts of such peak demand and load growth, and how those components should be managed. The strategy informs the investment expenditure for network optimisation, augmentation and the management of growth on Essential Energy's distribution network.

Additionally, the Distribution Growth Strategy includes Demand Management initiatives to improve the utilisation of the distribution network and to present the most efficient investment option between new technologies and traditional type augmentation for network projects. Investments have been included for increasing the proactive monitoring capabilities for load and demand growth and voltage performance of the distribution network that will assist in system optimisation and increasing network utilisation. These investments in demand management and network monitoring will allow for the deferral, reduction or modification of investments required to cater for localised demand growth.

### 7.1.3 Reliability Strategy

The primary purpose of the reliability strategy is to set strategies for achieving targets for duration and frequency of interruptions to network supply, considering business objective to maintain reliability while realising benefits from short term performance incentive scheme and ensuring compliance with NSW Reliability and Performance Licence Conditions for Electricity Distributors.

In terms of jurisdictional licence conditions, there are two applicable components, both overall network reliability standards (Schedule 2) and individual feeder standards (Schedule 3). To meet with these requirements, Essential Energy incorporates the following strategic approaches into its overall reliability strategy:

- Reliability management framework, structured to meet regulations and standards but not surpass
- Individual Feeder Standards management, targets reliability improvement, both capital and operational, of individual distribution feeders where underlying performance has trended outside the Individual Feeder Standards (Schedule 3) set out in the Reliability and Performance Licence Conditions.

In addition to the above strategies, two other key components of the reliability strategy include:

- Worst performing feeder segment management targets the worst performing of Essential Energy's feeder segments. These segments are identified initially when their performance is recorded as being in excess two times the feeder category average for 3 concurrent years, after which causal analysis is used to identify any underlying issues. These issues, often due to the customer densities involved, are not sufficient to impact overall feeder performance and as such the regulatory environment typically does not drive changes in performance. As a result, in developing the worst performing feeder segment strategy through stakeholder engagement, it was identified that the program required the support of consumer groups, which to date has been the case with many agreeing that it is in line with the needs of the customer. Essential Energy always welcomes further feedback from customer groups on issues such as this.
- In keeping with the Reliability management framework, under the AERs STPIS, Essential Energy is aiming to maintain reliability.

### 7.1.4 Power Quality Strategy

The primary purpose of the Power Quality Strategy is to manage the ability of the distribution system to perform and meet customer expectations in terms of voltage flicker, unbalance and harmonic performance, whilst also providing direction across Essential Energy's asset management functions to ensure compliance with the standards and regulations stipulated in Electricity Supply Standard (CEOP8026). The scope of this strategy covers measurement, monitoring, maintenance and improvement of power quality across Essential Energy's network.

The strategic elements of the overall Power Quality strategy are:

**Reactive Measures**

- Investigate received power quality complaints and customer feedback quickly and efficiently
- Verify that power quality problems are indeed network related and are outside the levels prescribed in Electricity Supply Standards
- Rectify any local or wider area problem in a timely, economic and effective manner, including the use of alternate remediation solutions
- Consult with and keep customers advised during all steps of investigation and rectification process.

**Proactive Measures**

- Migrate towards a more proactive power quality management approach through an improved visibility of network power quality performance delivered by leveraging the rollout of network technology and monitoring equipment. This is supported for the power quality emissions allocations process for new customer connections to capture the background Power Quality measurement information which is based on methodologies given in ENA Guides for Power Quality by means of advanced modelling in SINCAL power system analysis software
- Plan and implement a gradual migration in the median distribution voltage to 230 volts, in line with Australian Standard AS 61000.3.100 – 2011 (Amendment No.1 – 2016), which will minimise overvoltage situations and provide 'headroom' for distributed generation
- Systematic modelling and management of HV feeder voltage profiles and performance
- Improved management of new and additional loads and embedded generator connections.

### 7.1.5 Safety and Environment Strategy

The safety and environment strategy applies to Essential Energy's network assets and seeks to ensure the provision of an electricity supply that meets requirements for safety and that minimises harm to the environment, so far as is reasonably practical.
The strategy meets our compliance obligations and our business objective for continuous improvement in safety performance, while also addressing customer expectations, as expressed through customer engagement studies. Key components of the safety strategy include:

- Management of asset health to mitigate the risk of unassisted asset failures
- Targeted decommissioning and removal of high risk or redundant assets
- Targeted renewal of assets with alternative construction types in identified high risk locations e.g. overhead to underground assets
- Targeted measures to improve public awareness of risks associated with the electricity network e.g. installation of hi-vis markers to overhead conductors in areas of aerial crop spraying, public awareness campaigns

Key components of the environmental strategy include:

- Improved oil storage facilities ensuring compliance with the requirements of AS 1940
- Consider ceasing inspection, maintenance or operational activities in high risk environmentally sensitive areas, where alternative options are available
- Targeted procurement or use of less or non-hazardous materials
- Development of a business-wide approach to oil management
- Targeted reduction of emissions causing nuisance to the community in high risk areas
- Implementation of an effective asbestos management program

Other aspects of the network safety and environment strategy include the continuous improvement of data, analytics and information management capabilities as well as people and culture aspects of our approach to safety and environmental risk management.

### 7.1.6 Bushfire Risk Management Strategy

Essential Energy's bushfire and risk management strategy aims to prevent or minimise the impacts of fire ignition from electrical assets, so far as is reasonably practicable. The following strategic elements are those relating more specifically to bushfire prevention even though many others exist which may have an indirect relationship. Bushfire prevention strategies include:

- Identify high bushfire risk zones to ensure planning, design, construction, operations and maintenance activities are undertaken with an increased awareness of bushfire start risk
- Consideration of bushfire risk in network asset planning and design decisions
- Undertake asset inspection[7] and maintenance in a prioritised manner with a focus on high fire risk areas, and ensure fire start risks are identified and appropriately actioned
- Undertake vegetation management in the form of tree cutting and clearing to manage the risk of trees or vegetation coming into contact with live lines or equipment and igniting fires
- Provide advice and information to owners of private lines to inform them of fire risks on their lines and to make recommendations on risk control actions. Where no action is taken to correct defects on private lines within the prescribed notice period in high bushfire risk areas, Essential Energy will undertake works to correct the defect on a "do and charge" basis
- Institute operational limitations[8] on total fire ban days to minimise the risk of lines or equipment inadvertently starting a bushfire

[7] Asset inspection includes the use of LiDAR and pre-bushfire season annual fly over inspection of the network

[8] Operational limitations include managing the number of auto reclose operations on specific circuit breakers on total fire ban days.

- Analyse fire starts proven to be caused by Essential Energy's network and undertake root cause analysis to identify improved control or prevention measures that can be instituted or developed.

### 7.1.7 Asset Lifecycle Management Strategies

Essential Energy's asset lifecycle management strategies seek to ensure that network assets continue to achieve service level obligations while minimising the total lifecycle cost (opex and capex), by ensuring the efficient and optimal expenditure on these assets.
Elements considered in these strategies include inspection, maintenance, refurbishment, replacement, and disposal. Strategies can be categorised as either:

- Time-based: requiring asset treatments based on set time intervals
- Condition-based: requiring asset treatments based on identified asset condition or health
- Risk-based: requiring asset treatments based on the risk of asset failure, including consideration of the likelihood and consequence(s) of failure based on observed risk factors, or
- Predictive: requiring asset treatments based on consideration of the outputs of predictive analytics, particularly relating to the likelihood of asset failure.

Strategies will identify the optimum timing for treatment, including whether this is preventative or corrective, based on an understanding of the risks and costs associated with alternative practicable options.

Strategies are subject to regular review and improvement, based on findings from investigations and benefits realisation studies.

### 7.1.8 Asset Risk Management & Optimisation

Essential Energy has adopted a risk-based approach to achieving performance objectives from network assets at lower cost.

- Asset Risk Management is the overarching risk assessment framework. It provides a consistent approach for calculating risk value from understanding an asset's probability of failure and likelihood of consequence across Essential Energy's network assets. It also provides the approach for undertaking risk evaluation and identifying risk treatments
- Appraisal Value Framework is the framework for monetising different types and levels of consequence resulting from network asset failures. This supports the asset risk management procedure towards a monetised risk and value-based approach to asset management decision making
- Risk Informed Optimisation is the methodology used for optimising a portfolio of investment. Using a risk-informed approach, Essential Energy develops a prudent and efficient portfolio of expenditure which provides improved value within a reasonable financial constraint. Essential Energy will continue to refine the portfolio and optimisation process as improvements are made to data, systems and modelling.

### 7.1.9 Delivering the Network and Asset Lifecycle Management Strategies

The strategies outlined above create specific targets for asset sub-system and asset classes performance. These are applied to the Essential Energy network to identify network needs and options to address these needs. Options analysis is completed through the network planning process to determine and justify prudent and optimised expenditure. Relation planning decisions enable the delivery of the strategies through the successful completion of identified, justified and approved projects and programs of work. The delivery of the projects and ongoing programs is undertaken by Customer & Network Services, Accredited Service Providers and external contractors.

Other relevant documents which support the Asset Management System are listed below.

### 7.1.10 Network Planning Procedure

Essential Energy's network planning procedure ensures the network assets can continue to achieve the service level obligations at the lowest lifecycle cost. The key elements of the overall Network Planning strategy aim to:

- Provide an electricity network that is capable of supplying a customer's load requirements before they connect to the network
- Forecast where new network augmentation or zone substations and associated sub-transmission lines and sub-transmission stations are required
- Maintain an appropriate quality of supply and level of reliability on the existing network in accordance with the reliability and quality of supply strategies
- Facilitate preparation of annual and longer-term budgets that are economically efficient, taking into account both prudent capital investment and ongoing maintenance costs.

### 7.1.11 Network Operating Procedures

The operating procedures applicable to Essential Energy's network assets seeks to enable achievement of service level obligations while minimising the overall lifecycle costs, through active risk management and operational practices that maintain compliance with design parameters.

To achieve this outcome Essential Energy employs operating procedures that consist of the following elements:

- Asset availability is proactively managed
- Operational risk is understood and managed
- Operation is aided by engineered protective measures and 24-hour monitoring where possible
- Assets are operated within design parameters and, where design parameters are unknown, conservative limits are applied in-line with industry guidelines and standards
- Operational resources are strategically deployed
- Guaranteed service levels payments

## 7.2 Treatment of Distribution Losses

Distribution losses refer to the losses incurred in transporting energy across the distribution network. Of the total 2018/19 energy input into Essential Energy's widely spread network, 5.48 per cent was consumed in the form of network losses.

Essential Energy's investment decisions are guided primarily by the need to achieve the service level obligations at the lowest lifecycle cost. The value of network losses are used in comparing alternative network or non-network augmentation options, which either act to reduce the average current through the network or lower the resistance. Accordingly, Essential Energy's approach ensures that the value of network losses influences decision making with respect to:

- Any network planning and subsequent augmentation specifically the selection of voltage, conductor and transformers
- Network performance, operation and switching
- Asset maintenance and replacement decisions
- Procurement of equipment.

Network losses are considered in the project development stage, as well as in the detailed planning and approval stages.

## 7.3 Asset Issues Impacting Identified System Limitations

Network limitations are identified in the preparation of long-term strategic network development plans. These limitations are then subject to detailed planning studies which consider any related issues arising from individual asset management strategies which are likely to have a material impact on the studied network.

The detailed planning studies include an assessment of non-network alternatives, fault levels, voltage levels, quality of supply considerations, asset replacement, asset refurbishments and new connection applications.

Present value analysis is used to align the constraint solutions with other network requirements and optimise the investment profile to achieve service level obligations at the lowest lifecycle cost.

## 7.4 Obtaining Further Information on the Asset Management Strategy and Methodology

Further information on Essential Energy's asset management approach is available by contacting:

Essential Energy
Joshua Thomas
PO Box 5730
Port Macquarie NSW 2444
Email: josh.thomas@essentialenergy.com.au

# 8. DEMAND MANAGEMENT

## 8.1 Demand Management Activities in the Preceding Year

Essential Energy's internal demand management procedures for 2018/19 complied with the obligations set out in the National Electricity Rules. For 2018/19 this process included:

- Maintenance of a Register of Interested Parties
- The Distribution Annual Planning Report
- Review of emerging constraints in line with RIT-D process
- Screening of all projects below the RIT-D threshold
- Publication of Consultation Papers where appropriate via AEMO and Essential Energy external web pages
- Notification to Interested Parties of Demand Management opportunities
- Use of non-network service providers to investigate and advise on demand management options
- Consultation with prospective Demand Management Service Providers
- Collaborative agreements with leading academic institutions
- Participation in related industry working groups
- Pooling of demand management knowledge with other distribution network service providers
- Constraint and Growth mapping in conjunction with ISF which aims to promote non-network proposals from a variety of proponents.

There have been no consultations for major network augmentations during 2018/19. However, as part of the ongoing screening process of all projects below the RIT-D threshold for Demand Management and Non Network potential, triggered by a damaged section of line, Essential Energy has negotiated a non-network solution with a customer and decommissioned and recovered network assets linked to a rural pumping site located in a high cost to serve area of the network. This has resulted in a lower cost solution in terms of avoiding rebuilding the network and ongoing vegetation cost while also lowering bush fire risk.

In addition, Essential Energy is currently exploring the feasibility of a reliability based microgrid solution to back up the Urbenville zone substation as a potential lower cost solution compared to reconductoring part of the aging sub-transmission network that is causing a reduction to network reliability.

New and Ongoing Innovative Demand Management developments during 2018/19 included:

- Third Party Data to Improve Network Visibility**.** The Demand Management department is exploring access arrangements and cost compared to network side solutions with a range of emerging third-party data providers to build visibility across the network with a focus on the low voltage (LV) level to assist with planning and operating the network. Recent work includes: Data Agreement established with a 3rd Party to access locations across Essential Network where LV voltage data can be procured, and visualisation created for Planning linking 3rd party locations to network assets.
- Development of Demand Management screen test templates and supporting tools for network planners to facilitate least cost assessment of options as network constraints arise, with the aim of embedding new and improved existing demand management options into Essential Energy's planning process.
- Continuation of a joint industry research project (Networks Renewed) with the Australian Renewable Energy Agency (ARENA), University of Technology Sydney, Reposit Power, AusNet Services and Fronius, to test battery storage systems and advanced solar inverters with eligible customers within a virtual power plant arrangement to better manage the demand for network capacity and integration of renewables. The project will help optimise connection standards and tariffs to guide future uptake of battery storage to achieve optimal integration while ensure such technology does not negatively impact the network resulting in costly network expenditure. In addition, the project will explore the possible value battery storage technology can provide through deferring or avoiding network expenditure and the appropriate signals required to yield such potential.

- Constraint and Growth mapping in conjunction with the Institute for Sustainable Futures which aims to promote non-network proposals from a variety of proponents.
- Due to the varying customer density of Essential Energy's network across diverse terrain, there are areas of Essential Energy's network that result in a high cost to serve very few customers, causing cross-subsidisation of network tariffs. These parts of the network (typically fringes of the current network) present potential viable areas to transfer customers to an off-grid solution and decommission network assets. Essential Energy is currently exploring the practicality of implementing such least cost solutions within these areas triggered by network investment for the long-term interest of all customers.
- Continuation of Load Control System Optimisation studies for problematic areas of the network, which aims to further improve the cost effectiveness of the load control system and identify least cost alternative load control technology compared to traditional load control equipment.

There were two zone substation capacitor bank installations refurbished in 2018/19, resulting in continued demand reduction across the sub-transmission and transmission networks. Essential Energy has also continued to invest in upgraded load control functionality to enhance the dynamic management of the network to support the uptake of renewables while enabling lower cost solution to address network constraints as they arise.

## 8.2 Plans for demand management and embedded generation

Essential Energy has several strategic objectives which aim to ensure positive outcomes for its customers now and in the future through proactive and efficient promotion, development and implementation of demand management and non-network alternatives. These objectives include:

- Enhancement of the business case to further enable demand management and non-network alternatives as a primary element of the planning process and as a broad-based strategy
- Efficient development and refinement of demand management and non-network alternatives based technical skills, experience and solutions.

Throughout 2019/20 new innovative Demand Management developments include:

- Commencement of joint industry research project (Evolve) with the Australian Renewable Energy Agency (ARENA), Australian National University, Energy Queensland, Ergon Energy, Energex, Endeavour Energy, Ausgrid, Reposit Power, Evergen, Redback Technologies, SwitchDIn, and the NSW Government. The Evolve DER project aims to increase the network hosting capacity of distributed energy resources (DER) by maximising their participation in energy, ancillary and network service markets, while ensuring the secure technical limits of the electricity networks are not breached.
- Commencement of Dynamic Limits DER Feasibility Study (ARENA Funded) The Dynamic Limits DER Feasibility Study will explore implementing dynamic distributed energy resources (DER) export limits to better manage voltage and thermal constraints on the electricity network, focusing on local dynamic schemes.
- Commencement of a collaborative industry project to test a Dynamic Connection Agreement for Electric Vehicle Chargers for the purpose of increasing the utilisation of the network and establishing flexible connection standards to drive lower cost methods to connect to the network.
- Commencement of Network Visibility initiatives seeking to identify the balance between network and third-party measurement and state estimation techniques to build visibility across the network with a focus on the Low Voltage Level of the network.

## 8.3 Issues arising from applications to connect embedded generation

Essential Energy's distribution network continues to experience isolated issues relating to voltage rise from embedded generation units, resulting in over voltage tripping of the inverters, and in some cases supplying customers with voltages above Australian Standard limits. Since the inclusion of a one per cent voltage rise limit in the Service and Installation Rules of New South Wales, issues related to individual customers, i.e. issues due solely to voltage rise in customer service mains have reduced, with most issues identified related to legacy systems.

Issues may arise in newer systems where the service conductor is incorrectly sized, incorrectly identified, or the maximum system output is calculated based on an underestimated service length. There are also issues that revolve around voltage rise along the low voltage distribution network due to a high penetration of embedded generation within localised areas. This issue typically arises in overhead network areas consisting of original overhead network low voltage conductor.

Export limited inverters have allowed for the reduction in voltage rise issues at the customer's switchboard and provides greater equity in systems where multiple customers share a single transformer. The export limit allows customers to install the most economically sized systems while capping the amount that can be fed back into the network. The embedded generation installer often nominates an export limit during the initial application, and Essential Energy has suggested appropriate export limits depending on network limitations and the size of the installation.

As part of Essential Energy's commitment to improving network connection standards for the purpose of enhancing the solar PV hosting capacity of the network to drive higher utilisation of customer distributed energy resources (DER) and the network, from September 2018 Essential Energy mandated Volt-Var and Volt-Watt power quality response modes in alignment with AS4777.2 for all new Solar PV and battery storage installations. The new requirement will help manage network voltage in high DER uptake areas of the network while also minimise inverter tripping from excessive voltage rise onto to the network.

Going forward, Essential Energy will continue to identify more efficient options to address the issue of large increases in low voltage network voltage 'swing' brought about by localised pockets of embedded generation, for the long-term interests of customers. Based on learning outcomes from recent trials, such new methods to facilitate the effective and efficient uptake of embedded generation include but not limited to; a shift from static to dynamic connection standards and cost reflective pricing to drive efficient use of the network.

Linked to the history of electricity distribution development within New South Wales, Essential Energy's network was planned, designed, and operated for peak load, due to such, reverse power flow for some areas of the high voltage network is resulting in abnormal asset operation, amplifying existing voltage rise issues and incorrect measurements from network monitoring equipment. Such emerging issues are driving changes to Essential Energy's Asset Management policies and procedures to ensure asset configuration and capability is compatible with reverse power flow conditions, in addition, voltage regulation practices across all levels of the network.

The integration of increasing numbers of embedded generators has required some minor changes to operational procedures. The use of Fameca FC3000 LV network identification equipment produces inconsistent results during times of reverse power flow, requiring local embedded generation to be temporarily disabled or use of the equipment outside of peak generation hours. When mobile diesel generation is used on LV street circuits during planned outages, solar installations resynchronise and supply real power only, requiring the mobile generation to supply much of the reactive power for the LV loads along with the small amount of remaining real power. This poor power factor or even reverse power can lead to tripping of the mobile generation. To prevent this, local embedded generation must be manually disabled during planned outages where temporary generators are used. The alternative of operating the generation outside the embedded generation anti islanding frequency range has not been adopted within Essential Energy.

A potential emerging challenge likely to be experienced is the requirement for capital investment and operating expenditure to resolve issues caused solely by the connection of embedded generation. This is a long-term network issue, experienced as embedded generation penetration rates continue to increase under the current tariff structures. The installed solar capacity has seen constant growth as shown in Figure 5.

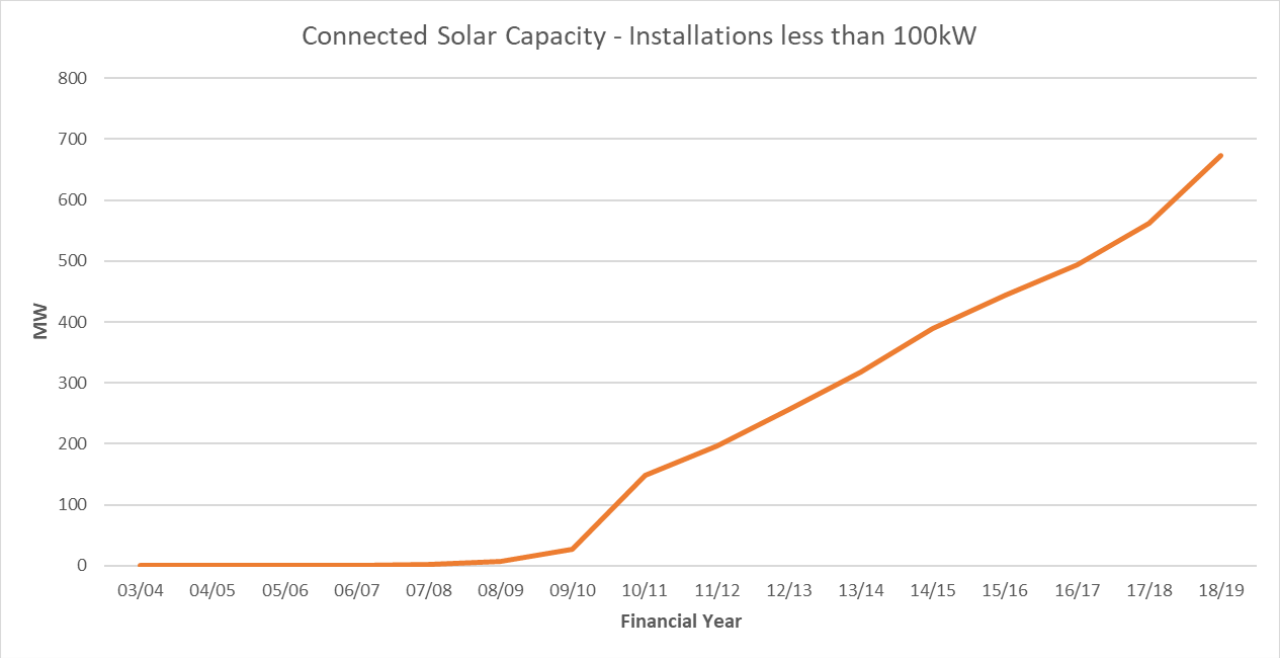



**Figure 5 – Installed Solar Capacity, Excluding Large Scale Generation**

In simple terms, as network expenditure to resolve issues caused by the connection of embedded generation occurs, connected embedded generation reduces the revenue being recovered over the life of that investment to a value below that of the investment required. This creates inequity, leaving the revenue burden on unrelated customers that are likely not to have embedded generation. This is an emerging issue that will be monitored to inform future network strategies.

## 8.4 Embedded Generation Connection Details

We are unable to differentiate between embedded generation enquiries and general connection enquiries as only simple statistics are recorded. The telephone statistics are based on the number of calls through 13 21 91 and selected option 2 for Network Connections, including solar (previously option 4), and the online portal counts total number of enquiries. The number of embedded generation applications processed has increased significantly from previous years. The introduction of Power of Choice meter contestability and upgrades related to the increased volume of battery installations contributed to an average of approximately 2000 applications per month.

**Table 9 – Connection Enquiries and Applications**

| Connection Enquiries and Applications | Number 2018/19 |
|---|---|
| Phone connection enquiries received | 17,323 |
| Online portal connection enquiries received | 357 |
| Load connection applications processed | 11,772 |
| Generation connection applications processed | 29,002 |
| Total connection applications received | 47,958 |
| Days to process generation applications | 1.8 |

# 9. INFORMATION TECHNOLOGY and COMMUNICATION SYSTEMS

## 9.1 Information Technology

This section of the document defines digital technologies Essential Energy has or is executing to effectively enable the business to deliver on its Customer, Regulatory and Stakeholder requirements. Table 10 outlines the functional area of implementation and a brief description of the investments for the 2018/19 period and Table 11 provides the areas of investment focus for the 2019/20 to 2020/21 period.

**Table 10 – Information Technology Investments 2018/19**

| Functional Area | Technology Initiative |
|---|---|
| Network Systems | Major initiatives undertaken in this area included:<br>• Commencement of an upgrade to PowerOn, including hardware replacement (continuing to FY20/21)<br>• Replacement of DAIS, the asset inspection system, with ASPECT (continuing to complete in FY20). |
| Customer Systems | Major initiatives in this area included:<br>• Implementation of a new system to improve customer complaints management processes<br>• Enhancements to ensure compliance with AEMC life support regulations. |
| Enterprise Systems | Major initiatives in this area included:<br>• Optimising and automating the preparation of Regulatory Information Notice (RIN) submissions (Phase 1)<br>• Implementation of a new budgeting and forecasting system to enhance and streamline this annual process (completing in FY20)<br>• Implementation of a travel and expense management system to enhance and streamline these administrative processes<br>• Commencement of planning for the Enterprise Resource Planning (ERP) upgrade/replacement program. |
| Technology Infrastructure | Major initiatives in this area included:<br>• Continued transfer of physical IT infrastructure to the cloud to improve flexibility and responsiveness (Continuing in FY20/21)<br>• Ongoing rationalisation of applications and infrastructure to ensure efficient use of technology and reduce associated costs including integration (continuing in FY20/21)<br>• Continued enhancement of application integration capability<br>• Commencement of initial Cybersecurity tools and capability uplift (continuing to FY20)<br>• Completion of the client device fleet refresh program to replace obsolete hardware. |
| Telecommunications Systems | • Continued the upgrade and diversification of core network and WiFi capabilities to improve resilience and increase bandwidth and coverage (continuing to FY20). |

**Table 11 – Information Technology Investments 2019/20 to 2020/21**

| Functional Area | Project Description |
|---|---|
| Network Systems | Major initiatives in this area included:<br>• Planning for the replacement of the existing Network Asset Management system to improve integration to core systems and support best practice processes (EAM)<br>• Implementation of supply chain technology to deliver integration with core systems and support field related activities (ERP)<br>• Complete the PowerOn Advantage implementation to create a more flexible working environment for field staff and manage demand on Network Operations<br>• Completion of the Asset Inspection System replacement (From DAIS to ASPECT)<br>• Empowering our frontline through optimising works scheduling and dispatch tasks. |
| Customer Systems | Major initiatives in this area included:<br>• Completion of remediation of hazard data in existing systems, enable capture of new data and ensure it is provided in a timely manner to both Essential Energy staff and external parties to improve safety<br>• Customer contact centre digitisation, automation and optimisation to enhance customer and employee experience, including the development of an online customer portal. |
| Enterprise Systems | Major initiatives in this area included:<br>• Implementation of the Enterprise Resource Planning (ERP) replacement program<br>• Completion of the implementation of the new budgeting and forecasting system. |
| Data Management | Major initiatives in this area included:<br>• A major renewal of the data platform to support and better inform business decision making<br>• Completion of phase 1 of the Regulatory Information Notice (RIN) optimisation program. |
| Technology Infrastructure | Major initiatives in this area included:<br>• A technology modernisation program, including data centre rationalisation, application rationalisation and enterprise application integration<br>• Client device renewal in line with new end user device strategy<br>• Completion of the Cybersecurity tools and capability uplift program (Phase 1) to meet regulatory requirements<br>• Implementation of technology solutions to enable mobility and collaboration in the refurbished head office premises. |
| Telecommunications Systems | Major initiatives in this area included:<br>• Completion of the upgrade and diversification of core network and WiFi capabilities to improve resilience and increase bandwidth and coverage. |

Table 12 below provides a summary of actual Information and Communication Technology (ICT) investment in the 2018/19 period and forecast investment for the 2019/20 to 2023/24 period.

**Table 12 – ICT Investment actual 2018/19 and forecast 2019/20 to 2023/24 (nominal $)**

| | Actual ($M) | Forecast ($M) | | | | |
|---|---|---|---|---|---|---|
| | FY19 | FY20 | FY21 | FY22 | FY23 | FY24 |
| Total ICT Capital Investment | 23.3 | 48.7 | 35.6 | 41.7 | 26.8 | 27.4 |

# 10. REGIONAL DEVELOPMENT PLANS

The tables in the preceding sections (1-10) are structured along Essential Energy's planning hierarchy of:

- Operational Region
  - Connection Point
    - Sub-transmission Line
      - Sub-transmission Substation
        - Zone Substation
          - Distribution Feeder.

Semi-geographic single line diagrams of the electrical network for each supply area have been included in the relevant sections of the zone substation and sub-transmission feeder demand forecasts and where system limitations have been identified these are noted on those diagrams.

The map in Figure 6 show the new configuration of one region and ten operational areas. The map also includes the depots and offices associated with each area.

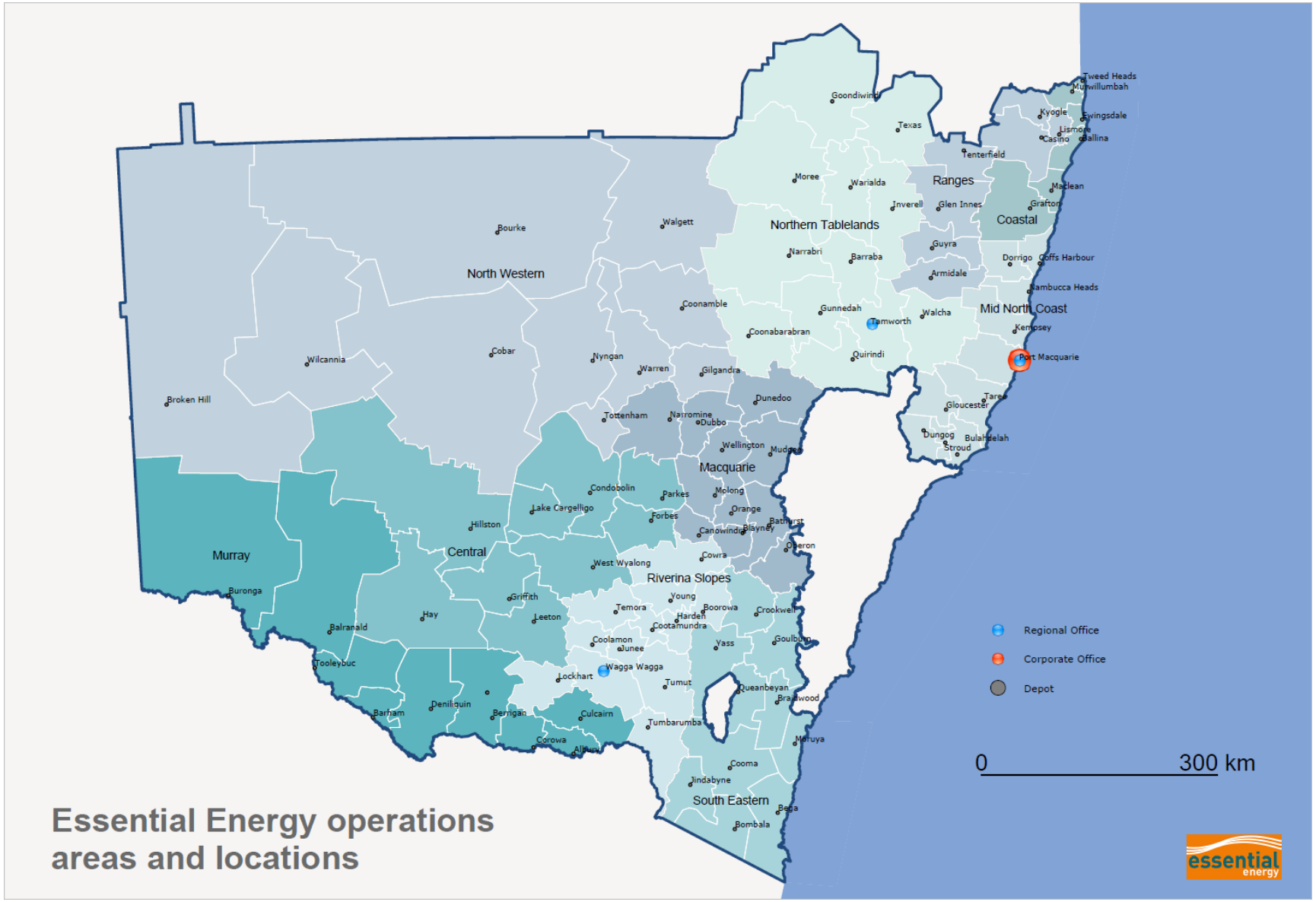



**Figure 6 – Diagram of Essential Energy's Operational Areas**

# 11. GLOSSARY

| | |
|---|---|
| AEMC | Australian Energy Market Commission |
| AEMO | Australian Energy Market Operator |
| AER | Australian Energy Regulator |
| AMP | Asset Management Plan |
| AREMI | Australian Renewable Energy Mapping Infrastructure |
| CAPEX | Capital Expenditure |
| CVR | Conservation Voltage Reduction |
| DAPR | Distribution Annual Planning Report |
| DNSP | Distribution Network Service Provider |
| FY | Financial Year |
| GWh | Gigawatt-Hour |
| HV | High Voltage (>1000V AC) |
| ICT | Information and Communication Technology |
| IN | Intelligent Network |
| IPART | Independent Pricing and Regulatory Tribunal |
| ISF | Institute of Sustainable Futures |
| kV | Kilovolt |
| LV | Low Voltage (typically 230V/400V) |
| MEPS | Minimum Energy Performance Standards |
| MVA | Megavolt-Ampere |
| MVAr | Megavolt-Ampere-Reactive |
| MW | Megawatt |
| NECF | National Electricity Customer Framework |
| NEL | National Electricity Law |
| NEM | National Electricity Market |
| NER | National Electricity Rules |
| OPEX | Operational Expenditure |
| PV | Photovoltaic (Solar Panels) |
| RIT-D | Regulatory Investment Test for Distribution |
| SAMP | Strategic Asset Management Plan |
| STS | Sub-transmission Substation |
| SAIDI | System Average Interruption Duration Index |
| SAIFI | System Average Interruption Frequency Index |
| SCADA | Supervisory Control and Data Acquisition |
| STPIS | Service Target Performance Incentive Scheme |
| SWER | Single Wire Earth Return |
| TNSP | Transmission Network Service Provider |
| TX | Transformer |
| WHS | Workplace Health and Safety |
| ZS | Zone Substation |

# 12. NER CROSS REFERENCE

| National Electricity Rules Version 124<br>Schedule 5.8 Distribution Annual Planning Report<br>For the purposes of clause 5.13.2(c), the following information must be included in a Distribution Annual Planning Report: | DAPR 2019 Section |
|---|---|
| **(a) information regarding the Distribution Network Service Provider and its network, including:** | |
| (1) a description of its network; | 1.1 About Essential Energy |
| (2) a description of its operating environment; | 1.1.1 Operating Environment<br>1.1.2 Essential Energy Statistics |
| (3) the number and types of its distribution assets; | 1.2 Essential Energy's Network<br>1.2.1 Number and Types of Distribution Assets |
| (4) methodologies used in preparing the Distribution Annual Planning Report, including methodologies used to identify system limitations and any assumptions applied; and | 1.3 Annual Planning Review<br>1.3.1 Network Planning Process |
| (5) analysis and explanation of any aspects of forecasts and information provided in the Distribution Annual Planning Report that have changed significantly from previous forecasts and information provided in the preceding year; | 1.4 Significant Changes from previous DAPR<br>1.4.1 Analysis and explanation of forecast changes<br>1.4.2 Analysis and explanation of changes in other information |
| **(b) forecasts for the forward planning period, including at least:** | |
| (1) a description of the forecasting methodology used, sources of input information, and the assumptions applied; | 2.1 Load Forecasting Strategy<br>2.2 Load Forecasting Methodology and Process<br>2.2.1 Sources of load forecast input information<br>2.2.2 Assumptions applied to load forecasts |
| (2) load forecasts:<br>(i) at the transmission-distribution connection points;<br>(ii) for sub-transmission lines; and<br>(iii) for zone substations,<br>including, where applicable, for each item specified above:<br>(iv) total capacity;<br>(v) firm delivery capacity for summer periods and winter periods;<br>(vi) peak load (summer or winter and an estimate of the number of hours per year that 95% of peak load is expected to be reached);<br>(vii) power factor at time of peak load;<br>(viii) load transfer capacities; and<br>(ix) generation capacity of known embedded generating units; | 2.3 Supply Area Forecasts<br>2.5 Transmission – Distribution Connection Point Load Forecast |

| National Electricity Rules Version 124<br>Schedule 5.8 Distribution Annual Planning Report<br>For the purposes of clause 5.13.2(c), the following information must be included in a Distribution Annual Planning Report: | DAPR 2019 Section |
|---|---|
| (3) forecasts of future transmission-distribution connection points (and any associated connection assets), sub-transmission lines and zone substations, including for each future transmission-distribution connection point and zone substation:<br>(i) location;<br>(ii) future loading level; and<br>(iii) proposed commissioning time (estimate of month and year); | 2.4 Future Connection Points |
| (4) forecasts of the Distribution Network Service Provider's performance against any reliability targets in a service target performance incentive scheme; and | 2.6 Forecast of Reliability Target Performance |
| (5) a description of any factors that may have a material impact on its network, including factors affecting;<br>(i) fault levels;<br>(ii) voltage levels;<br>(iii) other power system security requirements;<br>(iv) the quality of supply to other Network Users (where relevant); and<br>(v) ageing and potentially unreliable assets; | 2.3 Supply Area Forecasts |
| **(b1) for all network asset retirements, and for all network asset de-ratings that would result in a system limitation, that are planned over the forward planning period, the following information in sufficient detail relative to the size or significance of the asset:** | |
| (1) a description of the network asset, including location; | 3.4 Network Asset Retirements and De-ratings – Sub-transmission<br>3.5 Network Asset Retirements and De-ratings – Zone Substation |
| (2) the reasons, including methodologies and assumptions used by the Distribution Network Service Provider, for deciding that it is necessary or prudent for the network asset to be retired or de-rated, taking into account factors such as the condition of the network asset; | |
| (3) the date from which the Distribution Network Service Provider proposes that the network asset will be retired or de-rated; and | |
| (4) if the date to retire or de-rate the network asset has changed since the previous Distribution Annual Planning Report, an explanation of why this has occurred; | |
| **(b2) for the purposes of subparagraph (b1), where two or more network assets are:** | |
| (1) of the same type; | 3.5.3 Combined Asset Retirements and De-Ratings |
| (2) to be retired or de-rated across more than one location; | |
| (3) to be retired or de-rated in the same calendar year; and | |
| (4) each expected to have a replacement cost less than $200,000 (as varied by a cost threshold determination), those assets can be reported together by setting out in the Distribution Annual Planning Report: | |
| (5) a description of the network assets, including a summarised description of their locations; | |
| (6) the reasons, including methodologies and assumptions used by the Distribution Network Service Provider, for deciding that it is necessary or prudent for the network assets to be retired or de-rated, taking into account factors such as the condition of the network assets; | |
| (7) the date from which the Distribution Network Service Provider proposes that the network assets will be retired or de-rated; and | |
| (8) if the calendar year to retire or de-rate the network assets has changed since the previous Distribution Annual Planning Report, an explanation of why this has occurred; | |

| National Electricity Rules Version 124<br>Schedule 5.8 Distribution Annual Planning Report<br>For the purposes of clause 5.13.2(c), the following information must be included in a Distribution Annual Planning Report: | DAPR 2019 Section |
|---|---|
| **(c) information on system limitations for sub-transmission lines and zone substations, including at least:** | |
| (1) estimates of the location and timing (month(s) and year) of the system limitation; | 3.1 Sub-transmission Feeder Limitations<br>3.2 Sub-transmission and Zone Substation Limitations |
| (2) analysis of any potential for load transfer capacity between supply points that may decrease the impact of the system limitation or defer the requirement for investment; | |
| (3) impact of the system limitation, if any, on the capacity at transmission-distribution connection points; | |
| (4) a brief discussion of the types of potential solutions that may address the system limitation in the forward planning period, if a solution is required; and | |
| (5) where an estimated reduction in forecast load would defer a forecast system limitation for a period of at least 12 months, include:<br>(i) an estimate of the month and year in which a system limitation is forecast to occur as required under subparagraph (1);<br>(ii) the relevant connection points at which the estimated reduction in forecast load may occur; and<br>(iii) the estimated reduction in forecast load in MW or improvements in power factor needed to defer the forecast system limitation; | |
| **(d) for any primary distribution feeders for which a Distribution Network Service Provider has prepared forecasts of maximum demands under clause 5.13.1(d)(1)(iii) and which are currently experiencing an overload, or are forecast to experience an overload in the next two years the Distribution Network Service Provider must set out:** | |
| (1) the location of the primary distribution feeder; | 3.3 Primary Distribution Feeder Limitations |
| (2) the extent to which load exceeds, or is forecast to exceed, 100% (or lower utilisation factor, as appropriate) of the normal cyclic rating under normal conditions (in summer periods or winter periods); | |
| (3) the types of potential solutions that may address the overload or forecast overload; and | |
| (4) where an estimated reduction in forecast load would defer a forecast overload for a period of 12 months, include:<br>(i) estimate of the month and year in which the overload is forecast to occur;<br>(ii) a summary of the location of relevant connection points at which the estimated reduction in forecast load would defer the overload;<br>(iii) the estimated reduction in forecast load in MW needed to defer the forecast system limitation; | |

| National Electricity Rules Version 124<br>Schedule 5.8 Distribution Annual Planning Report<br>For the purposes of clause 5.13.2(c), the following information must be included in a Distribution Annual Planning Report: | DAPR 2019 Section |
|---|---|
| **(e) a high-level summary of each RIT-D project for which the regulatory investment test for distribution has been completed in the preceding year or is in progress, including:** | |
| (1) if the regulatory investment test for distribution is in progress, the current stage in the process; | 4.1 Regulatory Test / RIT-Ds Completed or in Progress |
| (2) a brief description of the identified need; | |
| (3) a list of the credible options assessed or being assessed (to the extent reasonably practicable); | |
| (4) if the regulatory investment test for distribution has been completed a brief description of the conclusion, including:<br>(i) the net economic benefit of each credible option;<br>(ii) the estimated capital cost of the preferred option; and<br>(iii) the estimated construction timetable and commissioning date (where relevant) of the preferred option; and | |
| (5) any impacts on Network Users, including any potential material impacts on connection charges and distribution use of system charges that have been estimated; | |
| **(f) for each identified system limitation which a Distribution Network Service Provider has determined will require a regulatory investment test for distribution, provide an estimate of the month and year when the test is expected to commence;** | 4.2 Potential RIT-Ds for Identified System Limitations |
| **(g) a summary of all committed investments to be carried out within the forward planning period with an estimated capital cost of $2 million or more (as varied by a cost threshold determination) that are to address:** | |
| (1) a refurbishment or replacement need; or | 4.3 Urgent and Unforeseen Investments |
| (2) an urgent and unforeseen network issue as described in clause 5.17.3(a)(1), including: | |
| (1) a brief description of the investment, including its purpose, its location, the estimated capital cost of the investment and an estimate of the date (month and year) the investment is expected to become operational; | |
| (2) a brief description of the alternative options considered by the Distribution Network Service Provider in deciding on the preferred investment, including an explanation of the ranking of these options to the committed project. Alternative options could include, but are not limited to, generation options, demand side options, and options involving other distribution or transmission networks; | |

| National Electricity Rules Version 124<br>Schedule 5.8 Distribution Annual Planning Report<br>For the purposes of clause 5.13.2(c), the following information must be included in a Distribution Annual Planning Report: | DAPR 2019 Section |
|---|---|
| **(h) the results of any joint planning undertaken with a Transmission Network Service Provider in the preceding year, including:** | |
| (1) a summary of the process and methodology used by the Distribution Network Service Provider and relevant Transmission Network Service Providers to undertake joint planning; | 5.1 Results of Joint Planning with the TNSP TransGrid<br>5.2 Results of Joint Planning with the TNSP Powerlink |
| (2) a brief description of any investments that have been planned through this process, including the estimated capital costs of the investment and an estimate of the timing (month and year) of the investment; and | |
| (3) where additional information on the investments may be obtained; | |
| **(i) the results of any joint planning undertaken with other Distribution Network Service Providers in the preceding year, including:** | |
| (1) a summary of the process and methodology used by the Distribution Network Service Providers to undertake joint planning; | 5.3 Results of Joint Planning with the DNSP Energex<br>5.4 Results of Joint Planning with the DNSP Ergon<br>5.5 Results of Joint Planning with the DNSP Ausgrid<br>5.6 Results of Joint Planning with the DNSP Endeavour Energy<br>5.7 Results of Joint Planning with the DNSP Evoenergy<br>5.8 Results of Joint Planning with the DNSP Powercor Australia |
| (2) a brief description of any investments that have been planned through this process, including the estimated capital cost of the investment and an estimate of the timing (month and year) of the investment; and | |
| (3) where additional information on the investments may be obtained; | |
| **(j) information on the performance of the Distribution Network Service Provider's network, including:** | |
| (1) a summary description of reliability measures and standards in applicable regulatory instruments; | 6.1 Reliability Performance<br>6.2 Quality of Supply Performance |
| (2) a summary description of the quality of supply standards that apply, including the relevant codes, standards and guidelines; | |
| (3) a summary description of the performance of the distribution network against the measures and standards described under subparagraphs (1) and (2) for the preceding year; | |
| (4) where the measures and standards described under subparagraphs (1) and (2) were not met in the preceding year, information on the corrective action taken or planned; | |
| (5) a summary description of the Distribution Network Service Provider's processes to ensure compliance with the measures and standards described under subparagraphs (1) and (2); and | |
| (6) an outline of the information contained in the Distribution Network Service Provider's most recent submission to the AER under the service target performance incentive scheme; | |

| National Electricity Rules Version 124<br>Schedule 5.8 Distribution Annual Planning Report<br>For the purposes of clause 5.13.2(c), the following information must be included in a Distribution Annual Planning Report: | DAPR 2019 Section |
|---|---|
| **(k) information on the Distribution Network Service Provider's asset management approach, including:** | |
| (1) a summary of any asset management strategy employed by the Distribution Network Service Provider; | 7.1 Essential Energy's Asset Management Approach |
| (1A) an explanation of how the Distribution Network Service Provider takes into account the cost of distribution losses when developing and implementing its asset management and investment strategy; | 7.2 Treatment of Distribution Losses |
| (2) a summary of any issues that may impact on the system limitations identified in the Distribution Annual Planning Report that has been identified through carrying out asset management; and | 7.3 Asset Issues Impacting Identified System Limitations |
| (3) information about where further information on the asset management strategy and methodology adopted by the Distribution Network Service Provider may be obtained; | 7.4 Obtaining Further Information on the Asset Management Strategy and Methodology |
| **(l) information on the Distribution Network Service Provider's demand management activities, including:** | |
| (1) a qualitative summary of:<br>(i) non-network options that have been considered in the past year, including generation from embedded generating units;<br>(ii) key issues arising from applications to connect embedded generating units received in the past year;<br>(iii) actions taken to promote non-network proposals in the preceding year, including generation from embedded generating units; and<br>(iv) the Distribution Network Service Provider's plans for demand management and generation from embedded generating units over the forward planning period; | 8.1 Demand Management Activities in the Preceding Year<br>8.2 Plans for demand management and embedded generation<br>8.3 Issues arising from applications to connect embedded generation |
| (2) a quantitative summary of:<br>(i) connection enquiries received under clause 5.3A.5;<br>(ii) applications to connect received under clause 5.3A.9; and<br>(iii) the average time taken to complete applications to connect; | 8.4 Embedded Generation Connection Details |
| **(m) information on the Distribution Network Service Provider's investments in information technology and communication systems which occurred in the preceding year, and planned investments in information technology and communication systems related to management of network assets in the forward planning period; and** | 9.1 Information Technology |
| **(n) a regional development plan consisting of a map of the Distribution Network Service Provider's network as a whole, or maps by regions, in accordance with the Distribution Network Service Provider's planning methodology or as required under any regulatory obligation or requirement, identifying:** | |
| (1) sub-transmission lines, zone substations and transmission-distribution connection points; and | 2.3 Supply Area Forecasts<br>10 Regional Development Plans |
| (2) any system limitations that have been forecast to occur in the forward planning period, including, where they have been identified, overloaded primary distribution feeders. | |

# 13. ZONE SUBSTATION INDEX