TRANSMISSION NETWORK LIMITATIONS ON THE NEW SOUTH WALES MID NORTH COAST

REVISION 1

April 2006

1. Introduction

1.1. Purpose and Scope

This Document was previously published in July 2002. This Revision 1 has been published to provide updated information.

This document has been prepared to:

- provide information on:
  - the nature of the demand for electricity (the electrical load) in various parts of 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 adopted by TransGrid and Country Energy; and
- seek information on non network solutions to the network constraints.

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. As part of the regulatory approvals process, a future consultation paper will describe the feasible options that 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 Stroud.

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

1.2.2. Local Supply Arrangements

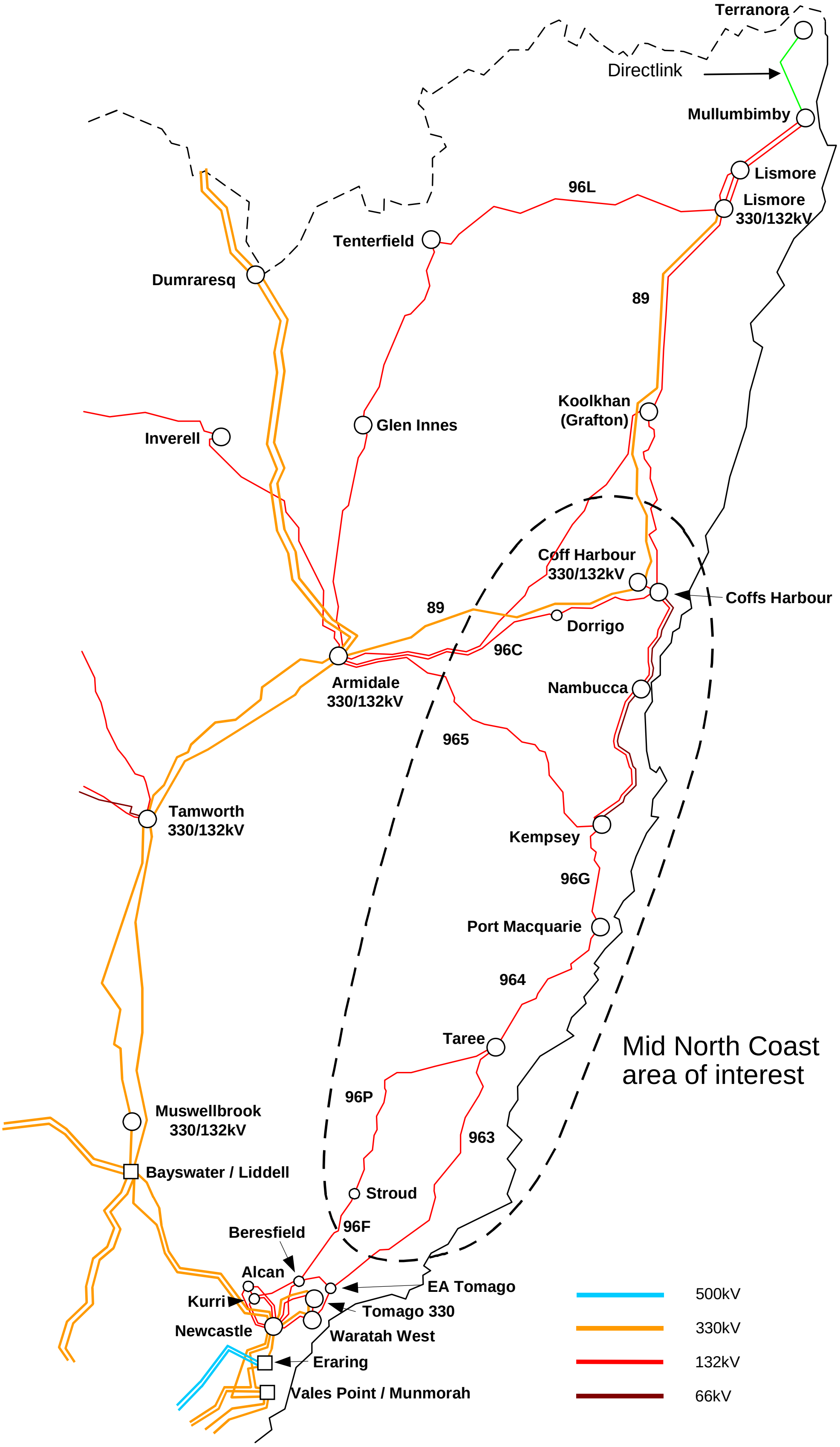
This area is supplied via a 132kV transmission network emanating from 330/132kV substations at Armidale, Lismore and Newcastle, as shown in Figure 1. A new 330/132kV substation at Coffs Harbour is scheduled for completion in mid 2006.

This network supplies substations at Coffs Harbour, Nambucca, Kempsey, Port Macquarie and Taree, which in turn supply the lower voltage Country Energy networks in those areas.

The 132kV network operates in parallel with the main 330kV network and consequently power flows on the 132kV network are affected, to a small degree, by flows on the 330 kV network. The flows on the 330kV 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.

In general, the capacity of the existing 132kV system is limited by unacceptably low voltages on outage of critical lines at times of high load. 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 132kV substations. The limit of the network's capacity is reached when the transformer tap changers at the 132kV 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, limitations due to the thermal ratings of some lines and transformers being exceeded on outage of critical network elements are expected to arise.

Figure 1 Supply System on the Mid North Coast After Establishment of Coffs Harbour 330/132kV Substation



Over the years, TransGrid has installed numerous capacitor banks at the 132kV substations to improve voltages both with all network elements in service and following outage of one element. TransGrid plans to install capacitors at Nambucca (which presently has none) by the end of 2006. Following this, the reactive power loads at the major 132kV substations will be fully compensated, the installation of additional capacitors would be of marginal benefit. Country Energy plans to install capacitors at a number of locations to relieve limitations within its networks on the Mid North Coast.

The capacity of 132 kV substations is limited by the thermal rating of the installed transformers.

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”.

3. Present and Expected Future Network Constraints

If all elements of the network are in service, the existing network is expected to be capable of adequately supplying the area at all times over the next ten years. However, with one network element out of service a number of limitations presently exist or are expected to arise within the next ten years.

These critical outages are described in the following sections. Information on the nature of the electrical load in the relevant parts of the Mid North Coast is included in the Appendices.

3.1. Outage of the Armidale – Coffs Harbour 330 kV Line

This line will be formed once Coffs Harbour 330/132 kV substation is established and connected to the existing Armidale – Lismore 330 kV line. It will become the primary supply for the Coffs Harbour area. Outage of this line can result in unacceptably low voltages on the Mid North Coast as well as the thermal rating of 132kV lines being exceeded. The capacity of this system depends on a number of factors, including:

- Whether it is possible to retain the Coffs Harbour – Lismore section of 330 kV line in service if the Armidale – Coffs Harbour 330 kV line is out of service.
- Power flows on the Queensland – NSW Interconnector (QNI). High levels of import from Queensland result in some “through flow” of power via the 132 kV network on the Mid North Coast, which increases the loading on some critical lines.
- Power flows on Directlink (a dc connection between Mullumbimby and the Tweed Shire). High levels of import from Queensland assist in maintaining voltage levels on the far north coast but also result in increased loading on some critical 132 kV lines.

The capacity of the network is expected to be exceeded by summer 2009/10 if the Coffs Harbour – Lismore 330 kV line can be retained in service and the full capability of Directlink is available (or earlier if either of these conditions is not met).

The summer maximum demand in the Coffs Harbour to Stroud area is growing by around 15 MW p.a. and the winter maximum demand by 13 MW p.a. Load reductions in the area of this order would be required each year to manage the emerging transmission limitations. The location of these demand reductions would influence their effectiveness in managing the transmission limitations. Load reductions in the Taree area would be the most beneficial. Reductions at Port Macquarie, Kempsey, Coffs Harbour and Stroud would be around 90%, 60%, 20% and 40%, respectively, as effective as reductions at Taree.

Additional information on the nature of the electrical load in this area is included in Appendix A.

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

When this line is out of service, Stroud, Taree and Port Macquarie are supplied from Newcastle and low voltages can occur at Port Macquarie. The capacity of this system is presently exceeded. Once the planned replacement of the Port Macquarie transformers by larger units (having a lower impedance and a larger tap changer range than the existing units) is completed, the risk exposure will reduce to a few hours over both summer and winter.

The summer maximum demand in the Stroud to Port Macquarie area is growing by around 9 MW p.a. and the winter maximum demand by 8 MW p.a. Load reductions in the area of this order would be required each year to manage the emerging transmission limitations. Load reductions in the Port Macquarie area would be the most effective. Reductions in the Taree area would be only about half as effective as reductions in the Port Macquarie area. Reductions in the Stroud area would be only about one quarter as effective as reductions in the Port Macquarie area.

Additional information on the nature of the electrical load in this area is included in Appendix B.

3.3. Outage of the Beresfield – Stroud 132 kV Line

When the Beresfield – Stroud 132 kV line (previously the Kurri – Stroud line) is out of service, Stroud is supplied via Taree and low voltages can occur at Stroud at times of high demand. On commissioning of Coffs Harbour 330/132 kV substation and Country Energy's capacitor at Stroud, the risk exposure will reduce to a few hours over summer and winter.

The summer maximum demand in the Stroud to Taree area is growing by around 6 MW p.a. and the winter maximum demand by 5 MW p.a. Load reductions in the area of this order would be required each year to manage the emerging transmission limitations. Load reductions in the Stroud area would be the most effective. Reductions in the Taree area and Port Macquarie area would be about three quarters and half as effective, respectively, as reductions in the Stroud area.

Additional information on the nature of the electrical load in this area is included in Appendix C.

3.4. Outage of the Tomago – Taree 132 kV Line

When the Tomago – Taree 132 kV line is out of service, there is only one remaining supply to Taree from the south. Under these conditions, low voltages can occur at Taree and the rating of the Beresfield – Stroud line can be exceeded. The severity of these limitations, and consequently the magnitude of load reductions necessary to manage them, depends on flows on the Queensland – NSW interconnector (QNI). Table 1 and Table 2 show the onset and approximate magnitude of load reductions presently required to manage the network limitations.

Table 1 Onset of Network Limitations

Network Limitation	Onset
Unacceptably low voltages at Taree	Existing in both summer and winter (500 MW export to QLD on QNI) Existing in both summer and winter (zero flow on QNI) Existing in both summer and winter (1,000 MW import on QNI)
Rating of Beresfield – Stroud line exceeded	Existing in both summer and winter (500 MW export to QLD on QNI) Winter 2008 (zero flow on QNI) Beyond 2010 (1,000 MW import from QLD on QNI)

Table 2 Approximate Magnitude of Load Reductions Presently Required to Manage Limitations

Network Limitation	Approximate Load Reduction Required (MW)
Unacceptably low voltages at Taree	25 (500 MW export to QLD on QNI) 20 (zero flow on QNI) 15 (1,000 MW import on QNI)
Rating of Beresfield – Stroud line exceeded	35 (500 MW export to QLD on QNI) No reduction presently required (zero flow on QNI) No reduction presently required (1,000 MW import from QLD on QNI)

The winter maximum demand in the Stroud to Port Macquarie area is growing by around 8 MW p.a. From the onset of the limitations, load reductions in the area of this order would be required each year to manage the limitations. Load reductions in the Taree area would be the most effective.

Additional information on the nature of the electrical load in this area is included in Appendix B.

3.5. Outage of a Taree 132/66/33kV Transformer

Taree 132/66/33kV substation is equipped with two 60 MVA 132/66kV and two 60 MVA 132/33kV transformers. The 66kV load is approaching the firm overload capacity of the 132/66kV transformers in both summer and winter.

Country Energy's 66kV system between Taree and Kempsey supplies intermediate 66/11kV substations at Kew, Laurieton and Telegraph Point. Should one Taree transformer be forced out of service at high load, around 10 MW to 15 MW of load could be transferred to Kempsey. Allowing for transfer of 12 MW, the summer firm transformer overload capacity of 66 MVA is expected to be exceeded around summer 2008/09 and the winter firm overload capacity of 78 MVA around winter 2012.

The summer maximum demand in the Taree area is growing by around 3.5 MW p.a. and the winter maximum demand by 3 MW. Load reductions in the area of this order would be required each year to manage the emerging transformer capacity limitations.

Additional information on the nature of the electrical load in this area is included in Appendix D.

3.6. Outage of a Kempsey 132/33kV Transformer

Kempsey 132/33/66kV substation is equipped with two 30 MVA 132/33kV and two 15 MVA 33/66kV transformers. The 33kV load is approaching the firm overload capacity of the 132/33kV transformers in both summer and winter.

The summer firm 132/33 kV transformer overload capacity of 33 MVA is expected to be exceeded around summer 2007/08 and the winter firm overload capacity of 39 MVA around winter 2008.

The summer maximum demand in the Kempsey area is growing by around 1.6 MW p.a. and the winter maximum demand by around 1.3 MW p.a. Load reductions in the area of this order would be required each year to manage the emerging transformer capacity limitations.

Additional information on the nature of the electrical load in this area is included in Appendix E.

3.7. Load Forecast

3.7.1. What Causes High Demands?

The highest demands in winter 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.

The highest demands in summer typically occur during the daytime. It is likely that air conditioning and other cooling loads are a major contributor to these demands.

An inspection of the daily maximum demand data for the Mid North Coast shows that the highest demands occur less frequently on Fridays, Saturdays and Sundays than on other days, suggesting different human activities on those days.

3.7.2. The Load Forecast

The forecast winter peak demands for individual 132 kV substations and relevant groupings of those substations in the Coffs Harbour to Stroud area are shown in Table 3 below.

Table 3 Winter Peak Demand Forecasts (MW)

Supply Point	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Coffs Harbour	82.0	84.7	71.5	73.9	76.3	78.8	81.4	84.1	86.9	89.7
Dorrigo	4.0	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.1	5.2
Hawks Nest				10.0	10.3	10.7	11.1	11.4	11.8	12.2

Supply Point	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Herons Creek				22.0	22.7	23.5	24.3	25.1	26.0	26.9
Kempsey 33kV	37.0	38.1	39.3	40.4	41.6	42.9	44.2	45.5	46.9	48.3
Kempsey 66kV	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
Macksville			9.0	9.3	9.5	9.8	10.1	10.4	10.7	11.1
Nabiac					40.0	41.4	42.9	44.5	46.1	47.7
Nambucca	32.0	33.0	12.9	13.3	13.7	14.1	14.6	15.0	15.5	15.9
Port Macquarie	76.0	78.6	81.3	77.0	79.6	82.3	85.1	88.0	91.0	94.1
Raleigh			12.0	12.4	12.7	13.1	13.5	13.9	14.3	14.8
Sawtell			16.0	16.5	17.0	17.6	18.1	18.7	19.3	19.9
Stroud	32.0	33.0	34.1	25.2	26.0	26.8	27.7	28.6	29.5	30.4
Taree 33 kV	28.0	28.7	29.4	30.2	30.9	31.7	32.5	33.3	34.1	35.0
Taree 66 kV	75.0	77.5	80.0	67.7	29.9	30.9	31.9	33.0	34.1	35.2
Stroud to Coffs Harbour	369	381	393	405	418	432	446	460	475	490
Diversified Stroud to Coffs Harbour	351	362	373	385	397	410	424	437	451	466
Stroud to Port Macquarie	211	218	225	232	240	247	256	264	273	282
Diversified Stroud to Port Macquarie	205	211	218	225	232	240	248	256	264	273
Stroud to Taree	135	139	144	133	137	142	146	151	156	161
Diversified Stroud to Taree	131	135	139	129	133	137	142	146	151	156

The forecast summer peak demands for individual 132 kV substations and relevant groupings of those substations in the Coffs Harbour to Stroud area are shown in Table 4 below.

Table 4 Summer Peak Demand Forecasts (MW)

Supply Point	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Coffs Harbour	78.6	82.4	86.3	74.5	78.0	81.8	85.7	89.8	94.1	98.7
Dorrigo	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.1	5.2	5.4
Hawks Nest					11.0	11.6	12.3	13.0	13.8	14.6
Herons Creek					21.0	22.2	23.5	24.9	26.3	27.8
Kempsey 33kV	31.5	33.1	34.7	36.5	38.3	40.2	42.2	44.3	46.5	48.9
Kempsey 66kV	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.5	2.6	2.7
Macksville				9.0	9.3	9.6	10.0	10.3	10.7	11.1
Nabiac						38.0	40.2	42.5	44.9	47.4
Nambucca	31.3	32.6	34.0	14.5	15.1	15.8	16.5	17.2	17.9	18.7
Port Macquarie	70.0	74.2	78.6	83.3	82.3	87.3	92.5	98.0	103.9	110.2
Raleigh				12.0	12.4	12.9	13.3	13.8	14.3	14.8
Sawtell				16.0	16.7	17.5	18.3	19.2	20.0	21.0
Stroud	33.5	35.1	36.8	38.6	29.5	30.9	32.3	33.9	35.5	37.2
Taree 33 kV	28.2	29.4	30.6	32.0	33.3	34.8	36.3	37.8	39.4	41.1
Taree 66 kV	68.0	72.1	76.4	81.0	70.8	37.1	39.3	41.7	44.2	46.8
Stroud to Coffs Harbour	347	365	384	404	425	447	470	494	519	546
Diversified Stroud to Coffs Harbour	316	332	350	368	387	407	427	450	473	497
Stroud to Port Macquarie	200	211	222	235	248	262	276	292	308	325
Diversified Stroud to Port Macquarie	188	198	209	221	233	246	260	274	290	306
Stroud to Taree	130	137	144	152	145	152	160	169	178	187
Diversified Stroud to Taree	123	130	137	144	137	145	152	160	169	178

These forecasts include new supply points. Those new supply points and the existing supply points at which they reduce demand are shown in Table 5 below.

Table 5 New Supply Points

New Supply Point	Existing Supply Point(s) Off-loaded
Hawks Nest	Stroud/EnergyAustralia Tomago
Herons Creek	Taree 66 kV and Port Macquarie
Macksville	Nambucca
Nabiac	Taree 66 kV
Raleigh	Nambucca
Sawtell	Coffs Harbour

Actual and forecast maximum demands for relevant parts of the Mid North Coast are shown in the Appendices.

4. 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.

4.1. Size

Options must, individually or collectively, reduce the loading on key network elements during one or more of the outages described above. Table 6 shows the forecast load growth in areas of the Mid North Coast affected by outages of various network elements. To be effective in delaying the onset of the particular limitation(s), load reductions of this order would be required (in the relevant area) each year.

For outages of transmission lines, load reductions in a number of locations may be useful. Table 7 shows how effective load reductions in particular areas are in overcoming limitations imposed by the line outages. The figures show effectiveness relative to reductions at the most effective location. For example, for an outage of the Beresfield – Stroud line, load reductions at Port Macquarie are only around half as effective as reductions at Stroud.

Table 6 Forecast Load Growth

Area	Relevant Network Outage(s)	Forecast Summer Load Growth (MW p.a.)	Forecast Winter Load Growth (MW p.a.)
Coffs Harbour to Stroud Area	(Future) Armidale – Coffs Harbour 330 kV line	21	13
Stroud to Port Macquarie Area	Kempsey – Port Macquarie 132 kV line	14	8
Stroud to Taree Area	Beresfield – Stroud 132 kV line Tomago – Taree 132 kV line	6	3
Taree (66 kV)	Taree 132/66 kV Transformer	4.5	2.5
Kempsey (33 kV)	Kempsey 132/33 kV Transformer	2	1.3

Table 7 Approximate Relative Effectiveness of Load Reductions

Line Outage	Location of Load Reduction				
	Coffs Harbour	Kempsey	Port Macquarie	Taree	Stroud
Armidale – Coffs Harbour 330 kV line	0.2	0.6	0.9	1.0	0.4
Kempsey – Port Macquarie 132 kV line	No Effect	No Effect	1.0	0.5	0.25
Beresfield – Stroud 132 kV line	Negligible	0.25	0.5	0.75	1.0

4.2. Time of Year

Possible options must be capable of reducing network loading or increasing network capacity during periods of high load in 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 in winter or summer. 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.

Should a critical transformer outage occur at time of high load, the temperature of the remaining unit would increase over a period of a few hours. Load reductions (of the necessary magnitude) within this period would be adequate to manage the transformer loading.

4.3. Timeframe

The times at which options would need to be in operation depends on the network limitation they are intended to address. The dates at which the five network limitations are expected to arise are shown in Table 8.

Table 8 Expected Onset of Network Limitations

Network Outage	Expected Onset of Limitation
Armidale – Coffs Harbour 330 kV line	From summer 2009/10 [1]
Kempsey – Port Macquarie 132 kV line	Existing over winter
Beresfield – Stroud 132 kV line	Existing over summer and winter
Tomago – Taree 132 kV line	Existing over summer and winter
Taree 132/66 kV transformer	From summer 2008/09 [2]
Kempsey 132/33 kV transformer	From summer 2007/08

Note 1: Based on maximum capacity of Directlink being available and the Coffs Harbour – Lismore 330 kV line being retained in service. This date would be earlier if either of these conditions is not met.

Note 2: Based on 12 MW of load being transferred to Kempsey. This would become summer 2009/10 if 15 MW of load is transferred to Kempsey.

4.4. 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.

4.5. 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 AER'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 AER's Regulatory Test.

5. Provision of Submissions

Proposals and other comments should be provided by email by 16 June 2006 to:

Email: regulatory.consultation@transgrid.com.au

Appendix A The Nature of the Coffs Harbour to Stroud Area Load

The demand for electricity in the Coffs Harbour to Stroud area is seasonal, with the highest demands occurring during winter. Summer maximum demands are presently around 80% to 90% of the winter maximum demands. However, summer demand is growing at a faster rate than winter demand and it is expected that summer demand will exceed the winter demand within about the next five years. Figure A1 shows the actual maximum demands (averaged over a half hour period) for each day from 1 July 1999 to 28 February 2006.

Figure A1 Daily Maximum Demands for the Coffs Harbour to Stroud Area

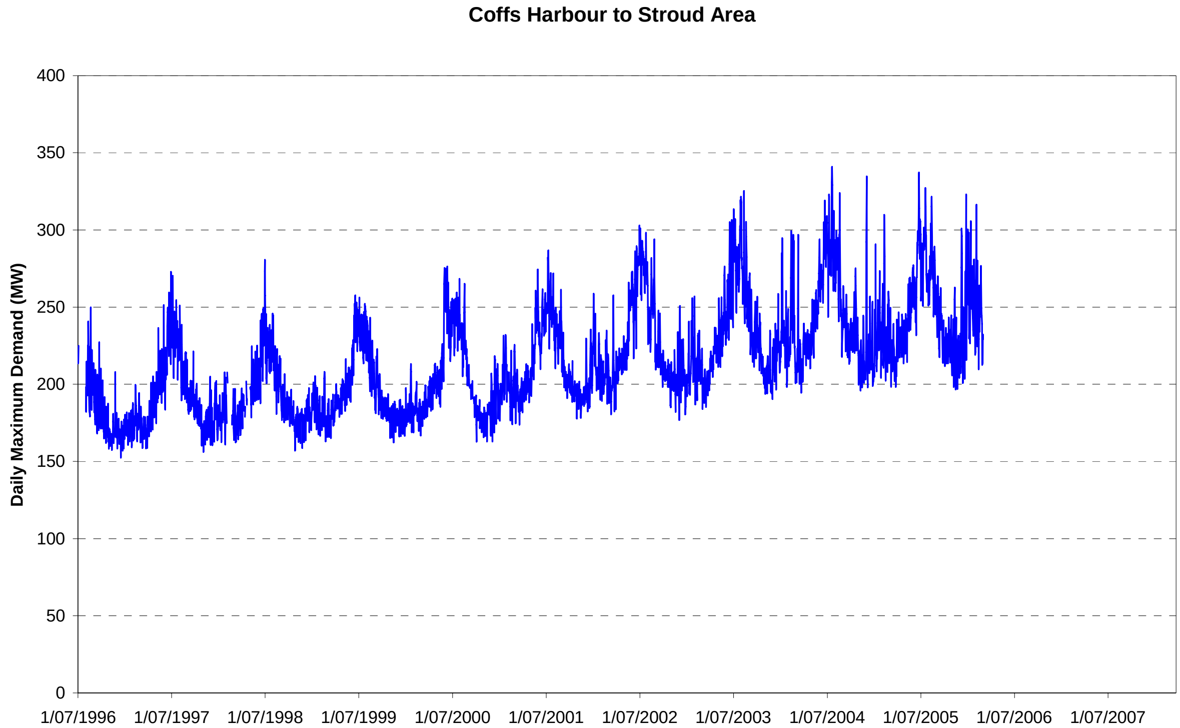


Figure A2 and Figure A3 show actual and forecast diversified winter and summer maximum demands.

Figure A2 Actual and Forecast Winter Maximum Demands for the Coffs Harbour to Stroud Area

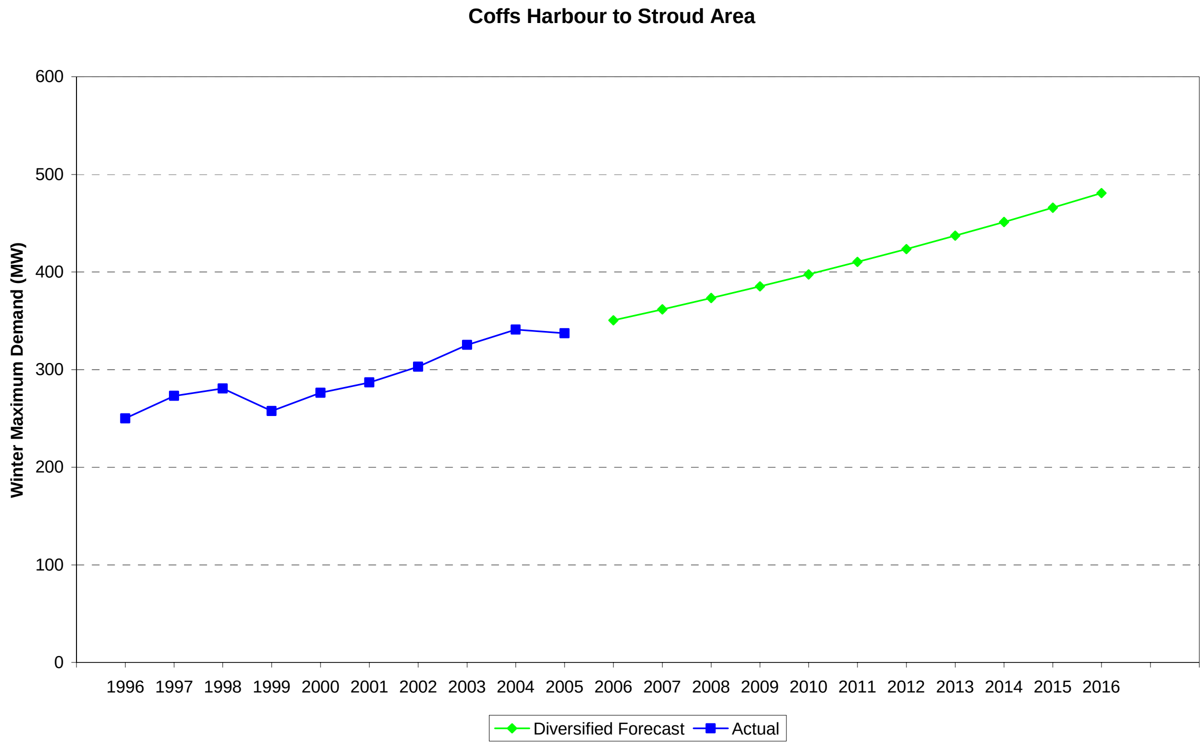


Figure A3 Actual and Forecast Summer Maximum Demands for the Coffs Harbour to Stroud Area

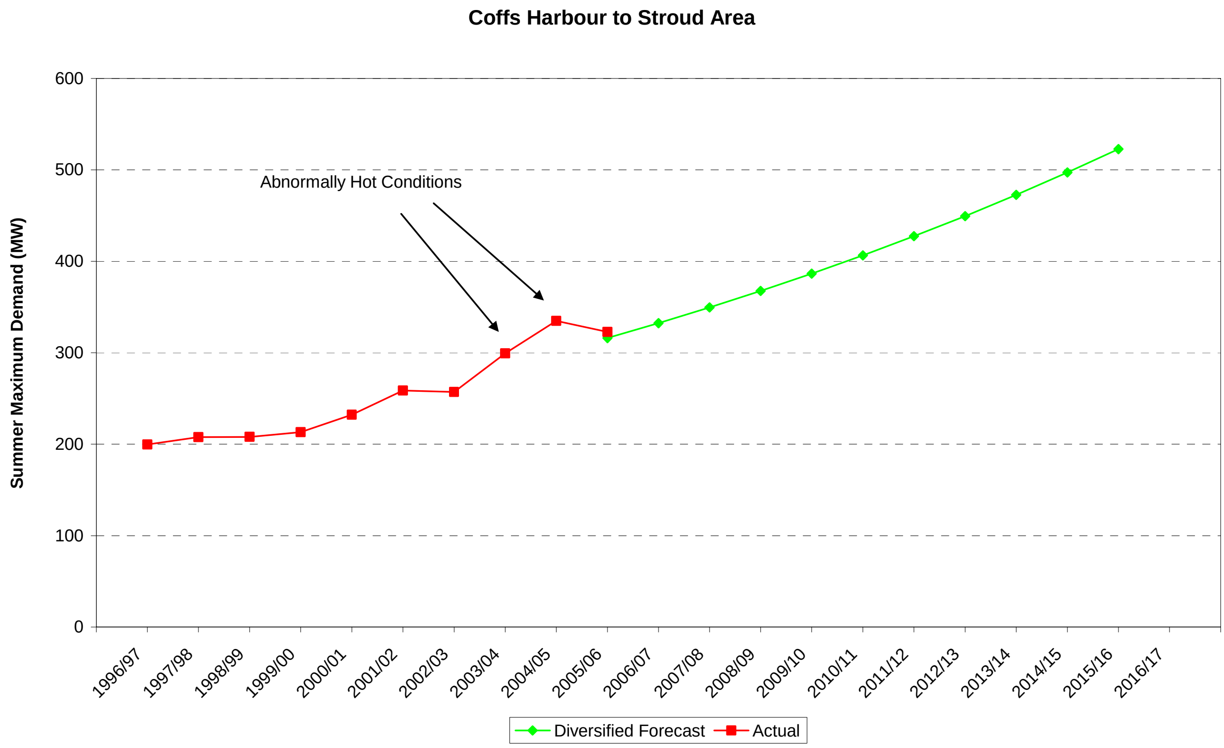
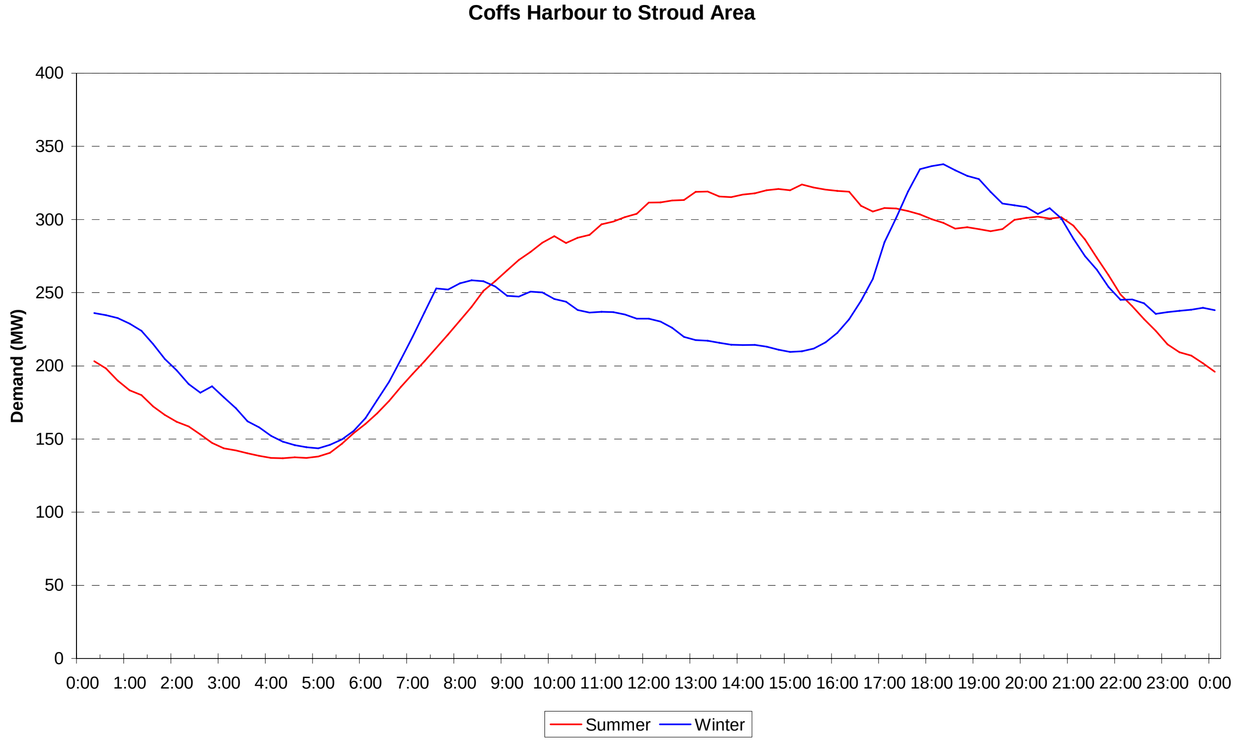


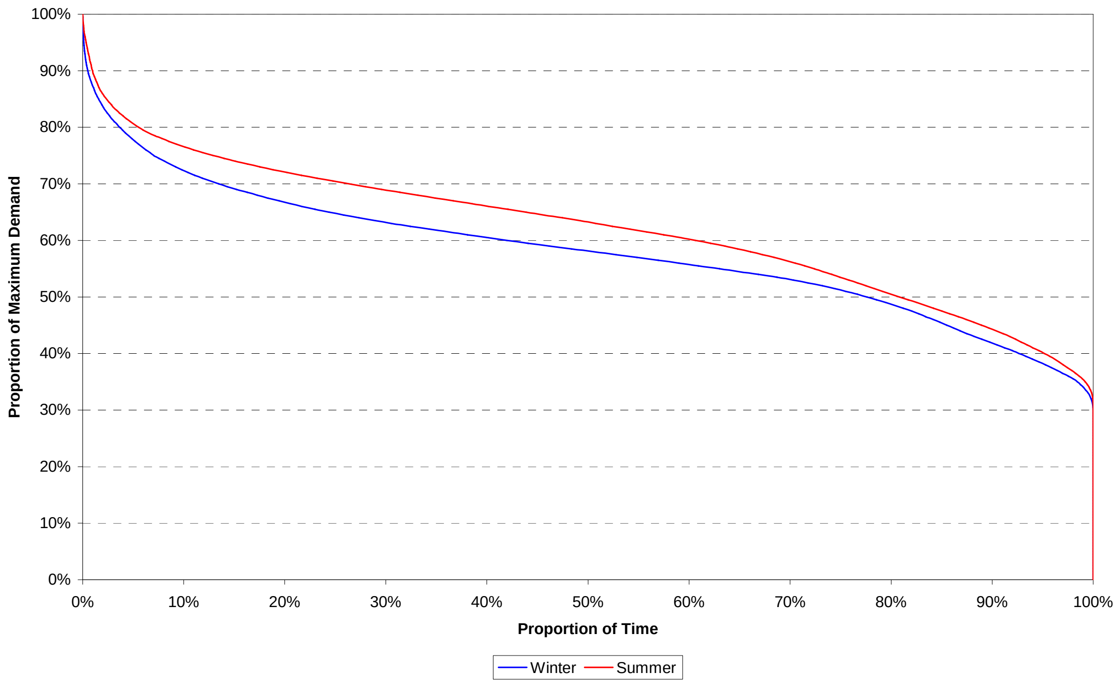
Figure A4 shows the load on the days of maximum demand in winter 2005 and summer 2005/06.

Figure A4 Load Profile on Day of Winter and Summer Maximum Demands



The highest winter demands exist for only comparatively short periods. Figure A5 shows the summer and winter load duration curves (average over the last four years). These curves show the proportion of time that particular demands, expressed as a proportion of the maximum demand in that season, are exceeded.

Figure A5 Load Duration Curves for the Coffs Harbour to Stroud Area



In general, periods of high demand occur more frequently and for shorter periods in winter than in summer. Table A1 shows the frequency and typical maximum duration of high demand events (where demand exceeds a particular proportion of the maximum demand for that season).

Table A1 Coffs Harbour to Stroud Area Typical Maximum Duration of Periods of High Demand

Proportion of Maximum Demand	Summer		Winter	
	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)
80%	70	12	80	4
85%	30	11	50	3
90%	15	9	20	2
95%	5	4	5	1

Appendix B The Nature of the Stroud to Port Macquarie Area Load

The demand for electricity in the Taree to Port Macquarie area is seasonal, with the highest demands occurring during winter. Summer maximum demands are presently around 80% to 90% of the winter maximum demands. However, summer demand is growing at a faster rate than winter demand and it is expected that summer demand will exceed the winter demand within about the next five years. Figure B1 shows the actual maximum demands (averaged over a half hour period) for each day from 1 July 1999 to 28 February 2006.

Figure B1 Daily Maximum Demands for the Stroud to Port Macquarie Area

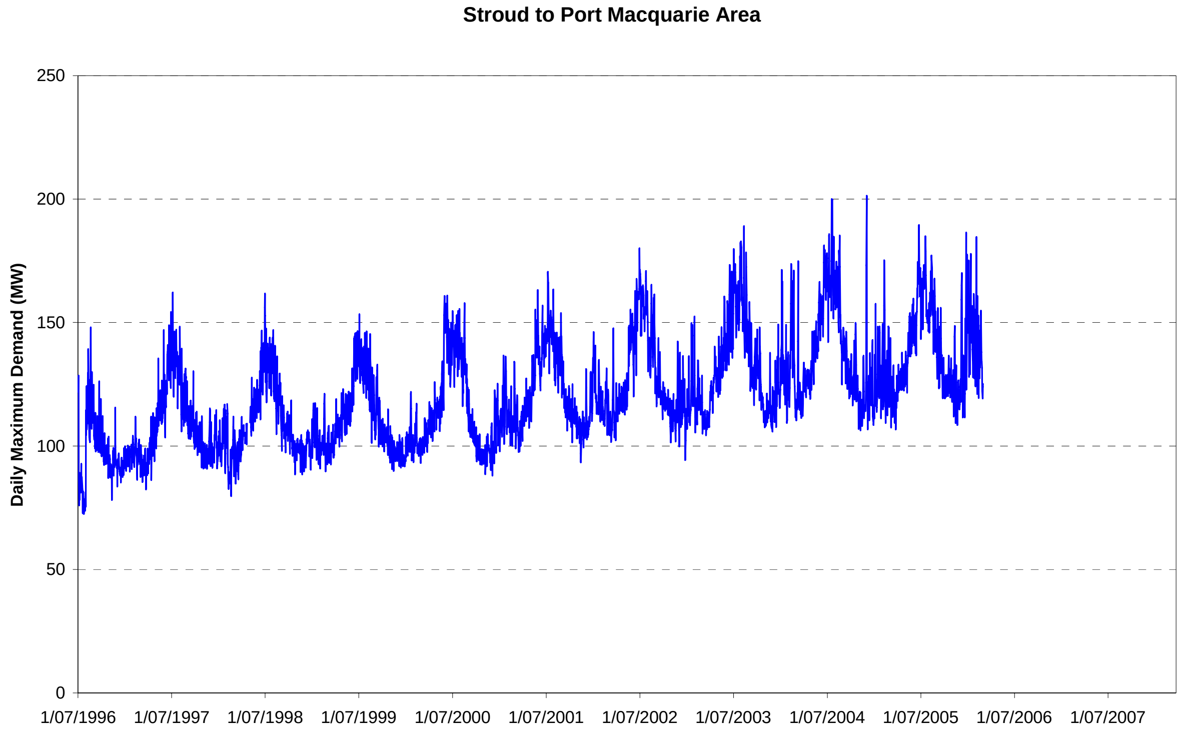


Figure B2 and Figure B3 show actual and forecast maximum diversified winter and summer maximum demands.

Figure B2 Actual and Forecast Winter Maximum Demands for the Stroud to Port Macquarie Area

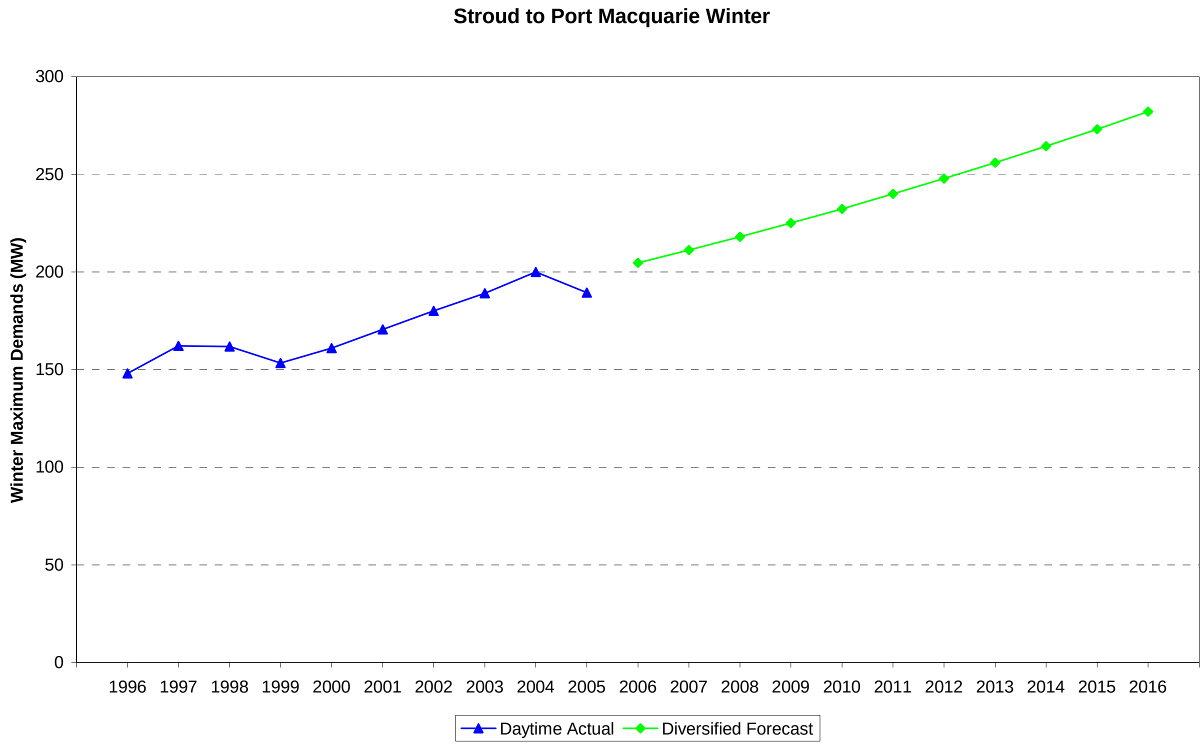


Figure B3 Actual and Forecast Summer Maximum Demands for the Stroud to Port Macquarie Area

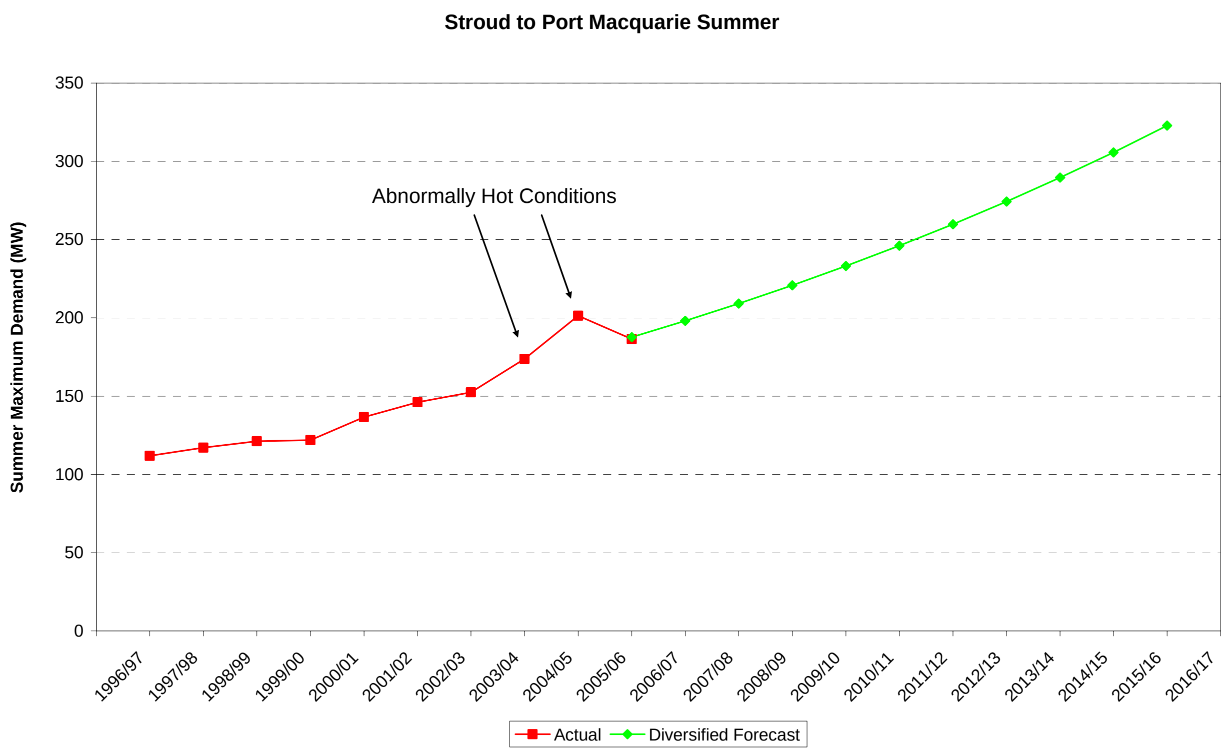
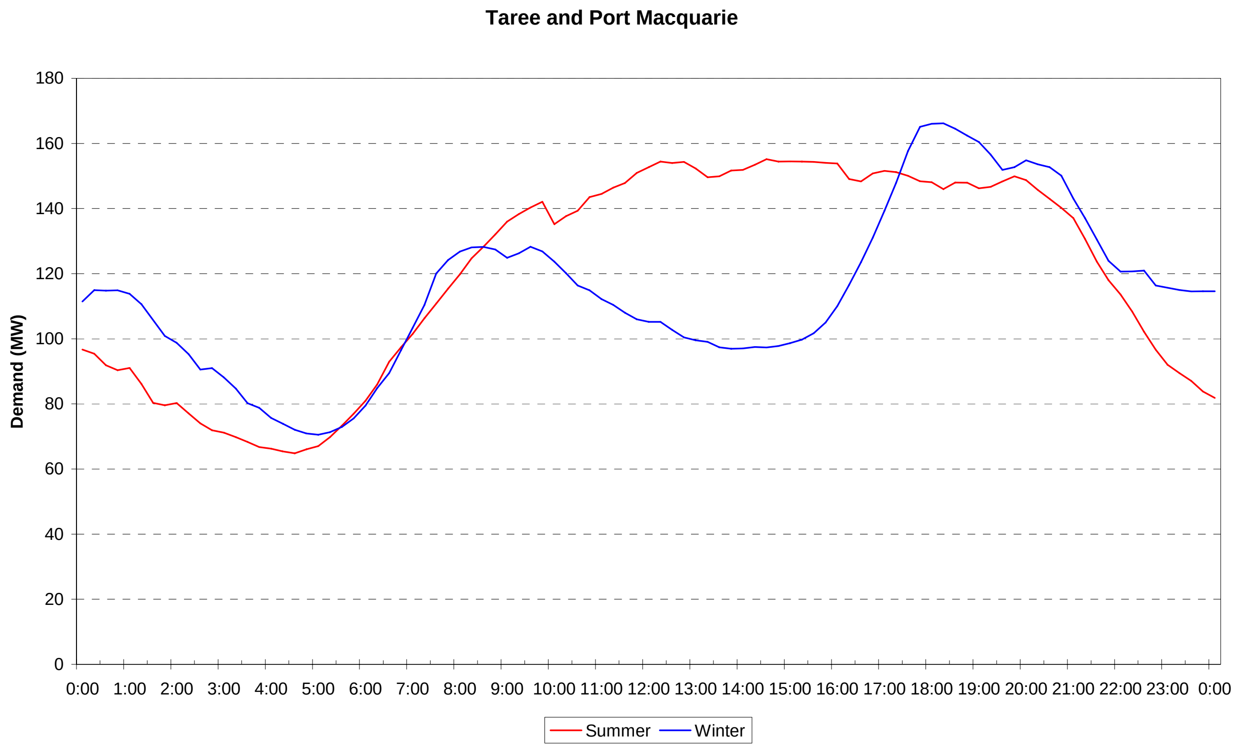


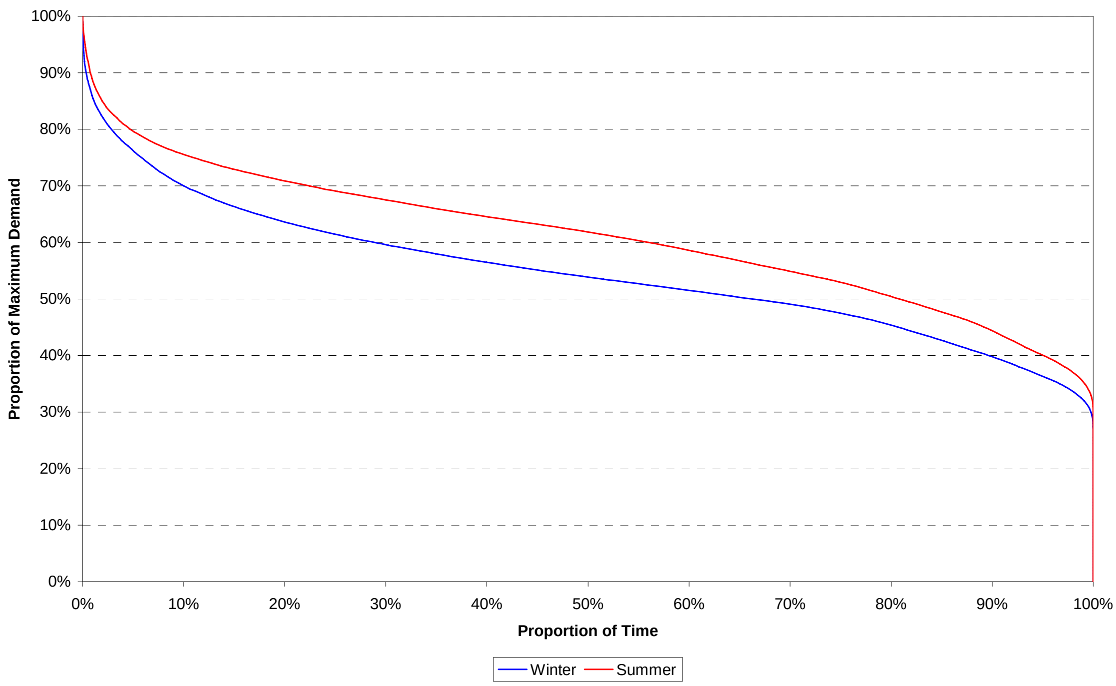
Figure B4 shows the load on the days of maximum demand in winter 2005 and summer 2005/06.

Figure B4 Load Profile on Day of Winter and Summer Maximum Demands



The highest winter demands exist for only comparatively short periods. Figure B5 shows the summer and winter load duration curves (average over the last four years). These curves show the proportion of time that particular demands, expressed as a proportion of the maximum demand in that season, are exceeded.

Figure B5 Load Duration Curves for the Taree to Port Macquarie Area



In general periods of high demand in the Taree to Port Macquarie area occur more frequently and for shorter periods in winter than in summer. Table B1 shows the frequency and typical maximum duration of high demand events (where demand exceeds a particular proportion of the maximum demand for that season).

Table B1 Stroud to Taree Area Duration of Periods of High Demand

Proportion of Maximum Demand	Summer		Winter	
	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)
80%	70	12	70	4
85%	25	11	30	4
90%	10	9	15	2
95%	5	4	3	1

Appendix C The Nature of the Stroud to Taree Area Load

The demand for electricity in the Stroud to Taree area is seasonal, with the highest demands occurring during winter. Summer maximum demands are presently around the winter maximum demands. However, summer demand is growing at a faster rate than winter demand and it is expected that summer demand will exceed the winter demand within the next few years. Figure C1 shows the actual maximum demands (averaged over a half hour period) for each day from 1 July 1999 to 31 August 2005.

Figure C1 Daily Maximum Demands for the Stroud to Taree Area

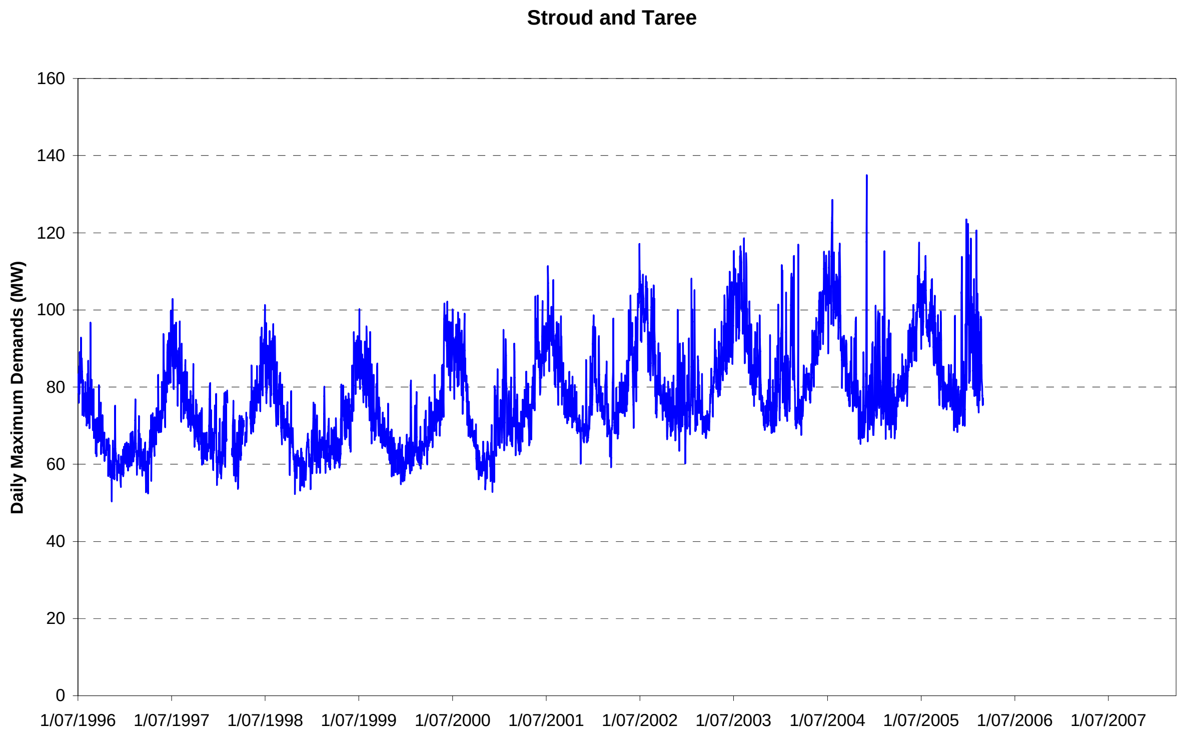


Figure C2 and Figure C3 show actual and forecast diversified winter and summer maximum demands (including the part of the existing Taree 66 kV load to be transferred to Herons Creek).

Figure C2 Actual and Forecast Winter Maximum Demands for the Stroud to Taree Area

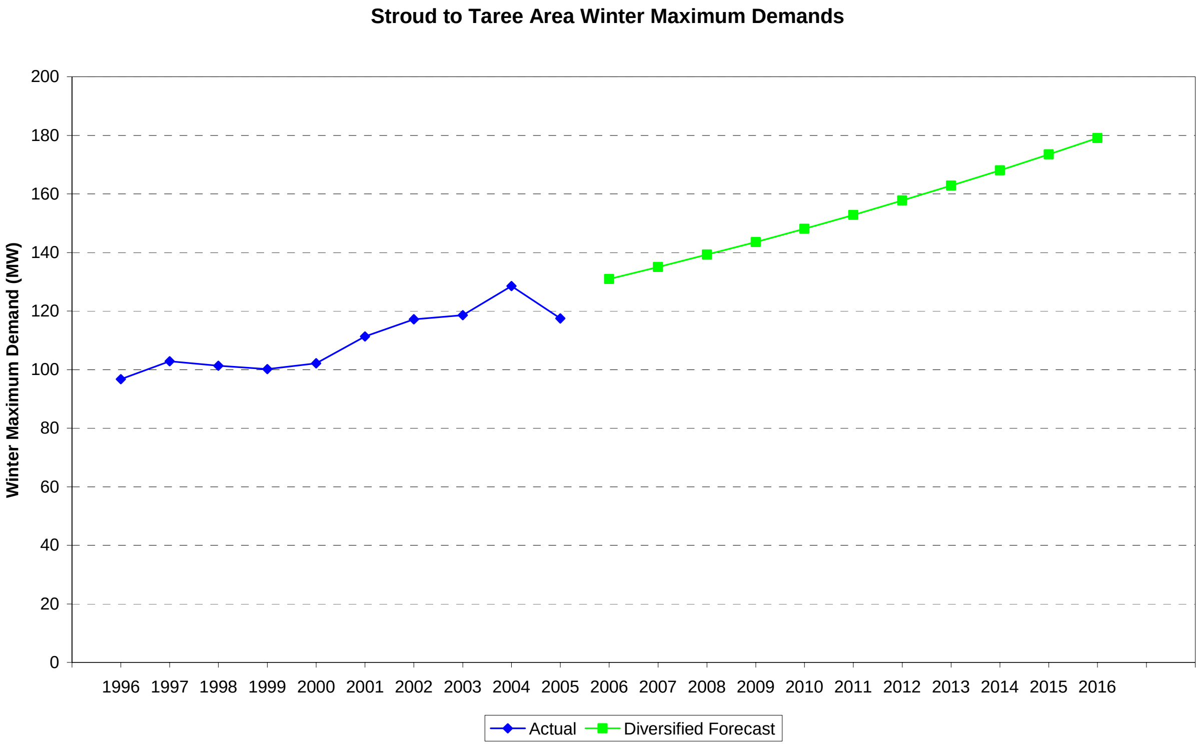


Figure C3 Actual and Forecast Summer Maximum Demands for the Stroud to Taree Area

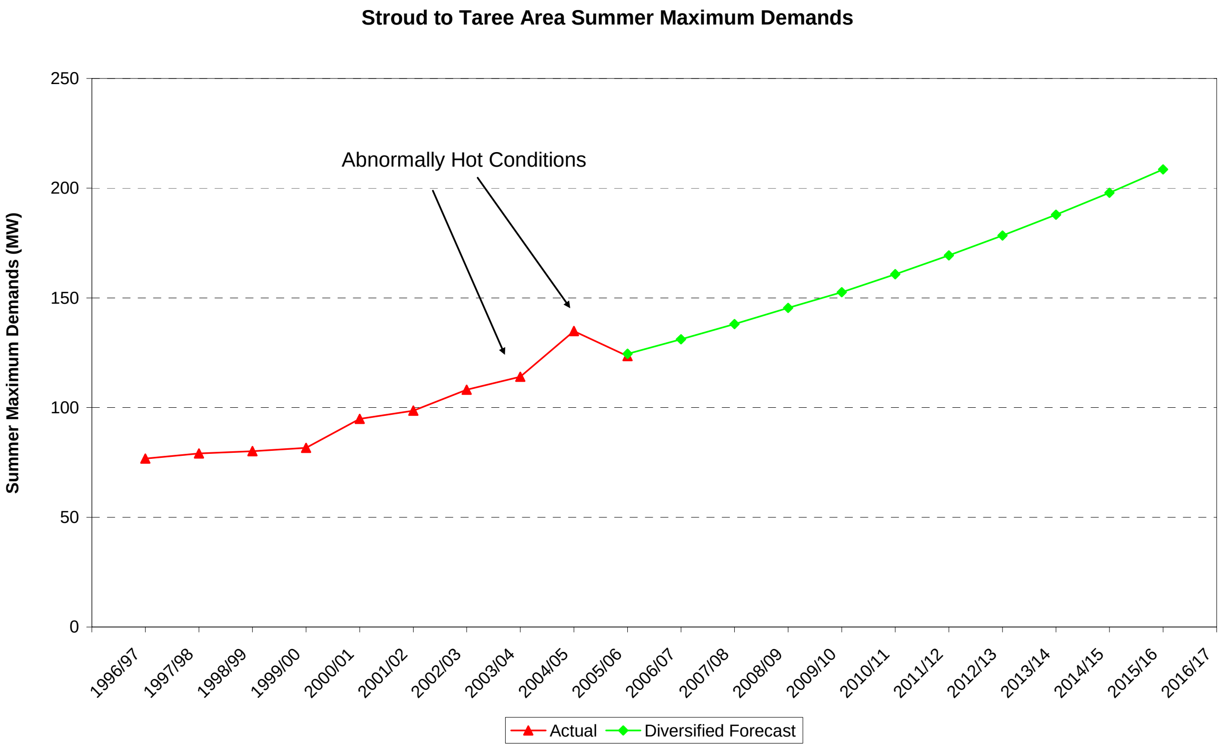
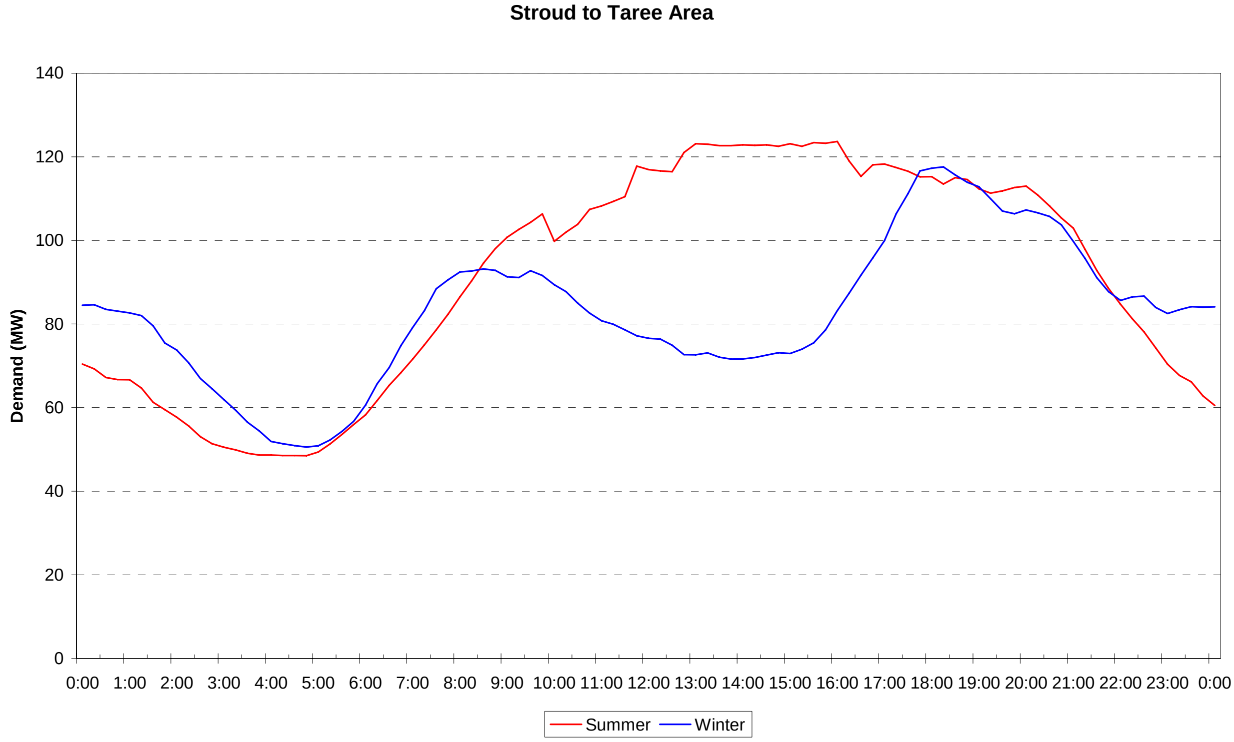


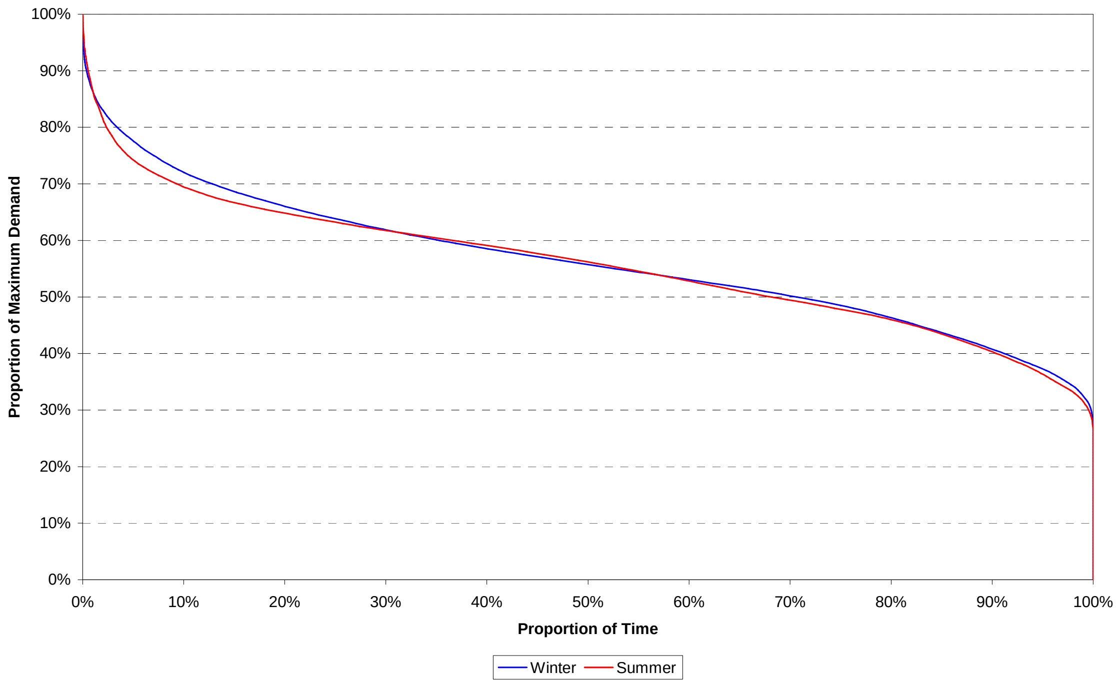
Figure C4 shows the load on the days of maximum demand in winter 2005 and summer 2005/06.

Figure C4 Load Profile on Day of Winter and Summer Maximum Demands



The highest winter demands exist for only comparatively short periods. Figure C5 shows the summer and winter load duration curves (average over the last four years). These curves show the proportion of time that particular demands, expressed as a proportion of the maximum demand in that season, are exceeded.

Figure C5 Load Duration Curves for the Stroud to Taree Area



In general periods of high demand in the Stroud to Taree area occur more frequently and for shorter periods in winter than in summer. Table C1 shows the frequency and typical maximum duration of high demand events (where demand exceeds a particular proportion of the maximum demand for that season).

Table C1 Stroud to Taree Area Duration of Periods of High Demand

Proportion of Maximum Demand	Summer		Winter	
	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)
80%	30	11	80	4
85%	20	9	40	4
90%	10	6	15	2
95%	5	3	3	1

Appendix D The Nature of the Taree 66 kV Load

The demand for electricity supplied at 66 kV from Taree is seasonal, with the highest demands occurring during winter. Summer maximum demands are presently similar to the winter maximum demands. However, summer demand is growing at a faster rate than winter demand and it is expected that summer demand will exceed the winter demand within the next few years. Figure D1 shows the actual maximum demands (averaged over a half hour period) for each day from 1 July 1999 to 31 August 2005.

Figure D1 Daily Maximum Demands for the Taree 66 kV Supply

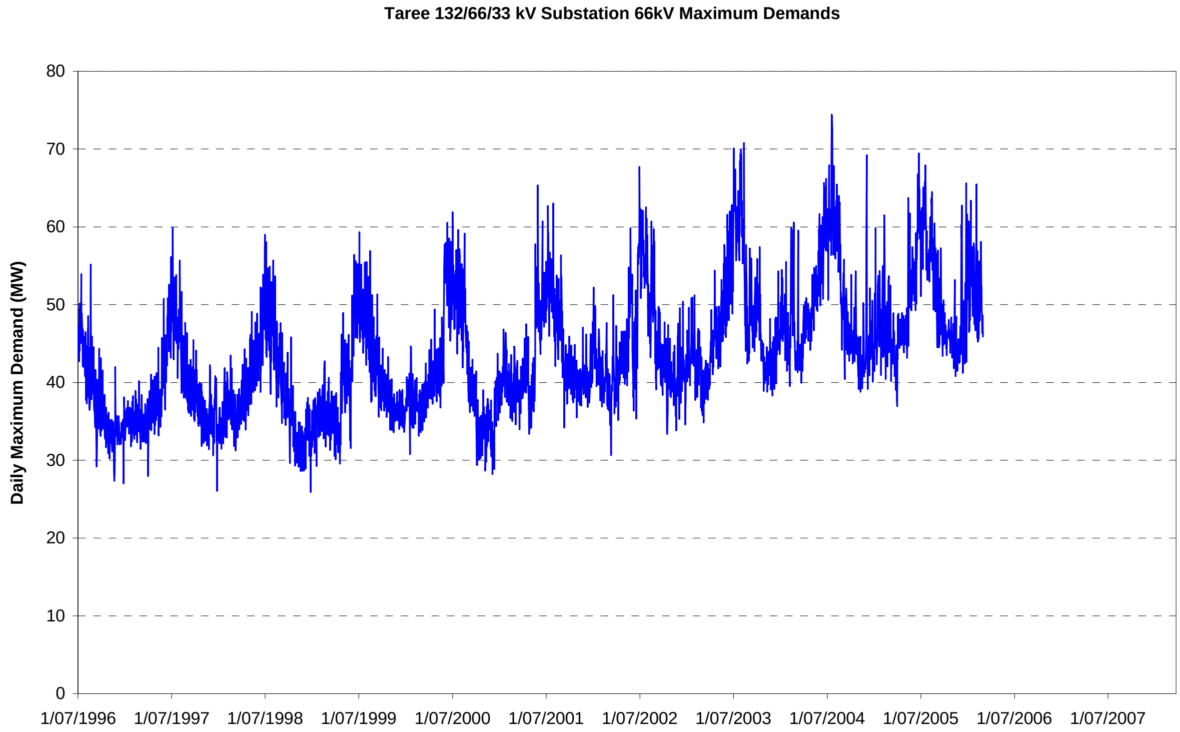


Figure D2 and Figure D3 show actual and forecast winter and summer maximum demands with 12 MW of load transferred to Kempsey[1]. These figures also include the Taree 66 kV load proposed to be transferred to Nabiac.

[1] Should a 132/66 kV transformer be out of service at times of high demand around 10 MW to 15 MW of load could be transferred to Kempsey. The graphs in Figure D2 and Figure D3 are based on transferring 12 MW of load.

Figure D2 Actual and Forecast Winter Maximum Demands for Taree 66 kV Supply

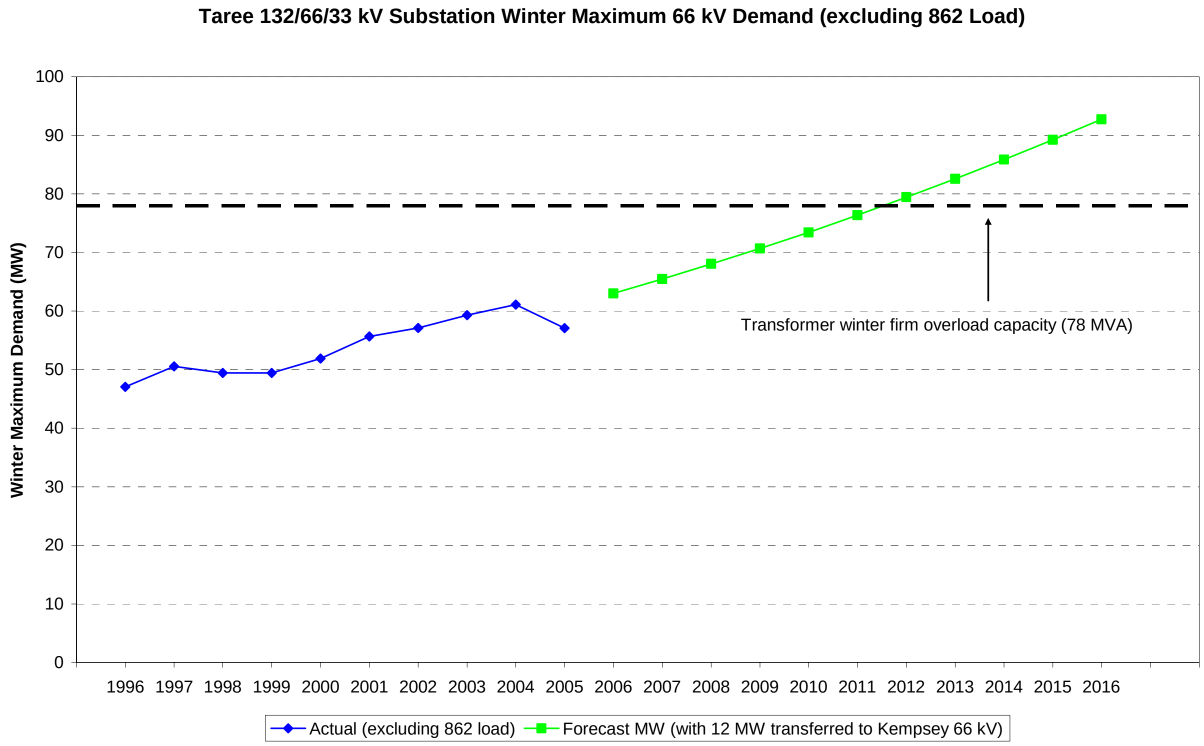


Figure D3 Actual and Forecast Summer Maximum Demands for Taree 66 kV Supply

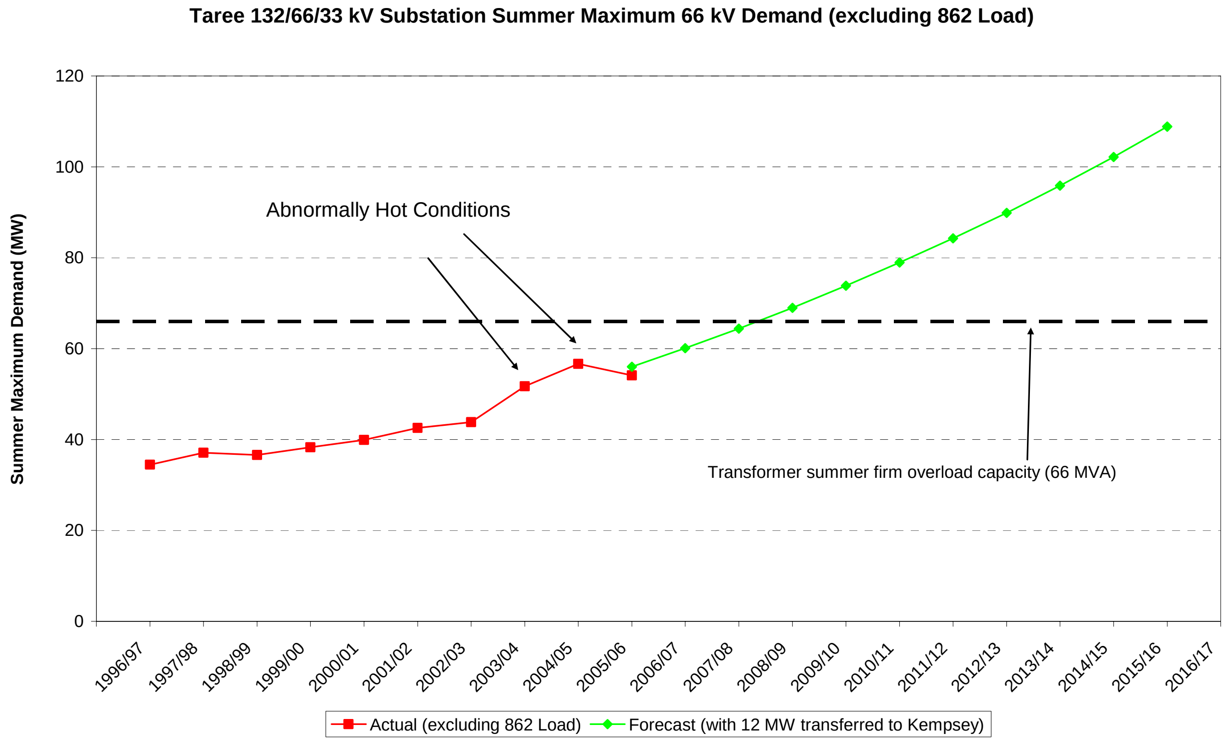
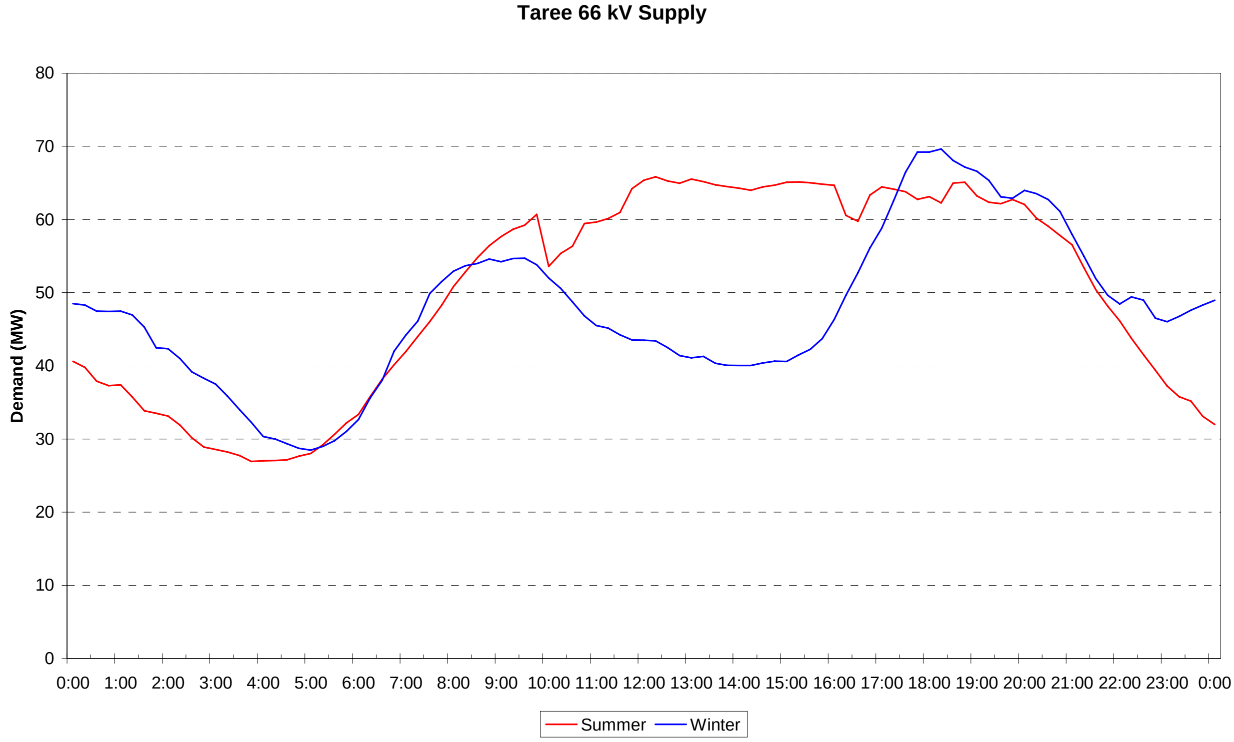


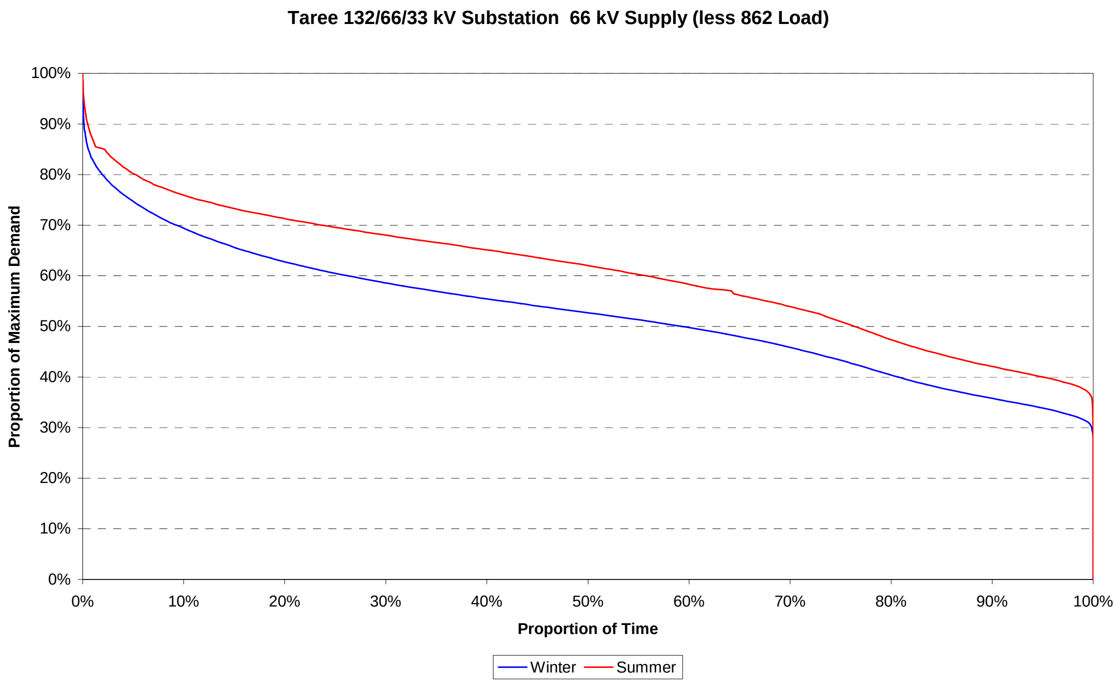
Figure D4 shows the profile of usage on the days of maximum demand in winter 2005 and summer 2005/06.

Figure D4 Load Profile on Day of Winter and Summer Maximum Demands



The highest demands exist for only comparatively short periods. Figure D5 shows the summer and winter load duration curves (averaged over the last four years). These curves show the proportion of time that particular demands, expressed as a proportion of the maximum demand in that season, are exceeded.

Figure D5 Load Duration Curves for the Taree 66 kV Supply



In general periods of high demand in the Stroud to Taree area occur less frequently and for shorter periods in winter than in summer. Table D1 shows the frequency and typical maximum duration of high demand events (where demand exceeds a particular proportion of the maximum demand for that season).

Table D1 Taree 66 kV Supply Duration of Periods of High Demand

Proportion of Maximum Demand	Summer		Winter	
	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)
80%	110	12	50	4
85%	50	11	20	3
90%	20	8	8	2
95%	5	5	4	1

Appendix E The Nature of the Kempsey 33 kV Load

The demand for electricity supplied at 33 kV from Kempsey is seasonal, with the highest demands occurring during winter. Summer maximum demands are typically around 80% to 90% of the winter maximum demands. However, summer demand is growing at a faster rate than winter demand and it is expected that summer demand will exceed the winter demand in around ten years. Figure E1 shows the maximum demands (averaged over a half hour period) for each day from 1 July 1999 to 28 February 2006.

Figure E1 Daily Maximum Demands for the Kempsey 33 kV Supply

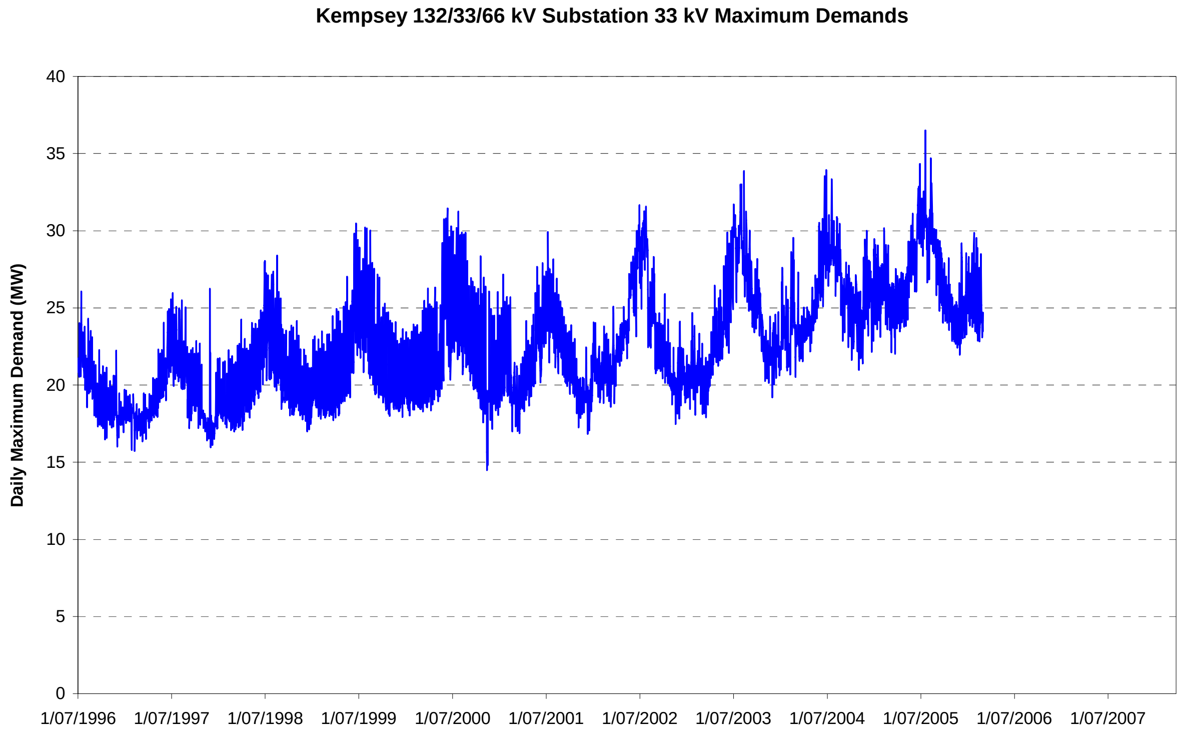


Figure E2 and Figure E3 show actual and forecast winter and summer maximum demands.

Figure E2 Actual and Forecast Winter Maximum Demands for the Kempsey 33 kV Supply

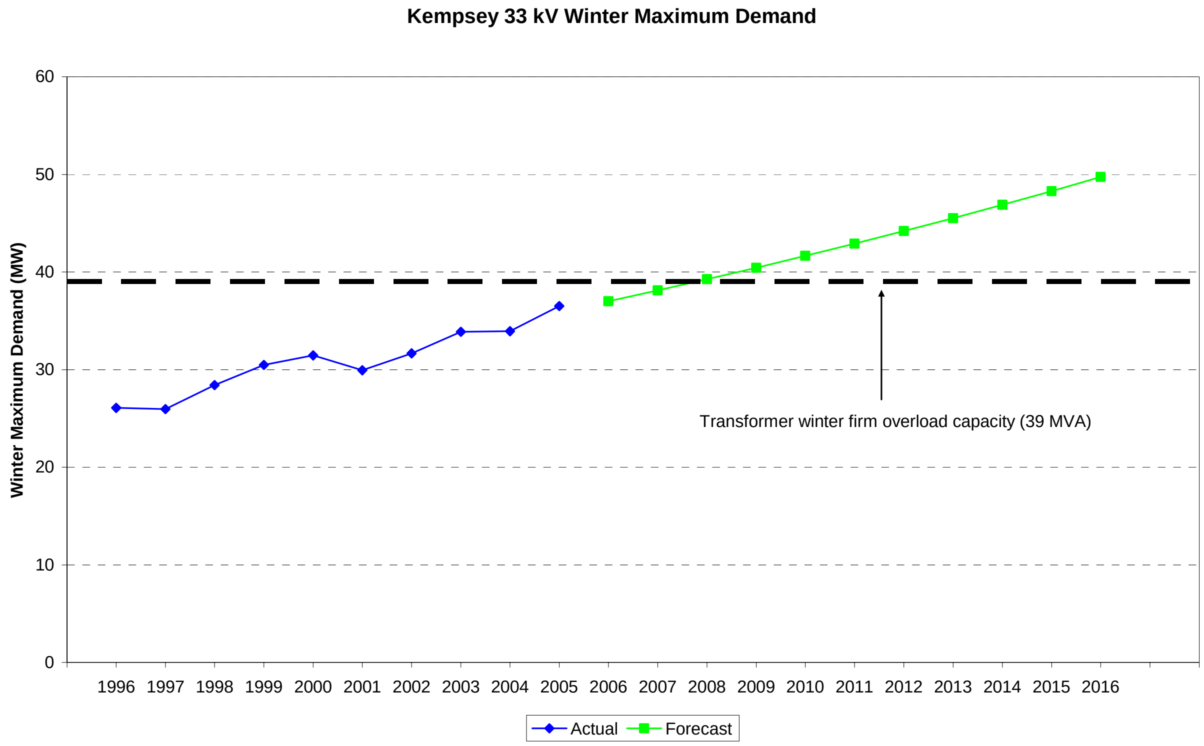


Figure E3 Actual and Forecast Summer Maximum Demands for the Kempsey 33 kV Supply

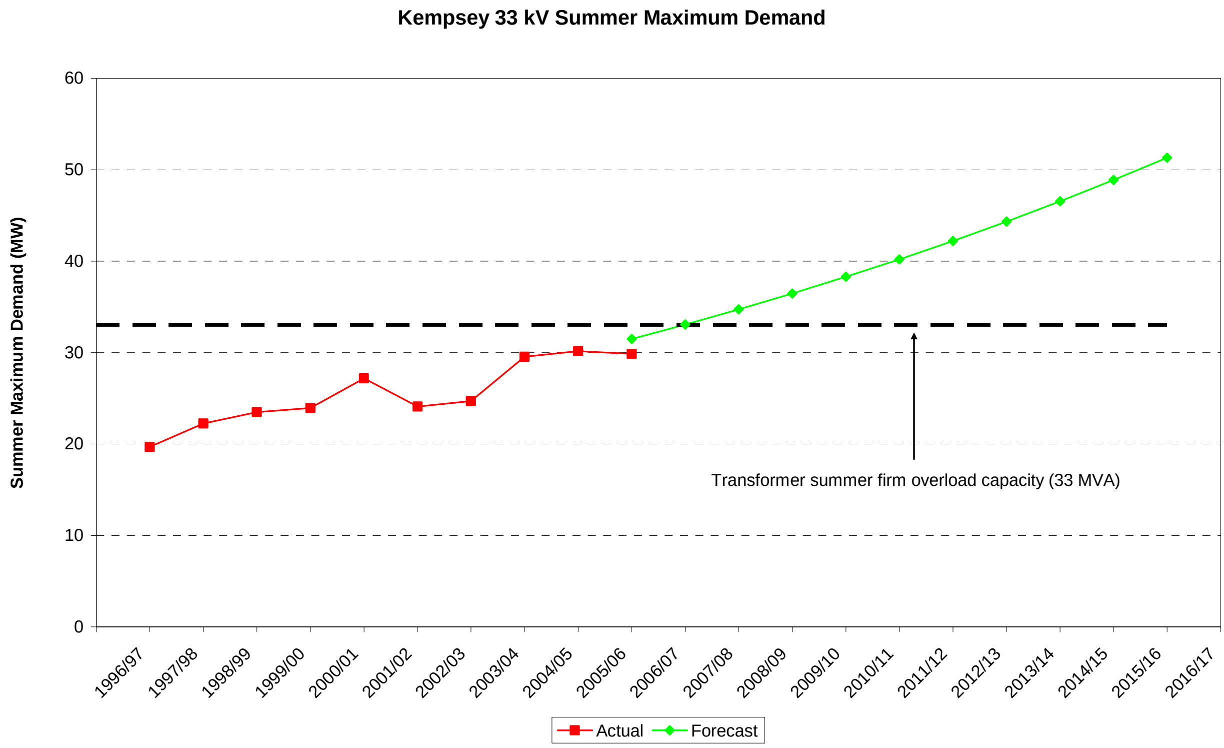
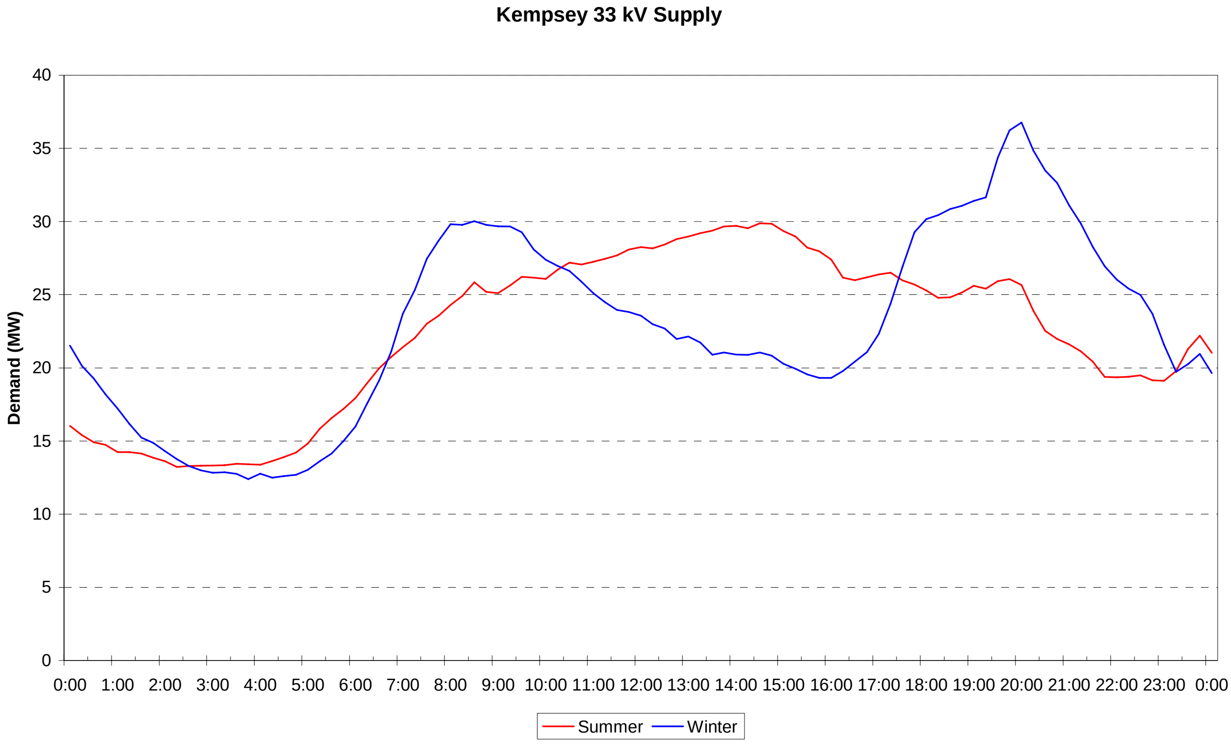


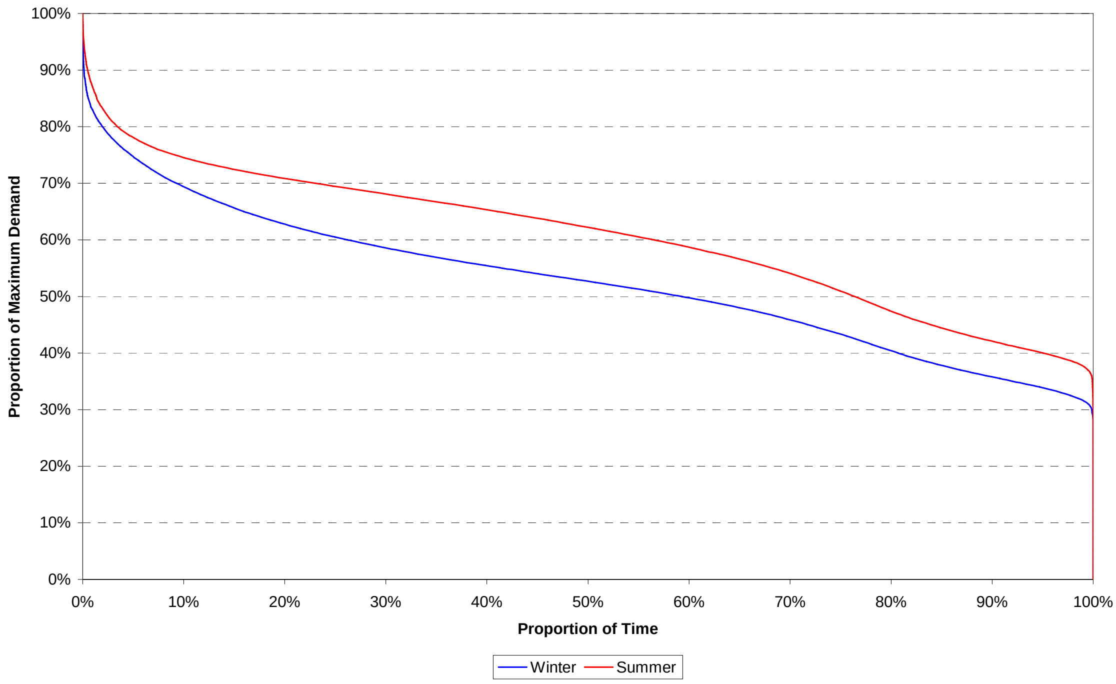
Figure E4 shows the profile of usage on the days of maximum demand in winter 2005 and summer 2005/06.

Figure E4 Load Profile on Day of Winter and Summer Maximum Demands



The highest demands exist for only comparatively short periods. Figure D5 shows the summer and winter load duration curves (averaged over the last four years). These curves show the proportion of time that particular demands, expressed as a proportion of the maximum demand in that season, are exceeded.

Figure E5 Load Duration Curves for the Kempsey 33 kV Supply.



Periods of high demand in the load supplied at 33 kV from Kempsey occur less frequently and for shorter periods in winter than in summer. Table E1 shows the frequency and typical maximum duration of high demand events (where demand exceeds a particular proportion of the maximum demand for that season).

Table E1 Kempsey 33 kV Supply Duration of Periods of High Demand

Proportion of Maximum Demand	Summer		Winter	
	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)	Typical Number of Events p.a.	Typical Maximum Event Duration (hours)
80%	90	11	75	3
85%	50	8	25	2
90%	20	5	7	1
95%	7	2	2	1