Request for Information –

Emerging Transmission Network Limitations

Electricity Transfer to the

Gold Coast and Tweed Area

Powerlink Queensland
22 August 2003

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1.0 Executive Summary

As part of their joint planning activities TransGrid, Country Energy, Powerlink and Energex have identified emerging limitations in the network supplying the far north coast of New South Wales and in the network supplying the Gold Coast. This document and a companion document produced by TransGrid and Country Energy detail these limitations.

This document deals with the area supplied by the Queensland electricity network, which includes the Gold Coast area (south of Cades County) in south east Queensland and the Tweed Shire in northern New South Wales. Powerlink and Energex have identified emerging limitations in the electricity network that transfers power to the Gold Coast/Tweed zone.

Electricity demand in the Gold Coast/Tweed zone is growing at one of the highest rates in Queensland. Demand is anticipated to grow at an average of 4.5 – 5.5% p.a for the next ten years.

The Gold Coast/Tweed zone is primarily supplied by two single circuit 275kV transmission lines from Swanbank to Mudgeeraba. A connection from one of these circuits to Molendinar, at the northern end of the Gold Coast, is under construction and planned for completion in late 2003. This 275kV network is supported by a 110kV connection from Belmont and Loganlea to Molendinar via Beenleigh. Some power can also be injected into the area from New South Wales via the Directlink market network service provider.

Consistent with the National Electricity Code and its transmission authority requirements, Powerlink plans future network augmentations so that the reliability and power quality standards of Schedule 5.1 of the Code can be met during the worst single credible fault or contingency (N-1 conditions) unless otherwise agreed with effected participants.

In the Gold Coast/Tweed zone, the most critical contingency will be an outage of the 275kV transmission line between Swanbank and Molendinar and Mudgeeraba. When that 275kV circuit is out of service, Powerlink has identified that the following network limitations are likely to occur:

- from the summer of 2005/06 onwards, the capability of the existing system limited by voltage stability will be exceeded

If no corrective action is taken, some interruptions to customer supply will need to occur throughout the area to prevent voltage collapse and to re-establish secure operation of the system.

The analysis is based on assumptions about future electricity demand and anticipated generation patterns. It indicates that reinforcement of supply to the Gold Coast/Tweed zone is required prior to late 2005 to avoid loss of supply to customers during a 275kV network contingency.

Powerlink seeks feedback on this Request for Information and information on potential solutions to the emerging limitations which may be able to be provided by parties other than Powerlink. Submissions are due by 19 September 2003. A decision is required by December 2003.

2.0 Introduction

As part of their joint planning activities TransGrid, Country Energy, Powerlink and Energex have identified emerging limitations in the network supplying the far north coast of New South Wales from Armidale and in the network supplying the Gold Coast from Queensland. This document and a companion document "Emerging Transmission Network Limitations on the New South Wales Far North Coast" produced by TransGrid and Country Energy detail these limitations and seek information on potential solutions to these emerging limitations.

This document deals with the area supplied by the Queensland electricity network, which includes the Gold Coast area (south of Cades County) in south east Queensland and the Tweed Shire in northern New South Wales.

Corrective action is required if reliable supply is to be maintained in the area during credible contingencies. This document seeks information on potential solutions that may be available. It is an integral part of Powerlink's approach to meeting National Electricity Code requirements that ensure adoption of the most cost-effective solution to future network limitations.

Consistent with the requirements of the NEC, Powerlink and Energex are working closely with our New South Wales counterparts, TransGrid and Country Energy. Information received in response to this document will be shared with our New South Wales counterparts and vice versa, with the objective of identifying the best overall solution(s) to the emerging limitations in both networks.

2.1 Purpose of the 'Request for Information'

The purpose of this paper is to:

- provide information about the existing transmission network in the relevant area

- provide information about emerging network limitations in the Queensland supply system and the expected time at which action must be taken to maintain system reliability

- seek comments on the approach and assumptions adopted

- seek information on solutions to the emerging limitations which may be able to be provided by parties other than Powerlink and Energex

- explain the process to be used to evaluate alternative solutions.

2.2 Background

Powerlink Queensland is responsible for ensuring its network has sufficient capacity to provide network services to customers[1]. If technical limits of its transmission system will be exceeded, Powerlink is required to notify Code participants within the time required for corrective action.

Before constructing any major network augmentation to maintain reliability of supply, Powerlink must also meet the following regulatory requirements[2]:

- consult with Code participants and interested parties regarding alternative solutions, including those which may be provided by parties other than Powerlink. These may include local generation, demand side management (ie – initiatives by customers to manage or reduce demand), interconnectors and options involving other networks including market network services.

  demonstrate proper consideration of various market development scenarios, including variations in electricity demand growth rates, and the ability of reasonable options to satisfy emerging network limitations under these scenarios.

- ensure that the recommended solution meets reliability requirements at the lowest total net present value cost when compared with other feasible solutions.

This discussion paper is a critical step in fulfilling these regulatory obligations in relation to the Gold Coast/Tweed zone.

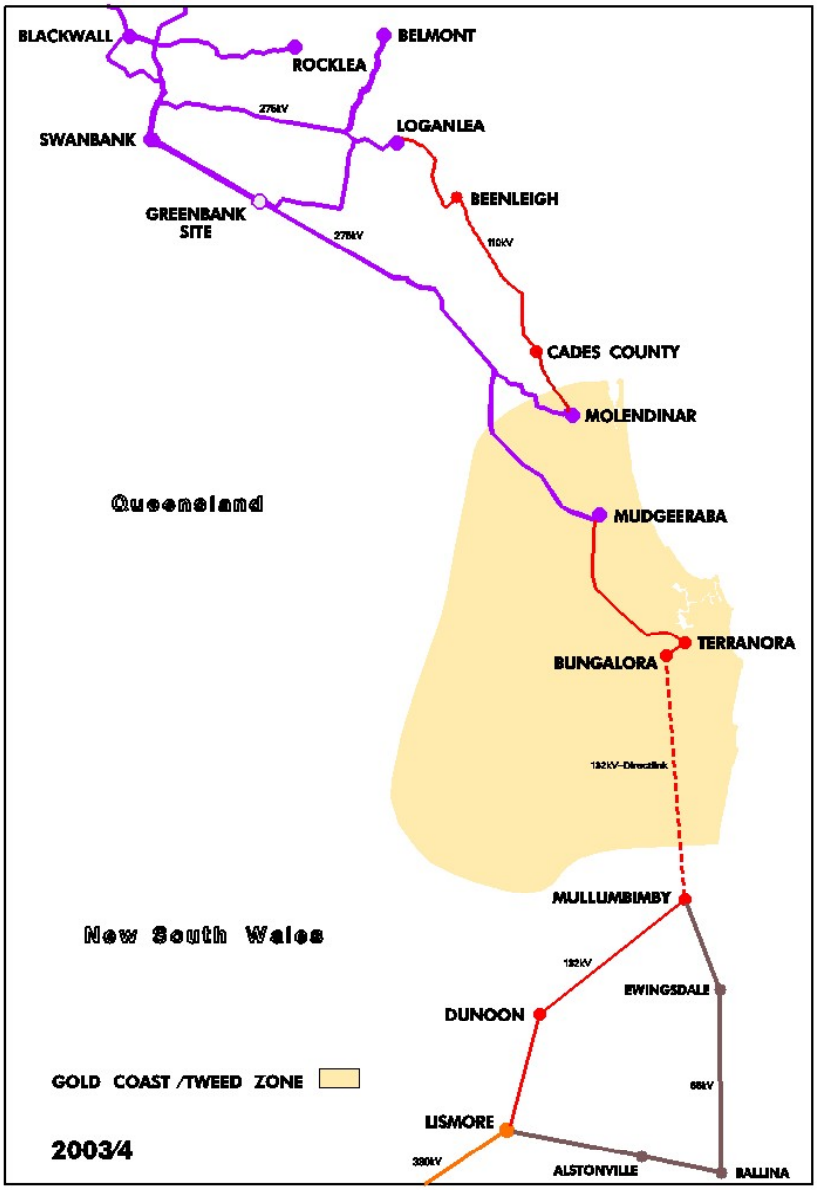
[1] Powerlink's transmission authority includes a responsibility "to ensure as far as technically and economically practicable, that the transmission grid is operated with enough capacity (and if necessary, augmented or extended to provide enough capacity) to provide network services to persons authorised to connect to the grid or take electricity from the grid." (Electricity Act 1994, S34.2).

[2] As set by the ACCC and contained in Chapter 5 of the National Electricity Code

3.0 Existing Electricity Networks

3.1 Geographic Area

The geographic area covered by this 'Request for Information' is referred to in this document as the Gold Coast/Tweed zone. The relevant area is shown on the map below[3], and spans the border between the states of New South Wales and Queensland. It is defined as the Gold Coast area of south east Queensland (south of Cades County) to Coolangatta, together with the Tweed Shire in northern New South Wales. This includes the entire Gold Coast/Tweed tourism, commercial and residential area.



[3] Map shown as at 2003/04 after 275kV tee connection to Molendinar is completed (now under construction)

3.2 Electricity Supply Overview

Customers in the Gold Coast/Tweed zone receive their electricity supply from local distributors in each state, namely Energex in Queensland and Country Energy (formerly Northpower) in New South Wales.

The majority of the electricity used in the area is produced at Queensland power stations. It is transferred to the Gold Coast/Tweed zone via Powerlink's 275kV transmission network, with support from the Energex 110kV network.

Some power can also be supplied to the Gold Coast/Tweed zone from power stations in New South Wales.

The following sections provide information about the existing transmission and distribution networks in Queensland (see also Figure 1). A brief description of the networks in New South Wales is also provided, but it is recommended that interested parties refer to the document "Emerging Transmission Network Limitations on the New South Wales Far North Coast" produced by TransGrid and Country Energy, which is also available on the Powerlink website.

3.3 Queensland Transmission Network

3.3.1. Existing System

The primary supply to the Gold Coast/Tweed zone is via two single circuit 275kV transmission lines from Swanbank (near Ipswich west of Brisbane) to Mudgeeraba (on the southern end of the Gold Coast). Under typical conditions, these high voltage transmission circuits deliver more than 95% of the power used in the area.

A secondary supply path is available from Powerlink's 275kV substations at Belmont and Loganlea to the Gold Coast area via Beenleigh. This path consists of a single circuit 110kV line between Beenleigh and Cades County, and another single circuit 110kV line from Cades County to Molendinar[4]. This 110kV network typically supplies power to areas to the north of the Gold Coast/Tweed zone (only as far south as Cades County). That is, power is transferred south from Beenleigh to Cades County and north from Molendinar to Cades County. However, during a contingency on a 275kV Swanbank-Mudgeeraba circuit, these 110kV circuits can flow southwards to provide back-up supply to the Gold Coast/Tweed zone.

The transmission network supplies bulk power to the lower voltage distribution networks owned by Energex and Country Energy via 110kV substations in the relevant area. These 110kV substations are located at Molendinar, Nerang, Southport, Surfers Paradise, Broadbeach, Burleigh, Robina and Terranora.

[4] Both lines are owned by Energex

3.3.2. Future Network Developments in Queensland

Powerlink is constructing a 275kV tee connection that will allow the establishment of a second Gold Coast 275/110kV injection point at Molendinar. This project consists of a 12.5 km transmission line connecting into an existing Swanbank-Mudgeeraba 275kV circuit at Maudsland. It is scheduled for completion by late 2003. The tee connection does not change the total amount of power able to be transferred to the Gold Coast/Tweed zone. It will, however, significantly improve the capability of the electricity network to transfer power within the Gold Coast/Tweed zone to where it is needed thereby overcoming capacity limits within the 110kV distribution network. The project will also provide additional 275kV to 110kV transformer capacity.

Powerlink is also installing a shunt capacitor bank at Molendinar to assist with managing voltage stability in the Gold Coast/Tweed zone. This is scheduled for commissioning in October 2004.

Energex is also carrying out works to strengthen its 110kV Beenleigh to Molendinar transmission lines and its distribution network in the Gold Coast area.

Energex is proposing the establishment of Coomera 110/33kV substation in 2004/5. Establishment of this substation will have the effect of transferring a significant portion of the 33kV load currently supplied from Molendinar to the area supplied from Loganlea.

These projects have been included in the planning studies that have identified emerging network limitations in the transmission network supplying the Gold Coast.

The network including these future developments is shown in Figure 1.

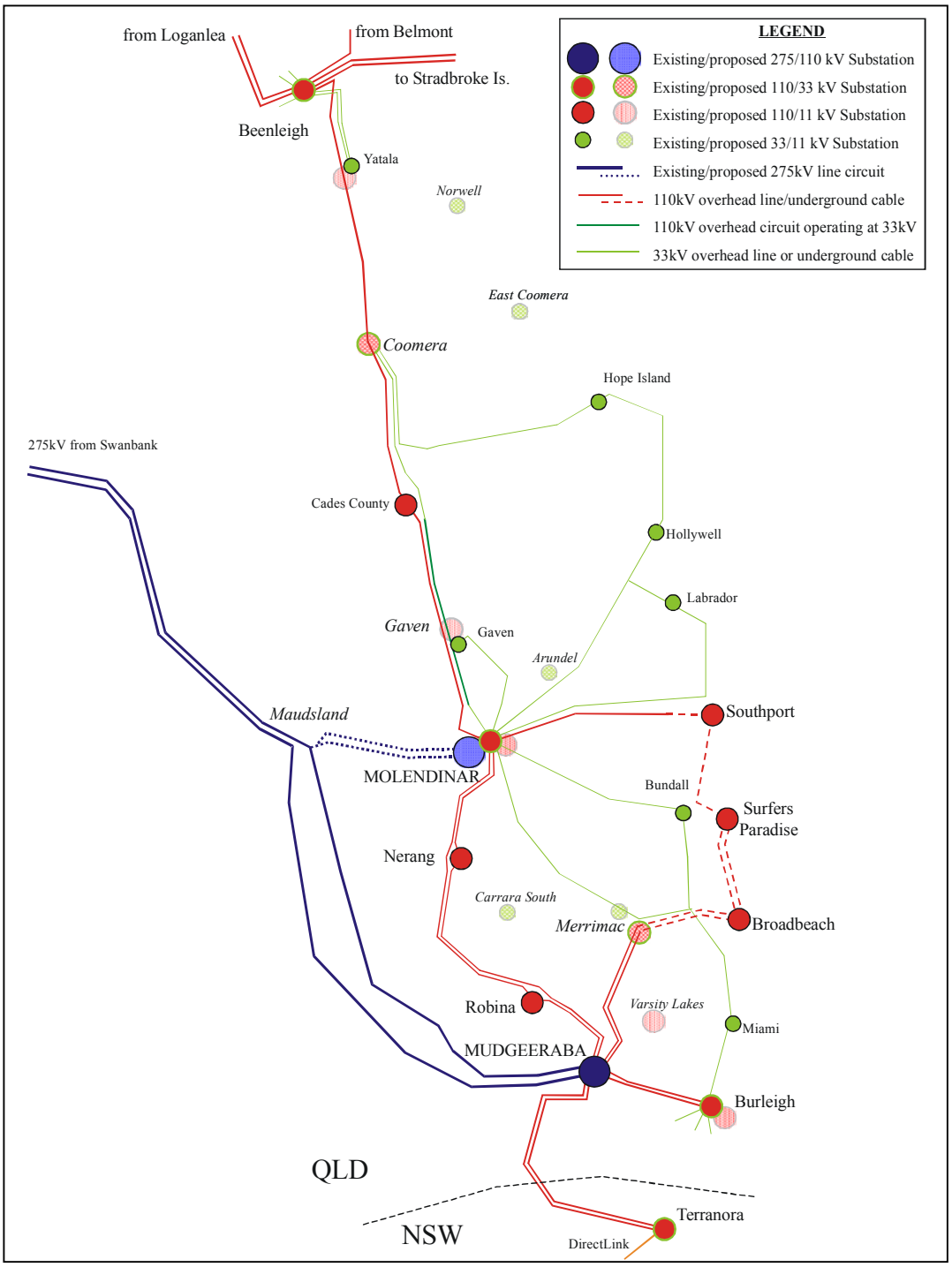


Figure 1: Gold Coast 110kV Network and 275kV supply

3.4 Adjacent Transmission Networks

As noted in section 3.2, it is possible to meet some of the local customer demand in the Gold Coast/Tweed zone via 'import' from the New South Wales region of the National Electricity Market.

Such import occurs by transferring power from NSW generators to northern New South Wales across TransGrid's high voltage transmission grid[5] to Lismore then across Country Energy's 132kV network to Mullumbimby. Lismore is supplied from the south via a single circuit 330kV line, supported by an interconnected 132kV network. Mullumbimby is connected to Lismore by a double circuit 132kV line.

From Mullumbimby, the northern-most 132kV substation in the New South Wales transmission network, the power can be transferred to the Gold Coast/Tweed zone via the market network service provider Directlink. This 180MW link operates between Mullumbimby and Terranora in the Tweed region of New South Wales, and effectively provides a connection between the Queensland and New South Wales state transmission networks.

At present, there are limitations in the power transfer possible across Directlink that are not related to the 180MW capacity of the link itself. There are limits in the electricity networks in both Queensland and New South Wales that can, in certain circumstances, restrict power transfer across Directlink.

When Directlink flows in a northerly direction towards Queensland, it places an equivalent additional demand on the New South Wales transmission network. That is, additional power needs to be transferred from New South Wales power stations to northern New South Wales to meet Directlink's requirements[6].

TransGrid has identified limitations in its network supplying the far north coast of New South Wales from Armidale. Details of these limitations are detailed in a companion document to this document entitled "Emerging Transmission Network limitations on the New South Wales Far North Coast".

The Directlink unregulated interconnector may be able to contribute to a solution to either the Queensland or New South Wales network limitations, for some period of time. However, given that network limitations are emerging in both areas, Directlink alone cannot provide a long term solution to both needs. Preliminary discussions have been held with Directlink.

[5] TransGrid is the owner and operator of the high voltage transmission grid in New South Wales.

[6] When Directlink is transferring power southwards, the reverse situation occurs. Southerly flow on Directlink requires the transmission network between Queensland power stations and the Gold Coast to carry sufficient power to meet the requirements of customers in the Gold Coast/Tweed area, as well as the amount being exported by Directlink.

4.0 Power Generation Capacity

4.1 Existing and Committed Generation Capacity

There are no large (>30MW) power generation facilities operating in the Gold Coast/Tweed zone. To Powerlink's and Energex's knowledge, there are also no commitments to establish scheduled generation facilities[7] in the area.

A non-scheduled embedded generator is located at Rocky Point Sugar Mill south east of Beenleigh. This facility has an annual output of approximately 160,000 MWh. Because of its location, this cogeneration facility primarily contributes to supplying the Logan/Beenleigh area. It plays only a minor role in meeting the energy needs of customers in the Gold Coast/Tweed zone. This role has been accounted for as a reduction in the demand forecasts in section 5.3.

The majority of power used in the area is produced at power stations to the west and north of Brisbane. It is transported to the area via the 275kV network from Blackwall and Swanbank. The closest major power generation source to the Gold Coast/Tweed area is at Swanbank, near Ipswich. The existing capacity available at this location is 855MW made up of 4 x 125MW units at the Swanbank B coal-fired power station and the 355MW gas-fired generating unit known as Swanbank E.

If Directlink is flowing northward, power also reaches the area from major power stations in New South Wales.

4.2 Future Generation Capacity

Powerlink and Energex are not aware of any proposals to establish a major power generation facility in the Gold Coast/Tweed zone.

However, several proposals for additional embedded generation facilities in the area have been publicly canvassed. Embedded generation facilities connect to the local lower voltage network rather than Powerlink's transmission grid, and are usually smaller than 30MW in size. Proposals include sugar mill cogeneration at Condong Mill in the Tweed area, a green waste plant at Stapylton near Beenleigh and municipal waste generation facilities.

Because no commitment has been made to these projects, they have not been included in the analysis outlined in this paper. However, interested parties should note that increases in embedded generation have already been factored into the load forecasts as noted in section 5.3.

[7] Scheduled generators are those that are dispatched according to bidding outcomes in the National Electricity Market, and are usually greater than 30MW in size.

5.0 Electricity Demand

5.1 Overview

The majority of the electricity demand in the Gold Coast/Tweed zone is associated with residential, commercial and tourism-related loads. Local industrial customers, primarily located at the northern end of the target area also contribute to the electricity usage in the area.

5.2 Pattern of Use

The Gold Coast/Tweed zone peak electricity demand occurs in winter.

However, summer peak demand is more critical in determining the ability of the transmission system to meet customer demand. This is because the transmission network is not physically capable of transferring as much power in summer as in winter[8]. In addition, summer demands place greater stress on the electricity system as summer peaks occur for longer periods during the day than winter peak demands.

As can be seen in Figure 2 below, summer peak weekday electricity demand in the affected area is relatively constant throughout the day, with little change in demand from 9.00am to 9.00pm. The load duration curve at Figure 3 shows the number of hours in the summer that high loads can be expected.

Daily Load Profiles - Summer

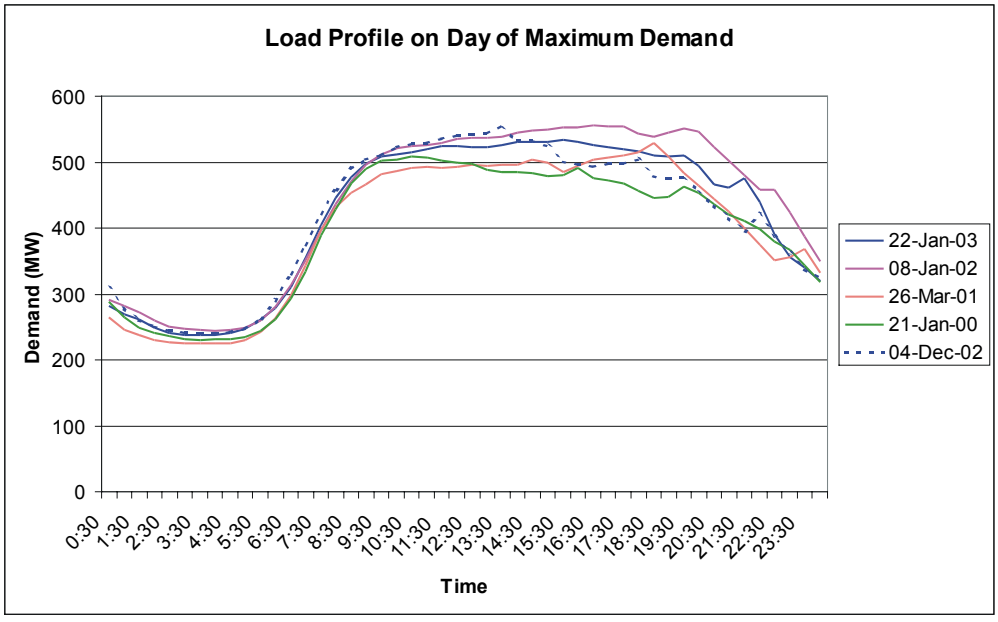


Figure 2: Load profiles of the summer peak for the Gold Coast/ Tweed zone

[8] High summer temperatures result in lower transmission line and equipment ratings and a greater reactive power demand (need for voltage support).

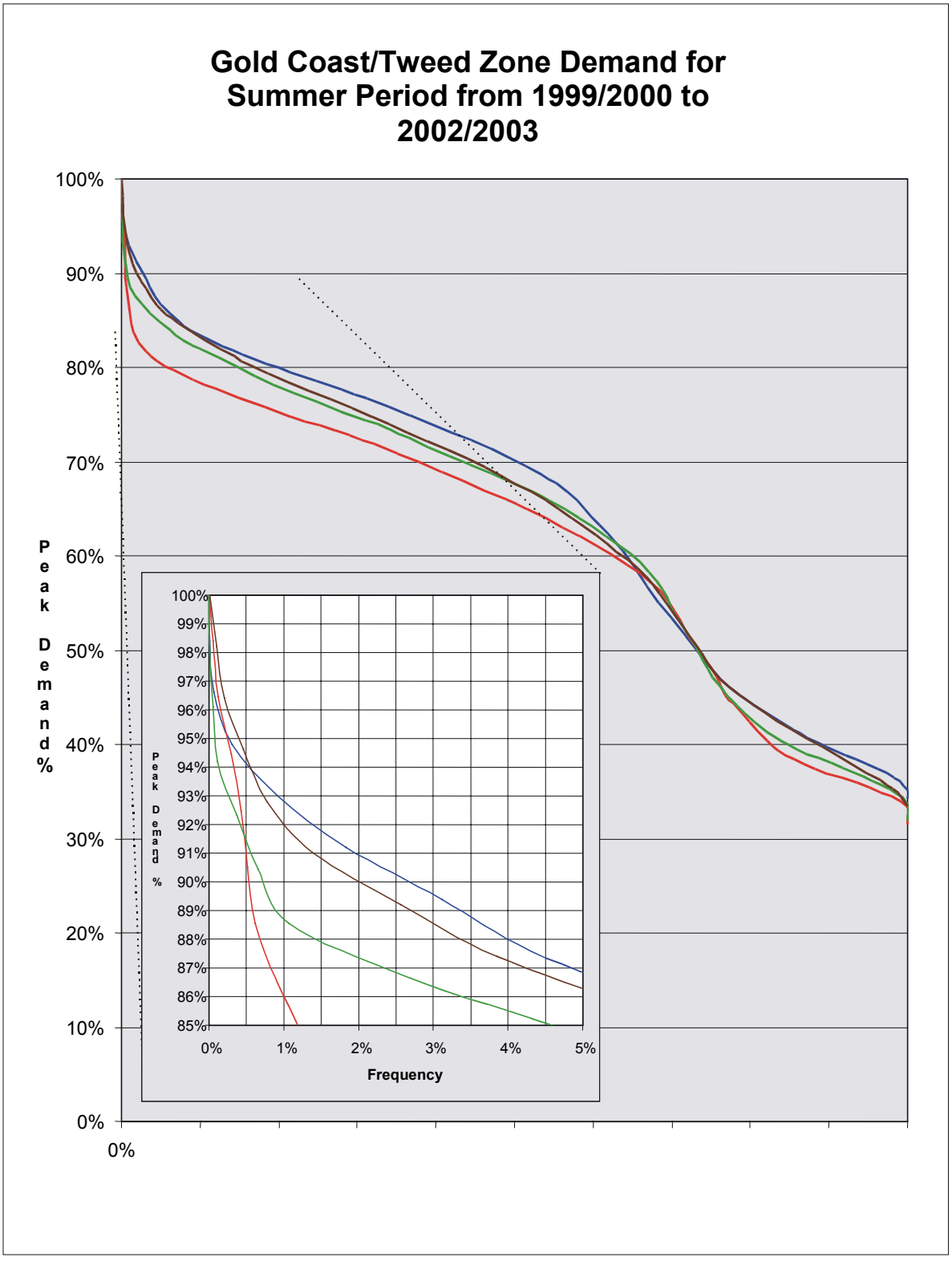


Figure 3: Gold Coast/Tweed Zone Cumulative Load Duration for the summers of 1999/00, 2000/01, 2001/02, 2002/03 (October – March)

5.3 Electricity Demand Forecasts

The Gold Coast local government area is experiencing one of the fastest population growth rates in Queensland. A correspondingly high growth in electricity demand is predicted averaging a predicted 3.6% per annum for the next 10 years, with an intense growth period of 6% p.a. over the next three year period. This fast growing demand for power (approximately 25 – 40MW per year) is placing considerable stress on the existing electricity supply system.

Gold Coast/Tweed Zone Forecast Maximum Summer Demand on Transmission Grid	
Moderate Growth	**Average Temperature (MW)**
01/02 actual	534
02/03 actual	582
03/04	649
04/05	656
05/06	685
06/07	711
07/08	731
08/09	758
09/10	781
10/11	806
11/12	832

The apparent reduction in the rate of growth in 2004/5 is due to the planned establishment by Energex of a new substation at Coomera. This will have the effect of transferring some demand, which is currently supplied from the Gold Coast/Tweed zone, out of the zone.

Powerlink obtains electricity demand forecasts over a ten-year horizon from Distribution Network Service Providers and customers at each connection point in Powerlink's transmission system. These forecasts thus take account of demand management programs in place or foreseen by distributors, and also the presence of embedded generation which may reduce the forecast of demand which needs to be supplied via each transmission connection point.

The Powerlink annual demand forecast is obtained by aligning the local distributor forecasts with an independent assessment of energy and demand forecasts for the Queensland region carried out by the National Institute of Economic and Industrial Research (NIEIR). This independent assessment included a review of the impact of new embedded generation. The NIEIR forecasts assume a medium economic scenario and assume a 50% probability weather pattern.

The demand forecast in the table was obtained by modifying the Powerlink annual forecast to reflect known changes in the timing of future augmentation projects such as the establishment of the Coomera substation.

6.0 Transmission Planning Criteria

As a transmission network service provider (TNSP), Powerlink must comply with technical standards in the National Electricity Code. In particular, requirements relating to reliability and system security contained in Schedule 5.1 of the Code are relevant to planning for future electricity needs. In particular, Schedule 5.1 requires that:

- the power frequency voltage is maintained within limits outlined in S5.1.4;
- voltage fluctuations do not exceed limits set out in S5.1.5;
- harmonic voltage distortion does not exceed limits set out in S5.1.6;
- voltage unbalance does not exceed limits set out in S5.1.7;
- the power system can operate in a stable state as defined in S5.1.8;
- faults can be cleared in times specified in S5.1.9;
- NEMMCO be advised of current ratings as required in S5.1.12. NEMMCO has a related obligation (4.3.1 (f)) to operate the power system within all plant capabilities.

Schedule 5.1 also includes details of credible contingencies and levels of redundancy to be considered in planning and operating the transmission network, such as:

- 'System Normal': the absolute minimum level of reliability required. Defined as the ability to supply all load with all elements of the electricity system intact (ie – loss of supply would occur during a single fault or contingency).
- 'N-1': able to meet peak load with the worst *single* credible fault or contingency, and
- 'N-2': able to supply all peak load during a *double* contingency.

Consistent with the National Electricity Code and its transmission authority requirements, Powerlink plans future network augmentations such that the reliability and power quality standards of Schedule 5.1 can be met under conditions of 'N-1'. The connection agreement between Powerlink and Energex includes obligations regarding the reliability of supply as required under clause 5.1.2.2 of the Code.

6.1 Planning Criteria for Gold Coast/Tweed zone

This paper summarises studies which assess emerging network limitations in the Gold Coast / Tweed zone. Consistent with Powerlink's planning criteria, section 8.0 of this paper covers the capability of the existing network to maintain supply during the disconnection of any single transmission element (ie: N-1 criterion). The most critical network element in the Gold Coast/Tweed zone will be the 275kV transmission line between Swanbank and Molendinar and Mudgeeraba (the Maudsland Tee)[9].

[9] Network limitations outlined in section 6.0 are based on expected power flows during an outage of the 275kV transmission line between Swanbank and Molendinar, and maximum current ratings of relevant transmission equipment advised to NEMMCO as required by S5.1.12 of the Code.

7.0 Background – Network Capability

There is a range of technical factors that influence transmission network capability. Most important in relation to the network supplying the Gold Coast/Tweed zone are voltage control and thermal ratings of equipment.

7.1 Voltage Stability

It is important for the quality of electricity supply to customers and the integrity of the total power system to maintain satisfactory voltage levels.

A fault or contingency can cause system voltages to fall rapidly. This is because a network fault causes increased power flows on the remaining equipment in service (ie- higher electrical current). Voltage drop is directly related to power flow, meaning that higher power flows following a fault or contingency result in a drop in voltage in the areas being supplied. Unacceptably low voltage profiles can lead to collapse of the power system and widespread uncontrolled loadshedding as the problem 'cascades' to other elements of the network. Other consequences of low voltages may include 'brown-outs', failure of and/or damage to customer equipment such as motors etc.

Following a contingency, voltage can be improved after some tens of seconds through automatic adjustments to transformer operation (tapchanging). To a limited extent, system voltages can also be managed through the installation of voltage regulation equipment in the network (eg – capacitor banks, static var compensators etc).

Other factors that influence voltage control include the type of power use (eg – air conditioning load requires more voltage support), the amount of local power generation and the number of generating units which are operating. If local generators are operating and are able to provide sufficient voltage support[10] when a contingency occurs, the impact of a network outage on voltages is reduced. Voltage collapse occurs if networks are so heavily loaded that voltage regulation equipment is unable to improve falling voltage conditions following a contingency.

7.2 Thermal Ratings

During the loss of items of transmission plant due to a fault or other contingency, the remaining elements of the transmission system must be able to carry the total load to avoid loadshedding. It is important to ensure that the physical capability of the remaining equipment will not be exceeded under these conditions.

The thermal ratings of lines and other equipment refer to the safe maximum current carrying capacity. For lines, these ratings are set at a level to avoid breaching statutory ground clearances. Ratings may be safely exceeded for very short periods, but extended operation above plant ratings will cause line conductors to sag below safe levels and/or items of equipment to burn out. Powerlink's transmission authority requires it to protect its transmission grid to ensure the safe transmission of electricity. Loadshedding may be required to avoid exceeding thermal ratings.

[10] ie - supplying reactive power (MVArs)

8.0 Emerging Network Limitations

8.1 Limiting Factors

The ability to reliably meet customer demand in the Gold Coast/Tweed zone is driven entirely by the capability of the transmission network, as there is no significant generation capacity in the zone.

The capability of the Queensland transmission system to transport power into the Gold Coast/Tweed zone is at present limited not by the thermal rating of the transmission lines but the loss of stable voltage control. This is often referred to as a "voltage stability limit", which is determined for the worst single contingency.

Additional capacity to supply power to the Gold Coast/Tweed zone is provided by the Directlink interconnector, which has the capacity to transmit up to 180MW into the Gold Coast/Tweed zone. Directlink is a "market network service provider" connecting the Queensland and New South Wales systems and as such its operations will depend on market conditions and the capacity of the systems to which it is connected[11]. The capability of the Queensland system itself is actually reduced when Directlink is supplying some of the load. However under these circumstances the total supportable load is increased because the reduction in transmission capability is less than the power supplied by Directlink. This means that for every MW supplied by Directlink, the maximum supportable load is increased by 0.3 to 0.4 MW.

8.2 Limiting Contingency

For supply to the Gold Coast/Tweed zone the critical contingency after the 275kV connection to Molendinar is established, will be an outage of the Maudsland tee, which will provide 275kV supply to both Molendinar and Mudgeeraba.

[11] TransGrid, the transmission network service provider in New South Wales, as part of the joint planning process with Powerlink, has issued a companion document to this request for information, commenting on emerging limits in the capacity of its system to supply the Far North Coast region of New South Wales.

8.3 Voltage Stability Limitations in the Gold Coast/Tweed zone

Detailed investigations have determined that during periods of peak load, the capability of the existing network to supply the Gold Coast/Tweed zone will be exceeded during a single contingency by the summer of 2005/6[12] [13] [14]. Without corrective action, customer loadshedding will be required during single contingencies from late 2005 onwards (in summer peak periods) in order to prevent voltage collapse and to allow safe operation of the system.

This analysis indicates that reinforcement of supply to the Gold Coast/Tweed zone is required by late 2005 to overcome voltage stability limitations and prevent loadshedding during single contingencies.

8.4 Other Emerging Limits

Two other limiting factors on the supply system to the Gold Coast/Tweed zone may emerge in the next five years depending on the solution adopted to address the voltage stability limit.

If the solution to the voltage stability limit permits the forecast load to continue to be supplied via only the existing transmission lines then additional network issues will emerge.

After the establishment of Coomera substation and other distribution works outlined in section 3.3.2 the Beenleigh to Cades County line will be turned in to the Coomera substation. By late 2005 the electricity supply to the Gold Coast/Tweed zone will be limited by the 110kV connection between Beenleigh and Coomera which will have a summer normal rating of 169 MVA and a summer emergency rating of 200 MVA. After that time an outage of one of the 275kV Swanbank to Mudgeeraba transmission lines will result in the loss of the Beenleigh to Coomera circuit due to overloading. The loss of this 110kV connection to the Gold Coast will place further stress on the single remaining 275kV circuit which could result in interruptions to customer power supply in the Gold Coast area.

[12] The transfer limit is influenced by the pattern of generation in south east Queensland. The base case assumed in this modeling is that Swanbank E power station is running at 320 MW, three Swanbank B units are running at 100MW each and two Wivenhoe units are running, one generating 100MW and one running as a synchronous condenser. This assumption is based on a typical market despatch observed in the summer period.

[13] Consistent with an approach of cost efficient network development, Powerlink and Energex have agreed some short term operational strategies to manage the network prior to the summer of 2005/06 should the demand require power flows which approach the transfer limit of the network. Such operational strategies are only a short term measure, and from the summer of 2005/06 onwards corrective action to address limitations in the capacity of the transmission system is required. The output of embedded generation has been included as a reduction in forecast peak demand and therefore has already been accounted for.

[14] The output of embedded generation has been included as a reduction in forecast peak demand and therefore has already been accounted for.

By 2007 to 2009, depending on load growth, the two existing 275kV transmission lines from Swanbank to Mudgeeraba will be approaching thermal limits in the event of an outage of the other 275kV circuit. The thermal ratings of these lines are 506 MVA summer normal and 706 MVA summer emergency.

These two emerging limitations may influence the economics of determining the most appropriate solution to increase the transfer limit into the zone so that forecast maximum demand can be met.

9.0 Factors Impacting Timing of Required Corrective Action

9.1 Assumed Electricity Demand

Section 8.3 identified that, without corrective action, the existing system will be unable to maintain supply during single contingencies by late 2005.

The primary driver of this emerging network limitation is the forecast growth in electricity demand in the area. The 2005 timing conclusion was based on a load growth forecast that assumed typical temperatures and medium economic growth. Changes to this assumption can alter the required timing for corrective action as follows:

Very Hot Conditions: If one in ten year extreme temperatures coincide with a single contingency during the summer of 2004/05 (a very low probability), system capability would be exceeded. In this situation, loadshedding may need to occur to manage voltage levels.

Mild Weather Conditions: Milder summer temperatures reduce the forecast demands on the transmission grid. If mild conditions occur, network voltages could be maintained during a contingency for one additional year (ie – until summer 2006/07).

9.2 Assumed Imports from New South Wales

As noted in section 8.3, Powerlink and Energex have determined that network limitations will exist in the Gold Coast/Tweed zone in late 2005 in the absence of import support from New South Wales.

As discussed in section 8.1 the maximum supportable load in the Gold Coast/Tweed zone is increased by imports from New South Wales across Directlink, but the increase in imports is partially offset by a resulting reduction in the capacity of the transmission network. Network studies indicate that 1MW of imports increases the maximum supportable load in the Gold Coast/Tweed zone by approximately 0.3 to 0.4 MW.

A network support service from Directlink may be a feasible partial or total solution for some period.

9.3 Assumed Generation

The transfer limit to the Gold Coast is sensitive to the levels of generation at Swanbank and Wivenhoe which are the power stations closest to the Gold Coast. When forecasting transfer limits Powerlink has made assumptions about the level of operations at these power stations based on discussions with the corporations which own the power stations (see footnote 12). Assuming that all these power stations were operating at their maximum capacity would increase the transfer limit but not by enough to defer the need for corrective action by a year.

9.4 Other Factors

Augmentations to the distribution network may influence the flows on the 275kV and 110kV system in the relevant area. Joint planning by Powerlink and Energex has established that there are no distribution augmentations likely to be committed in the near future that would impact the required timing for action to address the emerging transmission network limitations.

There are no other factors, given the existing electricity supply system and committed augmentations, which have been identified to influence the timing of emerging network limitations in the Gold Coast/Tweed zone.

9.5 Conclusion

It is Powerlink and Energex's conclusion that the existing electricity system supplying the Gold Coast/Tweed zone must be augmented before October 2005 if supply reliability is to be maintained during a single contingency.

An outage of one of Powerlink's 275kV feeders during the peak summer period from 2005/06 onwards will require customer load shedding. Also, because of the impact an outage of a feeder has on supply to the area, maintenance times for these feeders will be very restricted.

Given Powerlink's obligations outlined in earlier sections of this report, it is considered that the system supplying the Gold Coast/Tweed zone should be augmented by October 2005 at the latest.

10.0 Assessment of Alternative Solutions

As outlined in section 8.3 it is essential that action be taken prior to the summer of 2005/06 to maintain a reliable electricity supply to the Gold Coast/Tweed zone. This action may involve network augmentation, or the implementation of local generation and demand side management (DSM) options which reduce, defer or eliminate the need for new network investment.

10.1 Identifying Solutions

Powerlink identified in its 2002 and 2003 Annual Planning Reports the emerging network limitations in the Gold Coast/Tweed zone. Powerlink has received no information regarding proposals to address these emerging limitations from prospective solution providers in the normal course of business or in response to its Annual Planning Report.

This "Request for Information", and subsequent consultation, provides a further opportunity for alternative solution providers to submit details of their proposals for consideration. The information provided in this document on emerging network limitations in the Gold Coast/Tweed zone is intended to enable interested parties to formulate and propose feasible and definitive local generation, network and demand side management solutions.

10.2 Criteria for Solutions

To assist solution providers to understand the technical and other requirements, Powerlink has identified the following criteria which must be satisfied if solutions are to meet the underlying need for augmentation of supply to the Gold Coast/Tweed zone:

Size: Feasible options must be large enough, individually or collectively, to overcome the identified voltage limitations. 30 – 40 MW of additional load each year would need to be supplied by alternative means (eg – a local generator, DSM program etc). The capacity required depends on the interaction between the location of the generator or other solution and local voltage and load levels. Required capacity could increase by 30 - 100MW each year to keep pace with load growth depending on the location and type of alternative solution.

Time of Year: Options must, at a minimum, be capable of meeting demand during peak summer months. Satisfactory voltage levels will not be able to be maintained with the existing system during summer from late 2005 onwards.

Location: To be a viable 'standalone' non-transmission solution, an option must increase the maximum supportable load in the Gold Coast/Tweed zone.

Operation: If it is recommended that a new local generation option or a Market Network Service is the most appropriate solution to the emerging reliability issues, the generator or Market Network Service Provider will be required to operate "on demand" at certain times to satisfy reliability criteria. Such operation will be required regardless of the pool price at the time (the National Electricity Code prevents a generator or a Market Network Service Provider that is providing network support from setting the market price).

Generation will need to be operational during all periods that the transmission system would not otherwise be able to supply load if a contingency occurred. That is, they must be operating "pre-contingency", when the transmission system is intact. Otherwise, loadshedding will occur immediately following a fault on the relevant 275kV feeder (loadshedding would be automatic and instantaneous following an outage of the 275kV feeder to prevent 'cascading' voltage collapse).

Demand side programs must either reduce load pre-contingency or automatically disconnect sufficient customer supply immediately following a contingency. Proponents of the latter type of program are advised that the demand side response must be automatic and occur within very few seconds to prevent voltage collapse. Therefore, any customers agreeing to participate in such a program would not be able to have any warning of the power interruption.

The daily load curve shown in section 5.2 shows that the peak daily load in the area lasts 12 hours from 9.00am to 9.00pm. Any generation or DSM solution would therefore need to be capable of operating continuously for 12 hours a day.

Timeframe: All options must be operational before October 2005. As outlined, the required timing for corrective action to address emerging network limitations is prior to the summer of 2005/06.

Reliability: Options must be capable of reliably delivering electricity under a range of conditions and, if a generator, must meet all relevant Code requirements related to grid connection.

Certainty: Options must be committed by end 2003 using proven technology and have funding and project management to deliver within the required timeframe. Corrective action is critical to the reliability of electricity supply to the Gold Coast/Tweed zone – it is not considered appropriate to rely on uncommitted developments that may or may not proceed.

10.3 Assessment of Solutions

The ACCC's Regulatory Test and Chapter 5 of the National Electricity Code require Powerlink to consider local generation, DSM, inter-regional and network options on an equal footing.

The Regulatory Test also specifies the assessment methodology to be used:

"In the event an augmentation is proposed to meet an objectively measurable service standard linked to the technical requirements of schedule 5.1 of the Code, the augmentation satisfies the Regulatory Test if it **minimises the net present value of the cost** of meeting those standards having regard to a number of alternative projects, timings and market development scenarios."

An augmentation proposed to meet an objectively measurable service standard linked to the technical requirements of Schedule 5.1 of the Code, or other statutory requirements, is referred to as a 'reliability augmentation'.

Any regulated augmentation proposed as a consequence of addressing the emerging network limitation in supply to the Gold Coast/Tweed zone as outlined in this report will be a 'reliability augmentation' because:

- there is a clear need for the augmentation based on the limitations identified in this report
- the limitations are based on an objectively measurable service standard linked to the technical requirements of schedule 5.1 of the Code as set out in this report

This means the assessment of solutions will be based on minimising the net present value of the cost of meeting the service standard.

A public process is required, with disclosure of project costs and comparison of alternatives. As the outcome of the economic analysis could be a recommendation to proceed with a regulated solution, it is important that all feasible options are considered in the process.

If a non-network option satisfies technical requirements, is committed and can be implemented for a lower cost than a transmission augmentation, it is likely to be necessary for Powerlink to enter into a network support contract with the proponents of the alternative project to ensure supply reliability can be maintained. If regulated funding is required from Powerlink, it is necessary that grid support arrangements satisfy the Regulatory Test in terms of both economics and disclosure of relevant costs to the market.

11.0 Request for Information

Powerlink and Energex invite submissions and comments in response to this paper from national electricity market participants, solution providers and any other interested parties.

Consistent with the requirements of the National Electricity Code, information received in response to this document will be shared with our NSW counterparts.

Submissions should be presented in a written form and should clearly identify the proponent of the submission including contact details for subsequent follow-up if required. If parties prefer, they may request to meet with Powerlink and Energex ahead of providing a written response.

11.1 Submissions from Solution Providers

This is not a tender process – submissions are requested so that Powerlink can fulfil its regulatory obligations to compare the net present value cost of alternatives to the option of augmenting the transmission supply system to maintain supply reliability.

If your submission proposes a solution, it should contain the following information:

- Details of the party making the submission (or proposing the solution)
- Technical details of the project (capacity, proposed connection point if relevant etc) to allow an assessment of the likely impact on supply capability
- Sufficient information to allow the costs of the solution to be incorporated in a cost-effectiveness comparison in accordance with ACCC Regulatory Test guidelines
- An assessment of the ability of the proposed solution to meet the technical requirements of the National Electricity Code
- Timing of the availability of the option, and whether it is a committed project
- Other material that would be relevant in the assessment of the proposed solution

As the submissions may be made public, any commercially sensitive material, or material that the party making the submission does not want to be made public, should be clearly identified. It should be noted that Powerlink and Energex are required to publish the outcomes of the Regulatory Test analysis. If solution providers elect not to provide specific project cost data for commercial-in-confidence reasons, Powerlink and Energex may rely on cost estimates from independent specialist sources.

11.2 Timetable for Submissions

Please provide information by 19 September 2003 to:

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Tel: (07) 3860 2300
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11.3 Assessment and Decision Process

Powerlink intends to carry out the following process to assess what action, if any, should be taken to address the identified network limitations:

Part 1	Initial Information Request (this paper). Submissions (responses to this paper).	August 2003 September 2003
Part 2	Review and analysis. Likely to involve further consultation with Code participants and interested parties. Additional data may be requested to allow Powerlink to carry out the economic assessment process as required by the National Electricity Code and the ACCC Regulatory Test.	September - October 2003
Part 3	Presentation of draft report and recommendation of solution which satisfies the Regulatory Test Submissions on draft report Presentation of final report and recommendation	October 2003 November 2003 December 2003
Powerlink Queensland reserves the right to amend the timetable at any time. Amendments to the timetable will be made available on the Powerlink website (www.powerlink.com.au)		

The consultation timetable is driven by the need to make a decision by the end of 2003 if any option is to be in place by the summer of 2005/06. At the conclusion of the process, Powerlink and Energex intend to take immediate steps to implement the recommended solution to ensure that the reliability of the system can be maintained.