Final Recommendation:

Proposed New Large Network Asset –

Darling Downs Area

(including Toowoomba, the Granite Belt and Lockyer Valley)

Powerlink Queensland
8 July 2003

FOREWORD

Eleven submissions were received in response to Powerlink's Application Notice. Many of these submissions contained opinion pieces on what the authors thereof thought the Regulatory framework should be rather than what it is today (eg that the Regulatory Test should include social costs; that all powerlines should be underground; that the NEM reliability criteria should be economic rather than deterministic etc).

Whilst Powerlink disagrees with some of the content of those opinion pieces, this report is not the appropriate forum for a debate on those matters.

Consequently, this Final Report focuses on applying the existing regulatory processes to this particular reliability of supply limitation and proposed augmentation.

We note that two of the submissions supporting the proposed augmentation are from Energex and Ergon, who are willing payers of the transmission charges which will arise from the proposed augmentation.

There were two items in VENCorp's submission which require specific comment:

(a) the fundamental error in VENCorp's calculations which renders the conclusions of those calculations invalid.

    VENCorp has erroneously modified the load forecasts for Middle Ridge such that its forecasts are about 25% lower than the correct values. For example, VENCorp's load figure for 2004/05 was exceeded by the actual measured load in 1996/97, and its forecast for 2008/09 was exceeded by the actual measured load in 2001/02. The result is that VENCorp's calculations are out by 25%, with its recommended actions thus eight years too late.

    Powerlink notes that it did provide the correct loads and forecasts in its Request for Information document (June 2002). Had VENCorp simply used those numbers, it could have avoided this fundamental error. It would seem that VENCorp has made its assumptions in relation to load without the benefit of local knowledge of the network topology, and this error significantly affects the conclusions reached by VENCorp.

(b) the statement that "the proposed solution would add 4500MW of transmission capability " is incorrect. Firstly, it is inappropriate to add together the thermal limits of ingoing and outgoing lines to assess network capability. Secondly, the transmission capabilities of a network are determined by a complex range of variables including voltage and transient stability limits, generation despatch patterns and so on.

    By way of illustrating why adding thermal limits is quite inappropriate, such a calculation applied to the lines in and out of South Morang in Victoria would yield in excess of 20,000 MW or more than twice the summer peak load for the whole of Victoria. It would be surprising if VENCorp believed that the transmission capability of that part of the Victorian grid was anything close to 20,000 MW.

Powerlink's evaluation places major emphasis on three fundamental elements of the legislative and regulatory framework in which it operates:

1. Powerlink has strong and clear obligations to deliver reliability outcomes. The pertinent obligations are identified in this report. Powerlink's customers, Energex and Ergon, need Powerlink to meet those obligations so that they, in turn, can deliver reliable outcomes for their customers.

2. The Australian Competition and Consumer Commission ("ACCC") recently released its Draft Decision in relation to the Service Standards Guidelines. These have the effect of imposing financial penalties for unsatisfactory reliability outcomes in future years. Under the ACCC Draft Service Standards, the option of "waiting for market developments" would expose Powerlink to significant financial penalties attached to unsatisfactory reliability outcomes.

3. It is Powerlink who is exposed under the ACCC regulatory regime to the risk of financial loss via asset optimisation in future years. Asset optimisation risk (correctly) discourages fragmented planning and the development of a large number of small scale augmentations which have an accumulated cost which far exceeds the cost of the long run, optimally scaled development of the network.

Finally, recognising the likely interest in our Application Notice from non-industry people, we sought to write our Application Notice in language which kept industry jargon to a minimum. However, some of the issues raised in submissions require us to revert to technical jargon and the terminology of the ACCC Regulatory Test in several parts of this Final Report. This will serve to clarify matters for the industry readers, but probably cause concerns for other readers – to whom we apologise in advance for this unavoidable outcome.

1.0 EXECUTIVE SUMMARY

Powerlink Queensland has identified emerging limitations in the electricity transmission network supplying the Darling Downs area in south-west Queensland.

A draft recommendation to address these limitations was developed. In accordance with the National Electricity Code, Powerlink published this draft recommendation as an 'application notice' for a new large network asset in March 2003.

The Darling Downs area is primarily supplied by a single circuit 275kV line between Tarong and Middle Ridge substation in Toowoomba. Technical studies have identified that, from late 2004, an outage of this circuit will cause loss of supply to customers. Action is required to overcome these limitations before late 2004 to allow Powerlink to meet its obligations under the Electricity Act 1994 (Queensland), its transmission licence and technical standards in the National Electricity Code.

Powerlink carried out consultation to identify and determine feasible options to address the emerging network limitations. Powerlink sought information on potential non-network alternatives (eg - demand side management initiatives or local generation) as part of this process. The operation of the existing power station at Oakey to provide a grid support service when it might not otherwise be operating in the electricity market was the only potential non-network alternative identified through the consultation process. Negotiations regarding network support determined that it could not be provided with the certainty required to satisfy the reliability requirements. This alternative is therefore not a feasible solution to address the emerging network limitations.

Multiple network augmentation options were considered to address the emerging network limitations on the Darling Downs, taking into account a foreseeable subsequent limitation in supply to south-east Queensland. The two lowest cost feasible options were analysed in detail to compare the Net Present Value (NPV) of the costs to market participants, in accordance with the Australian Competition and Consumer Commission ("ACCC") Regulatory Test:

Solution A	Double circuit 330kV transmission line between Millmerran and Middle Ridge by late 2004 and associated substation works.
Solution B	Single circuit 275kV transmission line between Tarong and Murphy's Creek by late 2004 and associated substation works.

The financial analysis also considered anticipated/modelled projects to address expected limitations in supply to south-east Queensland. Based on load forecasts published in Powerlink's 2002 Annual Planning Report, the anticipated/modelled projects would be required by 2008/09 at the latest to satisfy reliability requirements. New forecasts prepared for the 2003 Annual Planning Report show a significant acceleration in demand growth in south-east Queensland. This indicates that a date earlier than 2008/09 is likely to be necessary. Market development scenarios were used to assess the impact of varying assumptions regarding the timing of anticipated/modelled projects. A range of years for the anticipated/modelled project to address south-east Queensland reliability limitations was included in the market development scenarios in the analysis.

The ACCC Regulatory Test requires that for reliability requirements (as is the case for the limitations outlined in this Final Report), the recommended option be the option with the lowest net present value cost compared with alternative projects. The economic analysis in this paper identified that Solution A is the least-cost augmentation option over the period of analysis for the range of scenarios considered. Sensitivity analysis showed the results to be consistent under

variations of critical parameters (such as capital cost, cost of network losses and discount rate) in the analysis.

In addition to minimising the net present value (NPV) cost in the ACCC Regulatory Test financial analysis, significant other benefits have also been identified that favour Solution A over Solution B. These include higher network reliability, lower overall community impacts by avoiding 80km of anticipated overhead line construction, and electricity market benefits with a net present value (NPV) of approximately $3 million. The market benefits were identified by independent consultants and are a consequential result of reduced future congestion on northward flows on the Queensland-New South Wales interconnector.

Powerlink issued an Application Notice in March 2003 containing a draft recommendation to implement Solution A to address the identified network limitations in the Darling Downs area.

That Application Notice recommended that:

- A 330kV double circuit transmission line be constructed between Millmerran and Middle Ridge, with associated substation works. It is proposed to make commitments to begin construction of this proposed new large network asset in mid 2003. The asset, estimated to cost $71.3 million, is required to be commissioned by the summer of 2004/05.

- The timing for the anticipated/modelled project between Middle Ridge and Greenbank be closely monitored, and if necessary, adjusted in the light of load growth forecasts and system needs. It should be noted that the ACCC Regulatory Test does not permit a network augmentation to be formally recommended for approval more than 12 months prior to the start of construction. It is, however, recommended that all planning consents be obtained and other preparatory works completed to allow the reliability requirements in south-east Queensland to be addressed within the time that corrective action is necessary.

Eleven submissions were received in response to this Application Notice, and are summarised in this Final Report. Four submissions were supportive including those from the two entities that will pay the resultant transmission charges, with the remaining submissions raising concerns with the process or Powerlink's conclusions. Three submissions requested a meeting with Powerlink. In accordance with those requests, meetings were held during June 2003 to clarify issues raised.

Powerlink has provided a response to the issues raised in submissions in this Final Report, in accordance with National Electricity Code requirements. Additional information has been provided, particularly in relation to alternative options raised by interested parties.

After considering the submissions received, Powerlink is of the view that no changes to the draft recommendation are necessary as a result of this process. The draft recommendation has therefore been adopted as the final recommendation. Immediate steps will be taken to implement this recommendation.

2.0 INTRODUCTION

Powerlink Queensland has identified emerging limitations in the electricity network in the Darling Downs area of south-west Queensland.

Where a transmission network service provider ("TNSP") proposes to establish a new large network asset to address such limitations, it is required to issue an 'application notice' under clause 5.6.6 of the National Electricity Code. The Code then requires consideration of submissions received in response to the Application Notice, and preparation of a Final Report in accordance with clauses 5.6.6 (e) and 5.6.6 (f).

This Final Report must contain information regarding:

- the reasons the augmentation is required, including, if relevant, why it is considered a 'reliability augmentation' as defined in the National Electricity Code;

- feasible options available to address the emerging network limitations, including any proposed non-network alternatives that meet the requirements;

- a detailed description of the proposed new large network asset;

- the technical details of the recommended solution, including the timetable for implementation and commissioning date;

- why the solution satisfies the Regulatory Test prescribed by the ACCC; and

- a summary of submissions received from interested parties and the applicant's response to each submission.

This final recommendation is based on:

- the assessment that a reliable power supply will not be able to be maintained in the Darling Downs area during single network contingencies from late 2004 onwards;

- the consultation undertaken by Powerlink to identify potential solutions to address these emerging network limitations;

- the interrelationship between the immediate limitations emerging in the Darling Downs area and the future supply needs of south-east Queensland;

- the analysis of feasible options in accordance with the Regulatory Test prescribed by the ACCC;

- the publication of an Application Notice containing a draft recommendation to address the identified network limitations to allow comment by interested parties; and

- the assessment of the submissions received in response to the Application Notice.

The recommended solution maximises the net economic benefits to participants in the National Electricity Market. These economic benefits arise from maintaining a reliable power supply in accordance with Powerlink's obligations during single network contingencies at the least cost to the market and therefore to end-use customers.

3.0 REASONS AUGMENTATION IS REQUIRED

3.1 Darling Downs Area

Powerlink has identified emerging limitations in the electricity network supplying the Darling Downs area in south-west Queensland. This area incorporates the major regional city of Toowoomba, the towns of Warwick and Stanthorpe to the south, Dalby and Millmerran to the west and the Lockyer Valley centred on the town of Gatton to the east.

Primary electricity supply to the area (refer map below) is via a single circuit 275kV transmission line between Tarong, near Nanango and Powerlink's Middle Ridge substation in the Toowoomba area. This is backed up by a lower capacity double circuit 110kV line from Swanbank, near Ipswich. The power flows on this line are predominantly towards Swanbank, but flows from Swanbank can occur during outages of the above-mentioned 275kV line. As electricity demand in the area has grown, power flows across these lines have increased, with peak loading occurring during the winter months from April to September.

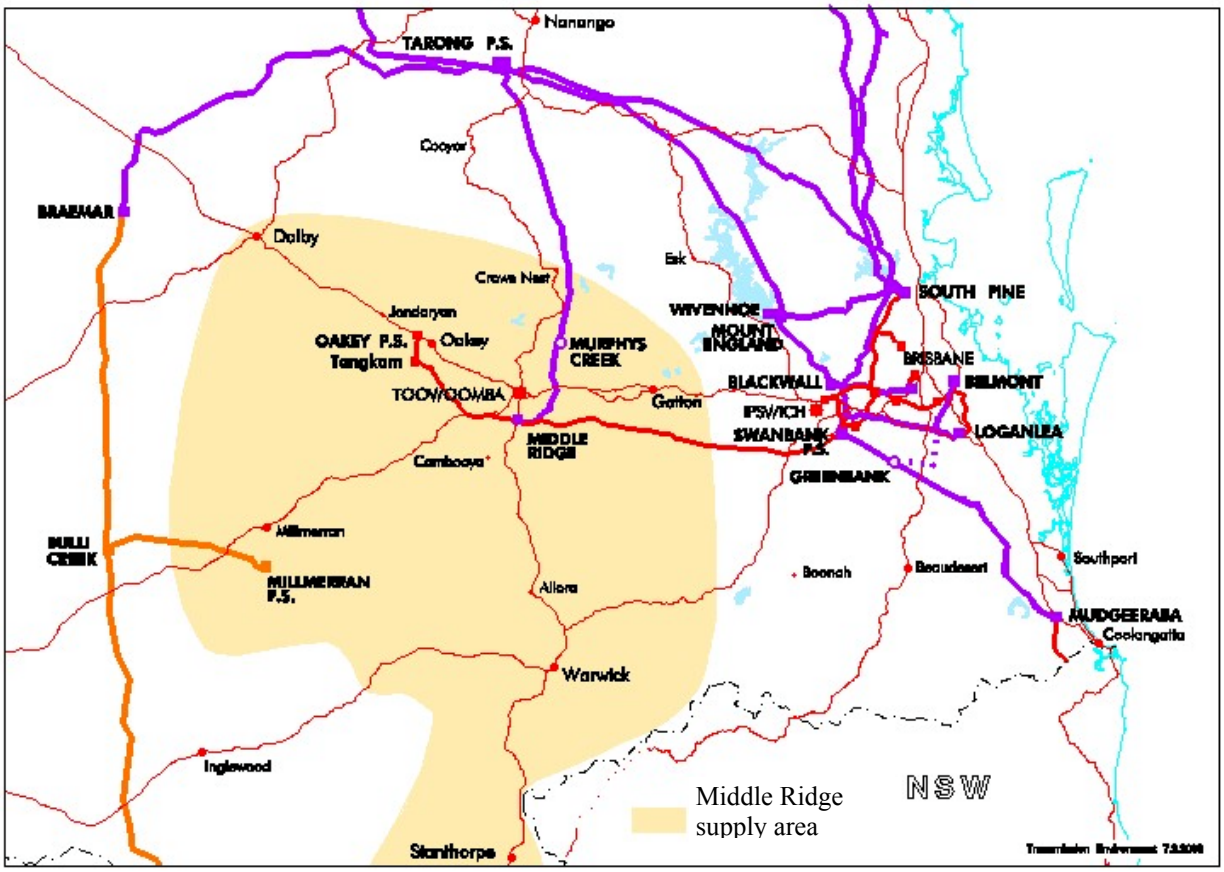


Figure 1 - Existing Supply System – Darling Downs Area

Powerlink's planning studies have identified that, from late 2004 onwards, the capability of its grid will be exceeded during an outage of the 275kV circuit between Tarong and Middle Ridge during both summer and winter peak periods[1]. During a single contingency, the voltage level of the entire area would become unacceptably low. In addition, flow on the Energex 110kV line between Abermain and Lockrose will exceed thermal ratings during contingency conditions requiring corrective action by late 2004.

Analysis to support this conclusion, including load forecasts and relevant assumptions, was published in the previous consultation document "Request for Information – Emerging Network Limitations Darling Downs Area."[2] Additional information is contained in Appendix 2.

Consistent with the National Electricity Code and its transmission licence requirements, Powerlink plans future network augmentations so that the reliability and power quality standards of Schedule 5.1 of the National Electricity Code can be met during the worst single credible fault or contingency (N-1 conditions) unless otherwise agreed with affected National Electricity Code participants. Additional information about the reliability standards Powerlink must comply with is contained in section 4.0.

If no corrective action is taken, interruptions to customer supply will need to occur throughout the Darling Downs area from late 2004 onwards to allow the electricity system to be operated safely (ie – to avoid unacceptable line overloads and voltage collapse when a fault or other outage of the existing Tarong to Middle Ridge line occurs). Powerlink therefore considers action to address the emerging network limitations in the Darling Downs area to be a 'reliability augmentation', as defined in the National Electricity Code[3].

The reasons outlined above demonstrate the need for immediate corrective action to augment the existing electricity network in the Darling Downs area.

3.2 Supply to South-East Queensland

There is also a foreseeable and readily identifiable limitation in electricity supply to the south-east Queensland area.

This limitation must be considered in any analysis of solutions to emerging network limitations on the Darling Downs, because the south-west Queensland area is a major source of power for the "generation deficient/transmission dependent" south-east Queensland area. Large amounts of power from Millmerran Power Station, Tarong Power Station, Central Queensland power stations and power stations in New South Wales feed into the transmission network at Tarong (see Figure 2 on the following page).

This power reaches customers in south-east Queensland via numerous routes. Some power presently flows from Tarong to south-east Queensland via the 275kV line to Middle Ridge. As outlined in the previous consultation document, under typical conditions this line supplies power to the Darling Downs and some power to south-east Queensland via the smaller 110kV lines between Middle Ridge and Swanbank.

[1] Assumes medium load growth forecasts as published in Powerlink's 2002 Annual Planning Report.
[2] Published 17 June 2002 - refer Powerlink's website: www.powerlink.com.au/asp/index.asp?pid=5&page=network
[3] A transmission network augmentation that is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction.

However, the majority of power transferred between Tarong and south-east Queensland flows on the other five 275kV circuits between Tarong and the Brisbane area[4].

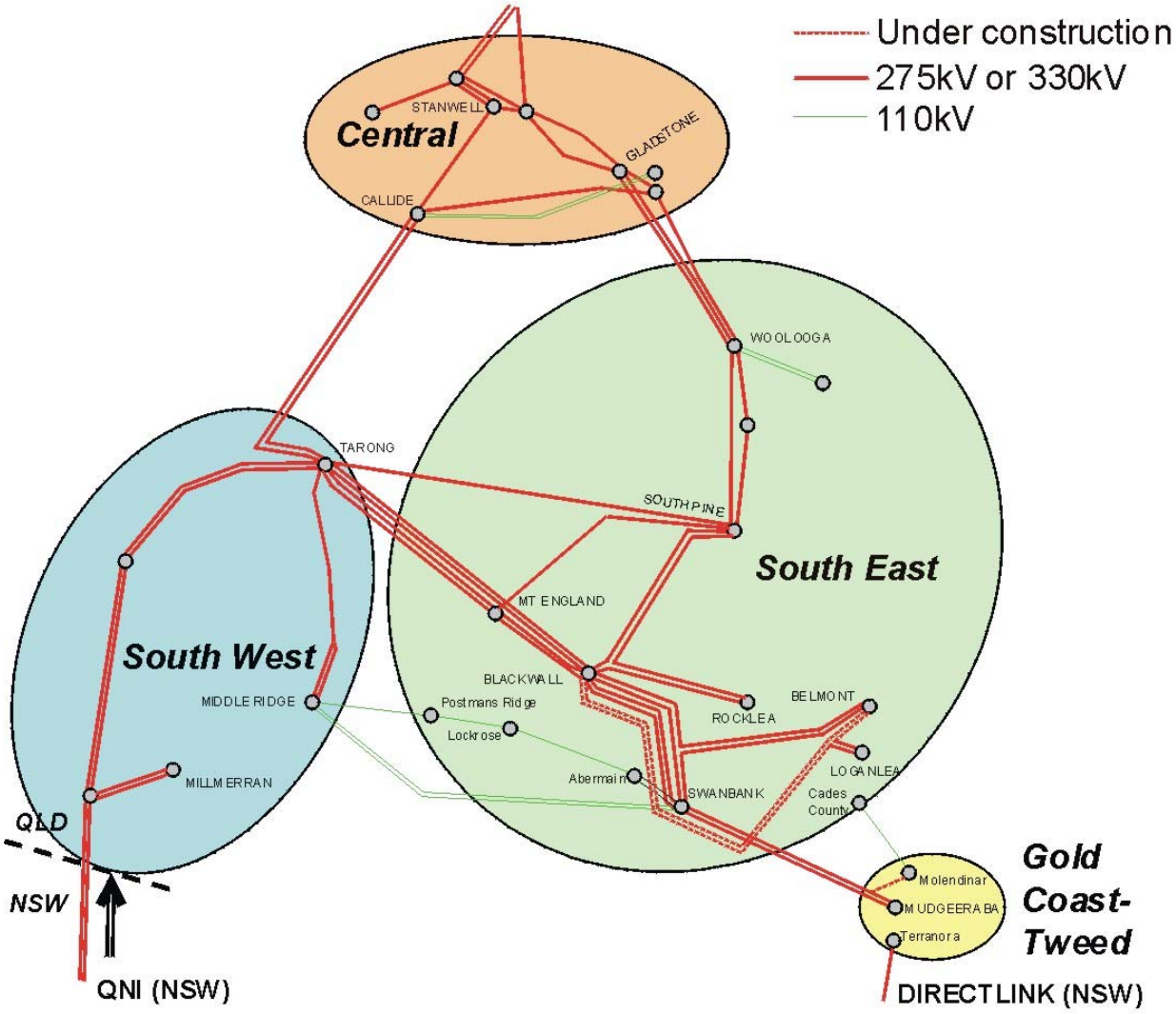


Figure 2 - Transmission Network Relevant to South East Queensland Supply

NOTE: FIGURE 2 IS DIAGRAMMATIC ONLY

Electricity demand in the south-east Queensland area, particularly in the southern Brisbane suburbs and the Gold Coast[5], is growing very rapidly - at a rate of approximately 200MW per year[6].

[4] Some power also reaches south-east Queensland via a coastal route from Central Queensland. This has been taken into account in the analysis of the emerging limitations in south-east Queensland.
[5] Supplied primarily from existing substations at Belmont, Loganlea and Mudgeeraba.
[6] Refer Moreton North, Moreton South and Gold Coast zone forecasts as published in Powerlink's 2002 and 2003 Annual Planning Reports.

This additional demand has been met by augmentation of the transmission system[7], as demand growth has not been matched by the installation of additional power sources. There has been no net increase in the generation capacity installed in south-east-Queensland in the last 15 years[8].

Without corrective action, demand is expected to exceed supply capacity in south-east Queensland by summer 2008/09 at the latest. This conclusion is based on forecast electricity demand, the transfer limits of the grid and existing and committed generation developments and decommitments[9], as published in Powerlink's 2002 Annual Planning Statement.

The unacceptable situation where demand exceeds secure supply capability is a clear reliability limitation. The consequence will be an inability to maintain a reliable power supply to Brisbane and the wider south-east Queensland area in accordance with the National Electricity Code and Powerlink's transmission licence conditions. In determining the timing at which this situation is likely to arise, the most optimistic generation dispatch pattern was assumed. That is, it was assumed that all generation in south-east Queensland could be operated to satisfy customers' electricity requirements, regardless of the merit order cost of operating generation in south-east Queensland in preference to generation outside south-east Queensland [10]. A less optimistic generation pattern would require network augmentation before 2008/09[11].

As noted above, corrective action is required by 2008/09 at the latest to maintain reliability of supply to south-east Queensland customers. The load forecasts compiled for Powerlink's June 2003 Annual Planning Report[12] show a significant acceleration in load growth in south-east Queensland. This indicates an earlier timing may be required (various timings are discussed further in section 7.2).

Market participants should note that electricity market dispatch could be affected by network transfer limitations into south-east Queensland prior to the time at which reliability limitations will arise. There is the potential for high wholesale market electricity prices to occur earlier due to congestion on the grid between south-west and south-east Queensland[13]. The transfer capability between Tarong and the Brisbane area has been reached on a number of occasions during the past few years, and has resulted in high wholesale pool prices. As demand increases without significant new generation, flows on the transmission system will increase.

[7] Such as the 275kV augmentation between Tarong and Blackwall (near Ipswich) in 1999.

[8] New generating units have been installed at Swanbank Power Station, the largest of which is Swanbank E with a capacity of 344/366MW. Several minor cogeneration developments have also occurred in the last few years. However, these new units are similar in total capacity to old generating units that have now been decommissioned. While not a generator, under some market conditions, the Directlink cable between northern NSW and the Gold Coast can provide a power injection of up to 180MW into the Tweed Shire of NSW and a residual amount into south-east Queensland.

[9] It should be noted that Powerlink's forecasts of demand and energy as published in its Annual Planning Report include an independent assessment of future renewable, cogeneration and other embedded generation sources that are likely to be connected to the Energex and Ergon distribution networks in the next ten years. If the allowed level of new generation does not eventuate, the demand/supply limitations will arise earlier.

[10] The assessment allowed for the largest generating unit in south-east Queensland (Swanbank E) to be unavailable due to maintenance or plant breakdown, and for 768MW of other south-east Queensland generation to be operating at peak load. This includes Swanbank B, Directlink flowing northwards and Wivenhoe Power Station (recognising that Wivenhoe as a pump storage hydro station is capacity limited for continuous operation). The analysis considered typical weather conditions (50% probability of exceedance peak load forecasts) only, as published in the 2002 Annual Planning Report.

[11] In this regard, it is noted that Directlink is increasingly exhibiting a predominantly southwards flow pattern in response to market prices.

[12] Each year a forecast for the next ten years is prepared.

[13] If bidding behaviour in the National Electricity Market results in dispatch of generation outside south-east Queensland before generation within south-east Queensland, more power needs to be transferred into south-east Queensland on Powerlink's transmission grid. If transmission congestion forces generation outside south-east Queensland to be 'constrained off' (ie – prevented from operating), high wholesale market prices may result.

4.0 RESPONSES TO THE CONSULTATION PROCESS

4.1 Submissions to Application Notice

Powerlink issued an Application Notice for a Proposed New Large Network Asset on 31 March 2003. It was recommended that:

- a 330kV double circuit transmission line be constructed between Millmerran and Middle Ridge, with associated substation works. It is proposed to make commitments to begin construction of this proposed new large network asset in mid 2003. The asset, estimated to cost $71.3 million, is required to be commissioned by the summer of 2004/05.

- The timing for a proposed subsequent augmentation between Middle Ridge and Greenbank be closely monitored, and if necessary, adjusted in the light of load growth forecasts and system needs. It should be noted that the ACCC Regulatory Test does not permit a network augmentation to be formally recommended for approval more than 12 months prior to the start of construction. It is, however, recommended that all planning consents be obtained and other preparatory works completed to allow the reliability requirements in south-east Queensland to be addressed within the time that corrective action is necessary.

Powerlink received 11 submissions to this Application Notice from the following parties:

- Delta Electricity
- Energex
- Ergon Energy
- Ms Lowe (property owner)
- Mr Moule (property owner)
- Power Down Under (property owner representative group)
- Tarong Energy
- Toowoomba Greens
- TransEnergie Australia
- TXU
- VENCorp

Three submissions requested meetings with Powerlink (Power Down Under, Mr Moule and Ms Lowe). Meetings with these parties were held during June in accordance with clause 5.6.6 (e) of the National Electricity Code.

Submissions to the Application Notice expressed a wide variety of views. Energex and Ergon, who require the augmentation to maintain reliability of supply to their customers, strongly support the proposed augmentation. Energex further encouraged Powerlink to consider an earlier timing for the augmentation to Greenbank in the Logan area in the light of Energex's latest load growth and forecast figures. Delta Electricity and Tarong Energy supported the proposed augmentation, with the primary reason given that it provides the lowest overall cost to customers. Tarong Energy and Energex specifically gave strong endorsement to the approach Powerlink adopted in applying the ACCC Regulatory Test.

VENCorp, TransEnergie, TXU, Power Down Under and Mr Moule challenged procedural issues associated with the application of the ACCC Regulatory Test and alternative options considered. The Toowoomba Greens submission focused largely on issues related to demand side management alternatives. Ms Lowe raised concerns related to the community and visual impact of the proposed augmentation.

In accordance with National Electricity Code requirements, this Final Report contains a summary of the submissions (refer Appendix 1) and Powerlink's response to the issues raised in these submissions.

4.2 Overview of Issues and Powerlink's Response

The matters raised in the submissions have been grouped into three categories:

(a) matters which are outside the scope of the ACCC Regulatory Test and National Electricity Code process (eg - community and visual impact, local government planning laws, electric and magnetic fields etc). These issues are summarised in Appendix 1 but have not been addressed in this Final Report. Such matters are being addressed via other mechanisms such as the Environmental Impact Assessment process for the proposed project.

(b) High level procedural matters (eg applicable reliability standard, planning approach) and alternative solutions including the use of Oakey Power Station to provide grid support. These matters are addressed in this section of the Final Report, with more detail in some areas in Appendix 2.

(c) Other issues including specific alternative solutions raised in submissions. These matters are addressed in Appendix 2 of this Final Report.

4.2.1. Applicable Reliability Standard and Related Process

Some parties suggested that Powerlink does not have an obligation to take action to meet reliability of supply standards. VENCorp suggested that Powerlink has no statutory obligation to ensure peak demand can be supplied and that, in its opinion, an acceptable action to meeting network performance standards is to allow customer supply to be interrupted (ie – blackouts) under a credible single contingency. TransEnergie and TXU also suggested applicable legislation does not require Powerlink to take action. Power Down Under and Mr Moule (property owner) claimed that Powerlink had not adequately demonstrated the emerging limitations on the network supplying the Darling Downs.

Powerlink has planning obligations under the National Electricity Code, the Electricity Act (Queensland), and Powerlink's transmission authority. Powerlink disagrees with the interpretation of these obligations outlined in the VENCorp and TransEnergie submissions. However, a debate regarding National Electricity Code and legislation interpretation is not necessary in the context of this report.

Powerlink notes that Schedule 5.1.2.2 requires that the standard of service to be provided at each connection point must be included in the relevant connection agreement. Powerlink has long standing connection agreements with both Ergon Energy and Energex who have confirmed that:

"the applicable reliability standard under the existing Connection Agreements between our organisations is to provide normal transfer capacity ***such that forecast peak demand can be supplied with the most critical single element out of service (ie – a reliability standard of N-1)****, unless specifically agreed otherwise in writing for particular locations. In this regard, we confirm that we have not agreed any other standard to apply for supply to the Middle Ridge and the Darling Downs area."*

Thus, in accordance with Schedule 5.1.2.2. of the National Electricity Code, Powerlink is required to meet the above described level of reliability for supply to Middle Ridge. This, on its own, is sufficient to establish the required level of reliability which Powerlink must deliver.

However, Powerlink further advises that the Queensland jurisdiction, in response to a review commenced in 2002 following the Network and Distributed Resources Code changes, has recently modified the reliability obligations in Powerlink's transmission authority, inserting the following clauses:

> *Clause 6.2: "The transmission entity must plan and develop its transmission grid in accordance with good electricity industry practice such that:*
>
> *(a) the power quality standards will be met by the transmission entity where those standards specify different obligations during normal and other operating conditions;*
> *(b) if the power quality standards do not specify different obligations during normal and other operating conditions, the power quality standards will also be met by the transmission entity even during the most critical single network element outage; and*
> *(c)* ***the power transfer available through the power system will be adequate to supply the forecast peak demand during the most critical single network element outage****.*
>
> *Clause 6.3: The obligations imposed on the transmission entity by clause 6.2 will apply unless otherwise varied by a connection or other agreement made by the transmission entity."*

It is therefore clear that the proposed augmentation is one which fits (on at least two counts), the National Electricity Code definition of a reliability augmentation, viz:

> *" a transmission network augmentation that is necessitated solely by inability to meet the minimum network performance requirements set out in Schedule 5.1 or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction"*

On this basis, the least cost (NPV) path of the ACCC Regulatory Test is applicable for the evaluation of solutions[14].

Powerlink is obliged to take corrective action to ensure that the above reliability of supply standards on the Darling Downs are met. As noted above, several parties including PDU, VENCorp and Mr Moule queried the timing and need for corrective action. The "Request for Information" document issued by Powerlink in June 2002 identified that the grid will be unable to maintain supply to customers at times of peak demand during a single network contingency from the summer of 2004/05 onwards, and identified the underlying technical limitations[15]. Powerlink confirms that this analysis is correct. Some additional information is provided in Appendix 2.

As noted in the Foreword, and discussed in more detail in Appendix 2, the load calculations undertaken by VENCorp which sought to dispute the 2004/05 timing, contained a fundamental (about 25%) error, and consequently the conclusions arising therefrom are invalid. In response to suggestions for Powerlink to use (higher) emergency transmission line ratings in its planning for this augmentation, Powerlink confirms that it has consistently used the emergency ratings in planning studies for the Darling Downs, as noted in the June 2002 consultation document.

4.2.2. Integrated Planning Approach

In identifying solutions to the Darling Downs limitations, Powerlink adopted an integrated planning approach by including consideration of known emerging limitations in supply to south-east Queensland. Tarong Energy, Ergon Energy and Energex agreed that the integrated approach would deliver the lowest cost to consumers and that it satisfies the ACCC Regulatory Test. Other parties such as Power Down Under, Mr Moule, VENCorp and TransEnergie expressed the view that the Darling Downs limitations should be assessed independently of emerging limitations in south-east Queensland.

[14] The ACCC Regulatory Test states that an augmentation proposed to meet an objectively measurable service standard linked to the technical requirements of Schedule 5.1 of the National Electricity Code shall satisfy the test if it minimises the net present value of the cost of meeting the standard.

[15] This situation is clearly contrary to the 'N-1' obligations in the connection agreements and transmission authority.

Powerlink believes that an integrated approach is required and that economic evaluation of solutions to immediate limitations should take into account foreseeable limitations in adjacent areas.

Indeed, the ACCC Regulatory Test explicitly requires inclusion of future projects, likely to be required in response to growing demand, in the economic analysis. The ACCC Regulatory Test was designed to ensure the most efficient network development over time. It prescribes economic evaluation based on net present value analysis, a methodology which is used to compare cash flows with different timing. In addition, the ACCC Regulatory Test specifically requires the inclusion of potential future projects in the economic analysis. The ACCC Regulatory Test states that:

"In determining the cost of an augmentation, the analysis should include modelling a range of reasonable alternative market development scenarios, ***incorporating varying levels of demand growth at relevant load centres, alternative project commissioning dates*** *and various potential generation investments and realistic operating regimes.…****These scenarios should include projects undertaken to ensure that relevant reliability standards are met****.*

These market development scenarios should include:

(a) Projects, the implementation and construction of which has commenced…. (committed projects)
(b) Projects, the planning for which is at an advanced stage and which have expected ***commissioning dates within five years (anticipated projects)***
(c) Other investments which are likely to be commissioned in response to growing demand ….(modelled projects) .

The foreseeable south-east Queensland need is particularly pertinent because:

(1) there are high load growths in the area, and Energex, in its submission, directs Powerlink's attention to its latest load forecasts which indicate a need as early as 2005/06. This compares with the Application Notice, in which Powerlink, based on earlier load forecasts, assumed the augmentation would be needed by 2008/09 at the latest to ensure reliability standards are met.

(2) The south-east Queensland area is significantly "generation-deficient" (compared with the adjacent "generation rich" area to the west), and there are no known generation proposals and no significant fuel sources. That is, it is a highly "transmission dependent" area, connected directly to the Darling Downs area.

In the context of the ACCC Regulatory Test, the augmentation between Middle Ridge and Greenbank in the Logan area is, at a minimum, a modelled project[16]. Given Energex's feedback about the timing and as Powerlink does not require a new easement, it more likely fits the category of an anticipated project. Powerlink assumed various commissioning dates for this anticipated/modelled project in its market development scenarios based on varying levels of demand growth and potential generation investments in south-east Queensland. Powerlink considers that this is clearly in accordance with the requirements of the ACCC Regulatory Test.

Powerlink believes that on the basis of the explicit requirements of the ACCC Regulatory Test alone, the integrated planning approach adopted by Powerlink is valid. For clarity in this report, Powerlink has applied the ACCC Regulatory Test terminology of "modelled/anticipated project" to what had previously been described (for the benefit of non-industry readers) as "stage 2".

[16] With Powerlink as the proponent.

There are several other reasons as to why integrated network planning is consistent with the National Electricity Code and the regulatory framework for transmission:

- An integrated approach leads to optimum development of the transmission network providing the lowest cost outcome for customers. As such, it minimises the risk of financial loss to Powerlink of optimisation of assets under the ACCC revenue regulation regime. This is an investment risk which Powerlink must bear in its transmission investment decisions.

  Optimisation of asset value is applied by the ACCC in five, 10, and/or 15 years time by assessing, with the benefit of hindsight, whether **the whole network** has been optimally developed. That is, whether the network, at that time, represents the optimal network for the loads and flows at that time. Optimisation (correctly) penalises Powerlink for undertaking a series of fragmented developments, which over the long run result in a higher cost network than the optimal long term topology. It is clear that the way to minimise optimisation risk is to plan on a "big picture" basis, and consider likely future augmentations in the adjacent area, especially if the need is, as in the case of south-east Queensland, very foreseeable.

- The integrated planning approach is consistent with broader approaches to planning in the NEM, including recent planning activities of both TransEnergie and VENCorp, associated with the Murraylink conversion to regulated status.

  The transmission planning provisions of the National Electricity Code embody integrated planning approaches, such as requiring transmission and distribution entities to jointly plan optimal solutions ignoring network boundaries, and requiring network planners to plan across State borders, ignoring the borders. Integrated planning of adjacent areas within a State is consistent with these provisions. The case is even more compelling when one of the areas (south-east) is significantly "generation deficient/transmission dependent" and the adjacent (south-west) area is significantly "generation rich".

  Powerlink considers there are parallels to this approach for planning electricity supply to South Australia (noting that the peak demand in south-east Queensland is higher than for SA). If it is valid to plan supply to the marginally "generation deficient" SA by considering the neighbouring marginally "generation rich" Victoria and NSW, then it is also valid to adopt integrated planning in adjacent areas in south Queensland, where the "generation deficiency/transmission dependency" is much more significant.

  Powerlink notes that whilst VENCorp and TransEnergie have criticised Powerlink's approach to the network limitations on the Darling Downs, the recent Murraylink application to convert to regulated status shows that both parties were willing to adopt an integrated planning approach in that case. VENCorp and TransEnergie computed the transfer capability of Murraylink by including a series of uncommitted, geographically distant network upgrades. This had a material impact on the regulated asset value determined by the ACCC[17]. In the same application, TransEnergie assessed (and the ACCC appears to have accepted) as a benefit of Murraylink, the deferral of a future network development in South Australia.

4.2.3. Potential Alternatives including use of Oakey Power Station

Some submissions also suggested that Powerlink did not recommend the lowest cost solution to address the Darling Downs and south-east Queensland reliability limitations. A detailed response to the specific alternative solutions proposed in the submissions (VENCorp, TransEnergie, PDU, TXU, and Mr Moule) is provided in Appendix 2. Some general comments and information regarding the use of Oakey Power Station to provide grid support is provided below.

[17] "Preliminary View – Murraylink Transmission Company Application for Conversion and Maximum Allowed Revenue". Australian Competition and Consumer Commission. 14th May 2003.

General Comments

Comments made on solutions to the reliability of supply limitations to the Darling Downs broadly fit into four categories:

(a) Suggested solutions which do not satisfy Powerlink's reliability of supply obligation (ie – the N-1 reliability standard). Options that require forced interruptions to customer supply to manage a single contingency on the Tarong to Middle Ridge 275kV line are not acceptable and have been dismissed[18];

(b) Solutions which rely on the Oakey Power Station – these are not feasible as discussed below;

(c) Potential solutions based on errors in assumptions and calculations. As noted above, VENCorp has substantially miscalculated the electricity demand on the Darling Downs. The forecast load VENCorp uses for 2004/05 was actually exceeded in 1996/97. Consequently, VENCorp's analysis and conclusions regarding the timing for corrective action is invalid. TransEnergie's simplified analysis that sums line ratings has also led to errors in its conclusions;

(d) Other potential solutions - A detailed response is provided in Appendix 2.

However, it is noted that many of the options suggested do not take into account the characteristics of the Queensland transmission network. Planning the transmission grid in Queensland requires a different paradigm than in some other states. The Queensland electricity supply requirements are characterised by the flattest load profile in the NEM, with the consequence that transmission lines are heavily loaded for long periods of time. The Queensland grid also has little or no spare capacity and must meet high and persistently positive growth in demand. This contrasts, for example, with the Victorian system which has a "needle peak" load profile, and where negative peak load growths have occurred. Many transmission lines in Queensland are also double circuit, rather than single circuit, construction. Thus, solutions which require lines to be taken out of service for extended periods (eg, for re-conductoring, tower raising, re-building etc) are not viable because such solutions would seriously impact reliability of supply to customers and be inconsistent with the reliability standards with which Powerlink must comply.

In addition, it is noted that many of the solutions proposed in the submissions were either technically infeasible or partial solutions or both. The reason for such "solutions" not appearing in Powerlink's analyses in the Application Notice is not one of oversight. Rather, the reason is one of a focus on feasible solutions given Powerlink's acute awareness of the topology of the Queensland grid and the limitations that imposes on the feasibility of possible solutions.

[18] It is worth noting that some options proposed by VENCorp may be applicable in the Victorian regulatory environment. However, Powerlink faces fundamental differences in regulatory arrangements. Powerlink has licence obligations to meet delivered standards of reliability and is exposed to asset optimisation risk. It will also face financial penalties for reliability outcomes under the Draft Service Standards. It is our understanding that VENCorp has no such obligations or risk of financial penalties.

Oakey Power Station

As stated in the Application Notice, pre-contingent operation of Oakey Power Station under a grid support contract[19] would be required to address the reliability limitations.

In its Application Notice, Powerlink advised that negotiations between Powerlink and Enertrade had determined that a grid support service from Oakey Power Station could not be provided with the certainty required to satisfy reliability requirements. Grid support from Oakey was therefore not a feasible solution.

Several submissions considered that Powerlink should obtain grid support from the Oakey power station, with some submissions containing comments on the technical capabilities of the power station.

Powerlink held substantive discussions with Enertrade in relation to the possibility of a grid support contract for the use of Oakey power station, but a suitable arrangement was not able to be achieved.

In the national electricity market, Powerlink is not able to direct generators to operate. Further, generators independently weigh up commercial options and decide their own appetite for risk, which is commercial-in-confidence to them.

Interested parties are advised that there are significant risk allocation and commercial matters to be addressed in grid support contracts. Powerlink has obligations in relation to delivering reliability outcomes, and these are further strengthened by the ACCC's service standards that carry financial penalties[20] for unsatisfactory service levels. The service levels specifically include the frequency, duration and magnitude of loss of supply events[21].

Powerlink also has obligations under the National Electricity Code, its transmission authority and connection agreements to plan and develop the network to meet the forecast peak demand under credible single contingencies. Potential liabilities that Powerlink may face if it is in breach of or negligent in the delivery of these obligations is a significant issue to be dealt with when contracting for grid support from generators.

Where a TNSP has to rely on grid support from a generator to meet reliability obligations (which might otherwise be provided by a network augmentation), the grid support contract must require an equivalent level of service by the generator for a considerable contract term. During the term of any such contract, the generator must operate at the necessary level each and every time it is called upon. This is necessary to ensure that demand in excess of the capability of the network can be supplied without supply interruptions to customers.

For the market operator of a peaking generator such as Oakey, these matters can have a significant impact on its strategic and commercial choices. Enertrade could not guarantee Powerlink's required levels of availability due to commercial limitations under the existing Power Purchase Agreement which are commercial-in-confidence. Powerlink respects the right of all generators to make those strategic choices, and to maintain confidentiality about those strategies.

[19] For the information of non-industry readers, grid support is a term that refers to a service offered by a third party to a transmission network service provider (TNSP). The third party is paid for this service under a contractual arrangement out of the TNSP's regulated revenue, provided this is justified compared with other alternatives and allowable under the ACCC's revenue regulation arrangements. The cost of grid support services flows through to transmission charges paid by customers.

[20] These service standards will apply to Powerlink from the next revenue reset by its economic regulator.

[21] It is noted that loss of supply standards do not apply to VENCorp or TransEnergie.

Powerlink notes, for the record, that Enertrade acted professionally and showed a willingness to seriously consider all the matters raised in the discussions. In that context, it is noted that Powerlink and Enertrade already have what is believed to be the largest grid support contract in the NEM. Under this contract, Enertrade provides grid support in North Queensland. Strategic and commercial considerations are different in North Queensland, due to the grid support being able to be provided flexibly from a portfolio of three power stations comprising eight individual generating units with multiple fuel sources, rather than the single Oakey power station situation.

Notwithstanding the best endeavours of both parties, the outcome of the discussions was that grid support from the Oakey power station is not a viable option to deliver the required level of reliability for the Darling Downs.

4.2.4. Other Issues

As noted above, Powerlink's response to other issues raised in the submissions to the Application Notice is contained in Appendix 2 of this Final Report.

5.0 OPTIONS CONSIDERED

5.1 Consultation Summary

In its 2002 Annual Planning Report[22], Powerlink identified that action would be required in the short-term to address an anticipated major network limitation related to supply to the Darling Downs area in south west Queensland. The same document also contained information about existing and committed generation, grid transfer limits out of Tarong and forecasts of electricity demand growth in south-east Queensland[23].

In June 2002, Powerlink issued a document[24] providing more detailed information on the emerging network limitations in the Darling Downs area. This paper was the first step in meeting regulatory requirements related to potential network augmentations. It sought information from Code Participants and interested parties regarding potential solutions, including non-network solutions, to address the anticipated network limitations.

Powerlink received a submission from one (1) party in response to the discussion paper:

- Enertrade, the organisation which bids the output of Oakey Power Station into the National Electricity Market. Oakey Power Station is a 344/320MW (winter/summer) gas turbine power station located approximately 25km west of Toowoomba.

During the consultation process, Powerlink also met with two other parties at their request to provide further details regarding the emerging network limitation. No submissions were provided by these parties.

The need for action to address an anticipated major network limitation related to supply to the Darling Downs area in south west Queensland prior to the summer of 2004/05 has been confirmed and is listed again in Powerlink's 2003 Annual Planning Report[25].

The remainder of the information in section 5.0 repeats what was published in the Application Notice. Additional information on options in response to issues raised in submissions to the Application Notice is contained in Appendix 2.

5.2 Non-Transmission Options Identified

The primary purpose of the "Request for Information" paper was to identify feasible non-transmission solutions to be included in the analysis. In summary, the consultation identified the following information regarding solutions to address the emerging network limitations:

[22] Published in June 2002
[23] As required by the NEC, Powerlink provides notice in the Annual Planning Report of emerging limitations in its network within a 5 year timeframe. Ten year load forecast information and information about generation commitments and decommitments is provided to allow market participants and interested parties to assess longer term issues.
[24] Request for Information – Emerging Transmission Network Limitations Darling Downs Area. Powerlink Queensland 17 June 2002. Refer Powerlink's website: www.powerlink.com.au/asp/index.asp?pid=5&page=network
[25] Published June 2003

5.2.1. Demand Side Management

Existing demand side management programs in the Darling Downs area, and routine hot water switching activities, have already been included in the demand and energy forecasts used in the planning process. A submission was received in response to the Application Notice regarding demand side options (refer Appendix 2). No proponent was forthcoming for any demand side management initiatives not already accounted for.

5.2.2. New Local Generation

An allowance for potential cogeneration and renewable energy developments embedded[26] in the distribution network in the relevant area is already included in Powerlink's forecasts of energy and demand. Generation above these allowed levels would be required if local generation were to reduce demand on the transmission network and defer the need for other forms of corrective action.

No additional recently committed local generation projects in the relevant area were advised to Powerlink during the consultation process. One potential local generation development that was in the very early stages of consideration (ie – pre-feasibility studies) was discussed during the early part of the consultation process. The potential proponent did not provide any additional information in response to the Application Notice. There were no indications that this generation proposal could be operational by the required timing of late 2004.

5.2.3. Existing Generation

Enertrade advised Powerlink that it may be interested in providing grid support services from Oakey Power Station to address the emerging limitations in the transmission grid supplying the Darling Downs.

Oakey Power Station is a relatively high cost dual-fuel generator (able to operate on either gas or diesel) that typically only operates during periods of high prices in the wholesale electricity market[27]. It is located approximately 25km west of Toowoomba on the Darling Downs.

Enertrade has sole rights to the full output of Oakey Power Station, and it bids that output into the National Electricity Market (NEM).

Several submissions to the Application Notice from other interested parties raised concerns regarding the potential use of Oakey Power Station as a solution. Responses to the issues raised and further information about Oakey and Enertrade is provided in section 4.2.3.

5.3 Transmission Options Identified

In addition to the consultation process to identify possible non-transmission solutions, Powerlink carried out studies to determine the most appropriate transmission network solution to address the emerging limitations on the Darling Downs in conjunction with other foreseeable reliability limitations in south-east Queensland.

[26] An embedded generator connects directly to the low voltage distribution network. Output from such generators therefore reduces the expected energy that the transmission grid is required to deliver. Embedded generators may also reduce the demand the transmission grid is required to deliver, depending on their mode of operation.
[27] Which may coincide with periods of peak electricity demand or capacity shortfall

Multiple options were investigated, including some in response to requests from community members on the Darling Downs. An overview of some of the options examined is provided on the following page. More information regarding Solution A and Solution B, the two lowest cost options examined in detail, is contained in section 6, and in the spreadsheets in Appendix 4.

Solution A	1. 330kV double circuit transmission line from Millmerran to Middle Ridge and associated substation works ($71 million). 2. Subsequent 275kV augmentation from Middle Ridge to Greenbank in south-east Queensland and associated substation works ($60 million). The proposed augmentation (1) addresses the reliability limitations on the Darling Downs. The anticipated/modelled project (2) increases the supply capability into the Logan area of south-east Queensland, to meet that future identified need. This option has a total estimated capital cost of $131 million.
Solution B	1. 275kV single circuit transmission line from Tarong to Murphy's Creek and associated substation works ($47 million). 2. Subsequent 275kV augmentation from Millmerran to Greenbank in south-east Queensland and associated substation works ($113 million). The proposed augmentation (1) addresses the reliability limitations on the Darling Downs. The anticipated/modelled project (2) increases the supply capability into the Logan area of south-east Queensland, to meet that identified future need. This option has a total estimated capital cost of $160 million.
Solution C	1. 275kV single circuit transmission line from Tarong to Murphy's Creek and associated substation works ($47 million) 2. 275kV augmentation Braemar – Tarong ($75 million) 3. Subsequent 275kV augmentation from Millmerran to Greenbank in south-east Queensland and associated substation works ($113 million). The proposed augmentation (1) addresses the reliability limitations on the Darling Downs. The anticipated/modelled project (2) has been suggested by community members. The proposed augmentation in Solution A increases the capability to transfer power in a northerly direction from the QLD- NSW interconnector (QNI) and Millmerran Power Station (refer section 10.1), whereas the proposed augmentation in Solution B does not. A second line between Braemar (a substation on QNI) and Tarong would provide additional capacity in this section of the grid. Items 1 & 2 of Solution C do not satisfy future supply requirements in south-east Queensland. Therefore, Solution C includes another anticipated/modelled augmentation (3) between Millmerran and Greenbank as per Solution B, to enable all potential solutions to be compared on an even basis. An alternative to this is shown in Solution D. Solution C has a total estimated capital cost of $235 million and was not a preferred option because of the significant additional cost above Solutions A and B.
Solution D	1. 275kV single circuit transmission line from Tarong to Murphy's Creek and associated substation works ($47 million). 2. 275kV augmentation Braemar – Tarong and associated substation works ($75 million).

	3. Subsequent augmentation from Halys (near Tarong) to Greenbank in south-east Queensland via Springdale (near Gatton) and associated substation works ($180 million). Solution D is similar to Solution C, except that it replaces the anticipated/modelled augmentation (3) between Millmerran and Greenbank with an augmentation between Halys, near Tarong, and Greenbank. The augmentations between Halys – Springdale - Greenbank would utilise strategic easements which Powerlink had obtained for the long-term future 500kV network. In Solution D, the Halys – Greenbank lines would be constructed at 500kV but initially operated at 275kV. This option has a total estimated capital cost of $302 million. This option was not a preferred option because of the significant additional cost above Solutions A and B.
Solution E	1. Conventional AC underground cable from Millmerran – Middle Ridge and associated substation works ($511 million). 2. Subsequent 275kV augmentation from Middle Ridge to Greenbank in south-east Queensland and associated substation works ($60 million). The proposed augmentation (1) addresses the reliability limitations on the Darling Downs. The underground line estimate provides for a connection with the same capacity as the overhead line in Solution A (approximately 800MW). The anticipated/modelled project (2) increases the supply capability into the Logan area of south-east Queensland. This option has a total estimated capital cost of $571 million, and was not a preferred option because of the significant additional cost above Solutions A and B.
Solution F	1. 4 x DC Light Underground Cables from Millmerran – Middle Ridge, AC/DC converter stations and associated substation works ($525 million). 2. Subsequent 275kV augmentation from Middle Ridge to Greenbank in south-east Queensland and associated substation works ($60 million). The proposed augmentation (1) addresses the reliability limitations on the Darling Downs. The underground line estimate provides for the installation of four cables using DC Light technology to provide a connection with the same capacity as the overhead line in Solution A (approximately 800MW). The installation of four underground/overhead converter stations at Middle Ridge would require substantial land area, and is likely to require additional property acquisition and connection works. This requirement has not been investigated in detail due to the substantial cost disadvantage of this option. The anticipated/modelled project (2) increases the supply capability into the Logan area of south-east Queensland. This option has a total estimated capital cost of $585M, and was not a preferred option because of the significant additional cost above Solutions A and B.

6.0 LOWEST COST SOLUTIONS

This section provides further information about the two lowest cost options analysed in detail, with the financial analysis to compare the two options contained in the spreadsheets in Appendix 4. Both solutions A and B suggest a proposed augmentation to address emerging limitations in the Darling Downs area. The solutions also include an anticipated/modelled project to address emerging limitations in south-east Queensland. These anticipated/modelled projects would be subject to a separate consultation process under the National Electricity Code within appropriate timeframes.

Solution A

Proposed Augmentation – Addressing Emerging Limitations in the Darling Downs area

Proposed Augmentation: 330kV transmission line from Millmerran to Middle Ridge		
Late 2004	Construct double circuit 330kV line from Millmerran to Middle Ridge	$71.3 million

Solution A addresses the limitation on the Darling Downs by the construction of approximately 90km of 330kV double circuit transmission line between Millmerran and Middle Ridge by late 2004 (refer Figure 3). Middle Ridge substation is located in the Toowoomba area, and is the primary bulk supply point for the entire Darling Downs area.

The proposed double circuit 330kV line in Solution A will initially be operated as a single circuit connection. This will overcome the emerging limitations on the Darling Downs. It will provide substantial additional capacity to transfer power into the Darling Downs area and prevent voltage collapse and line overloads when the existing 275kV line between Tarong and Middle Ridge is out of service[28].

A single circuit line has not been proposed between Millmerran and Middle Ridge, as this would require a second line to be constructed later through the same area to address future limitations in south-east Queensland. A double circuit line is a prudent investment, as it is more cost-effective than two single circuit lines, minimises the impact on communities in the area and maximises utilisation of easements. Construction of double circuit transmission lines provides the capability for increased transmission capacity[29] with significant cost savings over an additional single circuit line, due to easement sharing and common towers.

Solution A requires substation works at the existing Millmerran and Middle Ridge substations to connect the new 330kV line in late 2004. Additional 275/110kV transformation capacity will also be required due to the high capacity injection into Middle Ridge. The estimated capital cost of the proposed augmentation in Solution A is $71.3 million. Commitments to construction are required in mid 2003 to ensure completion by the required date of October 2004.

[28] Maintenance of a reliable power supply to the Energex substation at Postmans Ridge in the Lockyer Valley has also been taken into account.

[29] The capacity of the two 330kV circuits would be fully utilised when the subsequent anticipated/modelled project into south-east Queensland was completed, and the line reconfigured to enable double circuit operation (see Anticipated/Modelled Project).

Anticipated/Modelled Project – Addressing Emerging Limitations in South-East Queensland

Anticipated/Modelled Project: 275kV augmentation from Middle Ridge to Greenbank.[30]		
Late 2008	Construct double circuit 275kV line from Middle Ridge to Greenbank	$60.4 million

An anticipated/modelled project is forecast within Solution A to provide for the emerging reliability limitations in south-east Queensland. That anticipated/modelled project would involve:

- construction of approximately 105km of double circuit 275kV line between Middle Ridge and Greenbank (in the Logan area) in south-east Queensland by 2008/09 at the latest (refer Fig. 3);
- substation works at Middle Ridge and Greenbank to connect the new line;
- substation works to reconfigure the proposed augmentation between Millmerran and Middle Ridge from single circuit to double circuit operation.

The Logan area, together with the southern suburbs of Brisbane and the Gold Coast, has one of the highest rates of electricity demand growth in Queensland. A major injection of power into the heart of this growth area will be necessary to meet future customer electricity needs. The Greenbank substation site is located in the Logan area, at the conjunction of major 275kV lines which will supply Belmont, Loganlea and the Gold Coast. It would therefore be the ideal location for transfer of additional power into south-east Queensland.

The anticipated/modelled project within Solution A would allow greater transfer of power into south-east Queensland. It would provide a strong double circuit path between Millmerran and Greenbank. This would increase the ability to transfer power to south-east Queensland customers from all power sources interstate (via QNI) and from Millmerran, Tarong and Central Queensland generators[31]. Because it would increase supply capacity into south-east Queensland, the anticipated/modelled project would overcome the emerging reliability limitations associated with demand in the south-east corner of the State exceeding supply capacity.

Plans for the anticipated/modelled project within Solution A provide for a portion of the existing 110kV double circuit line between Middle Ridge and Swanbank to be replaced with a double circuit 275kV line.

The economic analysis in Section 9.0 includes both the proposed augmentation and the anticipated/modelled project within Solution A. This is necessary to ensure feasible options are compared on an equivalent basis in terms of the likely long-term development of the electricity grid[32].

[30] The timing in the above table is based on the electricity demand forecasts as published in the initial consultation paper and Annual Planning Report issued by Powerlink in June 2002. The financial analysis evaluates possible variations to this timing using the market development scenarios in section 7.0.

[31] Market participants are advised that it is expected this anticipated/modelled project would be constructed by not later than 2008/09 when it would be required for reliability purposes. That is, when demand in south-east Queensland would otherwise exceed supply capability taking into account existing and committed generation and existing grid transfer capability from Tarong and Central Queensland to south-east Queensland.

[32] Other works that are common to both options have not been included in the financial analysis as they do not alter the analysis conclusions.

Solution A – Capital Cost of Proposed Augmentation and Anticipated/Modelled Project		
Date Reqd	Proposed Augmentation	Capital Cost
Late 2004	Construct double circuit 330kV line from Millmerran to Middle Ridge	$71.3 million
	Anticipated/Modelled Project	
Late 2008	Construct double circuit 275kV line from Middle Ridge to Greenbank	$60.4 million

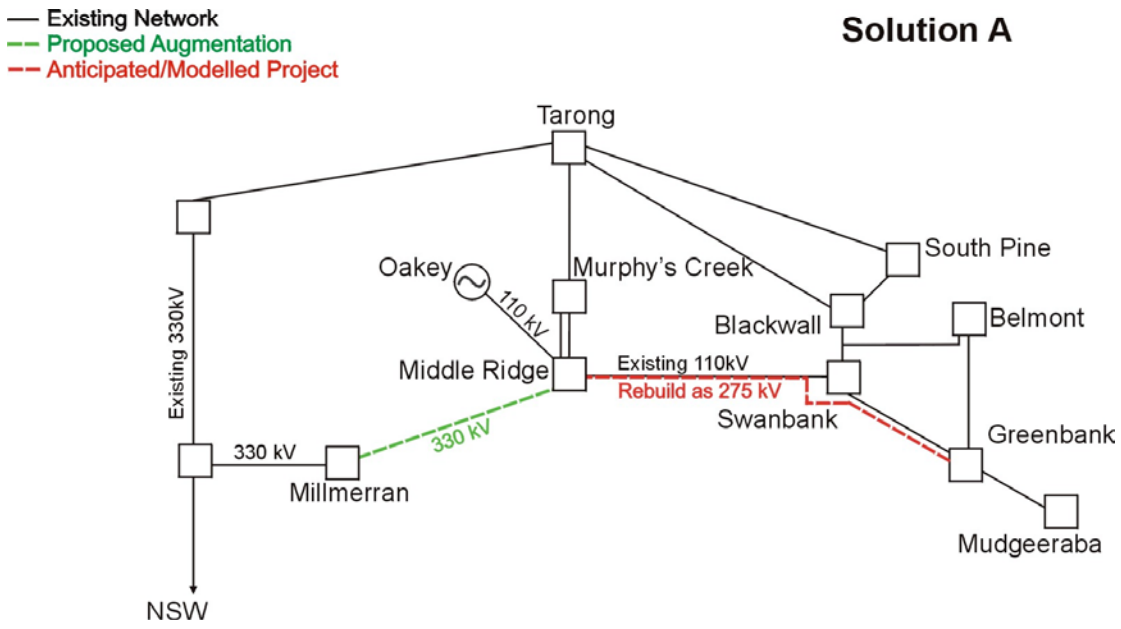


Figure 3 – Diagram showing proposed augmentation and anticipated/modelled project within Solution A

Solution B

Proposed Augmentation – Addressing Emerging Limitations in the Darling Downs area

Proposed Augmentation: 275kV line from Tarong to Murphy's Creek		
Late 2004	Construct single circuit 275kV line from Tarong to Murphy's Creek	$46.8 million

Solution B addresses the emerging reliability limitations on the Darling Downs by constructing approximately 80km of single circuit 275kV transmission line between Tarong and Murphy's Creek (refer Figure 4).

Murphy's Creek is located approximately 25km north of Middle Ridge. There is an existing single circuit 275kV line between Tarong and Murphy's Creek, and an existing double circuit 275kV transmission line between Murphy's Creek and Middle Ridge. The proposed new line in Solution B would be located adjacent to the existing single circuit line.

The single circuit 275kV line provides additional capacity to transfer power into the Darling Downs area, although the capacity is significantly less than the 330kV line proposed in Solution A. Solution B also provides less geographical diversity than Solution A, as the primary supply to the Darling Downs will come from a single source at Tarong. In Solution A, high voltage power transfers can occur from either Tarong or Millmerran[33][34].

Solution B would also require substation works at the existing Tarong and Middle Ridge substations, and line rearrangement works at Murphy's Creek, to allow the new circuit to operate as a direct connection between Tarong and Middle Ridge[35]. Increased injection into Middle Ridge at 275kV will also require additional 275/110kV transformation capacity. The estimated capital cost of the anticipated/modelled project in Solution B is $46.8M.

The financial analysis in this document assumes that the Solution B proposed augmentation is commissioned in late 2004. This would require a new easement to be obtained adjacent to the existing easement.

Anticipated/Modelled Project – Addressing Emerging Limitations in South East Queensland

Anticipated/Modelled Project: 275kV double circuit line from Millmerran to Greenbank		
Late 2008	Construct 275kV double circuit line from Millmerran to Greenbank	$113.2 million

[33] In both Solution A and B, some limited back-up supply is available from Swanbank if the other circuits supplying Middle Ridge are out of service.
[34] As with Solution A, maintenance of a reliable power supply to the Energex substation at Postmans Ridge in the Lockyer Valley has also been taken into account.
[35] That is, connections would be re-arranged to connect the new circuit between Tarong and Murphy's Creek to one of the existing two circuits between Murphy's Creek and Middle Ridge. The existing circuit between Tarong and Murphy's Creek would be connected to the other circuit between Murphy's Creek and Middle Ridge.

The anticipated/modelled project within Solution B would provide for the emerging reliability limitations in south-east Queensland to be addressed by constructing 195km of double circuit 275kV line between Millmerran and Greenbank (in the Logan area) in south-east Queensland and associated substation works by 2008/09 at the latest (refer Figure 4).

This would achieve similar outcomes to the anticipated/modelled project within Solution A, in terms of meeting the power requirements in the fast-growing areas of south-east Queensland. It would allow the transfer of additional electricity from power sources in south-western Queensland to customers in these areas, and therefore overcomes the emerging reliability limitations in south-east Queensland.

In Solution B, an anticipated/modelled project between Middle Ridge and Greenbank as in Solution A is not a technically feasible way of addressing reliability limitations in south-east Queensland. The existing circuits between Tarong and Murphy's Creek and Murphy's Creek and Middle Ridge were built in the late 1980s. The capacity of these older lines is much lower than the proposed new line between Tarong and Murphy's Creek. After the construction of the proposed augmentation between Tarong and Murphy's Creek, the existing and new circuits between Tarong and Middle Ridge would only have sufficient capacity to meet the power requirements of the Darling Downs. These circuits would be technically incapable of carrying significant additional power to meet future requirements in south-east Queensland[36]. It would therefore be necessary in Solution B to construct a new double circuit line from Millmerran to Greenbank.

As with Solution A, plans for the anticipated/modelled project within Solution B provide for a portion of the existing 110kV double circuit line between Middle Ridge and Swanbank to be replaced with a double circuit 275kV line.

The economic analysis in Section 9.0 includes both the proposed augmentation and the anticipated/modelled project within Solution B. This is necessary to ensure feasible options are compared on an equivalent basis in terms of the likely long-term development of the electricity grid[37].

Solution B – Capital cost of Proposed Augmentation and Anticipated/Modelled Project

Date Reqd		Capital Cost
	Proposed Augmentation	
Late 2004	Construct single circuit 275kV line from Tarong to Murphy's Creek	$46.8 million
	Anticipated/modelled project	
Late 2008	Construct 275kV double circuit line from Millmerran to Greenbank	$113.2 million

[36] Easement and environmental considerations would prevent the construction of a new double circuit 275kV line adjacent to the existing line, unless the existing circuits between Tarong and Middle Ridge were removed after the new line was commissioned. This would be more expensive than Solution A or B, and has been costed as Solution G in section 5.0.

[37] Other works that are common to both options have not been included in the financial analysis as common works do not alter the result.

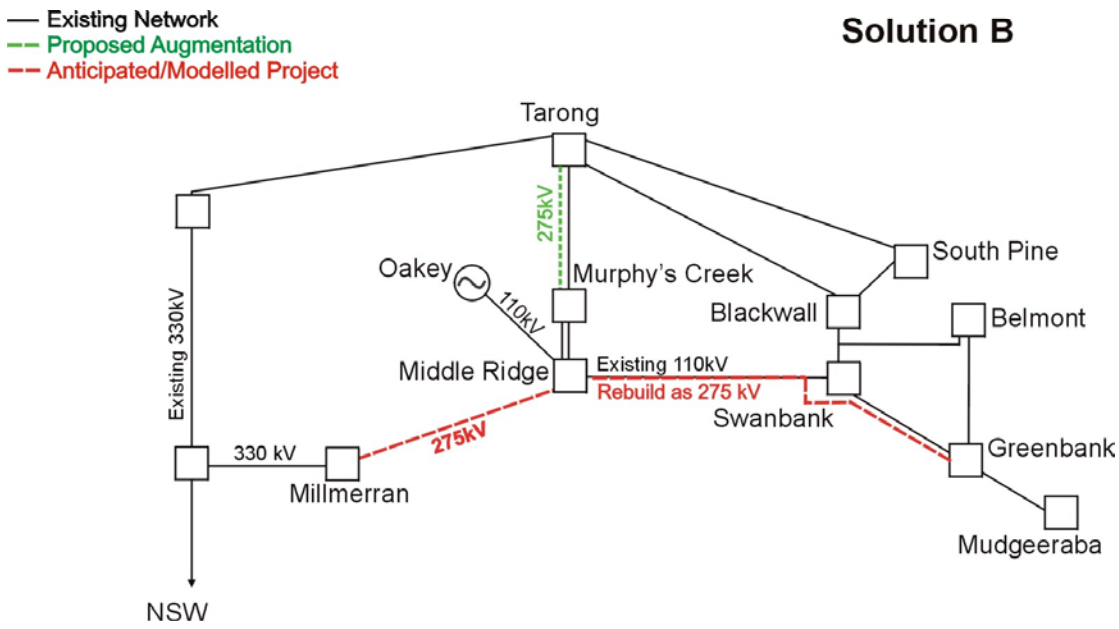


Figure 4 – Diagram showing the proposed augmentation and anticipated/modelled project within Solution B

7.0 MARKET DEVELOPMENT SCENARIOS

7.1 Context for Evaluation of Options

All feasible solutions to the identified network limitations must be viewed in the context of wider developments in the National Electricity Market:

- The Queensland Government is proceeding with the implementation of its policy requirement for Queensland energy retailers to source 13% of their energy from gas-fired generation from 1 January 2005. The 13% Gas Scheme is designed to deliver on the government policy objectives of diversifying the State's energy mix towards a greater use of gas and encouraging new gas infrastructure in Queensland, while reducing the growth in greenhouse gas emissions;

- Commonwealth legislation has been in effect since 1 January 2001 to encourage increased generation from renewable energy sources. Powerlink has incorporated independent forecasts of additional renewable energy generation into the forecasts of demand and energy used in assessing the expected incidence of future network limitations, as outlined in the Annual Planning Report;

- NEMMCO's Statement of Opportunities (SOO) issued in July 2002 contained information on existing and committed generation developments in Queensland. There is a considerable margin between supply capacity and demand on a statewide basis, with several large new generating units commissioned in Queensland in the past 18 months; and

- The large margin between supply capacity and demand for Queensland as a whole does not apply to the localised area of south-east Queensland. As outlined in section 3.2, electricity demand in the Moreton North, Moreton South and Gold Coast zones is growing at approximately 200MW per year. There has been no net increase in power generation installed in south-east Queensland during the past 15 years to match this demand growth.

7.2 Assumed Market Development Scenarios

The ACCC Regulatory Test requires that options to address network limitations be assessed against a number of plausible market development scenarios. These scenarios need to take account of:

- the existing system;
- future network developments;
- variations in load growth;
- committed generation and demand side developments; and
- potential generation and demand side developments.

The purpose of utilising this approach is to test the Net Present Value costs of the solutions being evaluated under a range of plausible scenarios.

The analysis in this document is primarily sensitive to the assumed timing of anticipated/modelled projects in Solution A and B. Factors such as those listed above impact on the financial analysis and Net Present Value comparison depending on how they affect the timing of the anticipated/modelled project into south-east Queensland.

As outlined in section 3.2, load forecasts show that the anticipated/modelled project into south-east Queensland will be required by 2008/09 at the latest. As load forecasts for the June 2003 Annual Planning Report suggest an earlier rather than later timeframe, market development scenarios have been developed for 2008/09, and the two years prior:

Scenario I	Anticipated/Modelled Project to address South-east Queensland Limitations 2006/07
Scenario II	Anticipated/Modelled Project to address South-east Queensland Limitations 2007/08
Scenario III	Anticipated/Modelled Project to address South-east Queensland Limitations 2008/09

Current trends indicating a timing earlier than 2008/09 include:

- South-east Queensland electricity demand continues to grow rapidly (by approximately 200MW per year). The most recent forecasts reflect accelerated growth rates in the next three years, due to factors including the increasing installation of air conditioning;

- On a net basis, there has been little or no increase in generating capacity in the south-east corner of the State for the past 15 years;

- Proposals for new power stations have been announced, but these are located outside south-east Queensland (eg - Kogan Creek in south-west Queensland, Townsville Power Station expansion/conversion in north Queensland etc);

- Reactive power demand is growing in association with the growth in electricity demand. This is a technical characteristic of the power system that requires corrective action to maintain appropriate system voltages. If the growth in reactive power demand is not addressed, it progressively diminishes the existing transfer capability of Powerlink's network supplying south-east Queensland;

- The 2008/09 timing is reliant on full availability and output at Swanbank B, Tarong/Tarong North and partial availability of Wivenhoe and Directlink (flowing northwards) at the time of high south-east Queensland demand. More conservative assumptions regarding the availability of this plant will reduce the load at which voltage collapse could occur and hence would require earlier corrective action.

Further description of how these issues relate to the market development scenarios is contained in section 7.3.

For the purposes of completeness of this document, a fourth market development scenario has also been developed. This scenario considers the sensitivity of the financial results to a situation where the anticipated/modelled project into south-east Queensland is deferred for three years beyond the latest date that Powerlink presently considers can be sustained (ie – to 2011/12).

Powerlink would emphasise that the only way this timeframe could occur is if new generation sufficient to satisfy three years load growth (ie – 400 - 600MW) was established in south-east Queensland. There are no indications that such generation is under consideration, and Powerlink's assessment is that its establishment in the short to medium term is not likely. Scenario IV is therefore a plausible, but unlikely scenario, which nonetheless provides a test of the robustness of the analysis.

Scenario IV	Anticipated/Modelled project to address South East Queensland Limitations 2011/12

7.3 Relationships between Scenarios and Market Factors

A brief description of the relationship between the scenarios and factors such as load growth, network developments and generation assumptions is provided below:

7.3.1. Variations in Load Growth:

Powerlink carries out the majority of its detailed planning using a medium economic growth, typical weather (50% probability of exceedance) forecast for electricity usage. These forecasts include all known information about existing and planned demand side initiatives, and also include independent forecasts of local embedded generation developments.

The 2008/09 timeframe was determined using these medium growth, typical weather forecasts. Higher or lower economic growth may influence the timing by up to one year. However, the largest impact would be a combination of greater installation of air conditioning and an assumption of extreme summer temperatures (ie – a 10% probability of exceedance forecast). Air conditioning load not only increases electricity demand – it also increases the reactive power demand on the system and impacts the power transfer capability of the transmission network. Under these assumptions, reliability limitations in south-east Queensland may be reached as early as 2005/06 (an outcome foreshadowed in Energex's submission to the Application Notice).

7.3.2. Future Network Developments:

The need for the proposed augmentation and anticipated/modelled projects in this report is independent of other identified network limitations that Powerlink is addressing elsewhere in its transmission grid.

Committed network developments, including the transmission line under construction between Blackwall, near Ipswich, and Belmont, in Brisbane's southern suburbs, have been taken into account in the analysis. There are no proposed network developments that are expected to have a material impact on the timing at which the anticipated/modelled project into south-east Queensland is required. Other network developments are therefore considered to be common to the two solutions analysed, and have not been included in the financial analysis.

7.3.3. Existing and Committed Generators

Oakey Power Station output impacts the emerging network limitations in the Darling Downs area, but this power station typically operates only at times of high wholesale electricity market prices which may or may not coincide with peak demand periods on the Darling Downs. Operating this power station under a grid support arrangement is not a feasible solution, as outlined in section 4.0. The emerging network limitations in the Darling Downs area are not sensitive to the generation pattern of other existing and committed generators.

When considering the impact of existing generators on the timing at which the anticipated/ modelled project into south-east Queensland will be required, Powerlink assumed a generation dispatch pattern as outlined in section 3.2. The most optimistic generation dispatch pattern was assumed; that is, that all generation in south-east Queensland could be operated to satisfy customers' electricity requirements, regardless of the merit order cost of operating generation in south-east Queensland in preference to generation outside south-east Queensland [38].

However, existing generators can impact the reliability limitations in the following ways:

- the MW output and reactive support provided by existing generators are key factors in the constraint equations that determine the capacity of Powerlink's existing transmission grid supplying the south-east Queensland area (eg – the "Tarong Limit"). Generation can increase or decrease the grid transfer capability into south-east Queensland, depending on its location. Additional generation in south-east Queensland reduces the grid transfer capability but increases the amount of load that can be supported in south-east Queensland;

- any further decommitments to existing generating units in south-east Queensland will bring forward the reliability requirement. Powerlink has not been advised of any further decommitments within south-east Queensland; and

- Powerlink has allowed for the largest single generating unit in south-east Queensland to be out of service due to maintenance or breakdown when determining the timing at which the anticipated/modelled project into south-east Queensland is required. Implicit in this assumption is the fact that demand will exceed supply capacity earlier than 2008/09, with resulting impacts on reliability of supply, if more than one major generating unit in south-east Queensland is simultaneously out of service during peak demand periods.

7.3.4. Potential Generators and/or Demand Side Response:

Recent additional generation capacity commitments within Queensland mean that a healthy electricity supply-demand balance for the State as a whole is anticipated over the medium term. New generation seems only likely to be developed where organisations identify commercial opportunities, rather than being developed in response to load requirements.

Smaller generation developments may occur in the Darling Downs and south-east Queensland areas in response to government initiatives to encourage the development of renewable energy generation and generation from gas-fired power sources. Powerlink is not aware of any well-advanced new generation proposals where the network limitations exist, and none have come forward in response to the consultation process.

[38] As noted in section 3.2, the assessment allowed for the largest generating unit in south-east Queensland (Swanbank E) to be unavailable due to maintenance or plant breakdown.

Should new generators be established in south-east Queensland prior to 2008/09, they may defer the timing that the reliability limitation will arise. This is heavily dependent on the size and operation of the proposed generator. As described above, the electricity demand in the south-east Queensland corner of the state is growing at approximately 200MW per year. Large amounts of new generation with high anticipated operating levels would therefore be required in the south-east area of Queensland to defer the timing of the reliability limitations[39]. There are no known proposals for large scale new generation in south-east Queensland at this time.

[39] The transfer capability of Powerlink's grid is dependent on the generation pattern within the National Electricity Market (refer constraint equations in Powerlink's 2003 Annual Planning Report). The amount of generation required to defer the reliability limitation by one year is therefore not exactly equivalent to the annual load growth. It will depend on the impact of the new generation on the transmission network transfer capability into south-east Queensland. The size of the generator, its location, anticipated operating regime and the number of generating units (and therefore reactive support it can provide) will all be critical in determining the impact of a new generator on the amount of supportable customer load in the south-east Queensland area.

8.0 FINANCIAL ANALYSIS OVERVIEW

8.1 Description of Financial Analysis Approach

Two forms of financial analysis were carried out.

(1) Powerlink carried out economic analysis to calculate and compare the Net Present Value (NPV) of the costs to market participants of each solution under the range of assumed market development scenarios. This analysis was carried out in accordance with the ACCC Regulatory Test, as required for reliability augmentations (refer section 9.0).

(2) In addition, ROAM Consulting Pty Ltd was engaged to carry out market simulations and economic analysis of the market benefits of the proposed augmentation in Solution A compared with the proposed augmentation in Solution B (refer section 10.1)[40]. This assessment was carried out for the purposes of providing information to market participants about indicative benefits, and has not been used in the ACCC Regulatory Test evaluation of the proposed new large network asset.

    Notwithstanding this, the calculated market benefits are significant in the (unlikely) Scenario IV, and would be worthy of consideration in the event that circumstances changed so that Scenario IV became more likely[41].

8.2 Summary of Results

A summary of the two forms of financial analysis is contained in the conclusions in section 11.0, together with the total capital cost of each option. However, the proposed augmentation is justified only on the basis of the analysis carried out in accordance with the ACCC Regulatory Test. This analysis identifies that Solution A is the least cost solution on a net present value basis.

[40] Following the implementation of anticipated/modelled projects to address south-east Queensland limitations, the market benefits of each solution were considered to be similar

[41] If this occurred, the analysis would need to be reassessed to take account of any relevant system changes

9.0 ACCC REGULATORY TEST ANALYSIS

9.1 ACCC Regulatory Test Requirements

The requirements for the comparison of options to address an identified network limitation are contained in the Regulatory Test prescribed by the Australian Competition and Consumer Commission (ACCC)[42].

The ACCC Regulatory Test requires that the recommended option be the option that "maximises the net present value of the market benefit having regard to a number of alternative projects, timings and market development scenarios".

The ACCC Regulatory Test contains guidelines for the methodology to be used to calculate the net present value (NPV) of the market benefit. For example, where an augmentation is required to satisfy minimum network performance requirements (ie – a reliability augmentation), the methodology published by the ACCC defines "market benefit" as the total net cost to all those who produce, distribute and consume electricity in the National Electricity Market. That is, the option with the lowest net present value cost maximises the market benefit.

Information to be considered includes the 'efficient operating costs of competitively supplying energy to meet forecast demand' and the cost of complying with existing and anticipated laws. However, the ACCC Regulatory Test specifically excludes indirect costs, and costs that cannot be measured as a cost in terms of financial transactions in the electricity market.

9.2 Inputs to Analysis

Solutions to address emerging network limitations in the Darling Downs area and in the south-east Queensland area as outlined in this document are required to satisfy reliability requirements linked to Schedule 5.1 of the National Electricity Code, Powerlink's transmission authority and the requirements of the Queensland Electricity Act[43].

According to the ACCC Regulatory Test, this means that the costs of all options must be compared, and the least cost solution is considered to satisfy the ACCC Regulatory Test. The results of this evaluation, carried out using a cash flow model to determine the Net Present Value (NPV) of the various options, are shown in section 9.3.

Cost inputs to the NPV analysis are described below.

The costs of the transmission augmentations outlined in the solutions in section 6.0 have been estimated by Powerlink. Sensitivity studies have been carried out using variations in the capital cost estimates of plus or minus 15% (see section 9.4).

The financial analysis considers all cost impacts of the proposed network augmentations to market participants as defined by regulatory processes. The estimated saving in the cost of network losses for each option has been included based on the assumption of typical load factor and an average cost of losses of $25/MWh. Sensitivity studies have also been carried out on the assumed cost of losses (see section 9.4).

[42] Powerlink is required to evaluate options for new transmission developments under the ACCC Regulatory Test in accordance with clause 5.6 of the National Electricity Code.
[43] Refer section 3.0.

Capital and operating costs for items which are common to all options were not included in the analysis. These common costs include the capital and operating costs of other future transmission works, where these costs are independent of the identified network limitations. As such, they have no impact on the relative ranking of options resulting from the analysis.

9.3 Reliability Assessment - Net Present Value Analysis

The economic analysis undertaken to comply with the ACCC Regulatory Test considered the net present value (NPV) of the costs of alternative options over the 15 year period from 2003 to and including 2017. Full details of this analysis are contained in Appendix 4. The sensitivity of the analysis to a 20 year evaluation period was also undertaken.

A discount rate of 10% was selected as a relevant commercial discount rate, and sensitivity analysis was conducted to test this assumption. A range of assumed market development scenarios was considered as outlined in section 7.0.

Under the ACCC Regulatory Test, it is the ranking of the options which is important, rather than the actual net present value results. This is because the ACCC Regulatory Test requires the recommended option to have the lowest net present value cost compared with alternative projects.

The following table is a summary of the economic analysis carried out for the reliability augmentation assessment in accordance with the ACCC Regulatory Test (full details in Appendix 4). It shows the net present value of each alternative, and identifies the best ranked option, for the range of scenarios considered.

Discount rate 10%		**Scenario I** *Anticipated/modelled project in 06/07*		**Scenario II** *Anticipated/modelled project in 07/08*		**Scenario III** *Anticipated/modelled project in 08/09*		**Scenario IV** *Anticipated/modelled project in 11/12*	
		NPV ($M)	**Rank**	**NPV ($M)**	**Rank**	**NPV ($M)**	**Rank**	**NPV ($M)**	**Rank**
Solution A	Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge	**$69.79**	**1**	**$63.95**	**1**	**$59.55**	**1**	**$49.09**	**1**
Solution B	Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck	$80.78	2	$73.67	2	$67.16	2	$50.77	2

The summary shows that Solution A has the lowest net present value cost for all scenarios.

9.4 Sensitivity Analysis

In addition to examining the impact of market development scenarios, the sensitivity of the solution ranking to other critical parameters was also examined. These critical parameters were:

1. Capital cost of transmission solutions
2. Cost of network losses
3. Discount rate
4. Length of analysis period

A solution must be implemented by late 2004 to overcome the identified network limitations on the Darling Downs. No sensitivity analysis was carried out to test various commissioning dates of the proposed augmentation. It is evident from the analysis that action is required prior to late 2004 in order to maintain a reliable power supply to customers on the Darling Downs. Any deferral of timing beyond late 2004 will result in unacceptable system reliability.

A solution will be required by summer 2008/09 to address the emerging reliability limitations in south-east Queensland. The NPV analysis considers the immediate limitation to the Darling Downs and the subsequent limitation to south-east Queensland through an assessment over a 15 year analysis period. The sensitivity of the analysis to the assumed timing of the anticipated/modelled projects (and therefore the incidence of the capital expenditure) has been taken into account in the economic comparison through the use of market development scenarios.

The effect of varying capital cost, cost of network losses and the discount rate was investigated using standard Monte Carlo techniques.[44] The following table shows the parameters that were investigated in the sensitivity analysis, the distribution that was assumed for each parameter and the range of values.

Parameter	Distribution
Capital Cost of Transmission Option	The capital cost of the two solutions was tested for sensitivity to variations of plus or minus 15% from the expected value. The variation in each cost was modelled as a triangular distribution with the assumption that the costs are statistically independent. This means that the cost of each network component is allowed to vary within plus and minus 15% independently of the over or underspend of the other components.
Cost of losses	The sensitivity to the average cost of losses was tested by allowing this parameter to vary randomly between $20/MWh and $30/MWh using a triangular distribution with a mode of $25/MWh.
Discount rate	The Monte Carlo analysis was repeated using discount rates of 8%, 10% and 12%.

The Monte Carlo analysis assigns a value to each of the above parameters according to its distribution and then ranks the options. This simulation is done many times (in this case, 1,000 times) to cover a large number of combinations of parameters. The analysis identifies which option is the best ranked option (the option that has the lowest cost on an NPV basis for the largest number of samples) and gives the frequency for which this option 'wins'.

The sensitivity of the ranking of options to the discount rate assumption was also investigated by repeating the above analysis with a discount rate of 8%, 10% and 12%. The following table shows the 'winning option' and the frequency for which it 'wins' for each scenario and discount rate across the range of parameters assessed.

	Discount Rate		
	8%	10%	12%
Scenario I (SEQ in 06/07)	A (99%)	A (99%)	A (99%)
Scenario II (SEQ in 07/08)	A (99%)	A (99%)	A (99%)
Scenario III (SEQ in 08/09)	A (98%)	A (97%)	A (96%)
Scenario IV (SEQ in 11/12)	A (72%)	A (66%)	A (61%)

[44] Using the @Risk add-in for Microsoft Excel.

As can be seen in this table, Solution A is the highest ranked option under the majority of scenarios. These sensitivity analysis results are consistent with the base case economic analysis.

The financial analysis was repeated using a 20 year analysis period to address the issue of whether a longer evaluation period should be used to reflect the long asset life of transmission lines. On this basis, the Net Present Value cost of Solution A was $9.9 million lower than Solution B (Scenario III - 2008/09). Results for other scenarios are contained in Appendix 5.

On the basis of the financial analysis and the sensitivity studies, Solution A is the option that satisfies the ACCC Regulatory Test.

9.5 Inter-Network Impact

Powerlink is required under the National Electricity Code to assess whether a proposed new large network asset is reasonably likely to have a material inter-network impact. Powerlink has studied the impacts of the proposed augmentation in Solution A (as recommended in this document) and submitted results to the Transmission Network Service Provider of New South Wales, TransGrid.

Powerlink and TransGrid have determined that the proposed new large network asset will not impose power transfer constraints or adversely impact the quality of supply within the New South Wales network.

10.0 OTHER FACTORS

Solution A provides significant other cost savings and benefits in comparison to Solution B, in addition to those included in the economic analysis in section 9.0. These are outlined below:

10.1 Market Benefits

The sole purpose of the proposed network augmentation is to address the emerging reliability limitations. Powerlink, as the relevant transmission network service provider (TNSP), must implement corrective action to satisfy its statutory obligations (refer section 3.0). For this reason, the proposed augmentation is classified as a reliability augmentation as defined in the National Electricity Code.

Nonetheless, a study has been carried out to assess the consequential market benefits arising from the proposed reliability augmentation. ROAM Consulting Pty Ltd was engaged to perform market dispatch simulations and determination of the relevant market benefits[45] of proposed augmentations in Solutions A and B. ROAM Consulting has considerable experience in electricity market simulations and economic analysis.

10.1.1. Analysis Approach

Presently, all power transferred in a northerly direction from interstate via the Queensland-New South Wales interconnection (QNI) and from Millmerran Power Station must be transmitted to Queensland customers via the transmission network between Bulli Creek substation (on QNI) and Tarong.

The proposed augmentation in Solution A (ie – the proposed new transmission line between Millmerran and Middle Ridge) provides an alternative path for this power to reach customers on the Darling Downs and, to a lesser extent, south-east Queensland. The additional transmission capacity provided by the proposed new line effectively increases the total transfer capability between Bulli Creek and some of the customers who are presently supplied from Tarong.

The proposed augmentation in Solution B comprises an augmentation between Tarong and Murphy's Creek. All power from QNI and Millmerran Power Station must continue to be transferred via the existing circuits between Bulli Creek and Tarong. In the proposed augmentation in Solution B, there is therefore no alternative path provided between Bulli Creek and customers presently supplied from Tarong.

ROAM Consulting Pty Ltd was engaged to assess the market benefits of the alternative path provided by the proposed augmentation in Solution A. These benefits are only provided by Solution A; no such market benefits are available from Solution B until the anticipated/modelled project to reinforce south-east Queensland occurs.

Anticipated/modelled projects in each solution were not modelled, as each solution results in a double circuit connection from Millmerran to Greenbank. It was therefore considered that the impact of the anticipated/modelled projects on the electricity market was sufficiently similar that there would be little variation in market benefits as a result of these anticipated/modelled augmentations.

[45] As defined by the ACCC - a similar methodology to that developed for the completion of the Economic Assessment of the proposed SNI Interconnector was applied.

10.1.2. Results of Market Benefit Analysis

ROAM Consulting Pty Ltd identified that Solution A provides savings to the electricity market in comparison to Solution B. Details of the net present value of the market benefits of implementing Solution A are contained in Appendix 6 and summarised in the table below:

Market Benefits Associated with Solution A[46]:

	04/05	05/06	06/07	07/08	08/09
Market Benefits $M	.013	0.06	0.14	1.12	3.73
NPV of Benefits $2.95M					

The estimated net present value of the market benefits provided by Solution A in comparison to Solution B is $2.95M[47]. These benefits arise from allowing the transfer of power from competitively priced generation to Queensland customers. Such benefits include[48]:

- savings in reduction in fuel consumption across all generators in the National Electricity Market (NEM);
- savings resulting from the deferral of investment in new generation infrastructure (responding to market signals and/or to changed reliability parameters).

The annual benefits are small in the initial years because:

- They arise from fuel and operating cost differences only as the increased capacity facilitates increased trading in the NEM. The fuel savings are projected to be small until 2007/08, after which time the savings increase annually;

- Queensland does not have any shortfall in electricity supply from a supply/demand balance perspective until 2008/09 for the conditions that have been studied. It is expected that the anticipated/modelled project into south-east Queensland will be required by this time, so that Solution A and B will offer similar market benefits after 2008/09. However, market participants are advised that if no alternative path between Bulli Creek and Tarong is created, the market benefits of Solution A over Solution B rise sharply to approximately $12 million per annum after 2008/09[49].

  The impact of this is of particular relevance to the (unlikely) Scenario IV. Whilst the NPVs of the market benefits for (the most likely) Scenarios I, II, and III are modest, the NPV of the market benefits of Scenario IV is $22.39 million. Given that the key decision criterion for selecting a solution – lowest NPV cost – is "line ball" between the solutions in Scenario IV, there is an argument for then using the market benefits as a "tiebreaker" in that scenario. In which case, Solution A would be clearly superior. However, given the improbability of Scenario IV emerging, this argument is essentially of academic interest only.

[46] For scenario III where augmentation into south-east Queensland occurs in 2008/09. Details of the results for other scenarios are contained in Appendix 4.
[47] See footnote above.
[48] Given the preliminary nature of this assessment and its incidental role in this evaluation, other potential sources of benefits such as reduction in ancillary services costs were not modelled.
[49] Due to the benefits of deferring capital investment in new generation plant.

10.2 Higher Network Reliability

Solution A also results in a more secure power system than Solution B.

The proposed augmentation in Solution A means that the Darling Downs will have high voltage supply from the Millmerran area in the west and the Tarong area in the north. The proposed augmentation in Solution B, on the other hand, concentrates the primary supply to the Darling Downs on a single easement corridor from Tarong.

Electricity transmission grids have been identified by the Commonwealth and State Governments as critical infrastructure. The geographic diversity of routes offered by Solution A enhances the reliability of supply to customers and the security of the power system. The electricity transmission system would be less vulnerable to natural disasters such as bushfires and storms, and other events that may cause multiple outages of elements of the transmission system.

10.3 Reduced Greenhouse Impacts

Solution A results in lower transmission system losses than Solution B. This indicates that the total greenhouse gas emissions during the generation of power will be lower for Solution A than Solution B, as less electricity would be lost during transmission.

10.4 Lower Community Impacts

Solution A also has benefits in that it has lower overall community impacts than Solution B.

Solution A requires the construction of fewer transmission lines to satisfy the emerging network limitations on the Darling Downs and in south-east Queensland. Solution A requires the construction of a transmission line between Millmerran and Greenbank. Solution B requires the construction of a transmission line between Tarong and Middle Ridge and a line between Millmerran and Greenbank.

While the community impacts are difficult to quantify as the impacts on specific communities and affected landholders vary, Solution A avoids the construction of approximately 80km of transmission line, thereby avoiding 80km of new easements and the related impacts on property owners and the broader community (eg visual impacts). Broadly speaking, Solution A will therefore result in fewer construction impacts, and fewer environmental and community impacts than Solution B.

11.0 CONCLUSIONS

The following conclusions have been drawn from the analysis presented in this report:

- There is no acceptable 'do nothing' option. If the emerging network limitations are not addressed by late 2004, power supply cannot be maintained during single 275kV contingencies on the line between Tarong and Middle Ridge supplying the Darling Downs area. Such a situation is not consistent with reliability standards which Powerlink must meet, as the Queensland transmission network service provider.

- Emerging limitations in supply to south-east Queensland are expected to result in a situation where demand will exceed supply capability by 2008/09. This must be considered in any assessment of local limitations on the Darling Downs as south-west Queensland is a major source of power for customers in the south-east region of the state.

- Powerlink carried out a consultation process in mid 2002, and was not advised of any demand side management initiatives or local generation options capable of addressing the identified network limitations to the Darling Downs. A grid support service from Oakey Power Station was investigated and discussed with Enertrade, but was not a feasible solution to the reliability requirements.

- Economic analysis carried out in accordance with the ACCC Regulatory Test has identified that Solution A in this paper is the least-cost solution over a fifteen year period of analysis under the majority of scenarios considered. Sensitivity analysis showed that this conclusion was robust to variation in capital cost and other assumptions. On this basis, an augmentation comprising a double circuit 330kV line from Millmerran to Middle Ridge at a cost of $71.3 million would satisfy the ACCC Regulatory Test. The anticipated/modelled project within Solution A would be required by no later than 2008/09, to satisfy reliability requirements in south-east Queensland.

- Economic analysis carried out by independent consultants has identified that Solution A provides consequential savings to the electricity market whereas Solution B does not. These market benefits have a net present value of approximately $3 million. Interested parties should note that such benefits are based on market analysis that includes assumptions about generator bidding behaviour. Such market benefits, if they arise, are a consequence of avoiding future congestion on northwards flows on QNI and are incidental to the purpose for which the proposed augmentations would be constructed.

Solution A Proposed Augmentation: 330kV Millmerran-Middle Ridge late 2004
Anticipated/modelled project: 275kV Middle Ridge-Greenbank late 2008
Solution B Proposed augmentation: 275kV Tarong-Murphy's Creek late 2004
Anticipated/modelled project: 275kV Millmerran-Greenbank late 2008

	Solution A	Solution B
CAPITAL COSTS		
Proposed Augmentation	71.29	46.81
Anticipated/Modelled Project	60.36	113.24
TOTAL CAPITAL COST ($M)	**131.65**	**160.05**
REGULATORY TEST ANALYSIS		
Proposed augmentation (Darling Downs) in late 2004		
Anticipated/modelled project (SE Qld) in late 2008		
TOTAL NET PRESENT VALUE COST ($M)	**59.55**	**67.16**
MARKET BENEFIT ANALYSIS		
TOTAL NPV OF MARKET BENEFITS ($M)	**2.95**	**0.00**
NET COST ($M)*	**56.60**	**67.16**
Solution A lower than Solution B by:	$ 10.56	Million (NPV)

*Net Cost = NPV Cost - NPV Market Benefits

- This information has been provided for the information of interested parties only and has not been used in the Regulatory Test analysis.

- Non-financial benefits were also identified. Solution A will deliver a more reliable and robust transmission network than Solution B. Solution A will also result in significantly lower overall community impacts, as it avoids the construction of approximately 80km of high voltage transmission line.

- Powerlink has carried out technical studies with TransGrid, its counterpart in NSW, and it has been determined that the proposed augmentation will not materially impact other transmission networks within the National Electricity Market.

- In addition to maximisation of benefit, the ACCC Regulatory Test requires that a transmission network service provider optimise the timing of any proposed network augmentation that is justified under the ACCC Regulatory Test. It is evident from the analysis that action is required prior to October 2004 in order to maintain a reliable power supply to customers on the Darling Downs. Any deferral of timing beyond late 2004 will result in unacceptable system reliability.

- The proposed construction timetable provides for award of construction and equipment contracts in Quarter 3 2003, commencement of substation works in Quarter 3 2003 and commencement of on-site line construction in Quarter 1 2004. The project is required to be commissioned prior to the summer of 2004/05, and is presently targeted for completion in October 2004.

12.0 FINAL RECOMMENDATION

Additional information has been provided in this Final Report in response to submissions to the Application Notice published on 31 March 2003. However, no changes to the draft recommendation are considered necessary based on an assessment of the submissions.

It is therefore recommended that the following 'new large network asset' be constructed to address the emerging transmission network limitations in the Darling Downs area:

- A 330kV double circuit transmission line between Millmerran and Middle Ridge with associated substation works. It is proposed to make commitments to begin construction of this proposed new large network asset in Quarter 3 2003. The asset, estimated to cost $71.3 million, is required to be commissioned prior to the summer of 2004/05. Technical details relevant to this proposed new large network asset are contained in Appendix 3.

The ACCC Regulatory Test does not permit a TNSP to recommend works for implementation under National Electricity Code processes earlier than 12 months prior to the start of construction. Therefore, the anticipated/modelled project to address south-east Queensland limitations cannot be recommended at this time. However, it is recommended that:

- The timing for the proposed augmentation between Middle Ridge and Greenbank be closely monitored, and if necessary, adjusted in the light of load growth forecasts and generation development. It is further recommended that planning consents be obtained and other preparatory works completed to allow the reliability requirements in south-east Queensland to be addressed within the time that corrective action is necessary.

Following publication of this report, Powerlink intends to take immediate steps to implement the above final recommendation.

APPENDIX 1 – SUMMARIES OF SUBMISSIONS RECEIVED

In accordance with National Electricity Code requirements, this appendix contains summaries of submissions received in response to the Application Notice issued on 31 March 2003. Submissions were received from 11 parties:

- Delta Electricity
- Energex
- Ergon Energy
- Ms Lowe (property owner)
- Mr Moule (property owner)
- Power Down Under (property owner representative group)
- Tarong Energy
- Toowoomba Greens
- TransEnergie Australia Pty Ltd
- TXU
- VENCorp

Responses to the issues raised in the submissions is in section 4.0 and Appendix 2.

Submission author: Delta Electricity

Issues:

1	Delta agrees that there is no acceptable “do nothing” option to mitigate the emerging limitations on the transmission network supplying the Darling Downs.
2	Delta understands the new line would relieve reliability problems for customers in the Darling Downs, but also expects significant market benefits would result. Delta believes the market benefit analysis in the Application Notice may be conservative as, while congestion in south-west Queensland may only be a few hours a year, those times correlate to high value periods.
3	Delta supports Powerlink’s recommended Option A, but on the basis that the current QNI transfer capacity (north and south) will not be degraded particularly during winter and summer peak periods.
4	Delta believes the proposal will mitigate congestion north of Bulli Creek and provide benefits for current Queensland generators and intending market participants in the Surat Basin and central Queensland.
5	Delta supports the recommendation for Option A.

Submission author: Energex (Retail and Network)

Issues:

1	Energex strongly endorses the solution proposed by Powerlink that will ensure reliability of supply to both the Darling Downs and south-east Queensland. Energex analysis indicates Powerlink's recommendation is a sound solution to the demand and reliability problems in the Toowoomba and surrounding areas.
2	Energex notes that Powerlink's Stage 1 Proposal (Millmerran-Middle Ridge), with consideration of future requirements to address limitations in south-east Queensland, provides the lowest cost solution overall. Energex considers the approach of proposing an integrated solution to Darling Downs and south-east Queensland is appropriate and represents a pragmatic interpretation of the ACCC Regulatory Test.
3	Energex suggests the reinforcement of Energex supply via Greenbank should occur earlier than indicated in the Application Notice. Energex encourages Powerlink to commence detailed assessment of stage 2 as soon as possible, as Energex believes the entire Millmerran-Middle Ridge-Greenbank line may be required to be in place as early as 2005/06 to meet the reliability needs of south-east Queensland.
4	Energex forecasts indicated the augmentation to Greenbank is required well before 2008/09, the date indicated in Powerlink's Application Notice. Energex maximum demand increased by 8% last summer and forecasts indicate similar growth over next few years. Energex states the South Coast and Brisbane areas will require substantial augmentation by 2005/06. Energex's annual load forecasts have been revised to 6-7%p.a., which is higher than the forecast of 5%p.a. used by Powerlink.
5	Energex would prefer transmission reinforcement in the near future to alleviate the Tarong limit and the possibility of load shedding in the event of a contingency. Energex understands reinforcement into Greenbank would achieve this.
6	Energex supports Powerlink's recommendation, as it is a prerequisite to the subsequent south-east Queensland reinforcement.

Submission author: Ergon Energy

Issues:

1	Ergon welcomes the proposed investment in transmission infrastructure outlined in the Application Notice. Ergon agrees that to "do nothing" is not an option.
2	Ergon supports Powerlink's recommendation of Option A to: • address the emerging network limitations on the Darling Downs; and • address the subsequent limitations in supply to south-east Queensland.
3	Ergon notes that solution A will produce the lowest overall economic cost for the project. Ergon recommends that Powerlink take appropriate actions to ensure these costs be distributed in the most equitable way possible across beneficiaries of the project.

Submission author: Mr Barry Moule (landowner)

Issues:

1	Mr Moule's submission states Powerlink failed to meet the Reliability Augmentation Test requirements and has failed to justify reliance upon the Reliability Augmentation Test for the following reasons: a) The proposed Option A is not an "augmentation". b) The need to enhance reliability is not proven. c) Powerlink has selectively and wrongly grouped network limitation issues in Darling Downs with reliability factors in south-east Queensland.
2	Mr Moule considers the proposed option A is not an "augmentation", but in fact a new and substantially large network, evidenced by Powerlink's reference to a "Proposed New Large Network Asset". Option A is for a 330kV line – the size and scale of the proposal is unprecedented in the Darling Downs, and not in keeping with other lines in the area.
3	Mr Moule's view is that the need to enhance reliability is not proven, evidenced by the closure of Middle Ridge gas turbine. Mr Moule considered that the Middle Ridge gas turbine was an 'augmentation' – which he defined as an ancillary facility that provides a boost to the main system. The gas turbine may have provided an option for supplementary power and there is a lack of evidence of significant outages in Powerlink's document. Mr Moule recommends Powerlink's assessment of network limitations be independently assessed.

4	Powerlink has selectively and wrongly grouped network limitation issues in Darling Downs with reliability factors in south-east Queensland and applied the Reliability Augmentation Test. The Darling Downs issues should be addressed as part of the Market Benefit Test while the reliability aspects of south-east Queensland should be addressed within the Reliability Augmentation Test.
5	Mr Moule states Powerlink's Application Notice should therefore be withdrawn. If Powerlink does not withdraw its Application, the ACCC should ensure Powerlink is limited to "reliability augmentation" action only.
6	Mr Moule states Powerlink has failed to present the lowest cost option, which would be a 275kV single circuit line from Tarong-Murphy's Creek and a 275kV double circuit line from Middle Ridge-Greenbank for a total cost of $107.4 million less savings from easement sharing and use of common towers.
7	Mr Moule also states that Powerlink did not identify the lowest cost corridor within Powerlink's option A, which would be a straight line between Millmerran-Middle Ridge (cost less than $114 million estimated on a proportional basis). Mr Moule recommends this be costed. At the meeting held in response to a request in Mr Moule's submission, he provided a map of a straight line route. Mr Moule stated that Powerlink had selected a loop which is an extra 10km longer, and in his view would be higher cost. Mr Moule considered that options to the north were not examined because of Powerlink's existing easement several kilometres out of Middle Ridge. Mr Moule's view is that Powerlink should justify why it didn't choose a straight line route in its Final Report, as he considers such a route would be feasible and less expensive.
8	Mr Moule states Powerlink failed to demonstrate the method by which it attempted to negotiate a Grid Support Service with the Oakey Power Station. Mr Moule states it would not be beneficial for the owners of Oakey and Millmerran Power Station to negotiate such an agreement as there would then be little reason to construct Option A. Mr Moule understands there to be common ownership links between the power stations and states Powerlink should illustrate how it attempted to counter this apparent conflict of interest. Mr Moule considers that Powerlink should look at trading off capital cost for operating cost by making incentive payments to Oakey to avoid capital investment. Mr Moule considers a higher price of electricity could have been accommodated because of the reduced need for new infrastructure. Mr Moule recommends Powerlink attempt to renegotiate a Grid Support Service with Oakey Power Station.

Submission author: Power Down Under (PDU) – Landowner representative group

Issues:

1	PDU states that Powerlink's Application must be rejected.
2	PDU submit that Powerlink's application does not recommend the least cost option. PDU state that to meet the emerging needs (5-15 years timeframe) of south-east Queensland and Northern New South Wales, a lower cost option is to augment Tarong-Murphy's Creek with a 275kV single circuit line (cost $47million) or double circuit line (cost $60.4million) and subsequently augmenting Middle Ridge-Greenbank with a 275kV double circuit line (cost $60.4 million). PDU state a further cost saving would ensue as Tarong-Middle Ridge would utilise existing easements (and possibly towers) with only minor widening required, as would Murphy's Creek-Greenbank – thereby offsetting significant compensation (and possibly construction) costs. PDU state that the option to augment the Tarong-Murphy's Creek line meets the criteria defined in the NEC and is the lowest cost option at $47 million.
3	PDU contends that the proposed Option A is consistent only with "New Large Area Network" in which case the applicable test is the Market Benefits Augmentation Stream ACCC Regulatory Test. PDU believes the Application fails this test.
4	PDU states that the manner which Powerlink has prosecuted the proposal is contrary to the Trade Practices Act and ethical standards expected of a Government instrumentality under the Public Sector Ethics Act 1994, Part 3, which states public officials should ensure public resources are not wasted, abused, used improperly or extravagantly.
5	PDU states that all feasible options have not been adequately explored, suggesting Powerlink has a motive for its preferred option and this motive should be disclosed. Options that have not been adequately explored include: 1. Augmenting the existing single circuit 110kV Greenbank-Middle Ridge line to a single circuit or double circuit 275kV line; 2. Augmenting the Tarong-Middle Ridge route with a 275kV line; 3. A direct line from Millmerran-Middle Ridge using existing road and rail easements and linking to the Oakey-Middle Ridge line. PDU states that Powerlink's recommended Option A supports a 330kV double circuit line, yet all Powerlink's references suggest a 275kV line (single or double circuit) would meet its objective. The rationale for this difference is not explained.
6	PDU states that the proposal must be confined to the supply of power to the Darling Downs, as only a proposal that is able to proceed within 12 months of notification should be endorsed unless unforeseen circumstances arise. This should be delineated from the need to meet increased demand in the southeast corner of Queensland and northern New South Wales.

7	PDU states that Powerlink did not provide details and adequate notice of its intention to landholders. Further, PDU contends that Powerlink did not present its proposals in a manner which was complete, timely, accurate and which enabled the "ordinary individual" to readily understand and make informed judgements and decisions on the basis of information provided.
8	PDU states that Powerlink did not release detailed costings, comparative costings or an analysis until 31 March 2003, despite written advice to PDU from the office of the State Minister responsible for energy that the information would be provided in December 2002.
9	PDU contends that TNSPs have historically been inaccurate in their forecast of future need, therefore the Application should be viewed with extreme caution.
10	PDU states insufficient time was allowed for the Environmental Impact Assessment. PDU concludes the EIA is a "rubber stamp" exercise that does not add value to the process. PDU states the EIA should be referred to a full range of independent experts for appraisal and input as part of the application process, and that Powerlink should be able to clearly demonstrate changes in their proposal reflecting the findings of the EIA.
11	PDU states Powerlink has not adequately demonstrated its stated objective of addressing emerging limitations in the electricity transmission network supplying the Darling Downs. PDU queries Powerlink's claims of summer and winter peak demands. PDU suggests Powerlink's objective is to construct a contingency line to Middle Ridge able to provide supply in event Tarong-Middle Ridge is temporarily decommissioned. If this is correct, PDU believes the application must be considered a reliability augmentation. Therefore Powerlink's Option A does not meet the requirements of being the least cost option.
12	PDU states Powerlink's application uses three different time periods as a basis for its calculations – two year timeframe for the Darling Downs, five year timeframe for South-east Queensland estimates, and 10 year timeframe for costs of the combined proposals. PDU assumes that these different timeframes are being used as leverage by Powerlink to achieve it predetermined or preferred outcome. PDU requests full disclosure of the rational for use of different and emergent timeframes.
13	PDU states Powerlink's application makes reference to a 10% discount rate for the net present values, but does not provide evident to support this claim or detail Powerlink's methodology.
14	PDU requests detailed statements from Powerlink and InterGen (owner of Millmerran Power Station) confirming that Option A is totally independent of the Millmerran Power Station. The group wants confirmation that there has never been nor is there any political, business or private connection between Powerlink and InterGen.

15	PDU suggests the National Electricity Code and the ACCC Regulatory Test are somewhat inconsistent, leading to difficulty in interpreting and applying the provisions consistently. PDU states this enables TNSPs the opportunity to compare unlike projects and construct self-serving outcomes.
16	The NEC states that the Trade Practices Act requires the ACCC to assess all access cost provisions against the statutory test, necessitating: • reflection of a fair balance between the interests of Network Service Providers and Access Seekers; and • being in the public interest (in competition, environment, social welfare, regional development and occupational health and safety). PDU state Powerlink's application does not provide evidence that these factors have been addressed and an explanation of modelling and assumptions used to compare options is required.
17	PDU states there is no evidence to support Powerlink's claim to have incorporated independent forecasts of additional renewable energy generation into the forecast of demand and energy used in assessing the expected incidence of future network limitations. This evidence is required.
18	PDU states it has information from Oakey that should have been considered in the application. (At the subsequent follow-up meeting, PDU provided information regarding the historical operation of Oakey Power Station. PDU stated their understanding that Oakey has only operated five times for short periods in the past 12 months, compared with approximately 90 times the previous year). PDU contends Oakey Power Station should not be lightly dismissed as it is cleaner and more consistent with State Government aims to have 13% of all electricity generated from non-coal origin by January 2005.
19	When considering community impact, Powerlink has relied heavily on distance as a co-variable. PDU states this approach leads to flawed conclusions as it does not consider whether new easements are required or whether the line can be built on existing easements.
20	PDU claims Powerlink's consultation process was flawed as it received only one submission.
21	PDU recommends: 1. Powerlink's application should be considered under the Net Benefits Test of the ACCC Regulatory Test; 2. If considered by the ACCC under the Reliability Augmentation Test: a. Powerlink should augment the Tarong-Middle Ridge line by constructing a 275kV single circuit or double circuit line to complement the existing line, which is consistent with the requirements of the Electricity Act, the ACCC Regulatory Test and the Public Sector Ethics Act in Stage 1; b. Powerlink augment the Middle Ridge to Greenbank line constructing a 275kV single circuit or double circuit line to complement the existing line as Stage 2.

Submission author: Ms Jennifer Lowe (landowner)

Issues:

1	Ms Lowe expressed her concern for the electric and magnetic fields emitted from high voltage powerlines. Ms Lowe's concern extends to livestock as well as people, and impact on soils near transmission lines.
2	Ms Lowe states that the proposed towers will create visual pollution, and affect property valuations in the area. Ms Lowe considers that the lines should be placed underground, as this is better for visual, health and maintenance reasons.
3	Ms Lowe contends the current town plan, approved by the State Government, clearly states no mid-heavy industry in rural areas. Ms Lowe considers that State Governments ignore local planning requirements.

Submission author: Tarong Energy

Issues:

1	Tarong Energy commends Powerlink for incorporating a robust planning model within the constraints imposed by the National Electricity Code and the ACCC Regulatory Test.
2	Tarong Energy states that while it appears Tarong-Murphy's Creek 275kV augmentation would be the cheapest short-term solution, this would force future actions to be more expensive than they need to be. Tarong Energy states that while this Application Notice is triggered by a specific network reliability issue in the Darling Downs area, it is important that the integrated and meshed transmission network be planned and developed as a consistent whole.
3	Tarong Energy believes Powerlink has correctly applied the ACCC Regulatory Test in this instance and fully supports the Application Notice.

Submission author: Dr Karey Harrison, Toowoomba Greens

Issues:

1	Dr Harrison states Powerlink has not met the ACCC Regulatory Test nor Chapter 5 of the National Electricity Code which requires Powerlink to consider local generation, DSM, inter-regional and network options on an equal footing.
2	Dr Harrison states Powerlink has only taken into account demand management programs in place or foreseen by distributors, not potential demand management programs with the capacity to reduce future load sufficiently to render unnecessary the proposed new and upgraded transmission lines.
3	The Queensland Greens acknowledge that existing and currently planned demand side management programs are insufficient to meet the forecast increases in demand. However the Greens suggest there are additional demand management initiatives that could be introduced that would avoid the need for this "new network asset".
4	While some of the demand management programs suggested would take three to five years to complete, there are demand management options that can be implemented immediately.
5	Dr Harrison recommends: • Implementing a higher tariff for newly installed air conditioners, given the high marginal cost to the system of air conditioners; • If new air conditioners are placed on a separate tariff, customers could be required to place new air conditioners on an interruptible supply, so they can be switched off automatically in the event of a fault or supply contingency; • impose a higher tariff on above average consumption by customers with existing air conditioners, to encourage consumers to switch existing air conditioners to the separate tariff. Dr Harrison states these measures would help ensure a cost imposed on the system by a minority (who operate air conditioners) was not passed on to all participants. The measures would also reduce air conditioning use, encourage installation of insulation and enable contingency load shedding which would avoid the need for upgraded transmission lines.
6	Dr Harrison states the ACCC Regulatory Test requires Powerlink to evaluate the cost of options over a long time period. If Powerlink were to offer customers insulation and solar hot water heaters at no up front cost – to be repaid in electricity bills – it would overcome the high up-front cost, which is the major obstacle in take up of these products. Dr Harrison contends the installation of insulation and solar hot water heaters would be more than sufficient to avoid the need for the proposed New Network Asset.

7	Dr Harrison states that demand management can meet greater energy requirements for around the same upfront investment as Powerlink's proposal, but at far lower future costs to consumers.
8	The Queensland Greens propose Powerlink be required to consider retrofitting existing housing with insulation and solar hot-water heaters to avoid the need for the new asset and that the ACCC enforce this as the least cost option.

Submission author: TransEnergie Australia Pty Ltd

Issues:

1	TransEnergie agrees that from summer 2004/05 an outage of Tarong-Middle Ridge transmission line occurring coincident with the Darling Downs area peak summer load means that all of the load would not be able to be supplied.
2	TransEnergie states Schedule 5.1 of the National Electricity Code and Section 34(2) of the Queensland Electricity Act 1994 does not appear to support Powerlink's claim that is it obligated to deal with and resolve the Darling Downs area supply problem. TransEnergie contends that Powerlink's identifying that with certain facilities or plant associated with the power system out of service the network may not be able to supply customers does not automatically create an obligation on Powerlink to augment the network - according to Schedule 5.1.2.1. of the National Electricity Code. Rather that obligation only comes through the specific terms and conditions of the applicable connection agreements; Powerlink has not given any clear indication of the terms and conditions of any relevant connection agreement that require it to maintain the network to the N-1 level. TransEnergie further contends the Queensland Electricity Act 1994 and associated regulations make no reference for Powerlink to adopt the N-1 planning criteria. TransEnergie questions whether the low probability (0.10% or 8.76 hours per year) of the simultaneous occurrence of the transmission line outage with the occurrence of peak load warrants the expenditure of $130 million on grid augmentation.
3	TransEnergie states Powerlink has breached the market failure criterion in the applicable regulatory instruments by bundling together supply to the Darling Downs area and supply to the south-east Queensland in general. TransEnergie believes that given the disparate timings, each issue needs to be considered separately, therefore Powerlink's approach is not permitted and its recommendation is flawed. TransEnergie states that the ACCC Regulatory Test contains provisions which emphasise the intended focus on market-based outcomes and the requirement to demonstrate the existence of a

	market failure before a regulated investment proceeds. TransEnergie further states that the ACCC, in developing the ACCC Regulatory Test, relied on two key principles of economic efficiency and competitive neutrality and the objective of the ACCC Regulatory Test is to prevent regulated investment from pre-empting market solutions. TransEnergie believes this to imply a presumption in favour of market-based investment and that regulated investments need to be 'held back' to sure that market-driven investments are not adversely impacted.
4	TransEnergie notes that the Request for Information did not seek information from market participants in regard to options for overcoming the south-east Queensland limitation, which was only identified in the subsequent Application Notice. Therefore it is inappropriate for Powerlink to conclude there have been no market-based responses to the emerging limitations in the south-east Queensland region, because the need for a response has not been clearly flagged to the market. TransEnergie believes Powerlink has inappropriately combined two applications of the ACCC Regulatory Test. TransEnergie states it is reasonable that Powerlink should consult regarding supply to the Darling Downs area as Powerlink identifies that additional support is required by the summer of 2004/05. However the south-east Queensland problem does not occur until several years later, with the exact date dependent on a number of factors. Therefore there should have been two separate applications of the ACCC Regulatory Test. TransEnergie further contends that Powerlink's bundling of the South-east Queensland issue with the Darling Downs resolution undermines the validity of the market failure provisions of the ACCC Regulatory Test by pre-empting the potential for market based solutions. TransEnergie considers that there is a real possibility that additional new generation developments might occur to meet the shortfall in south-east Queensland, and considers that Powerlink's determination to develop a new regulated transmission line might undermine the commercial feasibility of a non-regulated generation facility. TransEnergie states that a proper application for the ACCC Regulatory Test would consider only the power supply problems in the Darling Downs region itself. In that case Powerlink's Solution B is the lowest cost option - a single circuit 275kV line from Tarong-Murphy's Creek at a cost of $46.8 million

5	TransEnergie states Oakey Power Station is ideally located to provide a solution to the Darling Downs area issue and considers that solutions still exist to overcome the technical problems identified by Powerlink. Namely: • emergency line ratings are very much higher than normal ratings, therefore line ratings are not an issue; • prior to 2010/11, the only requirement is that at least one of the generators must be able to be started, synchronised and ready to pick up load within 10/15 minutes. Oakey Power Station is able to be fully operational in 10 minutes; • If immediate post-contingent voltages are severe then additional reactive support should be provided in either the transmission or distribution networks or both. TransEnergie also questions whether Powerlink has installed an instantaneous under voltage load shedding scheme to prevent cascading voltage collapse. It is TransEnergie's view that Powerlink needs to provide additional information to the market to support its position that Oakey Power Station does not provide a solution.
6	TransEnergie contends that Powerlink has not applied the ACCC Regulatory Test appropriately. TransEnergie has identified additional, potentially lower cost options, not considered by Powerlink, to resolve the Darling Downs area problem. Powerlink should investigate these options to determine their feasibility, including: • uprating of various 110kV lines - raising a certain number of towers and re-tensioning conductors to improve clearance levels: o TransEnergie identifies a proposal to: ▪ uprate Swanbank-Middle Ridge 110kV circuits in October 2004 (cost $2.5 million), ▪ uprate Abermain-Lockrose 110kV in October 2008 (cost $1.0 million); ▪ reactive support from capacitor bank (cost $2.0 million); ▪ grid support of approximately 50MW of generation from October 2010. o TransEnergie identifies a proposal to: ▪ rebuild Abermain-Lockrose 110kV as a double circuit feeder in October 2004 (cost $5.6 million); ▪ uprate normal summer rating of Swanbank-Middle Ridge in October 2007 (cost $2.5 million); ▪ Uprate normal summer rating of Postman Ridge-Lockrose 110kV in October 2010 (cost $1.0 million). • Alternative 275kV expansion plan involving single circuit 275kV line from Tarong- Murphy's Creek in late 2005 (cost $46.8 million); uprate (if required) existing Tarong-Murphy's Creek-Middle Ridge 275kV circuit at an unknown time (cost unknown).

7	TransEnergie states Powerlink's proposal to deal with the south-east Queensland problem is premature. Market based responses need to be given time to emerge and Powerlink needs to provide additional information on the problem to facilitate such a market based response. Specifically, all applications to establish a new large network asset must follow the process set out in clause 5.6.6. of the National Electricity Code. TransEnergie further contends that Powerlink appears to have made invalid assumptions in its analysis of the south-east Queensland problem, with the potential to arrive at incorrect conclusions regarding preferred options. TransEnergie identifies that in market development scenarios I, II and III described by Powerlink Swanbank E Power Station is assumed to be out of service. This assumption has a marked effect on the timing of the requirement for major network augmentation in SEQ and the NPV of the associated scenarios. It is TransEnergie's opinion that the likelihood of Swanbank E being available during peak demand periods is actually very high. TransEnergie believe that by considering Swanbank E out of service in the base assumption, Powerlink appears to be justifying the SEQ upgrade on the basis of N-2 design. TransEnergie concludes that Powerlink's NPV analysis is fundamentally flawed and needs to be repeated using Scenario IV as the base scenario. Also, that Powerlink should consider a further scenario in which additional generation emerges in SEQ. TransEnergie questions Powerlink's claim of a saving of $12 million per annum after 2008/09 due to Stage 1 of Solution A (presumably with Stage 2 also included beyond 2008/09). TransEnergie states the Application Notice is deficient in that full and complete disclosure of the assumptions and methodologies employed in the market benefit analysis are not disclosed. TransEnergie considers that an additional option should be considered in analysis of the SEQ problem - the options described in Item 6 above, combined with a 275kV double circuit from Middle Ridge-Greenbank via Swanbank.

Submission author: TXU

Issues:

1	TXU states Powerlink has failed to comply with its obligation to apply the ACCC Regulatory Test
2	Powerlink has insufficiently explored the option of using Oakey Power Station as an alternative to transmission investment. TXU contends Powerlink should not have restricted its negotiations to Enertrade, the company responsible for the power purchase agreement (PPA) at Oakey, but should have explored options with the plant owner including those outside the terms of the existing PPA. TXU believes Powerlink must enter direct negotiations with the owners of Oakey Power Station to determine if the station represents a feasible option with the lowest net present value compared with alternative projects, and if the grid support service from Oakey Power Station can be provided with the certainty to satisfy the reliability requirements of the National Electricity Code. TXU states that should this be infeasible, Powerlink should then provide a detailed explanation of the physical limitations that preclude it, with evidence of acceptance of that position from the station owners.
3	Powerlink has assumed the largest generating unit in SE Queensland was out of service when analysing future south-east Queensland limitations. TXU believes this approach to implement N-1 in a reliability sense is invalid under Chapter 5 of the National Electricity Code. TXU considers Powerlink is not required to ensure generation reliability standards to an N-1 standard for loss of generation, that a prior outage of a generator unit does not constitute a credible contingency event, and submits that s34(2) of the Electricity Act is more likely to reflect probability planning standard than a planning standard designed for N-1 contingency conditions.
4	The ACCC Regulatory Test precludes consideration of investment options for which construction is to begin more than 12 months from the current time. TXU believes Powerlink has inappropriately applied the Regulatory Test as it cannot reasonably conclude that the proposed augmentation will not pre-empt nor distort potential unregulated developments including network generation and demand side developments.
5	TXU states that large investments such as this have widespread economic impacts, and suggests that it was intended for such large investments to use the ‘second leg’ of the ACCC Regulatory Test – ie the purely economic evaluation.

Submission author: VENCorp

Issues:

1	VENCorp has concerns regarding the consistency of Powerlink's Application Notice with the procedural requirements set out in clause 5.6.6(b)(1)-(5) inclusive of the National Electricity Code. VENCorp considers the application notice: • does not disclose sufficiently detailed information to allow VENCorp and other interested parties to independently assess and verify Powerlink's analysis, provides insufficient information with respect to: o load forecasting for 10 years, o loading at substations to verify the thermal overload, o the operation of the 110kV connection between Tarong-Middle Ridge and its impact on the identified constraint, o details of design standards used to determine voltage control limits and transfer capability, o probability of the critical contingency event using both specific line historic data and generic line type data, and o assumptions in terms of ratings of circuits and rating methodologies used to determine thermal rating of lines and other plant. o VENCorp is unconvinced that the proposed assets is the lowest cost option and requires more information to assure itself that this is the case; • does not consider, let alone include a detailed description of, all other reasonable network and non-network alternatives to address the emerging limitations in the Darling Downs - for example: o reactive support (static or dynamic), o replacing conductors, o raising conductor heights, o building another circuit between Abermain and Lockrose and between Middle Ridge and Postman's Ridge, o a short-term interruption to customer supply to enable grid support from Oakey Power Station, achievable through an arrangement for an automatic post contingency start, o VENCorp is not clear as to whether Powerlink has adequately considered the extent and potential for demand side action, o a short term rating of 120MVA for Energex 110kV line between Abermain-Lockrose, capacitor banks to address voltage fluctuations and grid support from Oakey Power Station, o load shifting, in particular the possibility of distribution feeders being relocated to neighbouring substations to reduce loading on a particular connection point, or o the existence of generation options that are not offered; • does not set out all relevant technical details for the Proposed

	Augmentation, together with the construction timetable and commissioning date; • does not provide adequate analysis of why Powerlink considers the proposed augmentation is a reliability augmentation, particularly Powerlink does not: o identify clearly those network performance requirements set out in Schedule 5.1 of the National Electricity Code which it considers justify the proposed augmentation o support its assertion that the National Electricity Code requires it to plan its network so that these reliability and power quality standards in Schedule 5.1 can be met during the worst single credible contingency event (N-1 conditions) o demonstrate that is economically practicable to ensure that its transmission grid has sufficient capacity following an outage such that s34(2) requires. VENCorp states that the proposed augmentation and Stage 2 augmentation would add approximately 4,500MW of capacity - significantly beyond what is required to meet the identified constraint. VENCorp submits that the proposed augmentation is not required to allow Powerlink to meet its Schedule 5.1 obligations and that Powerlink has not demonstrated that it is required.
2	VENCorp observes that the Stage 2 augmentation addresses a different identified network limitation and would require its own application notice and approval process, as acknowledged by Powerlink. Insufficient information regarding emerging network limitations in south-east Queensland and alternative solutions is disclosed in the Application Notice for VENCorp to form any definitive view regarding this augmentation.
3	VENCorp has identified network performance requirements (based on analysis of Schedule 5.1 and other provisions of the National Electricity Code) that must be met by Powerlink in credible contingency conditions. VENCorp acknowledges that an outage of the Tarong-Middle Ridge line may result in voltage falls and/or flows exceeding the thermal rating on the Energex 110kV line between Abermain-Lockrose, VENCorp does not accept that an outage would result in an inability to meet any of the Schedule 5.1 requirements, due to the potential for interruptions to customer supply. VENCorp contends that Powerlink has not demonstrated that the proposed augmentation is required for it to meet the qualified grid reliability obligation established by s34 (2) of the Queensland Electricity Act 1994.
4	VENCorp has concerns with Powerlink's application of the ACCC Regulatory Test, specifically: • VENCorp states that Powerlink does not set out analysis of why it considers the proposed augmentation satisfies the ACCC Regulatory Test in its Application Notice,

	• VENCorp considers it appropriate to have regard to emerging network limitations for supply to SE Queensland in assessing the proposed augmentation, but does not consider it appropriate for Powerlink to assess the proposed augmentation and Stage 2 augmentation as one against the ACCC Regulatory Test, • The proposed augmentation is not the lowest cost option and therefore does not satisfy the ACCC Regulatory Test, • VENCorp considers the proposed augmentation is not a reliability augmentation, but should be assessed through the market benefit test set out in paragraph (b) of the ACCC's Regulatory Test, • VENCorp has identified a number of network and non-network alternatives that are lower cost than the proposed augmentation which must be considered. • VENCorp considers that grid support from the Oakey Power Station is a technically feasible non-network alternative and therefore must be considered in the economic analysis. VENCorp states that the project adopted as a network solution to the south-east Queensland network limitations and the associated costs of that solution are dependent on the solution adopted to address the emerging network limitation in the Darling Downs area.
5	VENCorp does not consider it appropriate for Powerlink to obtain planning consent and complete other preparatory works prior to the publication of a detailed application notice, a proper consultation on process and the approval of the Stage 2 augmentation.
6	VENCorp considers that any costs associated with the use of the Millmerran-Bulli Creek line and their recovery should be disclosed in the Application Notice.

APPENDIX 2 – RESPONSES TO SUBMISSIONS

Further Details on Issues Raised and Responses to Issues

This section provides further detail regarding Powerlink's response to the submissions to the Application Notice, expanding on the information provided in section 4.0. Parties are referred to Appendix 1 for a summary of the submissions received.

The responses are grouped into the following broad topic areas:

(1) Reliability Standards
(2) Least Cost Path of the ACCC Regulatory Test
(3) Project Justification
(4) Integrated Planning Approach
(5) Potential Alternatives
(6) Millmerran Power Station Issues
(7) Other Issues

1 Reliability Standards

Ergon Energy and Delta Electricity supported the recommended solution and noted that to 'do nothing' was not an option. However, several other parties suggested that Powerlink does not have an obligation to take action to meet reliability of supply standards.

VENCorp submitted that Powerlink could achieve objectively measurable performance standards in Schedule 5.1 by interrupting supply to customers. VENCorp also states that Powerlink has not demonstrated that it is required to maintain reliability of supply to customers during single network contingencies under s 34(2) of the Electricity Act (Queensland). VENCorp also expressed the view that consideration should be given to the probability of the critical contingency event rather than the deterministic 'N-1' approach adopted by Powerlink.

TransEnergie considers that neither the National Electricity Code nor the Electricity Act (QLD) requires N-1 redundancy criteria. TransEnergie therefore stated that identifying an N-1 problem does not automatically create an obligation on Powerlink to resolve the supply problem.

These matters have been addressed in section 4.2.1 of this report.

Landowner representatives (PDU and Mr Moule) indicate that they consider Powerlink has not provided enough information to adequately demonstrate that emerging reliability limitations exist. The 'Request for Information' document issued by Powerlink in June 2002 identified that the grid will be unable to maintain supply to customers at times of peak demand during a single network contingency from the summer of 2004/05 onwards. Limitations arise from both loading on transmission lines above their emergency thermal ratings and voltages dropping below statutory requirements.

This matter has also been addressed in section 4.2.1, with some additional information later in this Appendix.

2 Least Cost Path in the ACCC Regulatory Test

Several parties (VENCorp, TransEnergie, PDU and Mr Moule) claim that Powerlink has incorrectly used the least cost 'reliability limb' of the ACCC Regulatory Test, and that it should assess proposed solutions to the Darling Downs network limitations using the 'market benefits limb' within the ACCC Regulatory Test.

This matter has been addressed in section 4.2.1 of this report.

TXU suggests that the ACCC intended large investments to be evaluated using the market benefits limb of the test. Powerlink's response is that the ACCC specifically stated that it introduced the cost minimisation part of the ACCC Regulatory Test "in order for networks to meet their service standard obligations" (ACCC Regulatory Test Preamble Executive Summary). Powerlink's position is that the ACCC Regulatory Test does not require the market benefits limb to be used for reliability augmentations, and that the least cost path would be applied anyway to ensure Powerlink can meet its obligations.

PDU's submission stated that they consider the proposed augmentation to be a 'New Large Area Network' and that it should therefore be addressed either under the market benefit limb of the ACCC Regulatory Test or possibly the statutory test applied by the ACCC[50]. Powerlink cannot find any reference to the term "New Large Area Network" on the ACCC website or in the National Electricity Code.

Powerlink advises that the electricity infrastructure discussed in the Application Notice is required firstly to address reliability limitations for supply to the Darling Downs, and secondly to assist in addressing subsequent reliability limitations in south-east Queensland. The proposed asset is within the definition of augmentation under the National Electricity Code[51]. The proposed asset also fits within the definition of a "New Large Network Asset" (greater than $10 million capitalisation value). The applicable test to be applied is therefore the reliability limb of the ACCC Regulatory Test in accordance with clause 5.6.6 of the National Electricity Code. The application of this test is discussed above.

3 Project Justification

Ergon Energy's submission supported the recommended solution to address the emerging network limitations on the Darling Downs and the subsequent limitations in south-east Queensland.

Similar support for the proposed augmentation was provided by Energex. Energex stated in its submission that it strongly endorses the integrated solution proposed by Powerlink that will ensure the reliability of supply to both the Darling Downs and south-east Queensland.

Other parties such as Mr Moule and PDU raised concerns that the augmentation is unnecessary. For example, the PDU submission stated that Powerlink hasn't provided sufficient information to adequately demonstrate emerging limitations in the network supplying the Darling Downs. The landowner group expressed its view that the Darling Downs has sufficient power to meet requirements for many years and that Oakey Power Station has operated very infrequently in the past 12 months, apparently indicating adequacy of supply.

[50] Powerlink assumes this is a reference to the statutory test applied by the ACCC under subsections 90 (6) and 90 (8) of the Trade Practices Act for access National Electricity Code provisions which is essentially a public benefit test.
[51] Chapter 10 National Electricity National Electricity Code - "**Augmentation**: Works to enlarge a *network* or to increase the capability of a *network* to transmit or distribute *active energy*"

The ‘Request for Information’ document issued in June 2002 identified that the reliability of supply to customers will be unable to be maintained from 2004/05 onwards during a single network contingency (N-1 capability will be exceeded). Powerlink confirms that assessment (refer below).

Mr Moule argues that the shutdown of the Middle Ridge gas turbine shows that the need to enhance reliability has not been proven.

In response to Mr Moule’s comment about the decommissioning of the Middle Ridge gas turbine power station and PDU’s comments about the past operation of Oakey, Powerlink advises that, in the National Electricity Market, decisions regarding day to day generator operation or decommissioning of plant are commercial decisions of the power station owners, who have no obligations in relation to network reliability. Powerlink, which does have clear obligations for network reliability, is not involved in day to day operating decisions for Oakey and was not involved in the decision to decommission the gas turbine. Powerlink notes that it published information regarding the emerging network limitations on the Darling Downs in its 2001 and 2002 Annual Planning Reports, and that these reports were sent to the market operators of both Oakey Power Station and the now decommissioned Middle Ridge gas turbine. Additional operation of Oakey Power Station to ensure reliable supply to the Darling Downs would require implementation of a grid support contract between Powerlink and Enertrade. This is discussed in section 4.2.3 of this report.

VENCorp and TransEnergie conducted their own analysis of the emerging network limitations on the Darling Downs and described the results of this analysis, and the assumptions made, in their submissions. Both these analyses are – for different reasons – incorrect.

VENCorp has made a fundamental error in its analysis, changing the load forecast figures for the Darling Downs to arrive at figures which are too low by about 25% (70MW in 2001/02). The forecast load VENCorp uses for 2004/05 was actually exceeded in 1996/97. The load it used for 2008/09 was actually exceeded in 2001/02.

VENCorp appears to have ignored the load forecast information provided in Powerlink’s June 2002 ‘Request for Information’ document. The note to the load forecasts in that document listed the substation loads that comprised the forecast. Abermain substation load was not in this list, yet it appears that VENCorp subtracted the load at the Energex Abermain substation from the Darling Downs load forecast. This makes the conclusions VENCorp derived from its analysis invalid. If VENCorp’s calculations are corrected for this error, they indicate the emergency summer capability has already been exceeded for several years. Powerlink does not accept that network capability has already been exceeded.

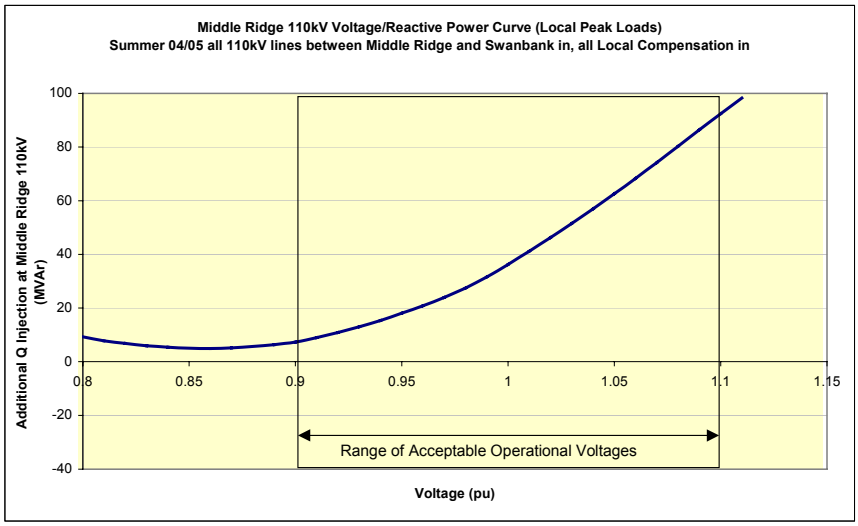
Although TransEnergie concluded that ‘from summer 2004/05 an outage of the Tarong to Middle Ridge 275kV transmission line occurring coincident with the Darling Downs area peak summer load means that all of the load would not be able to be supplied’, the analytical methodology used by TransEnergie was incorrect. TransEnergie’s analysis was based on simple additive analysis that does not account for different flows due to different line impedances (ie – TransEnergie has added line ratings without consideration of the physics of power flow behaviour).

Results of detailed power flow analysis carried out by Powerlink are shown below.

Voltage Limitations

In the June 2002 'Request for Information' document, Powerlink concluded that, by the summer 2004/05, the capability of the existing network would be exceeded during a single contingency on the Tarong to Murphy's Creek 275kV line. Under these conditions, the voltage level of the entire Darling Downs area will become unacceptably low and cause supply interruptions.

This voltage control problem at Middle Ridge in the summer of 2004/05[52] is illustrated in the graph below. For the information of non-technical readers, acceptable voltage operation cannot occur if the curve does not intersect the 'x' axis between 0.9 and 1.1pu[53]. As the graph shows, there is no point of intersection in 2004/05, and therefore voltage collapse and significant loss of customer supply would occur on the Darling Downs. This graph clearly shows that corrective action is required to address voltage criteria in accordance with the National Electricity Code. Interested parties are advised that the situation significantly worsens with the Postmans Ridge to Lockrose circuit open (refer discussion of thermal limitations below).



Thermal Limitations

As outlined in the June 2002 'Request for Information' document, supply to the Darling Downs is limited by both voltage and thermal limitations.

Reinforcement to the Darling Downs is required prior to summer 2004/05 to avoid unacceptable line overloads during a 275kV network contingency. The results of Powerlink's analysis[54] in the table below demonstrates that emergency ratings of the relevant lines supplying the Darling Downs are exceeded in 2004/05 during a contingency on the Tarong to Murphy's Creek 275kV transmission line. The Abermain-Lockrose line will overload first (which highlights the shortcomings in TransEnergie's simplistic approach of adding line ratings). By 2004/05, measures

[52] Local Darling Downs peak demands are higher in winter than summer, but the network is more highly loaded relative to its capacity during summer than during winter. The reactive power requirements are greater in summer than in winter and transmission plant has lower power carrying capacity in the higher summer temperatures. Also high summer peak demands generally last for many hours, whereas winter peak demands are for shorter morning and evening periods.

[53] There are two criteria: (1) two points of intersection between 0.9 and 1.1pu; and (2) adequate positive slope at the point of intersection to avoid large voltage fluctuations

[54] It is necessary to make an assumption that the Darling Downs voltage limitation can be addressed in order to use power flow analysis tools to examine thermal overload implications in 2004/05.

to address this overload will cause overloads on the Swanbank-Middle Ridge 110kV circuits. The power system will be unable to be operated safely without interrupting supply to customers[55].

Relevant 110kV power flows (MVA) with Tarong-Middle Ridge 275kV line out of service
At time of peak summer load:

Line and Thermal Rating (summer normal/summer emergency)	Summer03/04	Summer 2003/04 (adjusted) (1)	Summer04/05	Summer 2004/05 (adjusted) (1)
Tarong – Murphy's Creek Single Circuit 275kV (515/699 MVA)	0	0	0	0
Middle Ridge - Swanbank Double Circuit 110kV (108/148 MVA each circuit)	97	135	110	149
Lockrose - Abermain 110kV (78/94MVA)	97	41	106	42
Postmans Ridge - Lockrose 110kV (84/102MVA)	57	0	74	0
Middle Ridge - Postmans Ridge 110kV (84/102MVA)	45	21	60	23

Note (1) Opening the Lockrose to Postmans Ridge circuit alleviates overload on the Abermain to Lockrose line. However, this causes higher flows on the Swanbank to Middle Ridge 110kV circuits and worsens the voltage problems. It also is not desirable as it results in supply to the local substations being supplied by a single radial circuit, as acknowledged in the VENCorp submission.

4 Integrated Planning Approach

In identifying solutions to the Darling Downs limitations, Powerlink adopted an integrated planning approach by including consideration of emerging supply limitations in south-east Queensland. Submissions from interested parties stated differing views regarding this integrated approach.

This matter has been addressed in section 4.2.2 of this report.

The submissions from TXU and TransEnergie Australia referred to market failure provisions in the ACCC Regulatory Test regarding the pre-emption of non-regulated developments. TXU suggested that Powerlink cannot reasonably conclude that its proposed augmentation to address emerging limitations in south-east Queensland will not pre-empt or distort potential unregulated developments. TransEnergie criticised the approach of "bundling the two issues together" as being in breach of the market failure criterion in relevant regulatory instruments and not permitted.

The statement in TransEnergie's submission that "new regulated investment is to proceed only where there is a clearly demonstrated market failure" is incorrect. The ACCC Regulatory Test contains no market failure provisions for intra-regional augmentations[56]. The ACCC Regulatory Test does contain a provision that "the proposed augmentation should not pre-empt nor distort potential unregulated developments including network, generation and demand side developments".

[55] Due to control requirements, loadshedding on the Darling Downs would occur in large blocks of load (eg - approximately 30MW, an amount equivalent to the supply to the towns of Warwick and Stanthorpe)

[56] The ACCC stated in the Preamble to the ACCC Regulatory Test that it decided to set aside the inclusion of a market failure element in the draft ACCC Regulatory Test. The ACCC later amended note (7) of the ACCC Regulatory Test to introduce a market failure criterion for inter-regional augmentations and new interconnectors only. This does not apply to the proposed new large network asset described in the Application Notice for the Darling Downs area as this is an intra-regional augmentation.

In that regard, Powerlink notes that its Application Notice only recommends construction of the proposed augmentation between Millmerran and Middle Ridge by 2004/05. Powerlink has not been advised of any unregulated developments in that timeframe in response to either its June 2002 Request for Information or its Application Notice.

Powerlink also rejects TransEnergie's view that "there have been no market-based responses to the SEQ limitation because the need for such responses has not even been clearly flagged to the market". As noted in the Application Notice, the timing of the SEQ reliability limitation contains some uncertainty due to future load growth and market development assumptions. However, Powerlink's 2002 Annual Planning Report contained 10 year load forecasts for the Moreton North, Moreton South and Gold Coast zones and limit equations for the Tarong limit and CQ-SQ transfer limits. Existing generation capacity in south-east Queensland is well documented in public information published by NEMMCO and Powerlink. With this information, and information in previous Annual Planning Reports, Powerlink considers that an intending developer of new generation would have no difficulty in determining that future demand in the south-east Queensland area would outstrip existing generation and grid capacity in the medium term.

In relation to the pre-emption of unregulated developments, the ACCC Regulatory Test goes on to say that "to this end, a proposed augmentation must not be determined to satisfy this test more than 12 months before the start of construction date". No other consideration is required to avoid pre-empting non-regulated developments and Powerlink's Application Notice satisfies this provision.

The anticipated/modelled project to address the south-east Queensland reliability limitations (the 'Stage 2' augmentation between Middle Ridge and Greenbank) is not being recommended for implementation in this Application. Powerlink agrees with VENCorp that a separate Application Notice will be required for this subsequent augmentation within 12 months of the time at which Powerlink proposes to begin construction.

The community group, PDU, expressed a view that there was a need to separate the Darling Downs from the need to meet increased demand in south-east Queensland because the ACCC Regulatory Test prohibits a proposal from being approved more than 12 months prior to construction. The comments above address this matter.

In this context, the submission from Energex expresses the view that with recent load growth, additional supply to south-east Queensland may be needed as early as 2005/06 to maintain a reliable electricity supply to customers, and almost certainly before 2008/09 (Powerlink's Application Notice assumed the augmentation was required by 2008/09 at the latest). Energex indicated that its latest forecast for south-east Queensland load shows expected average annual load growth of 6-7% over the next few years, higher than the 4-5%p.a. in the earlier forecast, which was used by Powerlink in its analysis.

Interested parties should note that Energex's advice is likely to require Powerlink to address the south-east Queensland reliability need sooner than previously anticipated. The latest load forecasts, and this need, are clearly identified to the market in Powerlink's 2003 Annual Planning Report. In the context of the economic analysis in the Application Notice and this Final Report, any advance in the timing of the anticipated/modelled project to address the south-east Queensland reliability limitations increases the NPV gap between Solution A and Solution B, in favour of Solution A which is already the recommended augmentation.

5 Potential Alternatives

Least Cost Option

Some submissions suggested that Powerlink did not recommend the lowest cost solution to address the Darling Downs and SEQ reliability limitations. Several parties considered that Powerlink had not considered all feasible options when assessing the proposed augmentation against the ACCC Regulatory Test (PDU, TXU, Mr Moule, VENCorp, TransEnergie). The following alternatives were referred to in the submissions:

- interrupting customer supply in combination with minor works
- relocating distribution load to neighbouring substations
- use of short-term transmission line ratings in combination with Oakey Power Station
- a 'direct straight line' from Millmerran – Middle Ridge
- a 275kV alternative to the proposed 330kV augmentation
- augmenting the 275kV grid between Tarong and Middle Ridge, followed by a Stage 2 connection between Middle Ridge and Greenbank
- augmentation from Greenbank to Middle Ridge at 275kV
- provision of reactive (voltage) support
- upgrading the lines between Swanbank and Middle Ridge by replacing conductors, raising conductor heights, and building new lines
- demand side management initiatives
- use of generation solutions including Oakey Power Station

A response to the alternatives raised is provided below. However, Powerlink's response should be read with the following points in mind:

- Powerlink has attempted to minimise the use of technical terminology in this section of the Appendix. However, we regret that, particularly in relation to options to address voltage limitations, some of the terminology is highly technical and cannot be avoided in responding to the issues raised by some submissions.
- In accordance with Powerlink's reliability of supply obligations, options that require forced interruptions to customer supply to manage a single contingency on the existing Tarong to Middle Ridge feeders are not acceptable and have been dismissed;
- Options that rely on the Oakey Power Station are not feasible, as discussed in section 4.2.3 of this report;
- Some options put forward in the submissions are invalid because they are based on analysis containing fundamental errors. Others do not take into account the characteristics of the Queensland network (eg – solutions requiring lines to be taken out of service for extended periods).

Network options that were considered infeasible were not addressed in the Application Notice. Other combinations of options which would clearly be more expensive than the options proposed (eg – the installation of more items of equipment at a higher total cost) were also not included. Where information on these options is relevant in terms of responding to submissions, Powerlink has provided information in this Final Report.

Interrupting customer supply in combination with minor works

In accordance with Powerlink's reliability of supply obligations, options that require forced interruptions to customer supply to manage a single contingency on the existing Tarong to Middle Ridge feeders are not acceptable and have been dismissed.

Relocating distribution load to neighbouring substations

The VENCorp submission stated that the possibility of relocating distribution load to neighbouring substations does not appear to have been adequately addressed. This suggestion reflects a lack of understanding of the Darling Downs supply system. Under normal and contingency conditions, ALL of the substations in the Darling Downs area receive supply from the same source (either from the 275kV line from Tarong to Middle Ridge under normal conditions or from the 110kV lines from Swanbank under contingency conditions)[57]. Relocation of distribution load between these substations would not overcome the network limitations. There is negligible transfer capacity of loads within the subject area to outside this area via the distribution networks.

Use of short-term transmission line ratings

Some submissions suggested short-term line ratings be used to allow Powerlink time to operate Oakey Power Station. Solutions involving the use of Oakey Power Station to provide grid support are not feasible, as discussed in section 4.2.3. In any event, Powerlink is already basing its assessment of the network limitations on short-term emergency line ratings. In the June 2002 'Request for Information' document, Powerlink stated that the emergency line ratings would be exceeded by 2004/05 following a contingency.

Line ratings are determined by Powerlink, as the asset owner, in order to meet its statutory obligations for maintaining ground clearances. Powerlink notes that the emergency ratings it uses provide for capacity significantly above the normal line ratings. Powerlink considers that no rating above the emergency rating can safely be used in planning the network to meet reliability of supply obligations.

[57] The VENCorp submission refers to a 110kV connection between Tarong and Middle Ridge. We assume this is referring to the 110kV line between Dalby (supplied from Middle Ridge) and the western Queensland system at Chinchilla and Roma (supplied from Tarong). However, as noted in the June 2002 'Request for Information' document, due to line rating limitations between Dalby and Chinchilla, this connection is normally 'open'. It is not possible to supply the town of Dalby or any other load in the Middle Ridge area radially from Tarong via Chinchilla (a distance of some 240km). The Chinchilla-Dalby network can provide only limited (partial) emergency back-up to Dalby, following the implementation of significant network switching.

Augmentations from the West/North (ie – Millmerran/Tarong)

As outlined in the Application Notice, Powerlink considers that the emerging network limitations in supply to the Darling Downs can be overcome by new 330kV double circuit transmission line from Millmerran to Middle Ridge (Solution A) or a new 275kV single circuit transmission line from Tarong (Solution B). Each solution provides for the construction of an anticipated/modelled project (between Middle Ridge and Greenbank and Millmerran and Greenbank respectively) to address the south-east Queensland limitations.

Several submissions suggested variations or alternatives that would also involve augmentation to Middle Ridge from the west or north (ie – from Millmerran or Tarong). These included:

(a) A direct straight line route between Millmerran and Middle Ridge

(b) A 275kV rather than 330kV augmentation between Millmerran and Middle Ridge

(c) An augmentation from Tarong to Middle Ridge, with an anticipated/modelled project between Middle Ridge and Greenbank.

Variation on Solution A: Direct (Straight Line) Route Millmerran – Middle Ridge

Submissions from landowner Mr Moule and landowner representative group, Power Down Under, stated that the Application Notice did not contain evaluation of an option to construct a transmission line on a direct (straight line) route between Millmerran and Middle Ridge. These parties indicated that an alternative, shorter route was available that could utilise road and rail easements and existing line routes. The submissions considered that this would be a lower cost option than the options evaluated in the Application Notice.

Powerlink's response is that the ACCC Regulatory Test requires the solution to be the lowest net present value cost, subject to meeting technical standards and environmental requirements. The route selection is not part of the ACCC Regulatory Test per se, but is part of the environmental process, and must satisfy Powerlink's obligations under planning and environmental legislation.

The processes for selecting a study corridor and then selecting the final alignment are outlined in the Draft Environmental Impact Assessment (EIA) report for the project. These require the consideration of many factors, including seeking to avoid proximity to houses and schools, minimise land use impacts, visual impacts etc. The (environmental) process for selecting a study corridor involved looking at these factors for the area between Millmerran and Middle Ridge, including the area traversed by a direct straight line.

None of the existing infrastructure corridors in the general area provide sufficient clear width to permit the construction of the proposed power line within their boundaries. Very few of these corridors lie in a straight line between Middle Ridge and Millmerran. Thus, any attempt to use them would involve widening, with the associated impacts on adjacent owners, and adopting a length greater than the straight line distance between the two substations.

A straight line corridor as suggested in the submissions does not satisfy Powerlink's obligations for two primary reasons: the significantly higher impact on Class A agricultural land and the impact on residential development.

- A straight line route to the north of the corridor selected by Powerlink, while being a shorter distance, would pass through 52km of Class A (good quality) agricultural land. This is more than half the route length, and compares with only 20km of such high quality agricultural land being affected on the selected corridor. Much of this high quality land, extending from the

western boundary of the Condamine River floodplain through to Wyreema, is heavily cultivated. Extensive, and long established irrigations around the Yarramalong Weir and Condamine River would be impacted by this route.

- A straight line route would also heavily impact urban residential areas immediately to the west of Toowoomba. It would pass immediately south of the town of Wyreema and through the Top Camp / Hodgsonvale areas. The impact on these residential areas can be avoided by the use of Powerlink's existing 7km spare easement[58] south from Middle Ridge to Hodgsonvale; however a straight line route from the southern end of that existing easement to Millmerran would impact the township of Cambooya. Even disregarding the township of Cambooya, a straight line route between Millmerran and the southern end of Powerlink's existing easement at Hodgsonvale would result in approximately 90 homes within 1km of the alignment. This is an increase of about 40% on the number of homes within 1km of the proposed line on Powerlink's selected corridor.

Maps showing land use, population density, topography etc, and a more detailed discussion of factors considered, are contained in Powerlink's Draft Environmental Impact Assessment.

Variation on Solution A: 275kV Alternative to Proposed 330kV Augmentation

Power Down Under criticised the lack of information as to the selection of 330kV voltage for the proposed augmentation between Millmerran and Middle Ridge.

Both 275kV and 330kV options were considered for the proposed augmentation between Millmerran and Middle Ridge. The main factor to consider in choosing the voltage of any augmentation is the existing voltages at the substations at either end of a proposed transmission line. Where these are different, transformation is required (usually at one end) to 'step up or down' the voltage.

Tarong substation and Middle Ridge substation have existing circuits operating at the 275kV[59] voltage. Those substations do not have any existing circuits operating at 330 kV. It is therefore logical that any additional transmission lines between those two substations would be constructed to operate at 275kV.

However, Millmerran substation presently operates at 330kV. The only existing line out of Millmerran substation is a 330kV double circuit line to the Queensland – New South Wales interconnector at Bulli Creek which operates at 330 kV. Any new line between Millmerran and Middle Ridge therefore requires a 330kV/275kV transformer. The choices are to change voltages from 330kV to 275kV at the Millmerran end, and construct the line at 275kV; or construct the line at 330kV and change voltages from 330kV to 275kV at the Middle Ridge end. Tower construction costs are similar for these two voltages, but a 330kV line is capable of transferring more power and will have lower transmission losses when transferring the same power when compared to a 275 kV line. The latter was selected as the proposed augmentation, as it provides higher capability to meet future south-east Queensland requirements and reduced transmission losses for a similar estimated construction cost.

[58] Powerlink has an existing easement which extends about 7km south from Middle Ridge substation and which was acquired for a future augmentation of supply to Middle Ridge. Powerlink's corridor utilises that existing easement.
[59] In this discussion the voltages referred to are the 'nominal' voltages. Actual voltage may vary by up to 10% depending on network conditions at the time.

Augmentation: Tarong – Middle Ridge; Middle Ridge – Greenbank

Power Down Under questioned the lack of reference to the option of augmenting the grid between Tarong and Middle Ridge to address the Darling Downs limitations, and then carrying out a subsequent augmentation between Middle Ridge and Greenbank to address the south-east Queensland limitations. The landowner representative group considered this to be a lower cost option.

Powerlink acknowledges that this was not listed in section 4.3 of the Application Notice as one of the transmission options considered. However, the option was studied and was referred to within the discussion of Solution B in section 5.0 of the Application Notice. The first stage comprised a single circuit 275kV line between Tarong and Murphy's Creek. The Application Notice noted:

"In Solution B, a second stage augmentation between Middle Ridge and Greenbank as in Solution A ***is not a technically feasible way*** *of addressing reliability limitations in south-east Queensland. The existing circuits between Tarong and Murphy's Creek and Murphy's Creek and Middle Ridge were built in the late 1980s. The capacity of these older lines is much lower than the proposed new line between Tarong and Murphy's Creek in Solution B. After Stage 1, the existing and new circuits between Tarong and Middle Ridge would only have sufficient capacity to meet the power requirements of the Darling Downs.* ***These circuits would be technically incapable of carrying significant additional power to meet future requirements in south-east Queensland"****.*

This is why Solution B contained a stage 2 augmentation[60] between Millmerran and Greenbank.

However, construction of a double circuit 275kV line between Tarong – Murphy's Creek - Middle Ridge could provide the first step in a potential development to deliver capability to meet future requirements in south-east Queensland (but less capability than either Solution A or B):

1. Proposed Augmentation:
New 275kV double circuit transmission line from Tarong to Middle Ridge and associated substation works - $67 million. Dismantle and write-off existing transmission lines between Tarong and Middle Ridge - $27 million. Total $94 million.

2. Anticipated/Modelled Project
Subsequent 275kV augmentation from Middle Ridge to Greenbank in south-east Queensland and associated substation works. Total $56 million.

The proposed new augmentation (1) addresses the reliability limitations on the Darling Downs. In this proposal, a new 108km 275kV double circuit line would be constructed between Tarong and Middle Ridge, to replace the existing low capacity line between Tarong and Middle Ridge, which would be dismantled prior to the end of its economic life.

The anticipated/modelled project (2) increases the supply capability into the Logan area of south-east Queensland. However, it provides less capacity than solutions A and B, as there are less circuits available to supply the Darling Downs/south-east Queensland areas.

There are also construction scheduling limitations associated with this proposal. Easement restrictions require that lines be replaced using the same easements in some locations (ie – necessitating taking these lines out of service for extended periods). This means the proposed augmentation between Tarong and Middle Ridge (1) and the anticipated/modelled project between Middle Ridge and Greenbank (2) would have to be constructed in multiple stages. To maintain supply reliability to the Darling Downs during these periods, the Tarong to Murphy's Creek section would need to be completed by late 2004.

[60] Anticipated/modelled project

Likewise, it is essential that the anticipated/modelled project between Middle Ridge and Greenbank be completed two years earlier than required to allow the existing double circuit line between Murphy's Creek and Middle Ridge to be subsequently taken out of service and replaced. This necessary construction sequencing increases the relative net present value cost of this proposal, as the construction of some line sections would need to occur earlier compared with other solutions.

Powerlink carried out a preliminary economic evaluation of a double circuit augmentation between Tarong and Middle Ridge in accordance with the Regulatory Test economic evaluation methodology. However, as it was a higher cost than Solutions A and B and provided lower capability, detailed analysis of losses and subsequent capability requirements were not carried out. For information, the results of the preliminary analysis compared with the evaluation of Solution A and B are shown below:

Discount Rate 10%		Scenario III Anticipated/modelled project in 2008/09	
		NPV ($M)	Rank
Solution A	Proposed Augmentation: 330kV double circuit Millmerran-Middle Ridge	$59.55	1
Solution B	Proposed Augmentation: 275kV single circuit Tarong – Murphy's Creek	$67.16	2
Tarong – Middle Ridge - Greenbank	Proposed Augmentation: 275kV double circuit Tarong – Middle Ridge	$72.46[61]	3

A double circuit augmentation between Tarong and Middle Ridge is clearly a higher NPV cost solution than Solutions A and B. As noted above, it is also a lower capacity solution. The NPV cost would therefore be higher than in the above table, as this proposal would eventually require the construction of additional capability at an additional cost that was not factored into the preliminary analysis. Other disadvantages associated with this proposal include higher transmission losses, and that it would not deliver market benefits as outlined in section 10.1.

The sequencing requirement also means that this proposal could not be implemented in the timeframe required by market development scenario I, where augmentation into south-east Queensland is required prior by 2006/07, as there is insufficient time to allow the necessary staging of construction. This is significant, given the advice from Energex on its latest load forecasts.

A variation on the above proposal was suggested in the submission by TransEnergie. TransEnergie suggested constructing an additional single circuit 275kV line between Tarong and Murphy's Creek and, after the new line is built, that the existing circuit be uprated to overcome the capacity limitations referred to in the Application Notice (in conjunction with a new 275kV line between Middle Ridge and Greenbank).

The existing single circuit line between Tarong and Murphy's Creek and the existing double circuit line between Murphy's Creek and Middle Ridge are single conductor lines. It would not be practical to strengthen the towers on either of these line sections to the extent they could support twin conductors of the required capacity. The line would therefore need to be replaced with a new double circuit line, which is equivalent to the proposal described above.

[61] Includes advancement of write-off costs of existing lines as a cost that must be borne by market participants. As noted above, detailed loss studies were not carried out in the preliminary analysis. Inclusion of loss savings would widen the gap between this solution and solutions A and B, as transmission losses for this solution would be higher due to its lower capacity.

'Uprating' the existing single conductor configuration would provide only limited additional capacity for transfer of power into the Darling Downs and south-east Queensland areas (675/895MVA operating at maximum design temperature). In addition, the double circuit section between Murphy's Creek and Middle Ridge could not be taken out of service for extended periods to allow uprating, as this would result in the sole supply to the Darling Downs being provided by the existing lines between Swanbank and Middle Ridge which cannot supply all of the peak power requirements of the Darling Downs from 2004/05 onwards. This option is therefore not feasible.

Augmentations from the East (Greenbank/Swanbank)

Powerlink's planning studies show that the thermal limitations in supply to the Darling Downs cannot be overcome without the construction of a new transmission line to the area from the west or north.

As described earlier in this Appendix and in Powerlink's June 2002 'Request for Information' document, thermal limitations will occur from late 2004 onwards on the 110kV network between Abermain and Lockrose.

Various suggestions were made in the submissions (from TransEnergie, VENCorp and landowner representatives) to overcome these limitations by strengthening the existing 110kV network between Swanbank and Middle Ridge or by building new lines to the Darling Downs from the east. A response to these suggested alternatives is provided below.

<u>Augmentation from Greenbank to Middle Ridge at 275kV</u>

The submission from PDU stated that an option augmenting supply to the Darling Downs from Greenbank (as Stage 1) should have been addressed in the Application Notice.

This is not a technically feasible solution as:

- under normal conditions (that is, when the Tarong to Middle Ridge line is in service), a new 275kV line between Greenbank and Middle Ridge would carry power towards Greenbank. A high capacity new line would 'attract' higher flows due to the physics of power transfer. Without a new high capacity line into Middle Ridge from the west, this would cause the existing Tarong to Middle Ridge line to overload under normal (intact) conditions.

- This would mean the existing line would have to be taken out of service to allow the power system to be operated safely.

- Further comments on issues associated with power transfer from south-east Queensland to Middle Ridge are provided below.

'Uprating' Existing Network from Swanbank

Various suggestions were made in the submissions to overcome the thermal limitations by strengthening the existing 110kV network between Swanbank and Middle Ridge by raising towers, replacing conductors, etc.

Powerlink acknowledges that, in some circumstances, raising circuits to alleviate 'physical clearance' problems may be a practical method of gaining extra capacity from existing lines. These options were considered by Powerlink and were dismissed as technically infeasible for the lines between Swanbank and Middle Ridge. The reasons that 'uprating' the existing lines to achieve higher capacities are not feasible are:

- The double circuit line between Swanbank and Middle Ridge cannot be taken out of service to allow tower raising or conductor replacement. This line plays a critical role, both in supply to the Darling Downs during single contingencies, and supply to south-east Queensland during normal conditions. Due to Queensland's relatively flat load profile (consistently high demand), there are no times in the year where both circuits on this line can be taken out of service for an extended period.

- The existing single circuit lines between Abermain and Middle Ridge have already been substantially upgraded by replacing structures, rebuilding sections and increasing ground clearances. This work was carried out in 1991. Further 'uprating' is not achievable without rebuilding the circuits completely. This would require supply to the Lockyer Valley and other areas supplied from Lockrose and Postmans Ridge to be maintained on radial single circuit lines for extended periods while the lines were rebuilt in their entirety. This is unacceptable, as it would result in total loss of supply to customers in these areas if a single contingency occurred while work was in progress.

For comparison purposes, Powerlink makes the following comment regarding references to the SNOVIC project in Victoria in the VENCorp and TransEnergie submissions. Powerlink's understanding is that the scope of the SNOVIC project involved reconstructing 24 towers out of a total of 1600 to achieve higher clearance levels. Further, we understand that the SNOVIC project required a single circuit line to be taken out of service while new towers were constructed (in line) with existing towers. Powerlink advises that, by comparison, its 110kV line between Swanbank and Middle Ridge consists of 243 structures. Our assessment is that approximately 40% of these (that is, about 90 -100 towers) would require raising to achieve adequate clearance levels to run at higher temperatures and therefore achieve higher transfer capacity. It is not possible to take this double circuit line out of service for the extended period required for such works.

Construction of a fourth Circuit (ie – new line) from Swanbank to Middle Ridge

Construction of an additional new line – either a 110kV or 275kV circuit - between the Swanbank area and Middle Ridge is also not technically feasible for three reasons:

- The natural power flow (when the Tarong to Middle Ridge line is in service) is from Middle Ridge to Swanbank. Constructing a fourth circuit between Middle Ridge and Swanbank can cause overloads of associated equipment under normal (intact) conditions when all elements of the network are in service. This is the same problem that was discussed in relation to a possible option to construct a 275kV augmentation from Greenbank to Middle Ridge.

- Easement restrictions prevent the construction of new lines beside existing lines in some locations between the Ipswich area (Swanbank) and Toowoomba (Middle Ridge). Powerlink's longer-term plan to address south-east Queensland reliability limitations provides for a portion of the existing 110kV double circuit line to be replaced on the same easement after an alternate supply to the Darling Downs is in place.

- There is no opportunity for expansion of the Swanbank 275kV substation (ie – no more lines can be connected). The limits on expansion are due to restrictions in available useable land, undermining of the area (due to former mining operations), and the number of existing circuits to supply load and connect the power station generating units.

Even though a new line from Swanbank is not feasible, Powerlink would also point out that none of the submissions considered upstream consequences in Powerlink's network in the Swanbank area when proposing and costing such options.

- A new line between Swanbank and Middle Ridge would require power for the Darling Downs to be transferred approximately 230km from Tarong via the Ipswich area of south-east Queensland, and then west again to the Darling Downs under contingency conditions[62]. In the longer term, this is not a practical solution, as it places much greater stress on the system supplying south-east Queensland under contingency conditions.

- Powerlink acknowledges that no information was provided about the network east and north of Swanbank in its public documents. However, it is reasonable to expect that parties with transmission planning expertise such as VENCorp and TransEnergie would recognise that all options in an integrated transmission grid have 'flow-on' network consequences. This may not be a significant issue in some networks, but consideration of this is absolutely critical in Queensland. As noted above, Powerlink's grid in southern Queensland supplies a rapidly growing load, and has minimal spare capacity.

  A higher capacity network between Swanbank and Middle Ridge would cause additional power to flow through the network to the east of Swanbank under both normal and contingency conditions. This would cause corrective action (eg – new lines, new transformers and new substations) to address other limitations to be advanced. Powerlink's network in south-east Queensland is already having to cope with load growth of 4-5% per annum, with new forecasts indicating even higher rates of growth over the next three years. Any advancement of works would need to be factored into the economic analysis of an option involving a new line between Swanbank and Middle Ridge. Powerlink has not carried out such analysis, as reinforcement from the east (ie – Swanbank) is not a technically feasible means of overcoming the thermal limitation in supply to the Darling Downs.

Provision of Voltage Support

VENCorp and TransEnergie stated that Powerlink should consider the installation of reactive support equipment to address the identified voltage control limitations.

As described above, Powerlink considers that the thermal limitations in supply to the Darling Downs can only be overcome with a new transmission line from the west (either Millmerran or Tarong). Such a new transmission line also overcomes the voltage control limitations.

Examination of voltage control solutions is therefore not a useful approach, as such options cannot solve the thermal limitations and would be a partial solution only. The installation of reactive support equipment in addition to a new line from the west would be a more costly solution than the options examined by Powerlink (and involve the installation of unnecessary equipment).

[62] The output of the Swanbank generating units is fully utilised supplying existing customers in south-east Queensland.

VENCorp and TransEnergie recognised that voltage control options would be a partial solution only. However, there are several issues raised by these parties in relation to voltage control for which Powerlink considers a response is warranted.

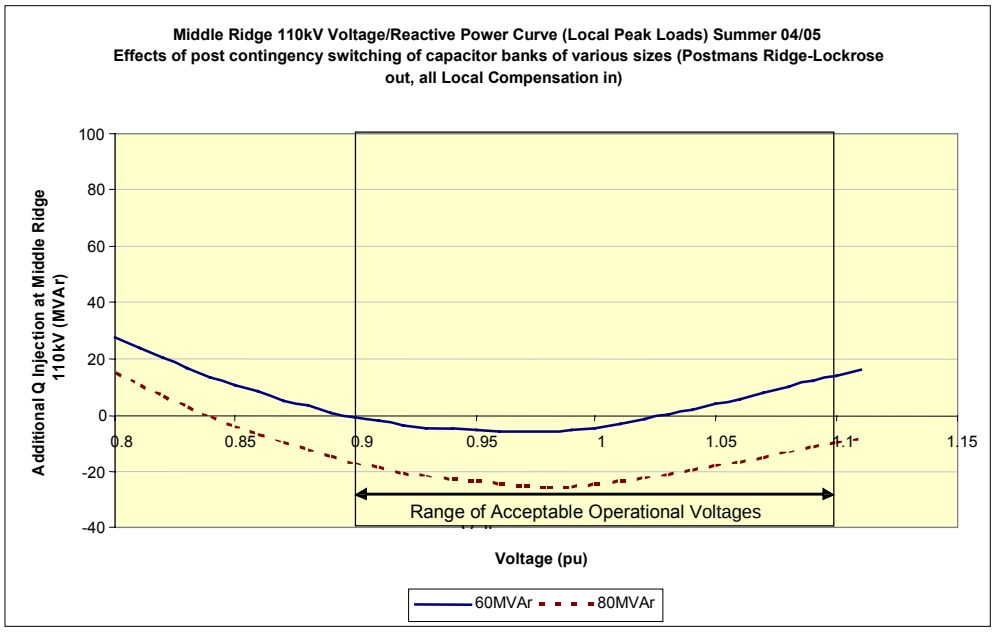
Firstly, the submissions stated that low cost voltage control solutions should have been considered. Powerlink's response is that it is standard planning practice to consider the installation of low cost reactive support equipment to address voltage limitations. Powerlink has already carried out such minor augmentations to address the Darling Downs supply issues. As advised in the June 2002 'Request for Information' document, two 50MVAr 110kV capacitor banks were installed at Middle Ridge in 2002, and a further 50MVAr 110kV capacitor bank has recently been commissioned at Abermain to assist with voltage stability issues. That is, low cost short-term solutions have already been implemented.

Secondly, VENCorp's submission expressed the view that further static reactive compensation was possible, based on a 'rule of thumb' for the level of load that may be voltage controlled through static shunt devices. Powerlink does not use this 'rule of thumb' in assessing its network. Rather, Powerlink relies on detailed power system analysis. The actual supply impedance of the existing system post-contingency is in the order of 0.18pu[63] not 0.1pu as assumed by VENCorp. Using the VENCorp rule of thumb, the 'loadability' of the existing system would be approximately 280MW (not 500MW as concluded by VENCorp).

As noted above, Powerlink does not use the VENCorp 'rule of thumb'. Instead, detailed power flow studies have been carried out. These studies have identified that:

- voltage levels on the Darling Downs under normal conditions will be unacceptably high if an additional capacitor bank is installed and operated pre-contingency.

- Additional capacitor banks of the necessary size (>40MVAr) switched in following a 275kV contingency will violate voltage fluctuation criteria in the National Electricity Code. In addition, based on the existing arrangement where the Postmans Ridge to Lockrose line is opened following an outage of the Tarong to Middle Ridge 275kV line, other National Electricity Code criteria related to voltage stability and magnitude of power frequency voltage (Schedule 5.1.4 and 5.1.8) will not be satisfied. This is illustrated in the graph below:



[63] Determined using a 'classical fault study' in PSS/E.

- The curve with an 80MVAr bank intersects the 'x' axis outside the acceptable voltage magnitude range of 0.9 to 1.1pu. With a 60MVAr bank, the positive slope at the intersection is very low[64] and excessive voltage fluctuations would occur during normal operation[65] of the network.

- Without other system modifications, any additional reactive support at Middle Ridge must therefore be dynamic in nature. This would require the installation of an 80MVAr SVC (Static Var Compensator). This equipment costs 8-12 times the cost of the capacitor bank options suggested by parties such as TransEnergie. As noted above, any voltage control equipment cannot solve the thermal limitations and is therefore only a partial solution.

Demand Side Management

The focus of the submission from the Toowoomba Greens was that Powerlink has only taken into account demand side management projects in place or foreseen by distributors, not potential programs. The Toowoomba Greens consider that options including a special air conditioning tariff and the retrofitting of insulation and solar hot water systems to houses are alternatives that should have been considered.

The submission notes that some of the options it is suggesting would take three to five years to complete. It provides no information on costs of the proposed demand side management initiatives, except a brief statement that insulation and solar hot water heaters could be installed for a similar upfront cost to Powerlink's proposal, with negligible future costs. Powerlink assumes this is referring to the $71 million for the proposed augmentation between Millmerran and Middle Ridge, but this was not clear in the submission.

Powerlink is a regulated transmission network service provider (TNSP), with its revenue for regulated services set by the ACCC. As a TNSP, Powerlink must comply with obligations to meet performance and reliability standards. As outlined in the June 2002 'Request for Information' document and the Application Notice, corrective action is necessary by summer 2004/05 to maintain a reliable power supply to the Darling Downs. Programs which take three to five years to complete will not satisfy the emerging reliability limitations.

In addition, given Powerlink's clear obligations for reliability (and associated financial and liability exposures), Powerlink cannot rely on potential demand side management programs that may, or may not, eventuate by 2004/05. Without corrective action, supply reliability standards will not be met.

For the information of interested parties, Powerlink itself is not able to introduce a new tariff for air conditioning, as this is a retail matter and retail tariffs are not set by Powerlink. Indeed, Powerlink is prohibited from engaging in electricity retail activities. Powerlink also considers that current ACCC and National Electricity Code provisions would only allow it to provide for the installation of insulation or solar hot water systems if this was undertaken by a third party as part of a 'grid support' service[66].

[64] A result of not satisfying the reactive margin criteria detailed in Schedule 5.1.8 of the NEC.
[65] Normal use of the electricity system results in perturbations on the network.
[66] Refer footnote 19 in 4.2.3

Such a grid support service must provide sufficient certainty that demand side mechanisms will deliver the required levels of reliability of supply. This would require a third party proponent who is prepared to implement these mechanisms and be paid for grid support by Powerlink under a contractual arrangement. Such a proponent would need to be a legal entity, willing to accept the commercial liabilities commensurate with Powerlink's reliability obligations, and with a credit standing to support that level of liability.

No proponent was identified through the consultation process in mid 2002 and there is no additional information to suggest there is now a proponent prepared to contract to provide grid support to overcome the Darling Downs initiatives through DSM initiatives.

Use of generation solutions not 'offered' during the consultation process

The VENCorp submission noted that Powerlink did not consider the use of any generation options that were not offered by third parties. This is a very similar issue to that addressed in the demand-side management section above. If Powerlink is to rely on a non-network solution to address reliability obligations, it is essential that there is a proponent willing to enter into a contractual arrangement for the provision of grid support.

Use of Oakey Power Station

This matter is addressed in section 4.2.3 of this report.

Powerlink is not able to divulge matters that are commercial-confidence in relation to Oakey Power Station.

VENCorp's suggestion that customer power supply could be interrupted to allow Oakey Power Station to be started has been dismissed as it is not consistent with Powerlink's N-1 reliability of supply obligations.

The TXU submission suggested negotiations should have included the power station plant owner. Powerlink notes that Enertrade has sole right to the entire output of Oakey. TXU also referred to the fact that both Powerlink and Enertrade are government owned corporations, giving rise to a potential conflict of interest. Powerlink's response is that the two corporations have independent boards that must satisfy separate commercial obligations.

6 Millmerran Power Station Issues

The submission from VENCorp stated that Powerlink should disclose in its Final Report the status of the assets between Bulli Creek and Millmerran, and any cost impacts associated with the use of this line on the ACCC Regulatory Test analysis for the proposed augmentation.

Powerlink advises that these assets (a 330kV double circuit transmission line between Millmerran Power Station and the Queensland –New South Wales interconnector at Bulli Creek substation) were constructed in 2001 as non-regulated connection assets for the Millmerran Power Station. Powerlink advises that it is intended that, following the commissioning of the proposed augmentation between Millmerran and Middle Ridge, the assets between Millmerran and Bulli Creek will be operated as part of the interconnected transmission network and the commissioning of the proposed augmentation will not change the regulatory status of these assets. As a consequence, there are no changes to the cost data in the ACCC Regulatory Test economic analysis for the proposed augmentation.

Power Down Under stated that they wanted assurance that the proposed augmentation was independent of the Millmerran Power Station, and that no political, business or private connection exists between the power station and Powerlink. Powerlink confirms that the need for the augmentation is driven solely by the reliability needs as outlined in the Application Notice. The existing assets between Millmerran Power Station and the Queensland-New South Wales interconnector at Bulli Creek are capable of transferring the full output of Millmerran Power Station. In fact, Millmerran Power Station has already been exporting its full capacity into the grid at Bulli Creek. Powerlink does have a connection agreement with Millmerran, as it has for every power station connected to its grid. No other contractual or ownership connections exist between Powerlink and Millmerran Power Station.

Mr Moule raised a concern that there was a conflict of interest between Millmerran and Oakey Power Stations due to common ownership. Powerlink notes that Enertrade has sole right to the full output of Oakey Power Station, and that there is no common ownership between Enertrade and the owners of Millmerran Power Station.

7 Other Issues

Level of Information

Submissions from VENCorp and TransEnergie Australia stated that insufficient technical detail was provided in the Application Notice to enable them to carry out an independent assessment of the network limitations. The Power Down Under group also expressed the view that there was insufficient information provided to allow them to make informed judgements and make an authoritative submission. Power Down Under also stated that Powerlink's documents are "unduly complicated and littered with jargon making them unintelligible to the average person".

Powerlink understands that the primary aim of the Application Notice required by clause 5.6.6 of the National Electricity Code is to provide information to Code Participants and interested parties in a public, transparent manner about:

- the reasons corrective action is required and the obligations which must be met;
- reasonable alternatives to address the network limitation; and
- the economic evaluation of options and justification carried out in accordance with the ACCC Regulatory Test

In satisfying this aim, Powerlink considers that a balance is necessary in its public documents regarding the level of information provided. There are challenges in meeting the needs of various audiences in a single document, while maintaining the document's 'readability'. It is Powerlink's experience that the majority of readers of documents relating to proposed new large network assets are interested parties who do not have detailed knowledge of electricity transmission systems. These readers include industry personnel without technical backgrounds in electricity transmission (eg – generation specialists, commercial, managerial and trading personnel) as well as people outside the electricity industry (eg - landholders and customer groups).

Powerlink strives to provide sufficient information in a format that allows these parties to readily understand the requirement for the proposed augmentation and the analysis conducted. In light of comments by interested parties, Powerlink has provided further information in this final report.

Powerlink recognises that parties with specialist transmission planning expertise may desire more information about the power system operation in the relevant area than can be readily provided in a consultation document. Powerlink published technical information regarding the emerging network limitations (network configuration, load forecasts, equipment ratings etc) in June 2002. It also published additional information relevant to the Darling Downs and south-east Queensland reliability limitations in its 2002 Annual Planning Report.

Contrary to a statement in VENCorp's submission, Powerlink's Application Notice did contain the proposed construction timetable for the augmentation in accordance with National Electricity Code requirements. The 'Conclusions' section stated that the proposed construction timetable provides for award of construction and equipment contracts in mid 2003, commencement of substation works in Quarter 3, 2003 and commencement of on-site line construction in Quarter 1, 2004. The project is required to be commissioned prior to the summer of 2004/05, and is presently targeted for completion in October 2004. Powerlink advises that award of contracts is now expected to occur in Quarter 3 2003.

Compliance with Public Sector Ethics Act

PDU stated that they considered that Powerlink had not complied with the Public Sector Ethics Act as it relates to the use of public resources. Powerlink advises that, while it operates according to strict corporate governance requirements, the Public Sector Ethics Act does not apply to a government owned corporation such as Powerlink.

Forecast Accuracy

Power Down Under stated the load forecasts have previously been inaccurate, and that the conclusions of the Application Notice should therefore be viewed with extreme caution. Powerlink refutes this statement. The only supporting statement provided by PDU for their assertion of inaccuracy was that the Eastlink interconnection project was cancelled. Powerlink does not see any linkage between the cancellation of Eastlink and the accuracy of load forecasts. The cancellation of Eastlink was a policy decision of the then-incoming government, which simultaneously awarded long-term power purchase agreements to support the construction of three gas turbine peaking generators. Powerlink also notes that the forecast figure for peak summer demand on the Darling Downs in 2002/03 provided in the June 2002 consultation document was 271MW. The actual peak demand experienced on the Darling Downs last summer was 277MW. Powerlink regards this as reasonably accurate forecasting. In further response to an issue raised by PDU, Powerlink advises that load forecasts account for independent predictions, provided by the National Institute of Economic and Industrial Research, of long-term growth in new cogeneration and renewable energy source generation projects in Queensland[67].

[67] As described in the Annual Planning Reports 2001, 2002 and 2003.

Scale of Proposed Solution

The VENCorp submission raised a general concern that the proposal was not in proportion to the problem. Powerlink strongly rejects VENCorp's statement that "the Darling Downs load will be 100MW above the N-1 capability in 10 years time, and the proposed solution including both stages, is to add 4500 MW of transmission capability into the area".

As noted above, VENCorp has substantially underestimated the electricity demand on the Darling Downs due to an error in its assumptions. Secondly, it appears that VENCorp has derived the capacity figure by simply adding the thermal rating of circuits between Millmerran and Middle Ridge and Middle Ridge and Greenbank.

Simplistic summations of thermal capacities of lines are meaningless. This is especially so for ingoing and outgoing lines. It also ignores the fact that power transfer is limited by factors other than thermal line ratings. Transmission grids operate as an integrated whole. Factors such as voltage stability, transient stability, ratings and impedance of both individual and groups of network elements, reactive characteristics, output of generators etc will all limit the capability to transfer power along the proposed circuits between Millmerran and Middle Ridge.

Referring to thermal capacity of a set of wires independent of the system in which they are connected is highly misleading. As an example, Powerlink understands the total thermal capacity of lines into and out of the South Morang substation in Victoria is more than 20000 MW. No load is directly supplied from this substation and the thermal capacity is more than twice the total power requirements of the entire state of Victoria. Clearly, simple addition of thermal ratings is an inappropriate means of describing transmission network capacity.

Costs and Analysis Methodology

Power Down Under considered that Powerlink did not disclose sufficient detail on the costs included in the analysis and on the modelling and assumptions used to compare options.

PDU stated that the costs do not include costs for acquisition of easements, compensation, environmental (spread of weeds, soil compaction etc), loss of production (income from national and export markets) and loss of jobs. Powerlink advises that all costs allowable under the ACCC Regulatory Test were included: "*costs that can be measured as a benefit or cost to producers, distributors and consumers of electricity in terms of financial transactions in the market. Any additional indirect costs should be excluded from the assessment".*

Powerlink advises that easement acquisition and compensation costs were included in the total cost estimates used in the ACCC Regulatory Test analysis. We also advise that the modelling and assumptions used total cost estimates and standard NPV analysis in accordance with the ACCC Regulatory Test. Powerlink also notes in response to comments in some submissions regarding the validity of the cost estimates that cost estimates of future projects are based on experience with recent similar transmission augmentation projects. It is also emphasised that the ACCC Regulatory Test analysis was robust to sensitivity studies that varied the capital cost estimates by plus or minus 15%.

PDU claimed that different timeframes had been used in the analysis and in verbal representations to their group by Powerlink. They also queried the use of a 10% discount rate in the NPV analysis. Powerlink's response is that only two timeframes are important in the ACCC Regulatory Test analysis: (1) analysis over a sufficient length of time to determine the first incidence of network limitations – in the case of the Darling Downs, this analysis identifies limitations by summer 2004/05, and (2) analysis over a longer time period in accordance with the ACCC Regulatory Test. Powerlink adopted a 15 year period for the NPV analysis, and also undertook a 20 year analysis period in its Application Notice, to demonstrate that the conclusions were not particularly sensitive to the evaluation period.

In relation to the discount rate, Powerlink comments that it received advice regarding an appropriate discount rate to be used in the ACCC Regulatory Test from KPMG in August 2001. A 10% discount rate was used in accordance with this advice and consistent with standard industry practice. In accordance with the ACCC Regulatory Test, sensitivity studies were carried out, including for variations to the discount rate. The conclusions of the analysis were found to be robust for reasonable variation of the discount rate.

Market Benefit Analysis

TransEnergie raised several issues in its submission in relation to the market benefit analysis outlined in the Application Notice. As Powerlink noted in its Application Notice, this analysis was incidental to the ACCC Regulatory Test and not applied in reaching the conclusion. TransEnergie considered that statements were contradictory and that the analysis was extremely sensitive to assumptions and methodology. As a result, TransEnergie considered that a full disclosure of assumptions was required or the benefits claimed for Solution A should be discarded. In contrast, Delta Electricity stated that it considered the market benefit analysis in the application notice may be conservative as the periods of congestion correlate to high value periods.

It is also noted that Energex Retail submitted that inclusion of competition benefits, being considered by the ACCC in its review of the Regulatory Test, would significantly increase the calculated market benefits of Powerlink's proposal.

The market benefit analysis referred to was carried out by independent consultants. As stated in the Application Notice, it was provided for the information of National Electricity Code Participants and interested parties only. Powerlink notes the comments by TransEnergie in relation to this market benefit analysis and sensitivity to assumptions. However, no further action is considered necessary, as the benefits identified were provided for information only, and were not used in justifying the proposed augmentation under the ACCC Regulatory Test.

Prior Outage of Generation

TXU and TransEnergie disagreed with Powerlink's assumption in the ACCC Regulatory Test market development scenarios which allowed for the largest generating unit in South-east Queensland to be out of service.

TransEnergie noted that this assumption has a marked effect on the timing of the requirement for a network augmentation into south-east Queensland, and that the NPV analysis is therefore fundamentally flawed.

TXU considered that prior outage of a generator unit does not constitute a credible contingency event under Schedule 5.1 of the National Electricity Code. It considers that Powerlink is not required to ensure reliability standards to an N-1 standard with coincident loss of generation, and therefore that Powerlink has improperly applied the ACCC Regulatory Test.

Powerlink disagrees with these statements. At the start of any power system investigation, two important inputs must be determined – the load forecast to be used and the generation pattern. These two inputs will determine the flows on the transmission system to be used in the analysis. In terms of transmission reliability studies, the inputs need to be determined based on the cases which affect network transfer capability.

As discussed in the Application Notice, the following input data has been used by Powerlink in making its initial assessment of timing for the anticipated/modelled project to address limitations in south-east Queensland.

- 50% probability of exceedance (POE) forecast
- Directlink flowing north
- Wivenhoe on line in generating mode
- Swanbank B generating at full output
- Swanbank E out of service
- Embedded generation operating
- Existing demand side management operating
- Transmission system intact.

Indeed considering the magnitude and type of load supplied in south-east Queensland (which has a peak demand in excess of 3000MW) more conservative network planning assumptions may well be appropriate. In this context, TransEnergie has referred to NEMMCOs role in coordinating generation outages through the MT PASA process to ensure that generator outages are not scheduled for critical times. The MT PASA process which NEMMCO undertakes is based on the 10% probability of exceedance (POE) forecast with intact transmission transfer capacity. The 10% POE load forecast used in the MT PASA process is much higher than the 50% POE load forecast used by Powerlink in its initial assessment of emerging south-east Queensland reliability limitations.

In its submission Energex stated that its latest load forecasts (on the back of the high growth in the 2002/03 summer) indicated that reinforcement into south-east Queensland will be required well before 2008/09. The sensitivity of the analysis to the timing resulting from these assumptions has been checked through the use of scenarios in the economic analysis.

Notwithstanding the above, Powerlink's analysis considered a range of timings for future augmentation into south-east Queensland to account for changes in generation and load pattern. The analysis was robust to a range of timings.

Community and Environmental Issues

Several submissions such as those by Ms Lowe and Power Down Under included matters that are outside the scope of the ACCC Regulatory Test and National Electricity Code process.

These issues included community and visual impact, local government planning laws, electric and magnetic fields etc. They have been summarised in Appendix 1 but have not been addressed in this Final Report. Such matters are being addressed via other mechanisms such as the Environmental Impact Assessment process for the proposed project.

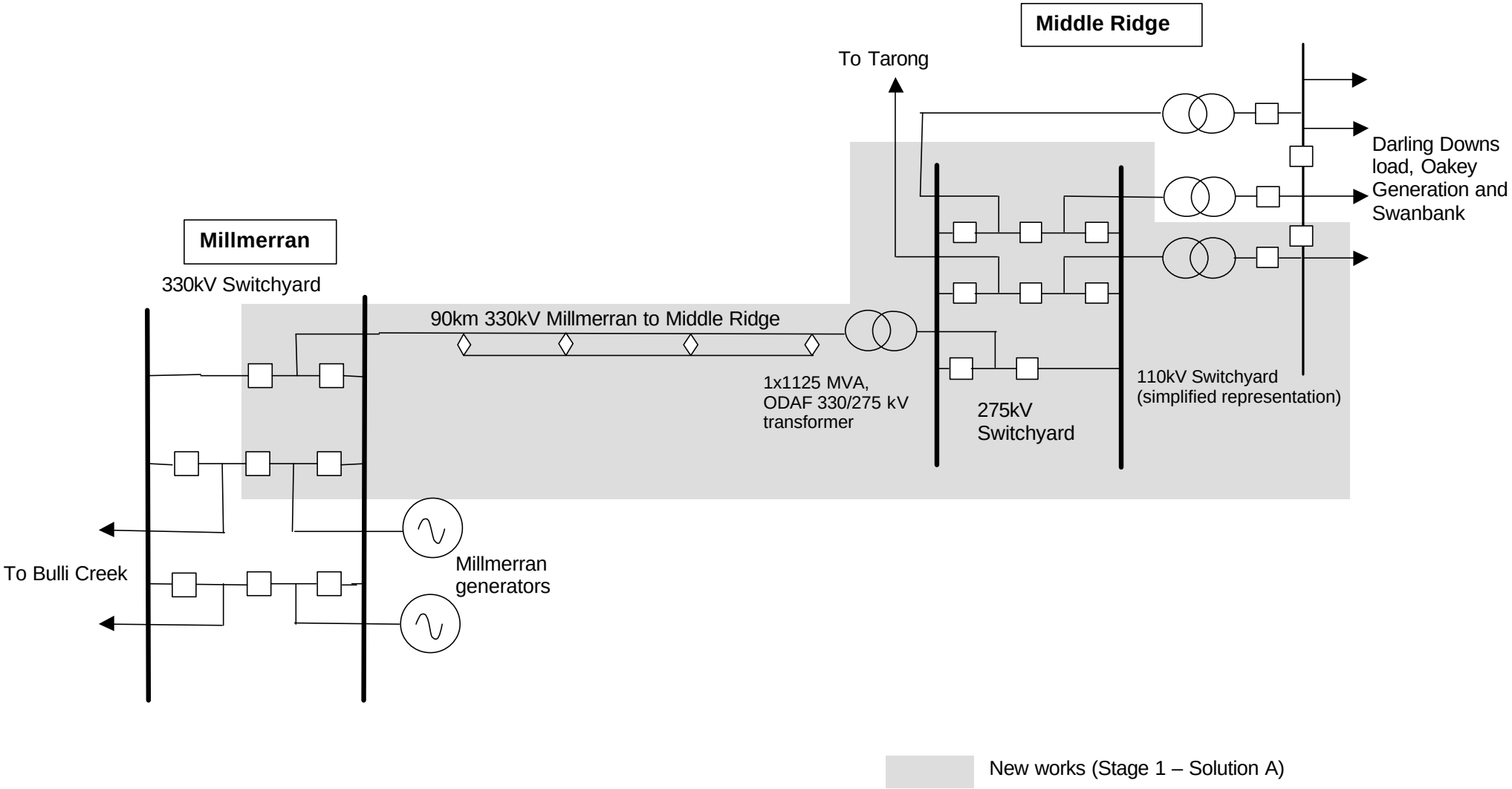
APPENDIX 3:

TECHNICAL DETAILS OF PROPOSED NEW LARGE NETWORK ASSET

The proposed new large network asset recommended in this application notice comprises the following works:

- 90km of 330kV double circuit twin “sulphur” conductor transmission line from Millmerran to Middle Ridge, including OPGW
- 330kV extensions to Millmerran substation with feeder rearrangement
- A 275kV switchyard at Middle Ridge with the following:
    - 1 x 1125MVA 330/275kV transformer
    - 1 x 250MVA 275/110kV transformer
    - 3 switching diameters
- 110kV works on the existing Middle Ridge bus as follows:
    - 110kV transformer bay
    - installation of a bus section circuit breaker to form three switched bus sections
    - feeder rearrangement
- Minor protection modifications at Tarong substation

New works are highlighted in the following network configuration diagram :



This diagram is representational only and does not necessarily depict physical arrangements

APPENDIX 4

Summary

15 Year Analysis Period

Discount rate 10%		Scenario I *Anticipated/modelled project in 06/07*		Scenario II *Anticipated/modelled project in 07/08*		Scenario III *Anticipated/modelled project in 08/09*		Scenario IV *Anticipated/modelled project in 11/12*	
		NPV ($M)	**Rank**	**NPV ($M)**	**Rank**	**NPV ($M)**	**Rank**	**NPV ($M)**	**Rank**
Solution A	Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge	**$69.79**	**1**	**$63.95**	**1**	**$59.55**	**1**	**$49.09**	**1**
Solution B	Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck	$80.78	2	$73.67	2	$67.16	2	$50.77	2

Development Options	**Scenario I** *Anticipated/modelled project in 06/07*	**Scenario II** *Anticipated/modelled project in 07/08*	**Scenario III** *Anticipated/modelled project in 08/09*	**Scenario IV** *Anticipated/modelled project in 11/12*
Solution A				
Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge	04/05	04/05	04/05	04/05
Anticipated/modelled project: 275kV DCST Middle Ridge - Greenbank	06/07	07/08	08/09	11/12
Solution B				
Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck	04/05	04/05	04/05	04/05
Anticipated/modelled project: 275kV DCST Millmerran-Greenbank	06/07	07/08	08/09	11/12

Scenario I — *Anticipated / modelled project in 06/07*

Solution A — DCST 330 Milm-MR, DCST 275 MR-Grnbk

Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=> TUOS		0.000	0.000	0.000	7.860	7.755	7.650	7.545	7.441	7.336	7.231	7.126	7.021	6.917	6.812	6.707	6.602
==> NPV of TUOS	$43.25																

Anticipated/modelled project: 275kV DCST Middle Ridge - Greenbank		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=>TUOS		0.000	0.000	0.000	0.000	0.000	6.655	6.566	6.477	6.389	6.300	6.211	6.122	6.034	5.945	5.856	5.767
==> NPV of TUOS	$27.92																

Relative Losses		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
* Losses $		0.000	0.000	-0.838	-1.303	-0.383	0.084	0.100	0.100	0.107	0.130	0.138	0.146	0.153	0.161	0.169	0.184
=> NPV of Losses	-$1.38																

Total NPV for Solution A **$69.79**

Solution B — SCST 275 Tar-MurCk, DCST 275 Milm-Grnbk

Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=> TUOS		0.000	0.000	0.000	5.161	5.092	5.023	4.954	4.886	4.817	4.748	4.679	4.610	4.542	4.473	4.404	4.335
==> NPV of TUOS	$28.40																

Anticipated/modelled project: 275kV DCST Millmerran-Greenbank		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=>TUOS		0.000	0.000	0.000	0.000	0.000	12.485	12.318	12.152	11.985	11.819	11.652	11.486	11.319	11.153	10.987	10.820
==> NPV of TUOS	$52.38																

Relative Losses		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
* Losses $		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Losses	$0.00																

Total NPV for Solution B **$80.78**

Scenario II — *Anticipated / modelled project in 07/08*

Solution A — **DCST 330 Milm-MR, DCST 275 MR-Grnbk**

Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=> TUOS		0.000	0.000	0.000	7.860	7.755	7.650	7.545	7.441	7.336	7.231	7.126	7.021	6.917	6.812	6.707	6.602
==> NPV of TUOS	$43.25																
Anticipated/modelled project: 275kV DCST Middle Ridge - Greenbank		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=>TUOS		0.000	0.000	0.000	0.000	0.000	0.000	6.655	6.566	6.477	6.389	6.300	6.211	6.122	6.034	5.945	5.856
==> NPV of TUOS	$24.13																
Relative Losses		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
* Losses $		0.000	0.000	-0.838	-1.303	-1.472	-1.525	-0.442	0.100	0.107	0.130	0.138	0.146	0.153	0.161	0.169	0.184
=> NPV of Losses	-$3.43																
Total NPV for Solution A	**$63.95**																

Solution B — **SCST 275 Tar-MurCk, DCST 275 Milm-Grnbk**

Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=> TUOS		0.000	0.000	0.000	5.161	5.092	5.023	4.954	4.886	4.817	4.748	4.679	4.610	4.542	4.473	4.404	4.335
==> NPV of TUOS	$28.40																
Anticipated/modelled project: 275kV DCST Millmerran-Greenbank		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=>TUOS		0.000	0.000	0.000	0.000	0.000	0.000	12.485	12.318	12.152	11.985	11.819	11.652	11.486	11.319	11.153	10.987
==> NPV of TUOS	$45.27																
Relative Losses		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
* Losses $		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Losses	$0.00																
Total NPV for Solution B	**$73.67**																

Scenario III — *Anticipated / modelled project in 08/09*

Solution A — **DCST 330 Milm-MR, DCST 275 MR-Grnbk**

Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=> TUOS		0.000	0.000	0.000	7.860	7.755	7.650	7.545	7.441	7.336	7.231	7.126	7.021	6.917	6.812	6.707	6.602
==> NPV of TUOS	$43.25																

Anticipated/modelled project: 275kV DCST Middle Ridge - Greenbank		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=>TUOS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.655	6.566	6.477	6.389	6.300	6.211	6.122	6.034	5.945
==> NPV of TUOS	$20.66																

Relative Losses		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
* Losses $		0.000	0.000	-0.838	-1.303	-1.472	-1.525	-1.579	-0.460	0.107	0.130	0.138	0.146	0.153	0.161	0.169	0.184
=> NPV of Losses	-$4.36																

Total NPV for Solution A **$59.55**

Solution B — **SCST 275 Tar-MurCk, DCST 275 Milm-Grnbk**

Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=> TUOS		0.000	0.000	0.000	5.161	5.092	5.023	4.954	4.886	4.817	4.748	4.679	4.610	4.542	4.473	4.404	4.335
==> NPV of TUOS	$28.40																

Anticipated/modelled project: 275kV DCST Millmerran-Greenbank		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
=>TUOS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	12.485	12.318	12.152	11.985	11.819	11.652	11.486	11.319	11.153
==> NPV of TUOS	$38.76																

Relative Losses		*02/03*	*03/04*	*04/05*	*05/06*	*06/07*	*07/08*	*08/09*	*09/10*	*10/11*	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*
* Losses $		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Losses	$0.00																

Total NPV for Solution B **$67.16**

Scenario IV

Anticipated / modelled project in 11/12

Solution A — **DCST 330 Milm-MR, DCST 275 MR-Grnbk**

		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge																	
=> TUOS		0.000	0.000	0.000	7.860	7.755	7.650	7.545	7.441	7.336	7.231	7.126	7.021	6.917	6.812	6.707	6.602
==> NPV of TUOS	$43.25																
Anticipated/modelled project: 275kV DCST Middle Ridge - Greenbank		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
=>TUOS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.655	6.566	6.477	6.389	6.300	6.211
==> NPV of TUOS	$11.93																
Relative Losses		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
* Losses $		0.000	0.000	-0.838	-1.303	-1.472	-1.525	-1.579	-1.656	-1.717	-0.485	0.138	0.146	0.153	0.161	0.169	0.184
=> NPV of Losses	-$6.08																
Total NPV for Solution A	**$49.09**																

Solution B — **SCST 275 Tar-MurCk, DCST 275 Milm-Grnbk**

		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck																	
=> TUOS		0.000	0.000	0.000	5.161	5.092	5.023	4.954	4.886	4.817	4.748	4.679	4.610	4.542	4.473	4.404	4.335
==> NPV of TUOS	$28.40																
Anticipated/modelled project: 275kV DCST Millmerran-Greenbank		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
=>TUOS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12.485	12.318	12.152	11.985	11.819	11.652
==> NPV of TUOS	$22.38																
Relative Losses		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
* Losses $		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Losses	$0.00																
Total NPV for Solution B	**$50.77**																

APPENDIX 5

Summary

20 Year Analysis Period

Discount rate 10%		**Scenario I** *Anticipated/modelled project in 06/07*		**Scenario II** *Anticipated/modelled project in 07/08*		**Scenario III** *Anticipated/modelled project in 08/09*		**Scenario IV** *Anticipated/modelled project in 11/12*	
		NPV ($M)	**Rank**	**NPV ($M)**	**Rank**	**NPV ($M)**	**Rank**	**NPV ($M)**	**Rank**
Solution A	Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge	**$80.89**	**1**	**$74.97**	**1**	**$70.65**	**1**	**$60.43**	**1**
Solution B	Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck	$93.94	2	$86.97	2	$80.61	2	$64.68	2

APPENDIX 6

Market Benefit Analysis — **Benefits of Solution A over Solution B (as calculated by ROAM Consulting Pty Ltd)**

Scenario I

Market Benefits Identified		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
=> Benefits $M		0.000	0.000	0.013	0.060	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of Benefits	$0.09																
Total NPV for Scenario I	**$0.09**																

Scenario II

Market Benefits Identified		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
=> Benefits $M		0.000	0.000	0.013	0.060	0.140	0.373	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of Benefits	$0.38																
Total NPV for Scenario II	**$0.38**																

Scenario III

Market Benefits Identified		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
=> Benefits $M		0.000	0.000	0.013	0.060	0.140	1.120	3.730	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of Benefits	$2.95																
Total NPV for Scenario III	**$2.95**																

Scenario IV

Market Benefits Identified		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
=> Benefits $M		0.000	0.000	0.013	0.060	0.140	1.120	11.190	13.240	13.870	4.623	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of Benefits	$22.39																
Total NPV for Scenario IV	**$22.39**																

Net Cost Analysis

	Solution A Proposed Augmentation: 330kV DCST Millmerran-Middle Ridge			**Solution B** Proposed Augmentation: 275kV SCST Tarong-Murphy's Ck		
Discount rate 10%	NPV COST	**NPV MARKET BENEFIT**	NET COST*	NPV COST	**NPV MARKET BENEFIT**	NET COST*
Scenario I *Anticipated/modelled project in 06/07*	69.79	**0.09**	69.70	80.78	**0.00**	80.78
Scenario II *Anticipated/modelled project in 07/08*	63.95	**0.38**	63.57	73.67	**0.00**	73.67
Scenario III *Anticipated/modelled project in 08/09*	59.55	**2.95**	56.60	67.16	**0.00**	67.16
Scenario IV *Anticipated/modelled project in 11/12*	49.09	**22.39**	26.70	50.77	**0.00**	50.77

* Net Cost = NPV Cost Less NPV Market Benefit