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Mr Sebastian Roberts
General Manager, Electricity Group
Regulatory Affairs Division
Australian Competition and Consumer Commission
GPO Box 520J
Melbourne VIC 3001

Dear Mr Roberts

Proposed Wollar-Wellington 330kV Transmission Line – Letter from Mr Needham 20/12/04

Reference is made to an informal meeting on the above project that took place on 18th March 2005 immediately following the public forum held by the Commission into the 5-year capital expenditure programs for both EnergyAustralia and TransGrid. The meeting involved Mr Needham (who addressed the forum on the same project), officers representing TransGrid (Messrs Gall, Burbidge and Thomson) and the Commission (Mr Fitts, Ms Mai, and Ms Mcdougall).

This discussion was arranged between all three parties to provide an opportunity for Mr Needham to explore his concerns with one of TransGrid's experienced power system planning professionals. Discussions focussed on the various technical, planning and economic considerations associated with the selection of the Wollar-Wellington 330kV line as the least cost solution for long term security of supply to the Western Area of NSW. Although several letters had been exchanged between Mr Needham and TransGrid during 2004 (referred to in our letter to you dated 3rd February 2005), TransGrid recognises that, to date, these exchanges have not allayed Mr Needham's concerns. It was in this context that 'face to face' discussions were considered appropriate.

Furthermore, and in light of these informal discussions, Attachment No.1 to this letter may also be helpful to Mr Needham. This attachment responds further, and in more detail, to the series of questions contained in Mr Needham's letter to the ACCC dated 20th December 2004. Additional information relating to requests not previously the subject of correspondence but which emerged during the 18th March 2005 discussion is also provided as Attachment No.2.

In order to place the capital investment of approximately $70 million in context, calculations show that the economic cost of a two-day outage of the existing single Mt Piper – Wellington 330kV line at times of high demand could be around $100 million. This would arise from the need to disconnect people and businesses in order to maintain satisfactory voltage levels at Wellington 132kV substation, and to protect the integrity of power supplies to remaining customers in western NSW. The actual amount of unserved energy would, of course, depend on the duration of the outage, the time at which it occurred, and how quickly it is possible to restore load.

Quality System
Quality Endorsed Company
ISO 9001 Lic 4067
Standards Australia

Environment
Certified Environmental Management
ISO 14001 Lic C0052
Standards Australia

Mr Needham's correct conclusion that the existing 330kV line has proven to be very reliable needs to be considered in the context that lines of this type can, and do, occasionally fail for extended periods. Accordingly, established practice, both in NSW and internationally, involves providing additional transmission capability when customer demand increases and the associated economic and social consequences of a line failure increase to unacceptable levels.

It is TransGrid's belief that the total of the information to follow herein, together with that provided in previous correspondence, represents a rounded and comprehensive treatment of the planning issues associated with the Wollar-Wellington 330kV line. TransGrid understands that it is the Commission's standard practice to publish information provided in relation to revenue cap decisions on its website and accepts that this letter may also be published to assist other interested parties in understanding the issues involved.

As such the issue of this letter and the attachment, together with previous correspondence regarding this matter should provide Mr Needham with all the information required to come to an informed assessment. Nonetheless, the Environmental Impact Statement for the proposed line is nearing the date for issue and public comment, and Mr Needham will, of course, be provided with the opportunity to provide further input to that process at his discretion.

Yours sincerely

Philgall 8/4/05

Philip Gall
Manager/Regulatory Affairs

Attachment

ATTACHMENT NO. 1
Wollar-Wellington 330kV Line and Concerns of Mr Needham, March 2005

This attachment responds to the series of questions contained in Mr Needham's letter to the ACCC dated 20th December 2004. The format will be to repeat in italics the statements and subsequent questions from the letter, and to follow each of these with TransGrid's response.

Additional information is also included at Attachment No. 2 relating to requests not previously the subject of correspondence but which emerged during an informal meeting on 18th March 2005 between Mr Needham, TransGrid and the ACCC.

STATEMENT

TransGrid's presentation entitled Development of Electricity Supply in the Western Area of NSW Final Report. Page 4 of 46 has a map of the network in the Western area. This map does not show the Ulan Township or Ulan Colliery. These locations are not shown in the Corridor Selection Summary Report nor are they in the Corridor Selection Report.

Question 1 – Please advise whether the Ulan Township and Colliery are supplied with power from this network. If so why have these significant locations not been included in this important presentation? Also, provide details of the power line or lines to a) the Ulan Colliery and b) the Ulan Township including length, voltage capacity and source of power.

TransGrid Response

Ulan mine and Ulan township are supplied from TransGrid's Beryl 132/66 kV substation via a 66 kV line, and a 132 kV line that operates at 66 kV. These lines are owned by Country Energy and are each approximately 30 kilometres long. We are not sure what "voltage capacity" might refer to, however, provided that the voltage level at the Beryl 66 kV busbar is within the normal range, and the lines are in service, voltage levels at Ulan should be satisfactory.

The reports referred to included maps showing the larger population centres in the area. The purpose of these diagrams is to convey an overview of the general geographical area so it is not necessary to show each and every town. Ulan, together with numerous other smaller centres, was not included on the diagram. This does not impact on the integrity of the analysis or empirical outcomes.

STATEMENT

In the above final report fig. 2 & 4, the forecast maximum demand load for year 2002 was approximately 240 MW. The approximate 2003 demand was 575 MW and 2004 was approximately 585 MW (read from the primitive graph).

Question 2. What was the actual demand for each of the above years?

Question 3 On how many days during winter in the above years did this occur?
Please give the number of days during summer or winter on which the maximum demand exceeded 470 MW giving the range and the times per day when this level was exceeded.

TransGrid Response

Question 2

The table below gives actual maximum demands and forecast maximum demands for the "western area" for 2002, 2003 and 2004. The table includes both the forecasts considered by TransGrid (with and without additional "spot loads"). As no additional "spot loads" have arisen, the actual loads are very close to the lower forecast.

Year	Forecast Maximum Demand (MW)		Actual Maximum Demand (MW)
	With "Spot Loads"	Without "Spot Loads"	
2002	540	513	518
2003	570	521	531
2004	578	529	527

Question 3
The maximum demand occurred on one occasion each year.

The relevance of the figure of 470 MW is not clear to TransGrid. Nevertheless, information on the times when the demand exceeded this level is provided in the table below.

	2002	2003	2004
Hours that load exceeded 470 MW	188.5	157.5	310.5
Maximum period that load exceeded 470 MW (hours)	4.25	8.75	10.5
Minimum period that load exceeded 470 MW (hours)	0.25	0.25	0.25
Average period that load exceeded 470 MW (hours)	1.41	1.50	1.63
Number of times that the load exceeded 470 MW	134	105	190

STATEMENT
Page 12 Fig 2.8 shows the forecast maximum demand for the Far Western Area of approximately 270MW for year 2002. 295 MW for year 2003 and 300MW for year 2004.

Question 4. What was the actual demand for each of the above years?

TransGrid Response
The table below gives actual and forecast maximum demands for the "far western area" for 2002, 2003 and 2004. The table includes both the forecasts considered by TransGrid (with and without additional "spot loads"). As no additional "spot loads" have been developed, the actual loads are closer to the lower forecast.

Year	Forecast Maximum Demand (MW)		Actual Maximum Demand (MW)
	With "Spot Loads"	Without "Spot Loads"	
2002	261	235	247
2003	288	240	235
2004	294	246	243

STATEMENT
In recent letters, TransGrid has confirmed that line 72 was placed in service in 1984 and that during this 20 year life, it has never been out of service during peak hour periods and outage statistics confirm that it has been forced out of service on only 5 occasions since 1992 in each case only momentarily with no loss of supply.

Question 5. How many times was it forced out of service from 1984 to 1992 and for how long and what loss of supply occurred on each occasion.

Question 6. On each occasion from 1984 to 2004 that it was forced out of service what was the cause of that failure?

TransGrid Response
Question 5
Data on outages prior to 1992 is not readily available due to a changeover of computer systems. The previous system's format (VAX mainframe) would not be readable without a costly format conversion process. However, the network would have been able to withstand an outage of the 330 kV line until the mid to late 1990s. Thus, there should have been no loss of supply for outages of the 330 kV line prior to 1992.

Question 6
The outage statistics for 72 line since 1992 are provided in Attachment No.3. These show (refer highlighted entries) that with just 5 forced outages, 72 line has been very reliable.

STATEMENT

TransGrid has stated that during the last 10 years, Line 72 was taken out of service for maintenance on 113 occasions- i.e. 11.3 times per year- for a total outage time of 472 hours (average 4.7 hours per occasion). With no loss of load during these maintenance periods. These outages were obviously for planned maintenance.

Question 7. What was the nature of this maintenance e.g. tower repairs, cable replacement, insulator repair, transformer, reactor, circuit breakers or other repairs?

Question 8 At what period were these services carried out e.g. midweek between 10am and 2pm. Saturdays or Sundays between 8am and 5pm.

TransGrid Response

The outage statistics for 72 line since 1992 are provided in Attachment No.3. These show that virtually all the outage time was for routine maintenance, and that most of this related to testing of protection and control systems. These systems are vital to ensuring that short circuits are isolated from the interconnected power system quickly and only when necessary, and that affected circuits are restored promptly once a short circuit is no longer present. The excellent performance of these protection and control systems has contributed to the negligible forced outage duration times to date on 72 line.

Outages for routine maintenance on this line are scheduled to occur during periods of relatively low demand. Under these conditions the remaining 132 KV network would be required to have sufficient capability to meet regional demand, even following a subsequent forced outage on this network. Periods of low demand vary from region to region. Typically these periods occur during spring and autumn and/or on weekends. Due to growth in customer demand over time these circumstances almost never arise on this system now. In fact, the only periods in which extended maintenance outages can occur is with close co-ordination with scheduled down time by a small number of large customers in the area.

STATEMENT

One of the significant elements in TransGrid's justification for the $67M expenditure is the forecast for future demand. This forecast is based in part on past increases in demand. However, past demand is distorted by what appears to be a one off 47MW load in year 98/99. TransGrid has confirmed that such a one off load will not reoccur, however, this figure has distorted the demand trend.

Question 9 Please advise the location of this load and who is the customer being supplied with the extra 47MW of power.

TransGrid Response

The load in question is a mine in the Orange area, supplied from TransGrid's Orange 132/66 kV substation.

The statement preceding this question is incorrect in two respects. First, it implies that the forecast "western area" load is based on an extrapolation of aggregate maximum demands for that area. This is incorrect. The "western area" load is based on forecasts of the maximum demands at each location in the area from which Country Energy or Integral Energy take supply. These forecasts incorporate demand growth at those locations. For major industrial loads, which are not expected to increase, the load is forecast to remain steady. In this way, development of "spot loads" does not distort the overall forecast.

Secondly, in its evaluation of supply to the area, TransGrid has used two forecasts. The first included additional "spot loads" such as new or expanded industrial loads. The second excluded additional "spot loads" to cater for the possibility that they may not occur.

STATEMENT

In order to understand the logic of TransGrid's future projections, it is imperative that they provide the nature of business of all customers who consume large amounts of power.

Question 10 What are the names and the nature of the business of all customers who consume large parcels of power in excess of 5 MWH? Please supply me with the maximum consumption of such one off projects such as the mine at North Parkes and each of the significant mines in Cobar, Orange etc. or any other significant businesses with a finite life and currently consuming in excess of 5MWH.

TransGrid Response

The question presumably seeks information on customers having maximum demands of 5 MW or greater (rather than using 5 MWh over some undefined period). These customers are supplied and metered by Country Energy, not TransGrid.

It would also be appropriate to advise that information of the nature requested is regarded as confidential (refer to clause 7.10 of the National Electricity Code).

STATEMENT

In the projections made by TransGrid, have they taken into consideration the impact of the gas pipeline in the Western Area?

Question 11. What impact on demand has TransGrid taken into consideration as a result of the gas pipeline in the Western Area?

TransGrid Response

Natural gas has been available in the area for many years. Its presence is one of the factors that has influenced load growth in recent years and is reflected in the forecast loads.

STATEMENT

TransGrid have informed us that the Net Present Value (N.P.V.) of the project using a discount of 12% is minus $24M based on their original forecasts.

Question 12 What is the N.P.V. based on the actual peak demand in years 2002, 2003 and 2004 projected forward from this base?

TransGrid Response

This question appears to be based on the assumption that load forecasts should start from the most recent maximum demand. This is not necessarily the case. Leaving this issue aside, if the load forecast was to be adjusted to start at the actual maximum demands recorded in 2002, 2003 and 2004 and the analysis repeated, the ranking of the options is extremely unlikely to change. Please refer to the response to Question 13 for an explanation of why the ranking, rather than the magnitude of the NPVs, is the critical consideration.

STATEMENT

TransGrid's calculation for NPV is based on the capital costs and the anticipated loss to the customer assuming the value to the customer of lost power to be $10 per KWH. As a typical customer, I pay only 14.7 cents per KWH i.e. they use a figure 70 times greater than the actual charge to the end customer. Such an outrageous inflation of the actual cost for the calculation of the N.P.V makes the study meaningless.

When evaluating any project all professionally managed private enterprises would expect the N.P.V. to be based on the cost of the investment and the anticipated earnings of the project using a discount rate applicable to the business. As one of the investors in this project, I believe that I am entitled to be given the results of such an orthodox N.P.V.

Question13. What is the N.P.V. of this project based on the expenditure of $67M and the return to the investor based on a discount rate of 12% (the rate used by TransGrid in their original study) and the actual revenue benefit to be obtained by the implementation of this project?

TransGrid Response

This question appears to be based on a number of misconceptions. It is important to understand the distinctions between the type of analysis conducted by TransGrid and that referred to in the statement preceding this question.

When a private enterprise is considering whether to invest in a particular project, it will usually conduct a financial analysis similar to that described in the statement preceding this question. In these cases, the organisation is usually assessing what is best for it alone and generally has the option of not investing in any project if the analysis shows that no project satisfies the organisation's investment criteria.

TransGrid is in a different situation in that it has reliability obligations to meet and does not have the option of not investing. TransGrid's objective is therefore to identify the option that satisfies the reliability requirement in the most cost effective way. In doing this for the supply to the west of the state, TransGrid applied the ACCC's regulatory test (an economic cost effectiveness test), in accordance with the requirements of the National Electricity Code. The purpose of this test is to identify the most *cost effective* option for the National Electricity Market (NEM) overall.

In short, TransGrid does not have the option of not investing and is required to apply an *economic* analysis (considering the NEM overall) rather than a *financial* analysis (which considers only TransGrid).

These distinctions have two relevant consequences. First, as not investing is not an option, TransGrid is interested in the *differences* between the NPVs of the various options, rather than their absolute magnitudes. It is the relative order of the NPVs that is important in deciding which option is the most cost effective.

The second consequence is that TransGrid must consider the economic cost to electricity users of interruptions to their electricity supply. The value to electricity users of the electricity they consume is greater than the price they pay for it (otherwise they would not use the electricity). When supply is interrupted, the actual cost to electricity users is the economic cost (for example the cost of lost production), which can be significantly greater than the price of electricity.

If the price of electricity was used instead of the economic cost of supply interruptions, the true cost of the interruption would be considerably understated and the analysis would be meaningless.

[In economic parlance, the difference between the value to the user and the price they pay is the "consumer surplus". Using the price of electricity in an overall economic analysis is not appropriate since it does not capture the consumer surplus].

In brief, the type of NPV analysis mentioned in the statement preceding the question does not comply with the requirements of the National Electricity Code and is not an appropriate analysis for TransGrid to have conducted. Consequently, there is no value in now undertaking the analysis.

STATEMENT

In their "Identification of a Need for Augmentation " page 13, TransGrid states "This network is capable of adequately supplying the electrical demand in the area at all times with all elements in service and will continue to do so over a planning horizon of at least ten years for reasonable load forecast scenarios". At the time of making this statement they were forecasting loads of 540 MW, 575MW and 585 MW for years 2002,2003 and 2004 respectively.

Question 14. How many years is this network capable of adequately supplying the electrical demand in the area at all times with all elements in service over a reasonable load forecast using actual consumptions in years 2002,2003, & 2004 as a basis for future projections?

TransGrid Response

This question appears to be based on the assumption that load forecasts should start from the most recent maximum demand. As previously stated in the response to Question 12, this is not necessarily the case. Again leaving this issue aside, if the load forecast was to be adjusted to start at the actual maximum demands recorded in 2002, 2003 and 2004, the network (*with all elements in service*) would be capable of supplying the load for at least ten years.

We note that whilst the performance of the network with all elements in service is interesting, TransGrid's reliability obligations (and consequently the need to reinforce the network) are based on its performance with one element out of service.

STATEMENT

In my correspondence with TransGrid, I have been bombarded with Motherhood statements such as "outage statistics for the 132 KV lines in this area are not relevant to the justification of the particular project". If the 330 KV is out of service during periods of maximum demand (a situation which has never occurred in it's 20 years of life) the 132 KV lines are the only means of providing power to the customers through the 66 KV and 22 KV lines which in turn, supply power to the end customer.
It is therefore absurd and patronizing of TransGrid to state reliability of the 132 KV lines is irrelevant. The reliability and capacity of these lines is relevant!

Question 15. What is the record of outage of the various 132 KV lines in the Western Area and what were the principal reasons for these outages?

TransGrid Response

The statement preceding this question appears to misunderstand TransGrid's reliability obligations and its planning philosophy. TransGrid plans development of its transmission system between Wallerawang/Mount Piper and Wellington on the basis of the expected unserved energy not being more than an agreed amount (ten system minutes). TransGrid has based its analysis on outages of only one network element at a time (single contingencies).

The most critical network element is the Mount Piper – Wellington 330 kV line. If it is out of service, the underlying 132 kV network does not have the capability to supply all of the load at times of moderate to high load. If any one of the 132 kV lines is out of service, the remaining network (which includes the 330 kV line) is presently capable of supplying all of the load.

In assessing the likelihood of interruptions, the single contingency considered is a key factor. The two general classes of single contingency are:

- an outage of the 330 kV line; and
- an outage of one of TransGrid's 132 kV lines.

Considering these in turn, the 330 kV line is the most critical network element. If it is out of service, all the 132 kV lines are assumed to be in service (as the single contingency is the 330 kV line). In this case the outage rates of the 132 kV lines are not relevant (as they are assumed to be in service).

In the case of the outage of one of the 132 kV lines, no load is at risk of being interrupted as the remaining network can presently supply all of the load. Consequently, in this case, the outage rates of the 132 kV lines are again not relevant, as no load is at risk.

STATEMENT

Diagram 1 & 2 Transmission Network in the Western Area show two 132 KV power lines providing power to Dubbo, Nyngan, Cobar, Bourke etc.

Question 16 Do both of the two 132 KV lines from Wellington to Dubbo continue to Nyngan, Cobar, Bourke etc? if not, where does the supply reduce to one 132 KV line and or 66 KV line?

Question 17 What was the maximum demand during summer and winter for these 132KV & 66 KV lines for years 2002,2003 & 2004?

Question 18 What was the maximum demand in winter and summer for line 94K and what is the capacity in KWH for this line?

TransGrid Response

Question 16

The 132 kV network supplying Dubbo and areas to the north and west is owned by Country Energy. It consists of two 132 kV lines between Wellington and Dubbo, two between Dubbo and Nyngan and one between Nyngan and the Cobar area. It supplies 132/66 kV, 132/22 kV or 132/11 kV substations at Dubbo, Narromine, Nyngan and in the Cobar area.

Question 17

TransGrid meters supply to Country Energy's network supplying Dubbo and areas to the north and west at Wellington. The actual maximum demands over recent summers and winters is shown in the table below.

Season	Maximum Demand (MW)
Summer 2001/02	139
Winter 2002	148
Summer 2002/03	142
Winter 2003	138
Summer 2003/04	147
Winter 2004	144

Question 18

The power flows on the 94K Wellington – Parkes 132 kV line are generally from Wellington to Parkes. The magnitude of the flow depends on a number of factors, including:

- generation patterns;
- the magnitude of the loads at Cowra, Forbes and Parkes;
- line outages within the network supplying Cowra, Forbes and Parkes; and
- outages within the network between Wallerawang/Mount Piper and Wellington.

As the line does not directly supply Country Energy loads (they are supplied at 66 kV and 132 kV from Parkes and at 132 kV from Wellington), TransGrid has no revenue metering of flows on this line.

Provided that the voltage at the 132 kV busbar of Wellington 330/132 kV substation is in the normal range, the line has the capability to carry the load that is likely to flow on it.

STATEMENT

In the original presentations, maximum demand figures are given for the whole Western Area and for the Far Western Areas.

Question 19. What lines are included in the Far Western Area?

TransGrid Response

The far west area load was taken to be the load supplied from the 132/66 kV, 132/22 kV and 132/11 kV substations at Mudgee, Beryl, Parkes and Wellington and the load supplied at 132 kV from Wellington 330/132 kV substation (via Country Energy's 132 kV lines to Dubbo).

This grouping of loads was selected since, when the 330 kV line to Wellington is out of service, it is electrically "furthest" from Wallerawang/Mount Piper and would therefore have the lowest voltage levels at the 132 kV busbars.

Knowing the 132 kV lines within this area is not particularly revealing as they (and the loads within the area) are connected to other 132 kV lines outside the area, which also supply loads outside the area. However, setting this aside, the 132 kV lines are:

- 94M tee to Mudgee
- 94M tee to Beryl
- Beryl to Wellington 330 kV
- Wellington 330 kV to Parkes;
- 945 tee to Wellington 330 kV;
- 945 tee to Wellington 132 kV; and
- Country Energy's lines supplying Dubbo and areas to the north and west..

STATEMENT

On page 5 TransGrid states "The Western Area of NSW as described in this report refers to that part of the Country Energy service area plus Lithgow in the integral service area. The area is outlined in the picture on the previous page and is about 176,000 sq. kms in size. Within it are a number of country centres of various size including Bathurst, Bourke, Cobar, Dubbo, Forbes, Gulgong, Lithgow, etc". The picture referred to does not include Lithgow.

Question 20 *Is Lithgow included in the Western Area as stated on Para 1 Page 5 if 46? If so, why is it not shown in any of the above networks and how does it connect into the network?*

TransGrid Response

The Lithgow load has been included in the western area load as it is supplied at 66 kV from Wallerawang.

ATTACHMENT NO. 2
Wollar-Wellington 330kV Line and Concerns of Mr Needham, March 2005

ADDITIONAL LOADFLOW STUDIES

Following discussions with Mr Needham on 18 March 2005, some additional loadflow studies were undertaken. The map on which these loadflow results are displayed was modified to be more in line with that suggested by Mr Needham. It should be noted that the form of the map does not affect the loadflow results as the underlying loadflow is unchanged.

Each of the additional studies considers the Mount Piper – Wellington 330 kV line (72 line) out of service in summer 2004/05 and uses the most recent forecast. A comparison of actual and forecast loads has revealed that, in aggregate, the actual maximum demands for summer 2004/05 slightly exceeded those forecast. For convenience the voltage levels at the 132 kV busbars of major substations have been included in tabular form below. A3 loadflow diagrams are also provided as hard copies.

Case 1
This case repeats the loadflow previously provided which Mr Needham was unable to read due to the quality degrading through it being photocopied and faxed.

Substation 132 kV Voltage Level (per unit)

Wallerawang	1.05	Bathurst (Panorama)	0.92
Mount Piper	1.05	Orange	0.87
Yass	1.05	Molong	0.84
Wollar	N/A	Wellington	**0.80**
Ilford	0.95	Parkes	0.76
Mudgee	0.86	Forbes	0.78
Beryl	0.83	Cowra	0.92

Case 2
This case is similar to Case 1, but has the load at Wellington 132 kV busbar reduced to achieve a voltage level of 1.0 per unit at Wellington 132 kV busbar. This shows that interruption of 135 MW (82% of the Wellington 132 kV load) would be required to achieve a satisfactory voltage level (of 1.0 per unit) at Wellington 132 kV busbar.

Substation 132 kV Voltage Level (per unit)

Wallerawang	1.05	Bathurst (Panorama)	0.98
Mount Piper	1.05	Orange	0.98
Yass	1.05	Molong	0.98
Wollar	N/A	Wellington	**1.00**
Ilford	1.01	Parkes	0.93
Mudgee	0.99	Forbes	0.93
Beryl	0.98	Cowra	0.99

Case 3
This case is similar to Case 1, but has a 70 MW generator at Wellington. This shows that the generator is insufficient to provide satisfactory voltage levels.

Substation 132 kV Voltage Level (per unit)

Wallerawang	1.05	Bathurst (Panorama)	0.95
Mount Piper	1.05	Orange	0.93
Yass	1.05	Molong	0.92
Wollar	N/A	**Wellington**	**0.91**
Ilford	0.98	Parkes	0.86
Mudgee	0.93	Forbes	0.87
Beryl	0.92	Cowra	0.96

Case 4
This case is similar to Case 1, but has a 330/132 kV substation at Wollar, a 132 kV line to Ulan and the existing 90R Ulan – Beryl line operating at 132 kV. Again the Wellington voltage is unacceptably low.

Substation 132 kV Voltage Level (per unit)

Wallerawang	1.05	Bathurst (Panorama)	0.96
Mount Piper	1.05	Orange	0.94
Yass	1.05	Molong	0.92
Wollar	1.05	**Wellington**	**0.92**
Ilford	1.01	Parkes	0.87
Mudgee	0.97	Forbes	0.88
Beryl	0.96	Cowra	0.97

Case 5
This case is similar to Case 4, but also has a 70 MW generator at Wellington. Note that the voltage level at Wellington is still unacceptably low.

Substation 132 kV Voltage Level (per unit)

Wallerawang	1.05	Bathurst (Panorama)	0.97
Mount Piper	1.05	Orange	0.96
Yass	1.05	Molong	0.96
Wollar	1.05	Wellington	**0.97**
Ilford	1.02	Parkes	0.91
Mudgee	1.00	Forbes	0.91
Beryl	0.99	Cowra	0.98

Out	ReasonID	Duration (Hrs)	Reason
05/02/1992 19:09	LIGHTNING OR STORM	0	*ELECTRICAL STORM*
04/03/1992 16:05	LIGHTNING OR STORM	0	*AT MT.PIPER NO INDICATION OF NO.2 PROT. OPERATION HOWEVER, I/T RECEIVE FLAG DOWN.*
31/03/1992 09:50	PROT/COM/LV/MEC WORK	5.72	*NO.1 PROT I/T MAINT*
01/04/1992 09:32	PROT/COM/LV/MEC WORK	5.75	*NO.2 I/T MAINT*
02/04/1992 09:42	PROT/COM/LV/MEC WORK	5.77	*NO.1 LBU I/T MAINT*
03/04/1992 08:40	PROT/COM/LV/MEC WORK	5.83	*NO.2 LBU I/T MAINT*
07/04/1992 09:40	PROT/COM/LV/MEC WORK	6.18	*NO.2 PROT DEF I/T'S*
12/06/1992 07:54	PROT/COM/LV/MEC WORK	6.25	*PROT WORK*
12/06/1992 15:23	PROT/COM/LV/MEC WORK	0	*I/S TRIP & A/R CHECKS*
11/09/1992 07:24	HV EQUIPMENT WORK	6.43	*O/H ABS AND CHECK INDICATION*
08/01/1993 08:28	PROT/COM/LV/MEC WORK	6.53	
14/04/1993 10:33	PROT/COM/LV/MEC WORK	0	*R4069 NO.1 I/T MAINT.*
15/04/1993 10:00	PROT/COM/LV/MEC WORK	0	*384 #2 I/TRIP MAINT.*
16/04/1993 10:54	PROT/COM/LV/MEC WORK	0.03	*383 #1 I/TRIP MAINT*
20/04/1993 10:45	PROT/COM/LV/MEC WORK	0.13	*R4129 NO.2 I/T MAINT.*
21/04/1993 09:36	PROT/COM/LV/MEC WORK	0.17	*R4167/8 #2 PROT I/T MAINT*
22/04/1993 10:30	PROT/COM/LV/MEC WORK	0.25	*R4187 #2 PROT I/T MAINT*
04/05/1993 09:08	PROT/COM/LV/MEC WORK	6.67	*PROT MAINT WORK AT WELLINGTON AND MT PIPER.*
05/05/1993 08:48	HV EQUIPMENT WORK	6.75	*LINE, PROT & REACTOR MAINT*
05/05/1993 15:36	PROT/COM/LV/MEC WORK	0.28	*R4287 INSERVICE A/R CHECKS*
09/09/1993 11:50	PROT/COM/LV/MEC WORK	0.30	*R9978 AUTO RECLOSE EXCHANGE*
10/09/1993 14:42	PROT/COM/LV/MEC WORK	0.30	
26/10/1993 07:54	HV EQUIPMENT WORK	6.88	*1087 LINEWORK*
26/10/1993 08:00	HV EQUIPMENT WORK	7.08	
27/10/1993 08:00	HV EQUIPMENT WORK	7.08	
27/10/1993 08:07	HV EQUIPMENT WORK	7.37	*1088 I & E FOR LINE WORK*
28/03/1994 11:14	HV EQUIPMENT WORK	5.70	
30/08/1994 10:13	PROT/COM/LV/MEC WORK	0.32	*R8224 I/S AUTO RECLOSE CHECKS*
24/10/1994 07:56	PROT/COM/LV/MEC WORK	7.55	*1070 PROTECTION MAINTENANCE*
25/10/1994 07:16	PROT/COM/LV/MEC WORK	7.58	*1075 ROUTINE PROTECTION MAINTENANCE*
27/10/1994 08:16	HV EQUIPMENT WORK	7.67	*1097 PROTECTION MAINTENNCE - WORK IN O.A.*
28/10/1994 07:57	HV EQUIPMENT WORK	7.73	*1098 I & E FOR ORANGE AREA - PROTECTION TRIP CHECKS*
20/12/1994 09:00	PROT/COM/LV/MEC WORK	0.32	*R12134 RECLOSE CHECKS-CANCELLED*
21/12/1994 06:14	PROT/COM/LV/MEC WORK	0.33	*R12171 RECLOSE CHECKS.*
28/03/1995 10:39	PROT/COM/LV/MEC WORK	0.37	*345 NO.2 I/TRIP MAINTENANCE*
29/03/1995 10:02	PROT/COM/LV/MEC WORK	0.37	*346 NO.1 I/TRIP MAINTENANCE*
30/03/1995 10:04	PROT/COM/LV/MEC WORK	0.38	*352 NO.2 I/TRIP MAINTENANCE*
04/04/1995 10:20	PROT/COM/LV/MEC WORK	0.42	*0386 NO.1 PROT I/T MAINTEMANCE*
05/04/1995 10:05	PROT/COM/LV/MEC WORK	0.47	*354 #2 PROTECTION DEFC I/T MAINTENANCE*
11/05/1995 08:00	PROT/COM/LV/MEC WORK	0.32	*R3314 PROTECTION MODS.*

Out	ReasonID	Duration (Hrs)	Reason
12/05/1995 08:15	PROT/COM/LV/MEC WORK	0.50	*R5144 CHANGE C.T. CCT FOR NEW FAULT RECORDER*
23/08/1995 10:34	PROT/COM/LV/MEC WORK	0.52	*R7169 Check fault recorder output*
23/08/1995 10:43	PROT/COM/LV/MEC WORK	0.58	*R7169 Check fault recorder output*
24/08/1995 10:26	PROT/COM/LV/MEC WORK	0.58	*R8166 Reclose checks*
23/10/1995 12:58	PROT/COM/LV/MEC WORK	0.62	*R10222 #2 PLC I/Trip. Fault maintenance*
16/01/1996 16:40	LIGHTNING OR STORM	0	*Trip & auto-reclose at Wellington & Mt Piper*
11/09/1996 11:35	PROT/COM/LV/MEC WORK	0.90	*R3074 Auto reclose check*
24/10/1996 08:05	HV EQUIPMENT WORK	7.85	
25/10/1996 08:05	HV EQUIPMENT WORK	8.00	
20/10/1997 10:25	PROT/COM/LV/MEC WORK	1.00	*In service auto reclose checks*
21/10/1997 08:00	HV EQUIPMENT WORK	8.23	*Linework CANCELLED*
24/10/1997 12:30	PROT/COM/LV/MEC WORK	1.05	*CVT monitor relay check*
10/11/1997 15:13	UNKNOWN	0	*NO REASON FOR TAR WAS FOUND*
01/12/1997 13:26	PROT/COM/LV/MEC WORK	1.08	*DEF trip link open whilst relay repaired*
11/12/1997 13:15	PROT/COM/LV/MEC WORK	1.20	
23/12/1997 13:55	PROT/COM/LV/MEC WORK	1.27	*Restore DEF trip link*
30/12/1997 08:55	PROT/COM/LV/MEC WORK	1.30	*Protection performance checks*
21/01/1998 14:08	PROT/COM/LV/MEC WORK	1.72	*Replace the CVT monitor.*
21/01/1998 14:08	PROT/COM/LV/MEC WORK	1.77	*Replace the CVT monitor.*
27/01/1998 09:25	PROT/COM/LV/MEC WORK	1.83	*Protection Performance Checks I/S*
27/01/1998 09:25	PROT/COM/LV/MEC WORK	1.87	*Protection Performance Checks I/S*
12/03/1998 08:00	PROT/COM/LV/MEC WORK	1.90	*#1 protection I/T maintenance. CANCELLED.*
26/03/1998 09:49	PROT/COM/LV/MEC WORK	1.95	*Annual intertrip maintenance*
27/03/1998 09:58	PROT/COM/LV/MEC WORK	2.02	*Intertrip maintenance*
31/03/1998 09:56	PROT/COM/LV/MEC WORK	2.08	
01/04/1998 09:54	PROT/COM/LV/MEC WORK	2.45	*PLC I/T LBU 2 annual maintenance*
02/04/1998 10:13	PROT/COM/LV/MEC WORK	2.57	*PLC I/T DEFB #2 prot annual maintenance*
16/06/1998 08:30	PROT/COM/LV/MEC WORK	2.65	*Replace & calibrate CVT monitor relay*
16/07/1998 12:57	PROT/COM/LV/MEC WORK	3.03	*In-sevice Auto reclose checks.*
09/09/1998 10:41	PROT/COM/LV/MEC WORK	8.25	*In service A/R checks #2 Prot*
24/11/1998 09:30	PROT/COM/LV/MEC WORK	3.17	*Calibrate the C.V.T. monitor relay*
11/02/1999 08:36	CONSEQUENTIAL	0	*WHITE PHASE POLE FAILURE ON REACTOR CB.*
12/02/1999 17:48	WORK IN OTHER AREA	8.37	*SVT 72 Rx CB 7292 at Wellington for Orange Area*
09/03/1999 10:05	PROT/COM/LV/MEC WORK	3.38	*In Service Trip and Auto Reclose*
09/03/1999 11:26	PROT/COM/LV/MEC WORK	3.63	*In Service Investigation #1 & #2 Prots in turn*
10/03/1999 10:10	PROT/COM/LV/MEC WORK	3.88	*In Service Investigation #1 & #2 Prots in turn*
18/06/1999 10:12	PROT/COM/LV/MEC WORK	3.92	*No.1 Protection I/T Emergercy maint.*
23/09/1999 10:05	PROT/COM/LV/MEC WORK	4.00	
29/10/1999 13:00	PROT/COM/LV/MEC WORK	4.00	*Calibrate the C.V.T. monitor relay*
03/12/1999 11:15	PROT/COM/LV/MEC WORK	4.00	*Repair functional test panel*
07/12/1999 11:05	PROT/COM/LV/MEC WORK	4.10	*Investigation of functional test panel*

Attachment No.3 - Outages of 72 line 1992-2003

Out	ReasonID	Duration (Hrs)	Reason
08/12/1999 11:29	PROT/COM/LV/MEC WORK	4.12	*#2 Prot I/T investigation*
09/12/1999 10:26	PROT/COM/LV/MEC WORK	4.12	*Investigate of functional test panel.*
10/12/1999 08:58	PROT/COM/LV/MEC WORK	4.12	*Investigate of functional test panel.*
28/03/2000 08:47	PROT/COM/LV/MEC WORK	4.17	*I/S Prot Maint*
29/03/2000 07:50	PROT/COM/LV/MEC WORK	4.20	*Protection maintenance*
06/04/2000 09:00	PROT/COM/LV/MEC WORK	4.28	*Prot Maint. I/S.*
01/05/2000 08:55	PROT/COM/LV/MEC WORK	8.72	*Protection maintenanceNo.1 & No.2 Prot. in turn.*
04/05/2000 09:43	HV EQUIPMENT WORK	8.83	*Field Work & Protection maintenance. Swgr maintenance at MtP*
24/05/2000 13:14	PROT/COM/LV/MEC WORK	4.28	
25/05/2000 10:15	PROT/COM/LV/MEC WORK	4.40	*No.2 protection fault finding F/T fail*
29/05/2000 10:09	PROT/COM/LV/MEC WORK	4.45	*Fault finding functional test fail.*
30/05/2000 09:53	PROT/COM/LV/MEC WORK	4.45	
07/06/2000 10:11	PROT/COM/LV/MEC WORK	4.50	*I/S A/R checks*
22/08/2000 08:33	HV EQUIPMENT WORK	9.00	*NO7 Murrami C.B.72 Maint*
12/10/2000 11:00	COMMUNICATIONS	4.50	*Fault repair*
08/11/2000 08:07	HV EQUIPMENT WORK	10.57	*Linework/Switchgear maintenance*
31/01/2001 10:52	PROT/COM/LV/MEC WORK	4.53	*No.2 I/T Maint*
15/03/2001 10:15	PROT/COM/LV/MEC WORK	4.63	*No.1 Prot I/T Maintenance*
19/03/2001 08:20	PROT/COM/LV/MEC WORK	4.80	*No.1 PROTECTION INTERTRIP MAINT*
20/03/2001 10:51	COMMUNICATIONS	4.80	*No.1 Prot I/T Maintenance*
21/03/2001 10:07	PROT/COM/LV/MEC WORK	4.85	
22/03/2001 09:52	PROT/COM/LV/MEC WORK	4.92	*No.1 Protection intertrips*
28/03/2001 10:10	PROT/COM/LV/MEC WORK	4.97	*No.1 I/T Funct Test Fail*
28/03/2001 10:10	PROT/COM/LV/MEC WORK	5.05	*No.1 I/T Funct Test Fail*
03/04/2001 11:17	PROT/COM/LV/MEC WORK	5.10	*I/T Repair*
04/04/2001 12:46	LV WORK	5.15	*No.1 Prot I/T - Repair*
26/04/2001 10:52	PROT/COM/LV/MEC WORK	5.20	*No.2 protn VF I/T Routine Maintenance*
12/07/2001 11:18	PROT/COM/LV/MEC WORK	5.22	*I/S A/R Checks*
29/07/2002 04:56	PROT/COM/LV/MEC WORK	12.48	*ISAR checks*
15/10/2002 07:44	HV EQUIPMENT WORK	31.40	
22/01/2003 10:40	COMMUNICATIONS	5.23	*I/T Fault Maint*
27/05/2003 08:05	PROTECTION	5.23	*Prot maint.*
28/05/2003 09:17	PROT/COM/LV/MEC WORK	5.42	*Prot Maint*
17/06/2003 07:55	PROT/COM/LV/MEC WORK	5.42	
20/06/2003 08:07	PROTECTION	5.42	*No. 1 Prot. Replace aided trip module.*
20/06/2003 09:51	PROTECTION	5.62	*Prot maint #2.*
15/09/2003 05:22	PROT/COM/LV/MEC WORK	5.63	