



EMERGING TRANSMISSION NETWORK LIMITATIONS ON THE NEW SOUTH WALES MID NORTH COAST

July 2002

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EMERGING TRANSMISSION NETWORK LIMITATIONS ON THE NEW SOUTH WALES MID NORTH COAST

1. Introduction

1.1. Purpose and Scope

This document has been prepared to:

- provide information on:
 - the nature of the demand for electricity (the electrical load) on the Mid North Coast of New South Wales;
 - the capability of the transmission network supplying that load; and
 - the basis on which TransGrid and Country Energy have identified network constraints (inadequate network capacity) which are expected to arise in the future;
- seek comments on the approach and criteria adopted by TransGrid and Country Energy; and
- seek information on solutions to the network constraints that may be provided by persons other than TransGrid and Country Energy. [TransGrid and Country Energy have previously published a request for proposals for demand management and local generation on the mid north coast. That request is available on both organisations' websites].

TransGrid and Country Energy are currently developing possible options to relieve the constraints identified. This document does not describe those options, however readers are encouraged to suggest possible options. A future consultation paper will describe the feasible options which arise from comments on this document as well as those being developed by TransGrid and Country Energy.

1.2. Background

1.2.1. Introduction

The part of the NSW Mid North Coast considered in this document is the area from Coffs Harbour to Port Macquarie. It has a population of around 200,000.

The area electrical load is characterised primarily by urban residential loads and commercial/light industrial loads in the main population centres and semi-rural loads in surrounding areas.

1.2.2. Local Supply Arrangements

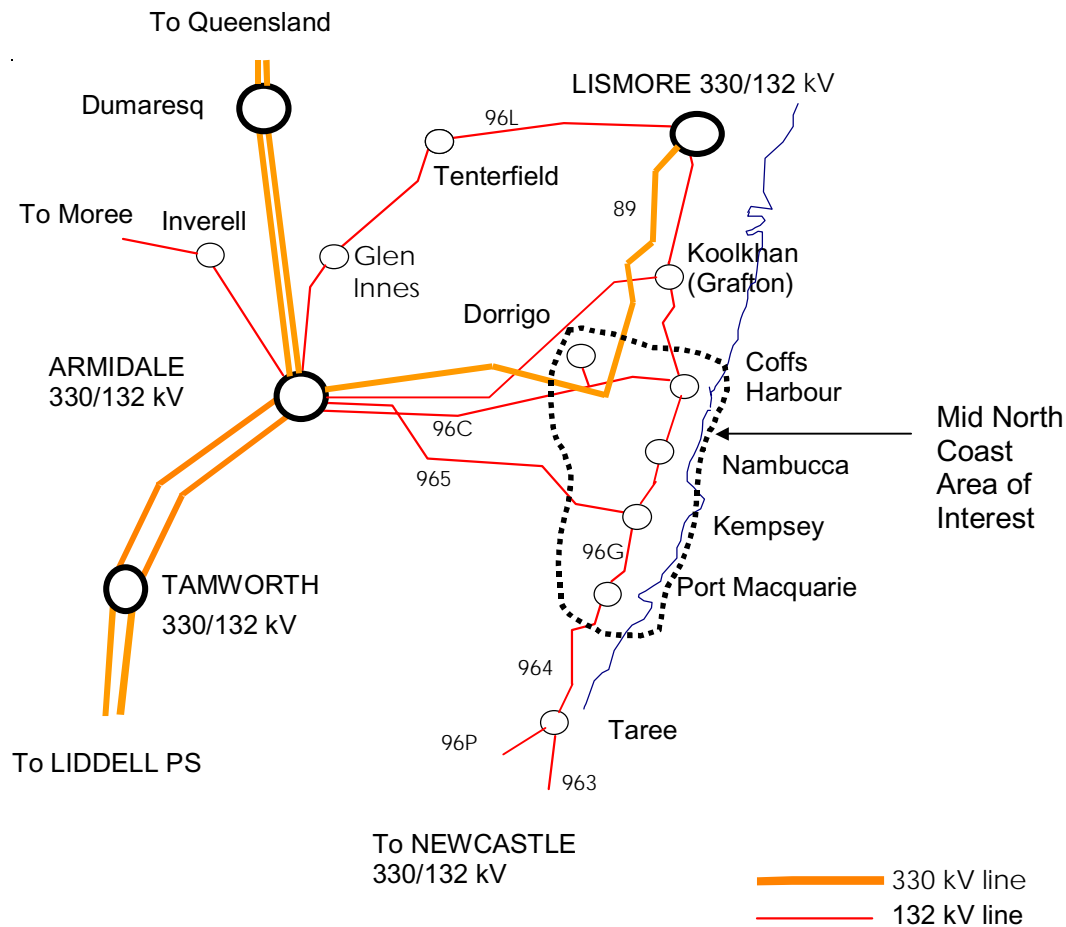
This area is supplied via a 132 kV transmission network emanating from 330/132 kV substations at Armidale, Lismore and Newcastle, as shown in Figure 1.

This 132 kV network supplies substations at Coffs Harbour, Kempsey and Port Macquarie, which in turn supply the lower voltage Country Energy networks in those areas. A new 132 kV line between Coffs Harbour and Kempsey and an associated 132/66 kV substation at Nambucca was commissioned in early June 2002.

The 132 kV network operates in parallel with the main 330 kV network and consequently power flows on the 132 kV network are affected, to a small degree, by flows on the 330 kV network. The flows on the 330 kV network are determined by loads and generation patterns in the National Electricity Market (which covers the eastern and southern states). A major influence on power flows on the 330 kV network in the north of NSW is the amount of power being imported from or exported to Queensland.

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Figure 1 Supply System on the Mid North Coast



The capacity of the existing 132 kV system is limited by unacceptably low voltages on outage of critical lines at times of high load. Over the years, TransGrid has installed numerous capacitor banks at the 132 kV substations to improve voltages both with all elements in service and following outage of one network element. As the reactive power loads at the major 132 kV substations are fully compensated (or very close to fully compensated), the installation of additional capacitors would be of marginal benefit.

2. Identification of Future Network Constraints

2.1. Load Forecast

2.1.1. The Nature of the Electrical Load

The demand for electricity in the Coffs Harbour to Port Macquarie area is seasonal, with the highest demands occurring during winter. Summer maximum demands are typically around 80% of the winter maximum demands. Figure 2 below shows the maximum demands (averaged over a half hour period) for each day from 1 January 1999 to 3 July 2002.

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Figure 2 Daily Maximum Demands for the Coffs Harbour to Port Macquarie Area

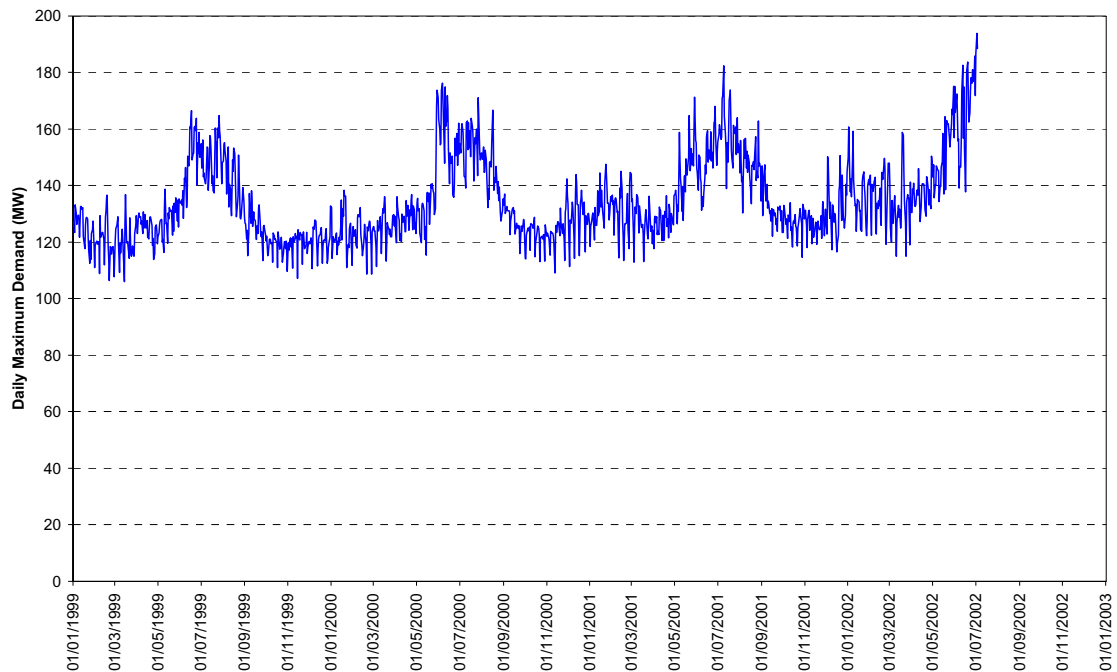
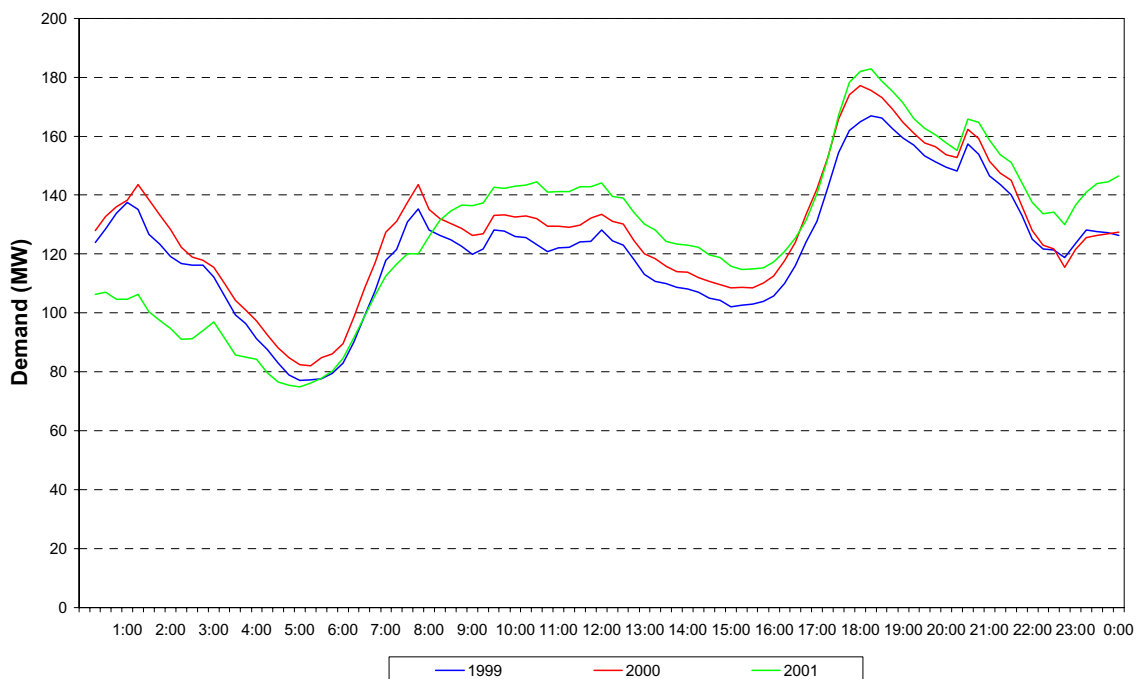


Figure 3 below shows the load on the days of maximum demand in 1999, 2000 and 2001. The impact of Country Energy’s existing demand management (load control) system is clearly visible. Load has been shifted from the morning and the evening peaks to after the evening peak (from the period commencing about 7 am to the period commencing around 8 pm and extending through until the early hours of the morning).

Figure 3 Load Profile on Day of Maximum Demand

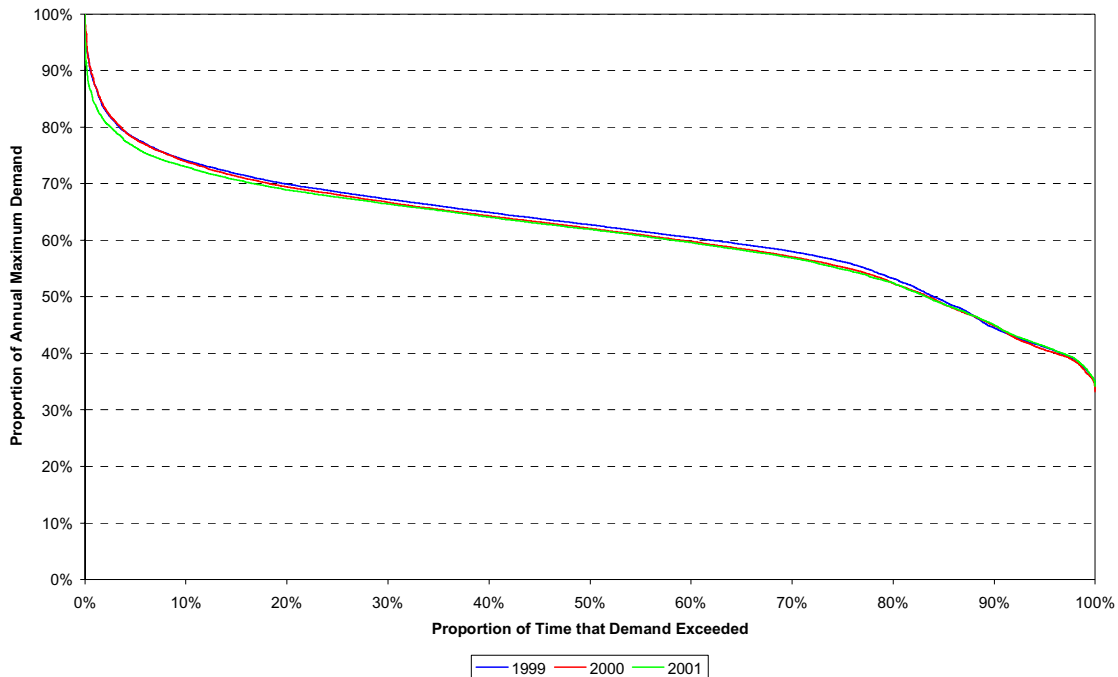


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The highest demands exist for only comparatively short periods. For example, demands above approximately 90% of the annual peak demand, occur primarily in “blocks” of two hours duration or less and those above approximately 95% of the annual peak demand, occur primarily in “blocks” of one hour duration or less.

Figure 4 shows the load duration curves for 1999, 2000 and 2001. These curves show the proportion of time that particular demands (expressed as a proportion of the maximum demand for that year) are exceeded.

Figure 4 Load Duration Curves for the Coffs Harbour to Port Macquarie Area



2.1.2. What Causes the Peak Demand?

As the highest demands occur during winter and are typically around 6:00 pm to 7:00 pm, it is likely that space heating and other domestic activities, such as cooking, are major contributors to those demands.

An inspection of the demand and Coffs Harbour ambient temperature data for the days of highest demand in 1999, 2000 and 2001 shows that:

- There is only a weak link between maximum demand and ambient temperature (as shown by the wide scattering of points in Figure 5 below).
- The highest demands tend to occur in June and July.
- The highest demands occur less frequently on Fridays, Saturdays and Sundays than on other days, suggesting different human activities on those days. The demand profile for the week of maximum demand in 2000 is shown in Figure 6 below.

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Figure 5 Maximum Daily Demand as a Function of Daily Average Temperature

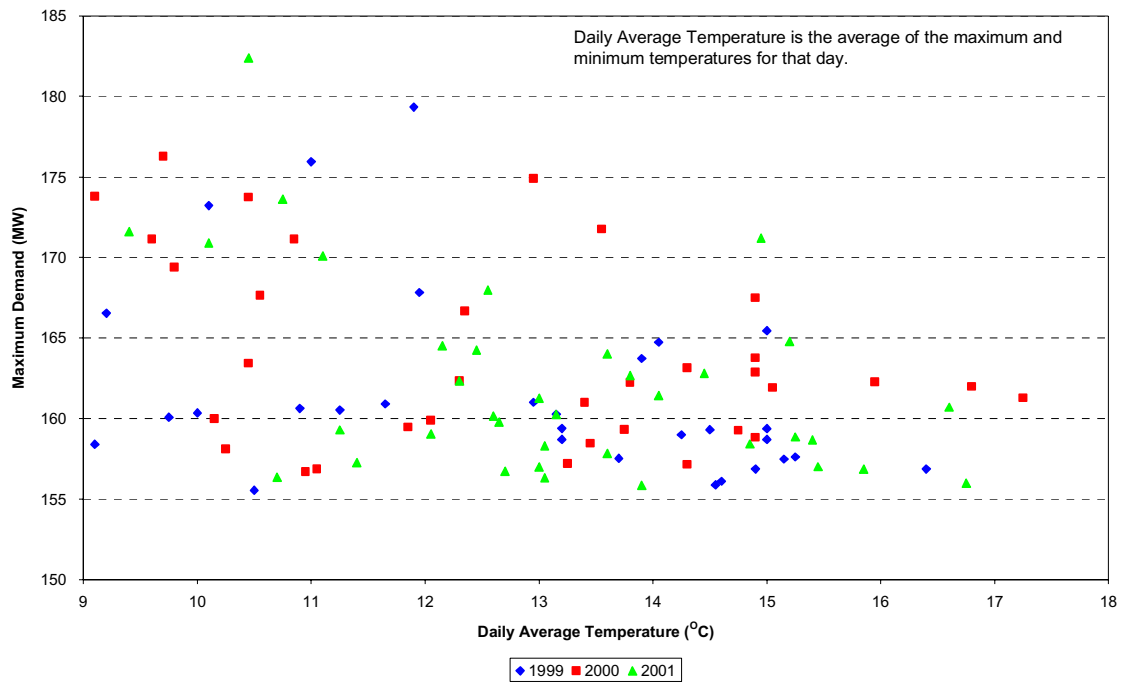
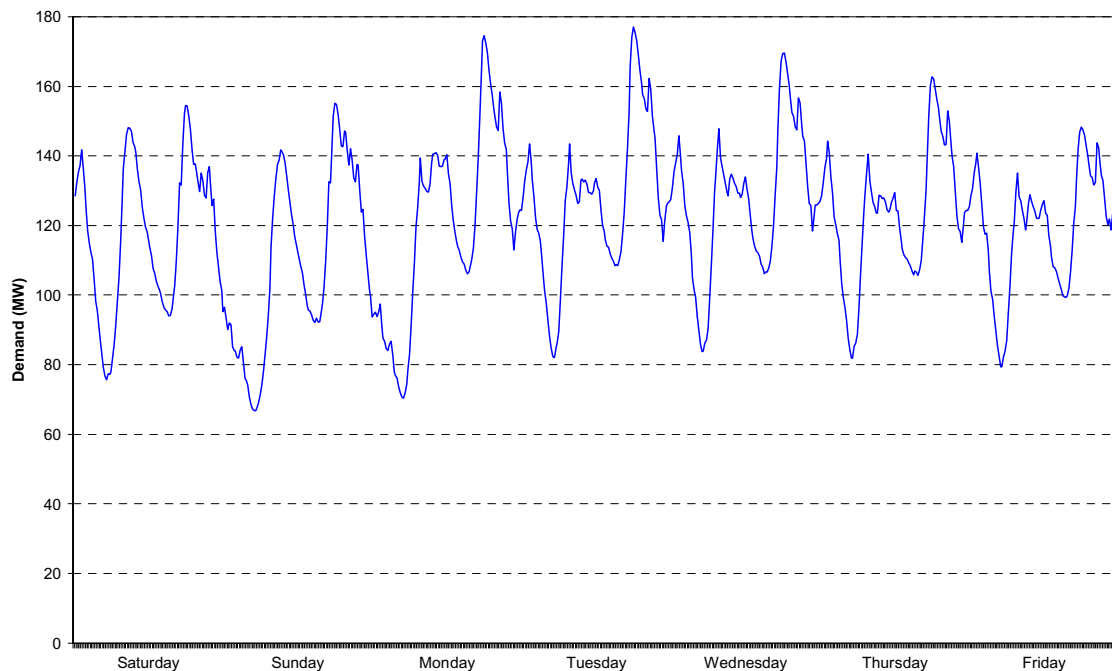


Figure 6 Demand Profile in the Week of Maximum Demand in 2000



2.1.3. Demand Management

TransGrid and Country Energy have issued a Request for Proposals for demand management on the mid north coast. That request can be found on TransGrid's website (www.transgrid.com.au) and Country Energy's website (www.countryenergy.com.au).

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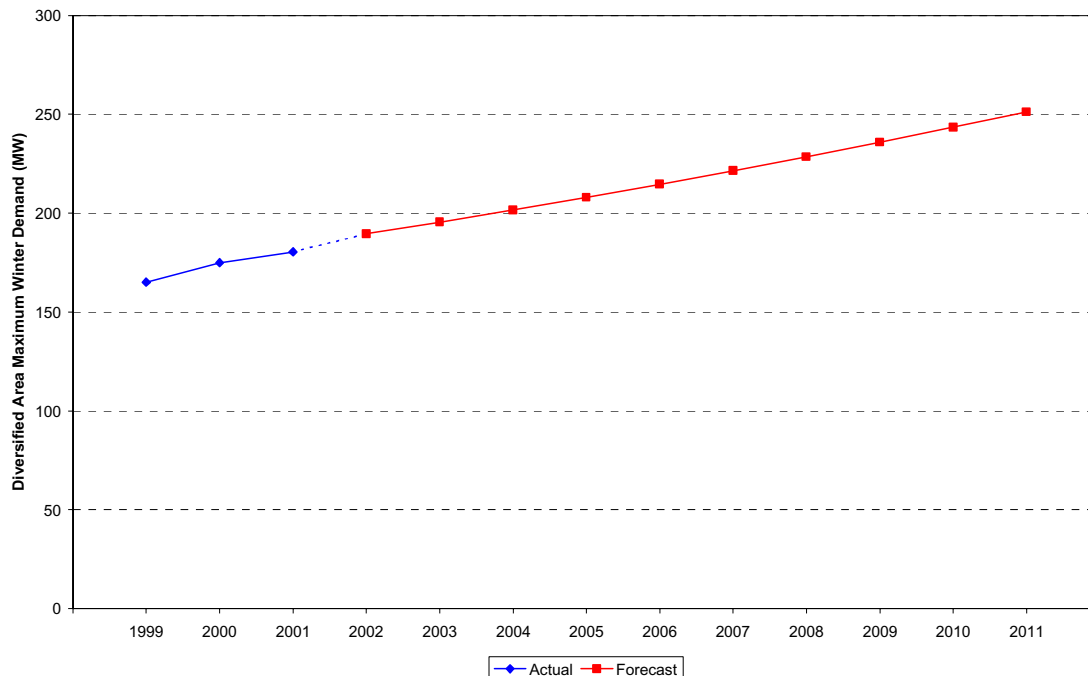
2.1.4. The Load Forecast

The forecast peak demands for the Coffs Harbour to Port Macquarie area are shown in Table 1 below.

Table 1 Winter Peak Demand Forecasts (MW)

| Supply Point | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|-------------------|------|------|------|------|------|------|------|------|------|------|
| Coffs Harbour | 63.0 | 64.9 | 66.8 | 68.8 | 70.9 | 73.0 | 75.2 | 77.5 | 79.8 | 82.2 |
| Dorrigo | 4.1 | 4.2 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 | 4.9 |
| Nambucca | 28.0 | 28.8 | 29.7 | 30.6 | 31.5 | 32.5 | 33.4 | 34.4 | 35.5 | 36.5 |
| Kempsey 66 kV | 4.0 | 4.1 | 4.2 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| Kempsey 33 kV | 31.7 | 32.4 | 33.1 | 33.8 | 34.6 | 35.3 | 36.1 | 36.9 | 37.7 | 38.5 |
| Port Macquarie | 66.6 | 69.2 | 72.0 | 74.9 | 77.9 | 81.0 | 84.2 | 87.6 | 91.1 | 94.7 |
| Total | 197 | 204 | 210 | 217 | 224 | 231 | 238 | 246 | 254 | 262 |
| Diversified Total | 189 | 196 | 202 | 208 | 215 | 222 | 228 | 236 | 244 | 252 |

Figure 7 Forecast Maximum Diversified Winter Demand for the Area



2.2. The Criteria Used to Determine Network Capacity

TransGrid and Country Energy have assessed the capability of the network to supply the forecast loads with one network element (a line or a transformer) out of service. This approach is widely used internationally and is generally referred to as an “N-1 criterion”.

2.3. Description of Network Constraints

If all elements of the network are in service, it is expected to be capable of adequately supplying the area at all times over the next ten years. However, with one line out of service, the increased loading on the remaining lines results in large voltage drops along those lines. This results in low voltages at the 132 kV substations. The limit of the network’s capacity is reached when the transformer tap changers at the 132 kV substations and at the substations within the Country Energy network can no longer restore the voltage to within the acceptable range at end use customer premises.

The three critical outages are described in the following sections.

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2.3.1. Outage of the Armidale – Coffs Harbour 132 kV Line

This line is the primary supply for the Coffs Harbour area. When it is out of service, the capacity of the two remaining lines, one via Grafton (Koolkhan) and the other via Kempsey, may not be adequate to supply the Coffs Harbour area at times of high demand. It is presently expected that this would occur from around winter 2005.

2.3.2. Outage of the Armidale – Kempsey 132 kV Line

This line is the primary supply for the Kempsey area. It also normally supplies much of the Port Macquarie load. When it is out of service, the capacity of the two remaining lines from Coffs Harbour and Taree, may not be adequate to supply Kempsey and Port Macquarie at times of high demand. It is presently expected that this would occur from around winter 2005.

2.3.3. Outage of the Kempsey to Port Macquarie 132 kV Line

When this line is out of service, supply to Port Macquarie is provided from Newcastle, via Taree. The capacity of this system is also expected to be exceeded around winter 2005.

3. Assessment of Options

To assist the development of possible options to overcome the limitations described above, the following requirements, which the options must satisfy, have been developed. Broadly, possible options will either increase the network capacity or reduce the loading on critical network elements. Load reductions can be achieved by reducing electricity usage at critical times or generating electricity “down stream” of the critical network elements (close to where it is used).

As it is possible that a combination of proposals may satisfy all of the criteria, even if each on its own may not, interested parties are encouraged to submit proposals which meet one or more of the criteria.

3.1. Size

Options must, individually or collectively, reduce the loading on key network elements during the outages described above. The load is growing at around 7 MW p.a. over winter. Additional network capacity or reductions in the load on the network of at least this magnitude would be required to delay the onset of network limitations by one year.

The physical location of the additional capacity or load reduction is also important. For example, demand reductions in the Coffs Harbour to Kempsey area would be beneficial if the Armidale to Coffs Harbour line is out of service, but not if the Kempsey to Port Macquarie line is out of service. Demand reductions in the Port Macquarie area would be beneficial if either of these lines was out of service, although they would be only about half as effective as demand reductions in the Coffs Harbour to Kempsey area if the Armidale to Coffs Harbour line is out of service.

3.2. Time of Year

Possible options must be capable of reducing network loading or increasing network capacity during periods of high load in winter. Should a critical line outage occur at times of high load, voltages in the area would change almost instantaneously. Possible options should preferably be in service at times of high demand in winter. However, if an option is controllable (for example curtailing an industrial process), it should be capable of being implemented very fast (within a few seconds). This would most probably require an automatic control system.

3.3. Timeframe

Options would need to be in operation by winter 2005.

3.4. Reliability and Certainty

Options should be capable of reliably providing additional capacity or reducing load. They should also utilise proven technology and be capable of being installed and operating by the required date. Contractual arrangements may be required to ensure proposals are implemented as agreed.

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3.5. Economic Assessment

As TransGrid and Country Energy may be required to make the submissions public, any commercially sensitive material and any other material which the party making the submission does not want to be made public should be clearly identified.

Under the regulatory requirements, TransGrid is required to publish the outcomes of its application of the ACCC's Regulatory Test. Should parties making submissions elect to not provide cost data for commercial reasons, TransGrid may rely on cost estimates from its own or independent specialist sources.

It should also be noted that, in accordance with regulatory requirements, TransGrid will recommend development of the option that satisfies the ACCC's Regulatory Test.

4. Provision of Submissions

Proposals and other comments should be provided by 31 August 2002 to:

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