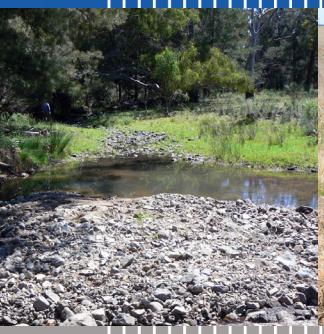
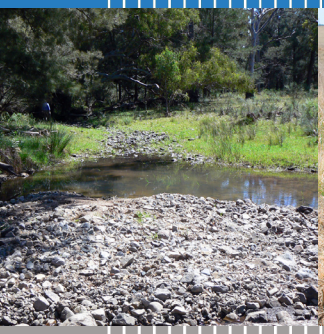




Appendix B
Constraints Identification and Project Need





Appendix B-1

Emerging Transmission Network Limitations on the NSW Far North Coast, 2003

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

August 2003

1. Introduction

As part of their joint planning activities, Powerlink, Energex, Country Energy and TransGrid have identified limitations in the network supplying the Gold Coast from the Brisbane area and the network supplying the far north coast of New South Wales from Armidale. This document and a companion document "Emerging Transmission Limitations Electricity Transfer to the Gold Coast and Tweed Area" produced by Powerlink detail these limitations.

Powerlink and TransGrid are now seeking options which may relieve one or both of the limitations.

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 Far 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 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 Far North Coast considered in this document extends from the Coffs Harbour area north to Byron Bay and west to Tenterfield. It has a population of around 300,000. It does not include the Tweed Shire which is supplied from the Queensland electricity network.

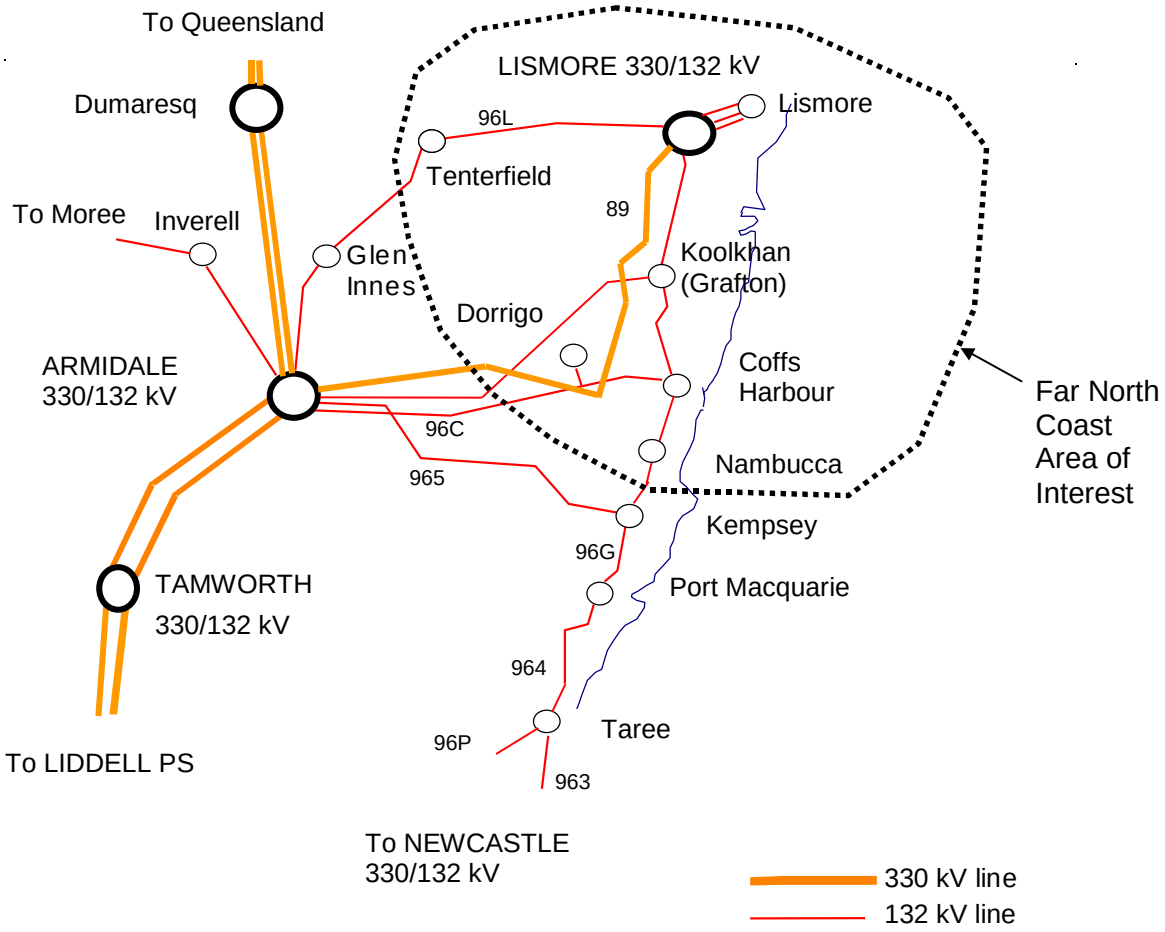
The area electrical load is characterised primarily by urban residential loads and commercial/light industrial loads in the main population centres and rural and semi-rural loads in surrounding areas.

1.2.2. Local Supply Arrangements

This area is supplied via a single 330 kV transmission line that connects 330/132 kV substations at Armidale and Lismore. A 132 kV transmission network operates in parallel with this 330 kV line as shown in Figure 1.

This 132 kV network supplies substations at Coffs Harbour, Nambucca, Koolkhan (Grafton) and Tenterfield (owned by TransGrid) and at Lismore and Dorrigo (owned by Country Energy). These in turn supply the lower voltage Country Energy networks in those areas.

Figure 1 Supply System on the Far North Coast



The capacity of the existing system is approaching the limits imposed by two constraints. The first is unacceptably low voltages on outage of the 330 kV line from Armidale to Lismore at times of high load. The other is the rating of the Armidale to Koolkhan 132 kV line (the oldest 132 kV line in the area) being exceeded on outage of the 330 kV line from Armidale to Lismore at times of high load during summer. TransGrid is presently investigating options to uprate this line.

Over the years, TransGrid has installed numerous capacitor banks at the 132 kV substations to improve voltages both with all network elements in service and following outage of one element. As the reactive power loads at the major 132 kV substations are fully compensated (or close to fully compensated), the installation of additional capacitors would be of marginal benefit.

TransGrid has recently installed a Static Var Compensator at the Lismore 330 kV substation which also improves voltages following disturbances in the system and prevents voltage collapse on outage of the 330 kV line at times of high load.

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 Lismore area is seasonal, with the highest demands occurring during winter. For the area as a whole, summer maximum demands are typically around 85% to 90% of the winter maximum demands. For the Lismore area alone, the summer maximum demands are nearly equal to the winter maximum demands.

Figure 2 below shows the maximum demands (averaged over a half hour period) for the area for each day from 1 July 1996 to 15 July 2003.

Figure 2 Daily Maximum Demands for the Coffs Harbour to Lismore Area

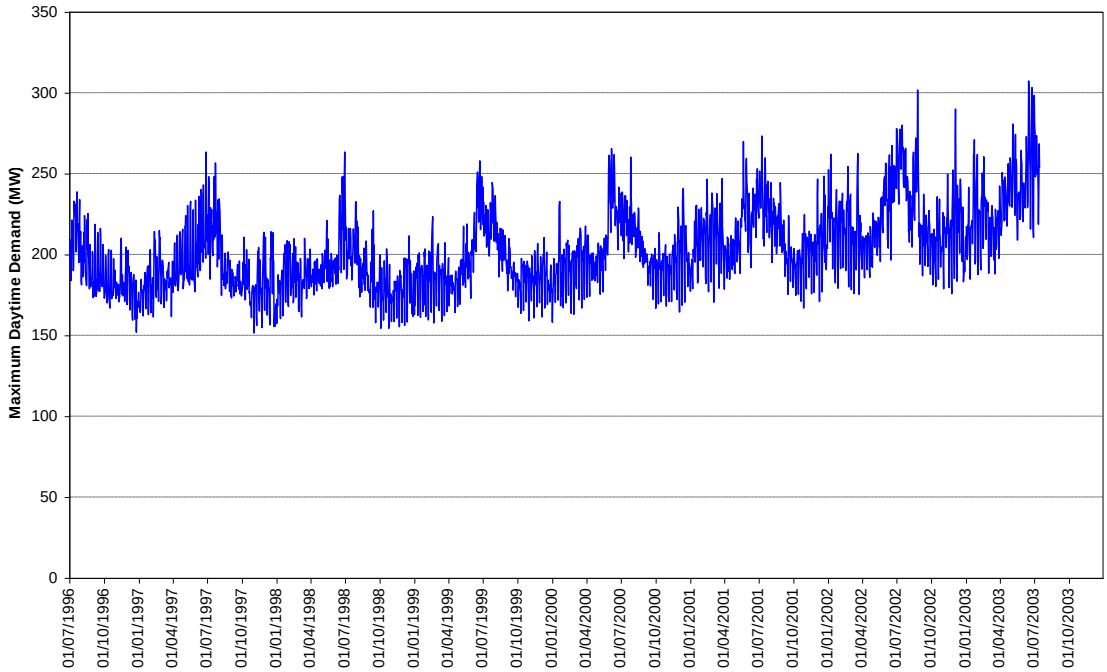


Figure 3 below shows annual energy usage for the Coffs Harbour to Lismore area from 1 July 1996 to 15 July 2003.

Figure 3 Annual Energy Usage for the Coffs Harbour to Lismore Area

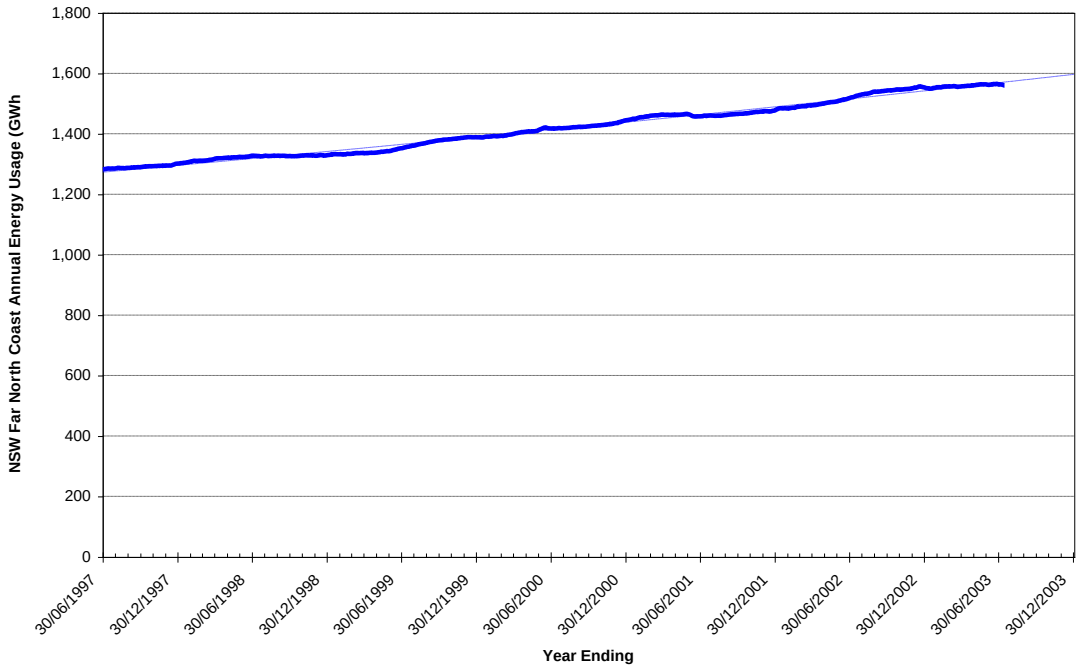


Figure 4 below shows the load on the days of maximum winter demand in 2001 and 2002. Figure 5 shows the load on the days of maximum summer demand in 2001/02 and 2002/03. The impact of Country Energy's existing demand management (load control) system is clearly visible, particularly over winter. Load has been shifted from the daytime and evening peaks to the period commencing around 8 pm and extending through until the early hours of the morning.

Figure 4 Load Profile on Day of Maximum Demand (Winter)

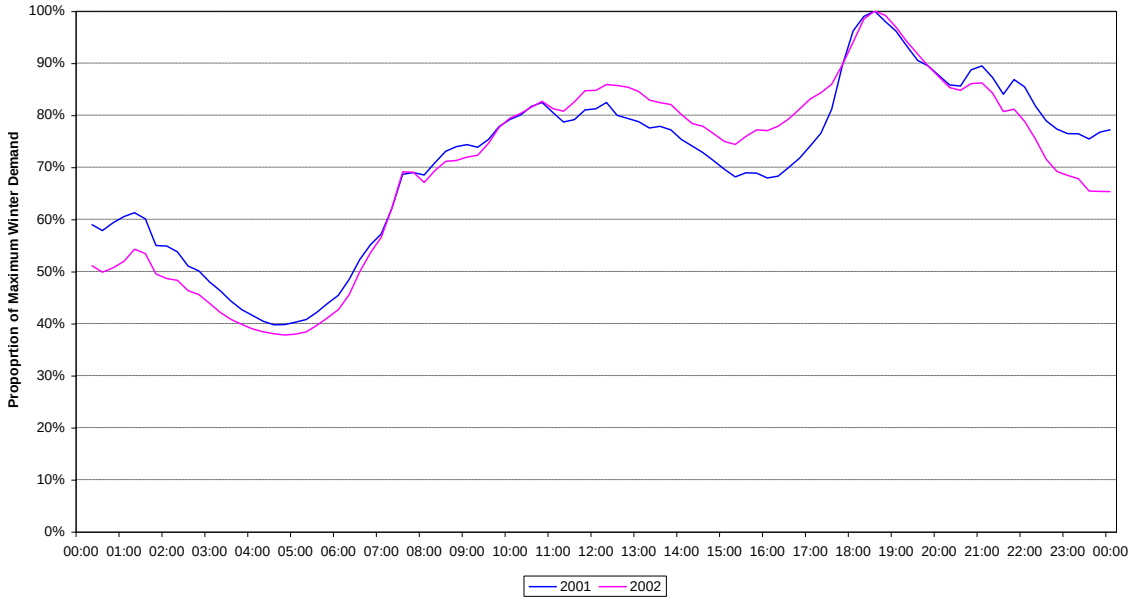


Figure 5 Load Profile on Day of Maximum Demand (Summer)

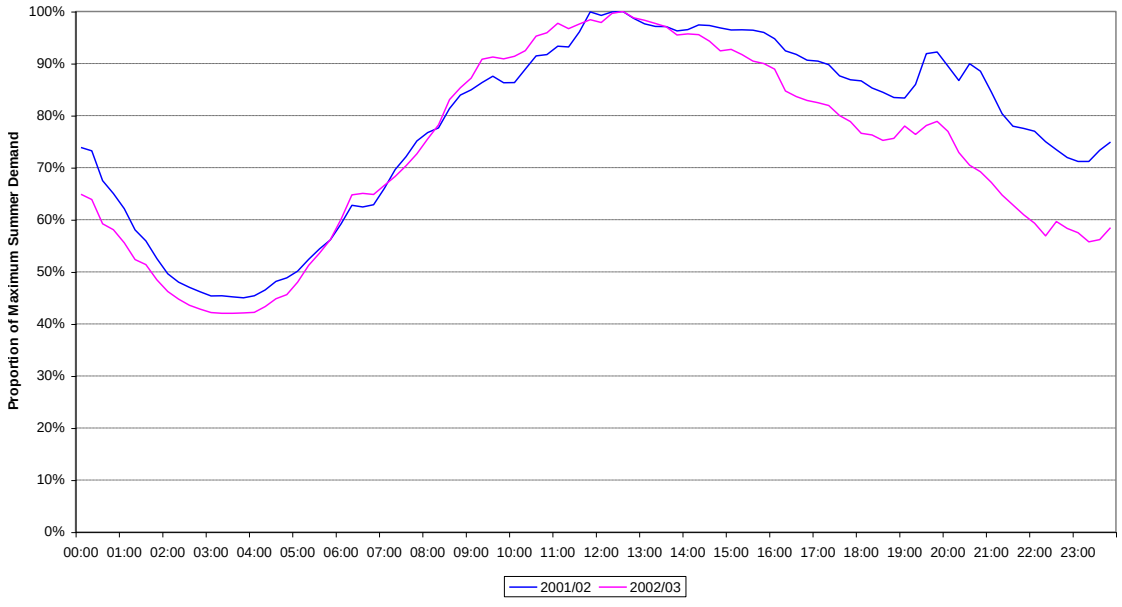
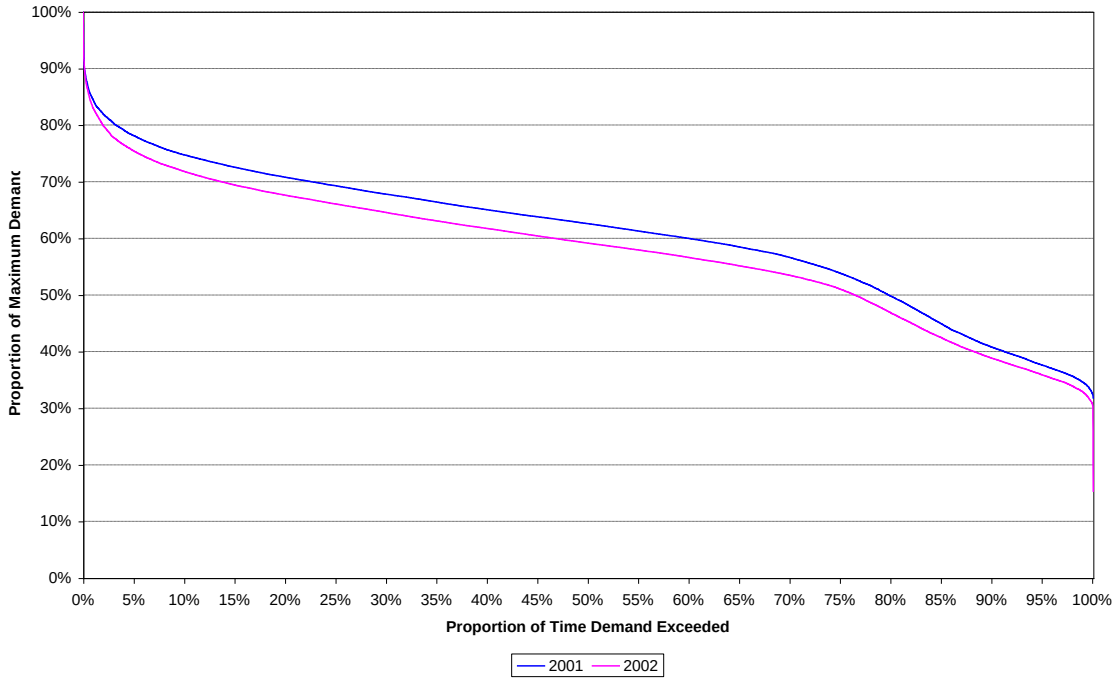


Figure 6 shows the load duration curves for 2001 and 2002. These curves show the proportion of time that particular demands (expressed as a proportion of the maximum demand for that year) are exceeded.

Figure 6 Load Duration Curves for the Coffs Harbour to Lismore Area



2.1.2. What Causes the Peak Demand?

As the highest winter demands typically occur 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. In summer, the highest demands tend to occur between 10:00 am and 4:00 pm suggesting that the use of air conditioning is a major contributor.

An inspection of the highest demand throughout the whole year shows that the highest demands occur on Monday to Friday during summer and Monday to Thursday during winter, suggesting different human activities on those days.

The demand profile for the week of winter maximum demand in 2002 is shown in Figure 7 below.

The demand profile for the week of summer maximum demand in 2002/03 is shown in Figure 8 below.

Figure 7 Demand Profile in the Week of Winter Maximum Demand in 2002

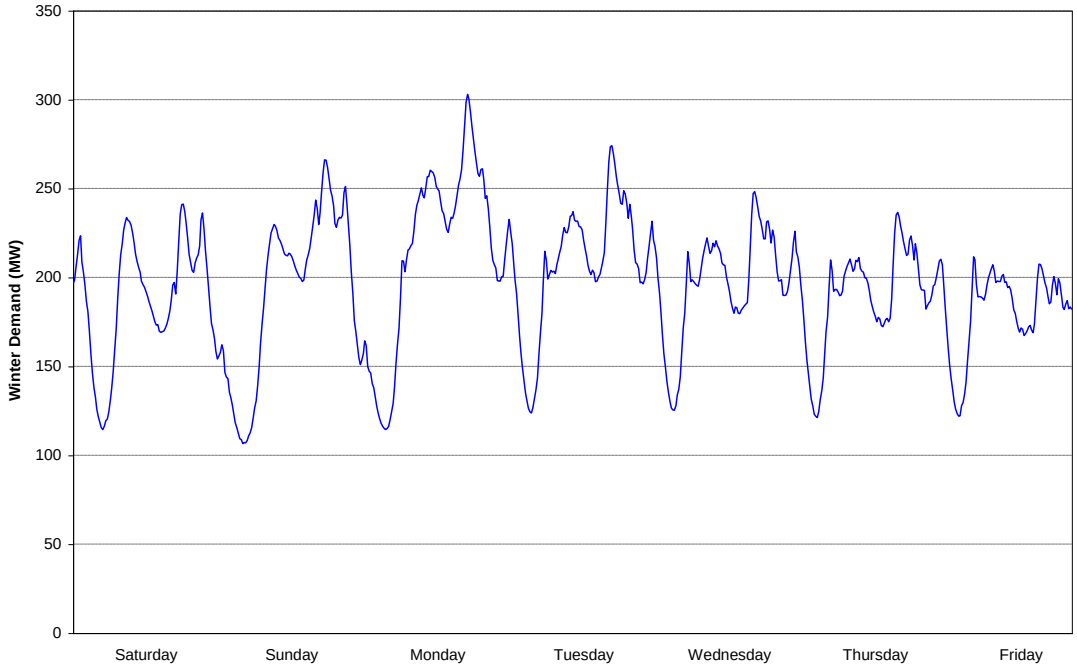
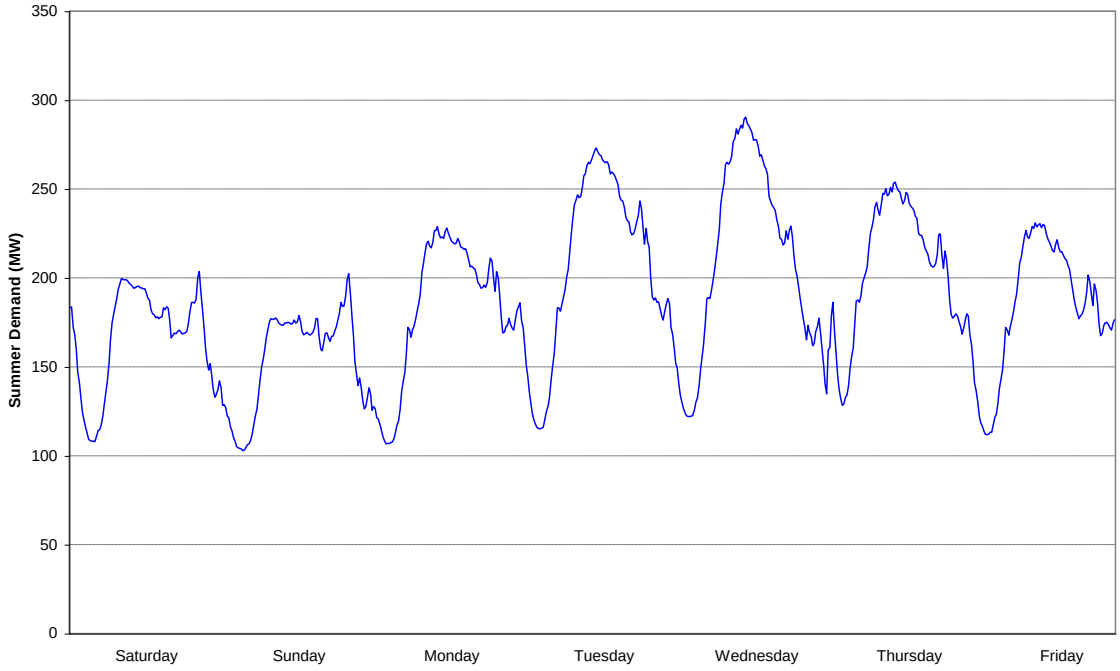


Figure 8 Demand Profile in the Week of Summer Maximum Demand in 2002/03



2.1.3. The Load Forecast

TransGrid and Country Energy have recently revised the forecast loads for the area. The forecast maximum winter demands are shown in Table 1 and the maximum summer demands in Table 2.

Table 1 Winter Peak Demand Forecasts (MW)

Supply Point	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Coffs Harbour Area	102	105	107	110	112	115	117	120	122	125
Koolkhan	49	50	52	54	56	58	59	61	63	65
Lismore	154	159	163	168	172	176	181	185	190	194
Tenterfield	6	6	6	6	6	6	6	6	6	6
Total	310	319	328	337	345	354	363	372	380	389
Diversified Total	301	310	318	327	335	344	352	361	369	378

The forecast peak summer demands for the Coffs Harbour to Lismore area are shown in Table 2 below.

Table 2 Summer Peak Demand Forecasts (MW)

Supply Point	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Coffs Harbour Area	93	97	101	104	108	112	116	120	123	127
Koolkhan	50	52	55	57	59	62	64	66	68	71
Lismore	146	152	158	164	170	176	182	188	194	200
Tenterfield	5	5	5	5	5	5	5	5	5	5
Total	294	306	318	330	342	355	367	379	391	403
Diversified Total	279	291	302	314	325	337	348	360	371	383

Figure 9 below shows the actual and forecast winter maximum demands for the area.

Figure 9 Forecast Maximum Diversified Winter Demand for the Area

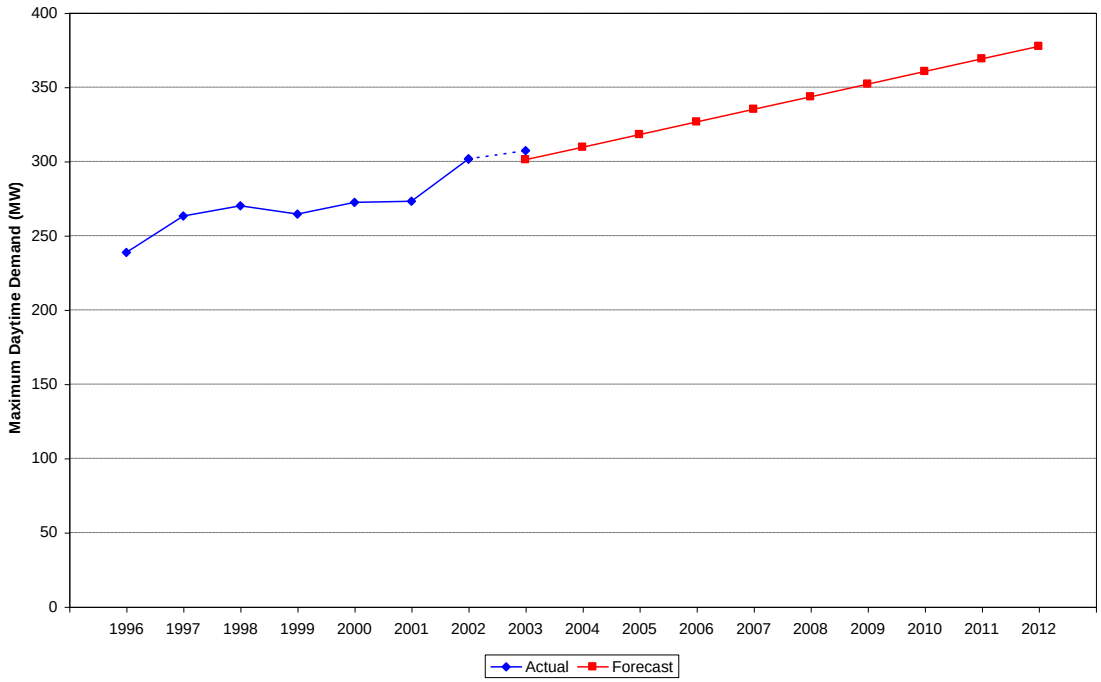
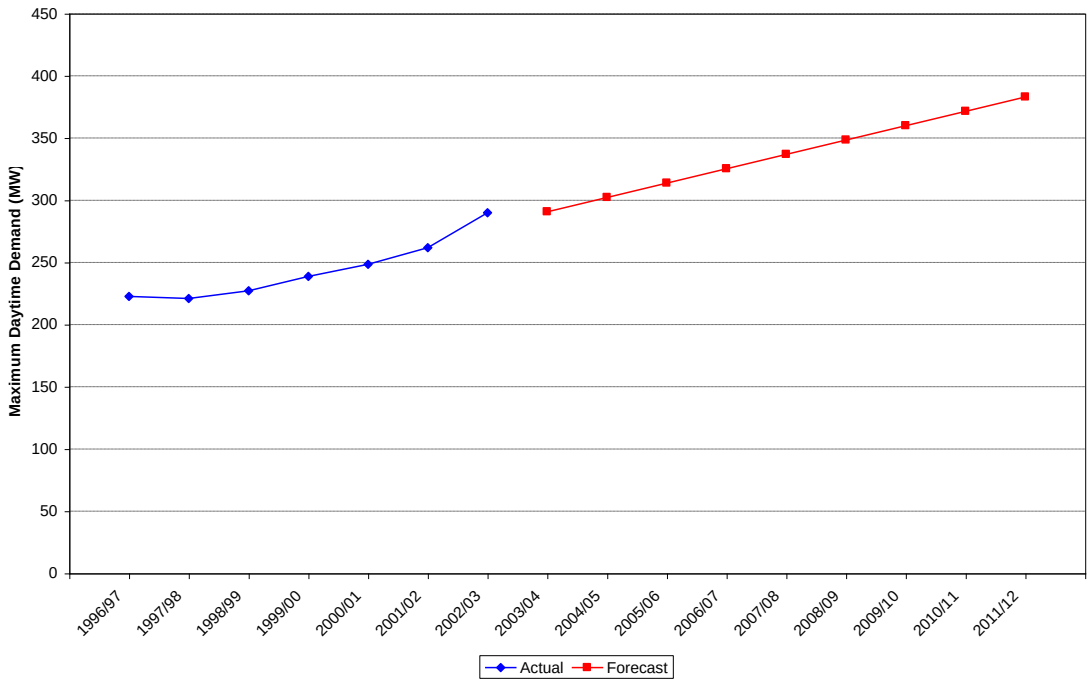


Figure 10 below shows the actual and forecast summer maximum demands for the area.

Figure 10 Forecast Maximum Diversified Summer 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 the 330 kV line out of service, the increased loading on the remaining 132 kV 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. In addition, over summer the rating of the Armidale to Koolkhan 132 kV line may be exceeded.

Based on the current forecast demands, the outage of the Armidale to Lismore 330 kV line at times of high load is expected to result in:

- unacceptably low voltages at 132 kV substations in the area from Winter 2006;
- the rating of the Armidale to Koolkhan 132 kV line being exceeded from around Summer 2003/04 (depending on the outcome of the uprating investigations); and
- unacceptably low voltages at 132 kV substations in the area from Summer 2006/07.

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 9 MW p.a. over winter and around 11 MW p.a. over summer. 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 Lismore area would be beneficial if the Armidale to Lismore line is out of service during times of high demand. Demand reductions in the Koolkhan area would be about 65 per cent as beneficial as reductions at Lismore while demand reductions in Coffs Harbour area would be about 40 per cent as beneficial. That is demand reductions of around 15 MW at Koolkhan or around 25 MW at Coffs Harbour would give the same benefit as a 10 MW reduction at Lismore.

3.2. Time of Year

Possible options must be capable of reducing network loading or increasing network capacity during periods of high load in both winter and summer. 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. 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 as early as summer 2003/04 if the Armidale to Koolkhan line is not uprated, otherwise by winter 2006.

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.

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 19 September to:

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Sydney South NSW 1235

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Phone: 02 9284 3092
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