3. Project Justification and Alternatives

This section provides an outline of the justification for the proposed 330 kV Transmission Line as well as feasible alternatives to the development. The mechanism used by TransGrid to determine the need for strengthening the State's transmission grid is provided as well as a description of how the project fits into the overall electricity supply network.

3.1 Electricity Supply Planning

TransGrid is responsible for the efficient transmission of bulk electricity generated at major power stations in NSW and other states to regional distribution networks in NSW. Local supply authorities, in this case Country Energy, control these regional networks and are responsible for supply to domestic and industrial customers. TransGrid owns and operates the State's main transmission network comprising 500 kV, 330 kV, 220 kV and 132 kV transmission lines and associated substations. Local supply authorities operate some 132 kV lines as well as 66 kV, 33 kV, 11 kV lines and associated substations. In additional they operate local distribution lines.

As the demand for electricity increases, local supply authorities require more power to be available at their substations from the transmission network. If sufficient power cannot be delivered to the local network by the transmission network, widespread supply interruptions may occur in the region. (Faults on the local network usually result in supply interruptions only to a small or moderate number of customers.) To increase the power transmission capacity of the transmission network, either new transmission lines and/other augmentations of the network are required.

To assess the capacity of its transmission network TransGrid must consider the risk and consequences of supply interruptions caused by failures of major elements of the transmission network. Examples include line outages occurring during storm events or equipment failure in a substation.

TransGrid has developed a number of supply and demand models, risk assessment methods and growth forecasts to identify future requirements for increases in the capacity of its network. This is undertaken in close consultation with local supply authorities and government agencies involved in regional planning.

The development of the Wollar to Wellington 330 kV transmission line stems from these considerations. It will overcome problems in the ability to maintain adequate supply during periods of equipment breakdown or failure in other parts of the transmission network.

3.1.1 Supply Adequacy and the Planning Criterion

Electricity supply authorities aim to provide a safe, sufficient and reliable electricity supply of suitable quality in the most cost-effective manner. Safety is achieved by appropriate design and compliance with statutory requirements. The supply is sufficient when there is sufficient generation capacity to meet the needs of all customers and the transmission and distribution networks can supply the customers' demand at all times without overloading any of the network lines or substation equipment. A supply of suitable quality has a correct voltage, low levels of harmonics (interference) and small voltage fluctuations with changing loads.

The supply is regarded as reliable when the risk of interruptions to supply under all reasonably possible (credible) conditions is minimal. The simplest approach to reliability planning is to apply a deterministic "N-1" reliability criterion. This type of planning criterion (planning standard) requires that network limitations do not occur for any single credible contingency.

TransGrid and Country Energy agreed that an N-1 criterion was not appropriate for the Western Area for the following reasons:

- The risk of a network voltage limitation during an outage of the 330 kV line to Wellington (number 72 line) has emerged and has been in existence for some years. Considering the high reliability of this line it would seem reasonable to allow consideration of options that may mitigate, without necessarily completely eliminating this risk, possibly more cost effectively than other options;

- The desirability of considering supply augmentation options that also prevent or delay the onset of the other potential limitations described in **Section 3.1.4** but may not completely eliminate the risk of the voltage limitation.

TransGrid and Country Energy agreed to adopt a slightly less risk-averse planning standard than an "N-1" criterion, namely an "Expected System Minutes Not Supplied" approach. This type of planning criterion accepts that there will be a small risk of supply interruptions, potentially at times of high system demand. The suitability of this criterion over the N-1 criterion was that it allowed for consideration of a greater range of, and potentially less costly, solutions to the network reliability problem.

Specifically, TransGrid and Country Energy determined that the "expected energy not supplied (in any year of a ten year planning horizon) should be less than 10 System Minutes for the worst single-element credible contingency".

3.1.2 The Planning Process

TransGrid and Country Energy have been carrying out joint planning to identify and monitor emerging limitations in the transmission network supplying the Western area for many years.

These limitations were outlined in TransGrid's Annual Planning Statements for 1999, 2000 and 2001, its Annual Planning Reports for 2002 and 2003 and discussed at the public forums associated with the Annual Planning Reviews for these years.

In 2001 TransGrid and Country Energy employed the services of an energy consultant to identify opportunities for demand management and local generation in the Western area that may address transmission system limitations.

In January 2002 they commenced formal consultation with power industry participants and other interested parties on options for the augmentation of supply to the Western area.

The consultation was focussed, as was required by the National Electricity Code (now National Electricity Rules), on an application of the ACCC's (now Australian Energy Regulator's) regulatory test to options for augmentation of electricity supply to the Western area.

It continued until August 2003 with the publication of the final report of the consultation that recommended construction of the Wollar – Wellington line and Wollar Switching Station, which was the option that satisfied the regulatory test.

During the consultation a number of reports were produced and published detailing the need for the augmentation, the options considered and the application of the regulatory test. A summary of these reports is contained in the remainder of **Section 3.1** and **Sections 3.2 –3.6**. All reports, including the energy consultant's report, are available from TransGrid's website at www.transgrid.com.au/publications/consultation.html.

3.1.3 Transmission Network Limitations – General Considerations

High voltage transmission networks have limits to the amount of electricity they can carry. The limiting factor can be one of a number of constraints including:

- ***voltage drop limit*** - the voltage at the receiving end of the transmission line that the voltage must remain above in order to avoid damaging consumers' equipment;

- ***ground clearance limit*** - where transmission line conductors carrying electricity increase in temperature, causing the conductors to reach the maximum allowable sag to preserve adequate ground clearances;

- ***conductor annealing limit*** - where conductors reach temperatures that could cause the metal to permanently weaken and stretch;

- ***substation power limit*** - a limit on the amount of power that can be delivered through a substation without equipment being overloaded.

The onset of any of these conditions requires restrictions on electricity use or interruptions to supply. These conditions occur at times of high electricity demand by the community. When any of these limits are approached, an upgrade of the electricity supply network must be investigated. The upgrade should be implemented before the risk to supply reliability becomes excessive. Such an investigation has led to the development of the Wollar-Wellington 330 kV transmission line proposal.

3.1.4 Transmission Network Limitations – Western Area

TransGrid's network in the Western Area (refer **Diagram 3.1**) is capable of adequately supplying the electrical demand in the area with all network elements in service and will continue to do so over a planning horizon of at least ten years for reasonable load forecast scenarios. However, the network is currently affected by a significant reliability limitation as discussed below.

If the 330 kV line between Mount Piper and Wellington 330 kV Substations were to be out of service, voltages in parts of Country Energy's sub-transmission and distribution networks, particularly in the areas west of Wellington, may not be able to be controlled to adequate levels during periods of moderate to high electrical demand.

This means that voltages in Country Energy's sub-transmission and distribution networks west of Wellington may drop below acceptable limits because of inadequate voltage levels in TransGrid's transmission network. This may result in voltages at points of supply to end use customers being below acceptable limits, with potential consequences such as:

- Noticeable dimming of incandescent lighting (brownouts); and/or
- Equipment mal-operations; and/or
- Equipment dropouts, with consequent interruptions to processes that depend on that equipment; and/or
- Permanent damage to equipment that is not designed to operate safely with a low supply voltage and does not have internal protection; and
- In extreme cases, system voltage collapse leading to a regional blackout.

Country Energy has determined that voltages in their sub-transmission and distribution networks west of Wellington may be controlled to acceptable levels if the voltage at Wellington 132 kV busbar is above 132 kV (i.e. 100% of nominal).

Other emerging limitations detailed below have been investigated. Based on the present load forecast it has been determined that they may not, in isolation, impact materially on planning within a ten year planning horizon. However, they do form an integral part of the planning considerations for the area because the timing of their emergence may be highly dependent on:

- The planning criterion adopted; and
- The emergence of significant blocks of load ("spot loads") with a short lead time. Spot loads typically arise from the connection of a large commercial or industrial customer, such as a mine.

1. If one of the 330/132 kV transformers at Wellington was to be out of service then the loading on the other in service 330/132 kV transformer may exceed its thermal rating. Based on the present load forecast, periods of risk during high electrical demand are expected to emerge for this potential limitation

from about 2005/2006. However, it is expected that this limitation would be relieved at low cost by installing larger capacity units as part of TransGrid's overall asset management strategy.

2. If any one of the 132 kV lines 944, 948 or 94X supplying the Bathurst/Orange area were to be out of service the power flows on the remaining two lines may exceed their thermal ratings during periods of high electrical demand. The timing of the emergence of this limitation may be significantly affected by the emergence of spot loads in the area.

3. If the 330 kV line between Mount Piper and Wellington 330 kV Substations were to be out of service power flows on 132 kV lines 944, 947 and 94M supplying Orange and Beryl may exceed their thermal ratings during periods of high electrical demand.

4. If one of the 330/132 kV transformers at Wallerawang or Mount Piper were to be out of service then the loading on the other two in service 330/132 kV transformers at these locations may exceed their thermal rating.

3.1.5 Maintenance Considerations

The foregoing planning considerations take account of unplanned outages of elements of the transmission network, such as those due to the effects of lightning strikes. However it is sometimes necessary to take account of maintenance outages, that is, those required to service and maintain transmission lines and equipment at substations. Unlike unplanned outages, maintenance outages can be planned to occur at times of low to moderate electrical demand (eg in spring, autumn, on weekends or public holidays) and are often not critical in determining the reliability limits of networks.

However, maintenance outages may be required to last for a day or more. If the electrical load has grown to the stage where maintenance outages cannot be planned without a risk of supply interruptions (because adequate "maintenance windows" no longer occur) then maintenance outages become important in determining the reliability limits of a network.

This is the case in the Western area when considering maintenance outages of number 72 line.

3.2 Project Justification

Country Energy supplies electricity to the Western area of NSW, covering an area of approximately 176,000 sq km in size. Within the Western area are a number of country centres of varying sizes including Bathurst, Bourke, Cobar, Dubbo, Forbes, Gulgong, Lithgow, Manildra, Molong, Mudgee, Nyngan, Oberon, Orange, Parkes and Wellington. The total existing population serviced by the network in this area is approximately 120,000, with peak consumption of electricity during winter 2004 being approximately 525 MW.

TransGrid's 330 kV and 132 kV substations at Wallerawang, Mount Piper, Beryl, Parkes, Panorama, Orange, Molong and Wellington provide bulk supply to Country Energy's subtransmission and distribution networks. TransGrid's transmission network that connects these substations comprises 132 kV transmission lines and a single 330 kV line as depicted in **Diagram 3.1**.

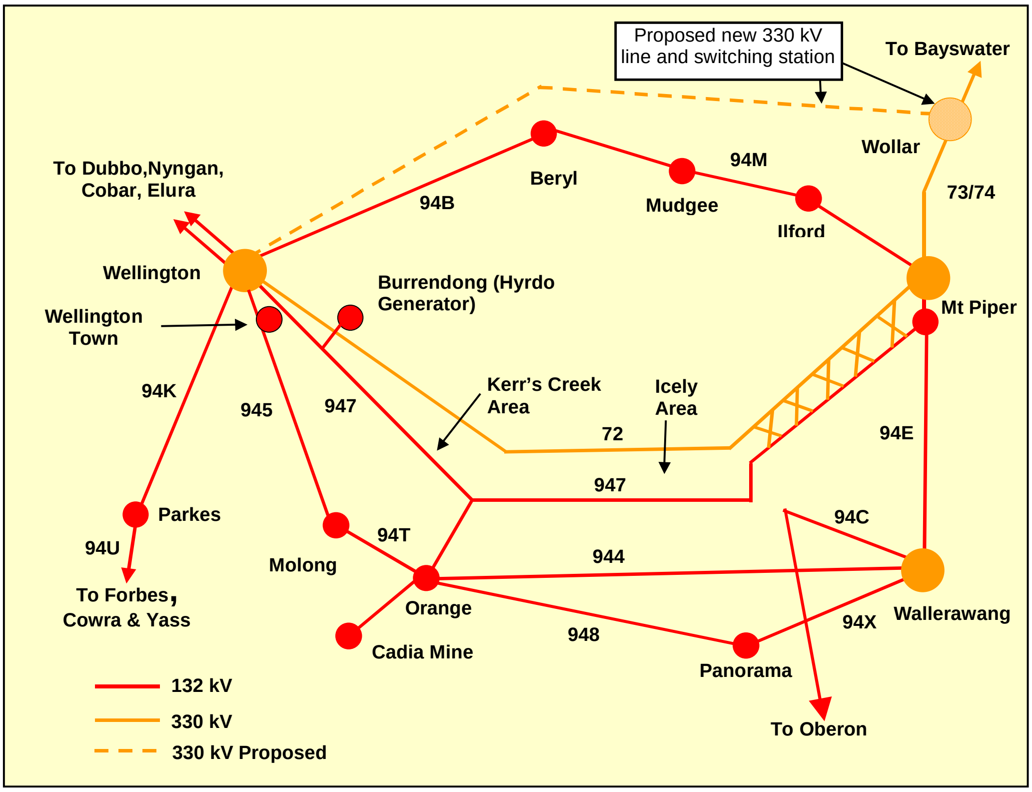

Diagram 3.1 –Transmission Network in the Western Area of NSW

3.2.1 Limitations in the Existing Transmission Network

A key element in TransGrid's transmission network in the Western area of NSW is the Wallerawang to Wellington 330 kV transmission line (depicted in Diagram 3.1 above as a solid orange coloured line).

Over recent years the electrical load in the Western area of NSW has shown steady growth punctuated by "step increases" due to the establishment of "spot loads" such as mines and industrial centres. This increase in load is expected to continue.

Due to this increasing load, if the Wallerawang to Wellington 330 kV line is out of service, the underlying 132 kV network (red lines in **Diagram 3.1**), at times of moderate to high load, will not have the capacity to maintain adequate standards of supply.

This is because the area would be beyond its voltage control limit (described in **Section 3.1.3**) with adverse effects on electrical supply (described in

Section 3.1.4) affecting most of the area, with widespread blackouts being a distinct possibility.

TransGrid and Country Energy compared the risk exposure profiles of these events with the planning criterion described in **Section 3.1.1**, and concluded that the criterion would not be satisfied during any year from 2002 onwards.

This highlights the clear need for an augmentation of the network.

3.2.2 Existing Electrical Loads and Their Economic Importance

In the western area approximately 60% of the electrical demand relates to commercial and industrial businesses of various sizes, with the remainder relating to residential customers. A number of mines in the area are large users of electricity. They produce base metals, precious metals and coal, thus contributing to Australia's export income and providing significant direct and indirect employment opportunities in the area.

3.2.3 Growth in Demand for Electricity

The amount of electricity supplied through the transmission network for use in the region has generally increased each year. The increase has been caused by:

- rising population, due to the attractiveness of the area;
- more households with fewer people per household;
- more community facilities and services;
- expanding agricultural, industrial, commercial and tourism ventures;
- cheaper and more readily available electrical appliances;
- improved living standards and amenities (including expansion of home and business computers); and
- people's higher expectations for a comfortable life-style wherever they may choose to live and work.

Balanced against these is a range of factors reducing the increase in the use of electricity. These include:

- increasing efficiency of new appliances and equipment due to technological improvement;
- energy conservation by individual households and enterprises;
- use of local sources of electricity, to produce electricity on the customer's premises; and
- substituting other forms of energy for electricity.

The TransGrid and Country Energy forecast of maximum electricity demand in the Western area over the period 2002 – 2009, which was the forecast available at the time the regulatory test was applied, is summarised in Table 3.1.

The current load forecast, covers the period 2005 – 2014 and has been published in TransGrid's Annual Planning report for 2005, which is available on TransGrid's website at www.transgrid.com.au/publications/apr/. This latest forecast is broadly in line with the earlier forecast and confirms the ongoing need for augmentation of the network.

Table 3.1 – Best Estimate Summer and Winter Maximum Demand Forecast

		Beryl	**Cowra**	**Forbes**	**Mudgee**	**Orange, Molong & Cadia**	**Panorama**	**Parkes & Nth Parkes**	**Wellington 132 kV**	**Wellington Town**
Load growth pa		4%	2%	2%	4%	2%	2%	2%	2%	2%
Spot load MW					15.0	25.0		2x5.0+20	7.0	
Spot load MVAr					5.5	9.2		2x1.8+7.3	1.5	
Spot load Season					2002	2002		2002, 2002/3 & 2003	2002	
2001/02	MW	31.2	27.0	34.6	18.7	112.7	69.6	45.6	152.8	7.2
	MVAr	12.2	10.5	15.7	6.9	44.1	21.7	16.6	31.0	2.8
2002	MW	34.0	25.7	34.9	37.3	145.8	76.7	52.9	166.7	8.5
	MVAr	13.3	10.0	15.9	13.7	56.7	24.0	19.2	33.8	3.3
2002/03	MW	32.4	27.5	35.3	34.4	138.9	71.0	71.0	162.9	7.4
	MVAr	12.7	10.7	16.0	12.7	53.8	22.2	25.8	33.1	2.9
2003	MW	35.3	26.2	35.6	38.2	147.2	78.3	78.4	169.9	8.7
	MVAr	13.8	10.2	16.2	14.0	57.3	24.4	28.5	34.5	3.4
2003/04	MW	33.7	28.0	36.0	35.2	140.1	72.4	76.4	166.0	7.5
	MVAr	13.2	11.0	16.3	13.0	54.3	22.6	27.8	33.7	2.9
2004	MW	36.7	26.7	36.3	39.1	148.5	79.8	78.8	173.2	8.8
	MVAr	14.4	10.4	16.5	14.4	57.8	24.9	28.6	35.2	3.5
2004/05	MW	35.0	28.6	36.7	36.0	141.3	73.8	76.8	169.2	7.7
	MVAr	13.7	11.2	16.7	13.3	54.8	23.1	27.9	34.3	3.0
2005	MW	38.2	27.3	37.1	40.1	149.9	81.4	79.3	176.5	9.0
	MVAr	14.9	10.6	16.8	14.7	58.4	25.4	28.8	35.8	3.5
2005/06	MW	36.5	29.2	37.4	36.8	142.5	75.3	77.3	172.4	7.8
	MVAr	14.2	11.4	17.0	13.6	55.3	23.5	28.1	35.0	3.1
2006	MW	39.7	27.8	37.8	41.1	151.3	83.1	79.8	179.9	9.2
	MVAr	15.5	10.9	17.2	15.1	59	25.9	29.0	36.5	3.6
2006/07	MW	37.9	29.8	38.2	37.7	143.8	76.8	77.7	175.7	8.0
	MVAr	14.8	11.6	17.3	13.9	55.8	24.0	28.2	35.7	3.1
2007	MW	41.3	28.4	38.5	42.1	152.7	84.7	80.3	183.3	9.4
	MVAr	16.1	11.1	17.5	15.5	59.5	26.5	29.2	37.2	3.7
2007/08	MW	39.4	30.4	39.0	38.6	145	78.3	78.2	179.1	8.1
	MVAr	15.4	11.9	17.7	14.2	56.4	24.5	28.4	36.4	3.2
2008	MW	43.0	28.9	39.3	43.2	154.2	86.4	80.8	186.9	9.6
	MVAr	16.8	11.3	17.9	15.9	60.2	27.0	29.3	37.9	3.7
2008/09	MW	41.0	31.0	39.7	39.6	146.3	79.9	78.6	182.5	8.3
	MVAr	16.0	12.1	18.0	14.6	56.9	25.0	28.6	37.1	3.2
2009	MW	44.7	29.5	40.1	44.3	155.6	88.2	81.3	190.5	9.8
	MVAr	17.5	11.5	18.2	16.3	60.8	27.5	29.5	38.7	3.8

3.2.4 Demand Management

Activities aimed at encouraging the efficient use of electricity and/or reducing peak electricity demand is known as "demand management". The intention is to reduce both the total electricity consumption and the peak electricity demand. It is the peak demand (rather than the total consumption) that usually determines a need to augment the transmission network.

TransGrid and Country Energy have been active in the development and implementation of demand management programs throughout NSW and continue to play a role in development of demand management strategies at various levels including individual industries, communities and regions.

Demand management strategies seek to influence the way in which consumers use electricity. TransGrid and Country Energy take account of the impact of demand management initiatives in preparing forecasts of future electricity requirements. Demand management is thus an essential part of network planning.

Energy efficiency and demand management programs include, for example:

- conversion of appliances to off-peak use, including hot water services;
- cutting waste by turning off lights, etc;
- targeted improvements recommended in energy audits of businesses and industrial plants;
- thermally efficient building designs;
- energy labelling of appliances and marketing of energy efficient products;
- establishment of Energy Advisory Centres;
- education and consumer awareness programs.

The success of demand management programs in deferring installation of additional transmission infrastructure in any area is dependent on the rate of population growth and on the willingness of the community to modify their patterns of use of electricity and/or to invest in energy efficient appliances, buildings and industrial plant.

The overall effect of demand management has been and will continue to be, a reduction in the rate of growth of electricity consumption in New South Wales. However, growth in demand will still occur through the growth in population of the area, opportunities for new and expanded industrial development, and the other factors described in Section 3.2.3.

In the case of the Western area the reasonably forecast effects of demand management, as detailed in the energy consultant's report commissioned by

TransGrid and Country Energy, are not timely enough or sufficient to avoid or even significantly delay the ongoing need for augmentation of the network.

3.2.5 Project Justification - Summary

Based on forecast loads, the planning criterion for reliability of supply of electricity determined by TransGrid and Country Energy is currently not being satisfied and this situation will continue as the electrical load grows.

This indicates that there is a need for an augmentation of supply, the need arising from the consequences of not doing so, namely:

- ❒ increased risk of black outs and supply failures in the region;
- ❒ increased risk of brown outs which can damage electrical equipment;
- ❒ increased risk of damage to electricity infrastructure due to overloading; and
- ❒ reduction in the ability to service new industries and population growth.

These consequences are not acceptable to government and the community.

Since the planning criterion is not currently being satisfied, the timing of the construction of network augmentation options will be determined by their lead times rather than by a requirement to optimise a particular in-service date.

3.3 Project Alternatives – Other Energy Sources

In principle, strengthening of the electricity supply to the Western area can be achieved by a combination of small-scale or large-scale local generation units or by augmenting the transmission network.

However, network augmentation can be avoided only if alternative energy sources can meet all of the expected growth, and/or if some of the existing electricity use/demand that is creating the network limitations is removed.

At present, the electricity supplied by TransGrid and Country Energy is produced by generating companies from a mixture of coal-fired, hydro-electric and combustion-turbine plant. There are a number of alternative energy sources that could, in principle, be sited at or close to customers' premises to meet electricity supply needs. These are discussed in the following sections.

3.3.1 Solar Energy

- ❒ **Photovoltaic -** Australian researchers are world leaders in several aspects of solar energy research and development. However, at present, electricity generation using photovoltaic cells would cost at least five times as much as electricity supplied from the above sources. A solar plant of sufficient size and with adequate backup facilities to meet the needs of the Western area would be very costly.

The conversion of solar energy to electrical energy is only possible during the daytime and under fine conditions. The peak electricity demand in the Western area occurs during winter evenings when there is no sun light for solar plant to convert to electricity. Thus if a photovoltaic installation were to be established, another electricity supply augmentation would still be required to ensure that an adequate supply of electricity could be maintained during periods when the solar generation was not available.

It is possible, due to further technological advance and cost reductions, that local photovoltaic generation will begin to reduce daytime loads within ten years. However, this will not remove the need for the current proposal.

- **Solar Thermal** - As well as the conversion of solar energy into electrical energy, the technology of conversion from solar to heat energy is well advanced, particularly for specific applications such as solar hot water heating, heating and cooling of buildings and some low temperature industrial applications. Similarly to the above, solar thermal, being dependent on the sun, cannot alleviate existing supply limitations without costly backup systems.

3.3.2 Hydro-electric Power

Either large or small-scale hydro-electric developments in the area would incur net overall costs far greater than the proposed transmission line with significant environmental impacts. There are also limited resources of this nature in the Western area, as discussed in the energy consultant's report.

3.3.3 Wind Energy

The generation of electricity by wind is dependent on prevailing weather conditions. Although wind can contribute to the total available generation on the National Grid, as for solar power an alternative supply system to the Western area would still be necessary to cover periods when generation from local wind sources was not adequate. A large number of wind generators would be required to adequately augment supply to the Western area. They would cover a substantial area of high exposed ground in order to capture sufficient wind energy and would be costly to build. They would also require connections to the TransGrid's transmission network or Country Energy's network. Thus, whilst reducing the consumption of fossil fuel elsewhere, wind power generation would have significant capital cost, environmental impact, visual impact and availability disadvantages.

3.3.4 Combustion Turbines

Combustion turbines are suited to support the system for emergency conditions during interruptions to transmitted supply.

It is possible to install local gas or diesel fired combustion turbines at any environmentally acceptable location to support the voltage and/or meet regular peak loads. While the capital cost of such installations is modest compared to the capital cost of coal fired generation, the cost of their operation is high because of the high cost of natural gas or distillate fuel compared with coal. They are not an economical means of meeting the normal daily load although they do have a place in meeting peak loads.

In the case of the Western area combustion turbine options were examined by TransGrid and Country Energy in their application of the regulatory test but found to be significantly less cost effective than transmission network augmentation options.

3.3.5 Biomass

Biomass is matter derived from biological sources - plants and animals, and the wastes that result from their growth, processing or disposal. These wastes are then used as fuel for the generation of electricity. A typical example is the use of bagasse (a sugar industry waste product) for electricity and steam production.

With the types of agriculture in the area, there is little potential for electricity generation from biomass.

3.3.6 Geothermal Energy

There are no known locations in the area where geothermal energy can be used for the production of electricity. Therefore, this form of alternative energy source would not form part of a feasible supply augmentation option.

3.3.7 Fuel Cells

Currently, the technology and production facilities do not exist for ready application of fuel cells of any significant scale, in the available time or at reasonable cost.

3.3.8 Nuclear Power

In NSW, government authorities such as TransGrid are currently prohibited from developing nuclear generated power supplies under the *Uranium Mining and Nuclear (Prohibition) Act,* 1986 (P2 S9).

3.3.9 Conclusion

There is increasing potential for alternative energy sources to make an increasing contribution in future years but not a contribution which would avert the need for the proposed transmission network augmentation.

3.4 Project Alternatives - Network Options

Augmenting the transmission network is an option to augment supply to the Western area of NSW. This involves developing additional transmission lines and connections in order to provide additional transmission network capacity to supply electricity to the Western area via existing generation sources.

As previously discussed, given that a no supply augmentation strategy is unacceptable to government and community, that demand management programs cannot defer the need for an augmented supply any longer, and that alternative energy sources cannot currently meet existing and future demands, transmission network augmentation is seen as the only viable approach.

Planning studies by TransGrid and Country Energy identified a number of ways to augment the transmission network to the Western area of New South Wales. The transmission network augmentation options considered by TransGrid and Country Energy in their application of the regulatory test are outlined in the following sections. Explanatory diagrams and other details can be found in the regulatory consultation papers available from TransGrid's website at www.transgrid.com.au/publications/consultation.html.

3.4.1 Option 1 (Wollar-Wellington)

This option involves:

- Establishment of a new 330 kV switching station at Wollar. Wollar is located on the Bayswater – Mount Piper double circuit 500 kV line Number 73/74 (currently operating at 330 kV) approximately 120 km north of Mount Piper. The switching station would be configured to allow for future operation of 73/74 line at 500 kV by adding a transformer and switchgear;

- Construction of a 330 kV line between Wollar and Wellington 330 kV Substation;

- Connection of the new line at Wollar and Wellington. At Wollar the new line would be connected to the western circuit of the Bayswater – Mount Piper line. At Wellington the double circuit breaker termination of Line Number 72 would be rearranged to terminate number 72 line and the new line in single circuit breaker configuration;

- Installation of a new 330 kV reactor switchbay and 50 MVAr 330 kV shunt reactor at Wellington; and

- Communications and protection upgrades to accommodate the new system connections.

This option would provide a second 330 kV line to Wellington by a completely new route (see Diagram 3.1). It completely removes system limitations associated with outages of number 72 line until well beyond a ten year planning horizon. This option may also be constructed without any complex staging and potentially risky system rearrangements.

3.4.2 Option 2 (Yetholme – Kerr's Creek)

This option would involve:

- Establishment of a new 330/132 kV substation at Kerr's Creek. Kerr's Creek is located approximately 20 km east of Molong on the Mount Piper – Wellington tee Orange 132 kV line Number 947. The substation would be initially configured with a single transformer, 50 MVAr 330 kV shunt reactor and switchbay similar to that at Wellington in Option 1;

- ❐ Construction of a 330 kV line between Yetholme and Kerr's Creek Substation. Yetholme is at the western end of the double circuit 330 kV line from Mount Piper, which currently carries part of number 72 and 947 circuits. Investigations by TransGrid indicated that a feasible line route would be approximately 90 km in length;

- ❐ Construction of a new single circuit 132 kV line from Kerr's Creek to Molong (approximately 25 km) and a short double circuit section of 132 kV line from Kerr's Creek to number 947 line;

- ❐ Rearrangement of 132 kV lines near Orange and Yetholme to achieve the 132 kV network configuration required;

- ❐ 330 kV rearrangements and connections at Kerr's Creek, Yetholme and Mount Piper to achieve the 330 kV network configuration required;

- ❐ Installation of a new 330 kV double circuit breaker switchbay and rearrangement of connections at Mount Piper; and

- ❐ Communications and protection upgrades to accommodate the new system connections.

This option provides a new 330 kV line to a location at Kerr's Creek, approximately two thirds of the distance between Mount Piper and Wellington. A 132 kV line from Kerr's Creek to Molong and other 132 kV connections would be required to offset the loss of an existing 132 kV circuit (some of which is re-used to form part of the new 330 kV line).

This option substantially removes the risk of system limitations associated with outages of number 72 line. However, a small risk remains below the level required by the planning criterion and this risk would increase with time. This option also provides an additional 330/132 kV transformer in the area and so addresses some emerging transformer capacity limitations.

3.4.3 Option 3 (Yetholme – Wellington)

This option would involve:

- ❐ Construction of a 330 kV line between Yetholme and Wellington via Kerr's Creek. Yetholme is at the western end of the double circuit 330 kV line from Mount Piper that currently carries part of 72 and 947 circuits. Investigations by TransGrid indicated that a feasible line route would be approximately 140 km in length;

- ❐ Reconstruction of the existing single circuit 132 kV line 944 between Wallerawang and Yetholme as double circuit 132 (approximately 25 km). During the reconstruction period the western section of line number 944 would have to be tee connected to the existing line 94C circuit;

- ❒ Rearrangement of 132 kV lines near Yetholme and Wallerawang to achieve the 132 kV network configuration required;
- ❒ 330 kV rearrangements and connections at Wellington, Yetholme and Mount Piper to achieve the 330 kV network configuration required;
- ❒ Installation of a new 330 kV double circuit breaker switchbay and rearrangement of connections at Mount Piper;
- ❒ Installation of a new 330 kV reactor switchbay and 50 MVAr 330 kV shunt reactor at Wellington; and
- ❒ Communications and protection upgrades to accommodate the new system connections.

This option provides for a second 330 kV line to Wellington via a route that roughly parallels the route of the existing number 72 line. It completely removes system limitations associated with outages of number 72 line until well beyond a ten year planning horizon. This option requires the reconstruction of an existing 132 line between Wallerawang and Yetholme to double circuit construction. This is required to offset the loss of an existing 132 kV circuit (some of which is re-used to form part of the new 330 kV line).

3.4.4 Advantages, Disadvantages and Risks of Network Options

A comparison of potentially significant advantages, disadvantages and risks associated with the three network augmentation options is presented in Table 3.2.

Given the fact that the Wollar – Wellington option satisfied the regulatory test and considering the advantages, disadvantages and risks of this option vis-a-vis the other options, the preferred option is the Wollar – Wellington development.

This is the only option that, in addition to satisfying the regulatory test:

- ❒ Completely eliminates the network voltage limitation for the foreseeable future, and
- ❒ Does not involve complex and potentially risky 132 kV line rearrangements or the removal of part of the existing 132 kV line number 947.

Table 3.2 – Comparison of Transmission Options Advantages, Disadvantages and Risks

Option 1: Wollar - Wellington		Option 2: Yetholme – Kerr's Creek		Option 3: Yetholme - Wellington	
Advantages	**Disadvantages and Risks**	**Advantages**	**Disadvantages and Risks**	**Advantages**	**Disadvantages and Risks**
Provides significant route diversity with 72 line.	Increases the cost of a future project to uprate the Bayswater – Mount Piper line to 500 kV because of the cost of the Wollar transformer has to be included in that evaluation.	Provides an extra 330/132 V transformer in the area	A section of 132 kV line between Orange and Yetholme is unused (although this is mitigated by looping 947 line into Orange).	Facilitates construction of a future substation in the Kerr's Creek area as the new line would pass to the west of 72 line and close to potential sites in this area.	Only minor route diversity with 72 line.
Project risks are relatively small as there are no complex and potentially risky 132 kV line rearrangements.	The Wollar transformer, if required, would be non-standard if built to minimum requirements. Alternatively a more expensive but standard transformer could be installed.	Enables 947 line to be looped into Orange without an extra switchbay at Orange.	Project risks are higher than for the Wollar option as there are complex and potentially risky 132 kV line and 330 kV rearrangements near Yetholme and Kerr's Creek.	No new substation sites are required (at least initially).	Project risks are higher than for the Wollar option as there are complex and potentially risky 132 kV line rearrangements near Yetholme.
The option to construct a future 330 kV substation at Icely is retained.	The proposed site for Wollar is relatively difficult for MW radio access.	Communications are suited for further development towards Orange, Cowra, Forbes and Parkes.	An outage of 72 line to install an OPGW may be required prior to commissioning of the new substation.	Completely eliminates voltage problem at Wellington for an outage of 72 line for many years.	An outage of 72 line to install an OPGW may be required prior to commissioning of the new line.
Completely eliminates voltage problem at Wellington for an outage of 72 line for many years.	Partial sunk costs in Mount Piper – Yetholme 330 kV circuit (offset by its use at 132 kV).		The risk of voltage problems at Wellington for an outage of 72 line are not completely overcome.	The option to construct a future 330 kV Substation at Icely is retained.	Longest length of new 330 kV line (of any of the options considered).
	Does not provide additional 330/132 kV transformer capacity in the area.		There is a risk that the Kerr's Creek area may not be the optimal long term location for the substation.		Does not provide additional 330/132 kV transformer capacity in the area.
	The cost of constructing a 330/132 kV substation in the Kerr's Creek area (if appropriate in the future) is higher than for the Yetholme – Wellington option as 72 line is not near the most desirable sites.		Only minor route diversity with 72 line.		

3.4.5 Economic Considerations

TransGrid and Country Energy prepared a comparison of estimated capital costs for the three transmission line options for their application of the regulatory test. This is summarised in Table 3.3 below.

The dollar values in this table represent the preliminary cost estimates for the options prepared in 2002, and were based on notional routes for option comparison purposes only. In addition they did not include easement costs, as these were assumed to be equivalent for all three options.

Given the early stage of investigations and evaluations, the dollar values in the table could vary by + or – 25%.

Table 3.3 – Capital Costs of Transmission Options (in $ millions)

Works	Option 1 Wollar-Wellington	Option 2 Yetholme–Kerrs Ck	Option 3 Yetholme-Wellington
500, 330 kV line works	49.0	44.0	62.0
132 kV line works		5.0	5.5
Wollar Switching Station	7.0		
Kerr's Creek Substation		9.8	
Wellington Reactor	1.5		1.5
Mount Piper 330 kV Mods		2.0	2.0
Communications	3.5	2.0	2.5
Subtotal	**61.0**	**62.8**	**73.5**
Wollar Sub & Transformer (assumed required in 2008*)	6.7		
Total	**67.7**	**62.8**	**73.5**

* 2008 is the earliest possible date. The Net Present Value of this augmentation will be lower if 500 kV operation of the Bayswater – Mt Piper transmission line is deferred to a later date.

TransGrid also engaged the services of economic consultants, National Economic Research Associates (NERA) to apply the ACCC's regulatory test to augmentation options for the Western area. The main conclusions to be drawn from the modelling by NERA are:

- The modelling suggested that, of the three transmission options, either the Wollar to Wellington or the Yetholme to Kerr's Creek network augmentation would provide the most cost effective means of meeting the system planning criterion that TransGrid and Country Energy have determined for the Western Area;

- Whether the Wollar to Wellington or the Yetholme to Kerr's Creek network augmentation is more cost effective will depend on whether or not the Mount Piper to Bayswater line is upgraded from 330 kV to 500 kV; and

- The ranking of the options is robust to (reasonable) changes in the underlying assumptions when these are undertaken one at a time and consistently across options.

3.5 Preferred Transmission Line Development

Following detailed assessments of the options described above, TransGrid and Country Energy have concluded that the preferred augmentation is Option 1: Wollar to Wellington. This option was preferred because it entirely removes the system limitations that occur during an outage of 330 kV line number 72 and it establishes a 330 kV ring that is secure against any local incident such as a bushfire affecting part of the ring.

The Wollar to Wellington project will include the following key components (see Diagram 3.1):

- Construction of a new 330 kV switching station at Wollar;
- Construction of a 330 kV single circuit transmission line between Wollar Switching Station and the existing Wellington 330 kV Substation; and
- Minor works at Wellington 330 kV Substation.

3.6 Project Justification Issues and Mr Robert Needham

Following the selection of the “preferred corridor” in late 2003, Mr Needham, a landowner affected by the proposed Wollar-Wellington line, raised concerns regarding the need and justification for the project with TransGrid. Through 2004 and early 2005, correspondence and discussions between Mr Needham and TransGrid occurred, with TransGrid providing a number of documents and additional information to Mr Needham through 2004 relating to the need and justification for the proposed transmission line.

On 20 December 2004, Mr Needham wrote to the ACCC detailing his concerns with the project justification. The ACCC regulates TransGrid activities in a number of areas and one of ACCC’s responsibilities is to review TransGrid’s capital expenditure program to ensure efficient and effective expenditures. (On July 1 2005 these responsibilities passed to the new Australian Energy Regulator.)

In January 2005, on behalf of the ACCC, PB Associates completed a comprehensive review of TransGrid’s forward 5-year capital expenditure program. This work by PB Associates included a review of each capital project proposed by TransGrid for the 5 -year regulatory period 2004-05 to 2008-09. The Wollar-Wellington 330 kV transmission line project was one of the projects examined. PB Associates, after exercising its own independent assessment of each project, concurred with the need and timing for the Wollar-Wellington augmentation.

On 18 March 2005, the ACCC held a public forum in Sydney so that interested parties could state their views on TransGrid's capital expenditure application for the regulatory period 2004–05 to 2008–09. The public forum is a normal part of the expenditure review processes of the ACCC. Mr Needham made a presentation of his concerns regarding the need and justification for the proposed Wollar-Wellington line at the public forum.

After the public forum, Mr Needham, the ACCC and TransGrid met to discuss his particular concerns. At that meeting, it was agreed that TransGrid would provide detailed information and responses to the 20 specific questions posed by Mr Needham in his letter of 20 December 2005 to ACCC. On 8 April 2005, TransGrid provided Mr Needham and the ACCC with the detailed responses to those questions.

TransGrid is of the view that the questions asked by Mr Needham and the answers provided by TransGrid may be of assistance to others asking similar questions. Whilst Mr Needham's correspondence with the ACCC, and his presentation to the public forum, the ACCC and TransGrid's responses to the correspondence, the PB Associates report supporting the need for the transmission line and a range of other documents can all be found and reviewed on the ACCC website (www.accc.gov.au), a copy of Mr Needham's letter of 20 December 2004 to the ACCC and TransGrid's response of 8 April 2005 have been included in **Appendix E**. of Volume 2 of this EIS to assist in the understanding of this issue.

3.7 Route Development Process

Once the preferred project option was identified, the next step was to identify potential corridors for the required transmission line and a site for the switching station at Wollar.

The objectives of the route development process were to:

- identify the constraints relevant to corridor selection;
- undertake specific studies to supplement available information on identified constraints and opportunities; and
- develop potential route corridors within which a transmission line could be constructed.

Preliminary investigations carried out for the proposed transmission line included site inspections, map studies, examination of recent aerial photography and a search of public documentation to identify areas of significant flora, fauna and known archaeological and heritage sites. Desktop studies of available information provided an overview of known cultural heritage sites and a preliminary assessment of the flora and fauna in the area. From the information gathered it was possible to predict areas having potential archaeological and flora and fauna sensitivity.

Three preliminary corridor options were identified based on constraint information. These avoided areas of high significance such as major physical obstructions, main population centres and National Parks. The three corridors proposed are described in the following sections.

3.8 Alternative Route Options

The preliminary corridors were made up of sections and links which could be combined to form complete corridors from a number of switching station site options at Wollar through to the existing substation at Wellington. The corridors identified were named the Northern, Central and Southern Corridors. They were used for consideration in the community consultation program and each of them was described in detail in the document entitled *Corridor Selection Report*. A brief description of each corridor is provided below.

3.8.1 Northern Corridor

The northern corridor traversed north of Wollar bordering Goulburn River National Park, then turned west, passing Ulan to the south and continue north west before turning south west to pass Beryl. The corridor continue west, crossing the Cudgegong River before terminating at the substation north east of Wellington.

A northern corridor variation was also proposed that provided an alternative path to the Northern corridor between Ulan and Beryl. This variation was considered necessary as the Northern Corridor traversed potential mineral resources in the North of the study area, as identified by the Department of Mineral Resources.

3.8.2 Central Corridor

The central corridor traversed south of Wollar, winding between the northern and southern parts of Munghorn Gap Nature Reserve and then proceeded west along an existing 60 m wide easement through Cooks Gap. The corridor then continued southwest through the southern outskirts of Gulgong, and Two Mile Flat before proceeding to the Wellington substation.

3.8.3 Southern Corridor

The southern corridor originated approximately 5 km south of Wollar. This corridor also passed between parts of Munghorn Gap Nature Reserve and on to Moolarben, before turning south west to Home Rule and thence via Twelve Mile to Wellington substation.

3.9 Assessment of Viable Corridors

Field inspections and desktop studies were carried out to provide a preliminary indication of the environmental and social impact of each of the viable corridors proposed. Each corridor was approximately 1 km wide but in some areas where fewer constraints existed and further options were required, the corridors were widened. Issues that were given particular attention along each of the corridors were:

- ❐ The number of houses potentially affected within the corridors;
- ❐ The property sizes along the route;

- The number of houses 250 m and 500 m from a proposed notional transmission line alignment;
- The number of schools that may be present;
- Agricultural land capability;
- Visual impact;
- Tourism impacts;
- Areas of National Park / Nature Reserve;
- The health, structure and integrity of existing vegetation;
- The number of threatened flora and fauna species;
- The number of Historical Heritage Items; and
- The number of Indigenous Heritage Items.

3.9.1 Number of Houses

The number of houses potentially impacted by each of the proposed corridors in increasing order were the Northern Corridor (58), the Southern Corridor (69), the Central Corridor (85), and the Northern Corridor Variation (91). While the number of houses potentially affected by the Northern Corridor Variation was the highest, the impact on houses in the Middle and Southern Corridors was considered greater than the Northern Corridors due to the density of the houses and the difficulty of keeping adequate separation distances from them. This was a factor of subdivision size, location of villages along each corridor and the general constraints in locating a line which does not “zig zag” throughout the landscape.

3.9.2 Distance of Transmission Line to Existing Houses

The number of houses within 250 m, and 500 m from the notional alignment within each corridor was determined. It was found that the Southern Corridor had the lowest number of houses within 250 m (14), followed by the Northern Corridor (15), the Central Corridor (23) and the Northern Corridor variation (26). The Southern Corridor also had the lowest number of houses within 500m (41), followed by the Northern Corridor (42), Central Corridor (64), and the Northern Corridor variation (67).

3.9.3 Use of Existing Infrastructure Easements

The feasibility of following the existing infrastructure easements and Crown land (excluding National Parks, Reserves, State Forests and Infrastructure) was considered in the development of viable options. The Northern Corridor and the variation follow the Sandy Hollow Railway easement between Wollar and Ulan and both traverse approximately 2 km of crown land. The Central Corridor would not contain any crown land, and the Southern Corridor would contain 1 km of crown land.

3.9.4 Property Size

The Southern Corridor contains around 54 properties in the 0 to 10 ha size range, compared with 70 for the Northern Corridor, 71 for the Northern Corridor Variation and 90 for the Central Corridor. However, in the 10 to 50 ha range the Northern Corridor contains 140 properties, compared to 162 for the Northern Corridor Variation, 175 for the Southern and 190 for the Central Corridor.

3.9.5 Tourism Impacts

The Southern Corridor would have the highest impacts on tourism with several vineyards and guesthouses being within the vicinity, followed by the Central Corridor. The Northern Corridor options would have the least impact on tourism.

3.9.6 Visual Impacts

The Southern Corridor would have the highest visual impact due to the tourism in the area, number of houses and properties, and the clusters of rural-residential settlements in the corridor and within the visual catchment. This was followed by the Central Corridor. The Northern Corridor options would have the least visual impact.

3.9.7 Land Capability

The Southern Corridor contains 24 km of fertile land suitable for typical cultivation agriculture (includes vegetables, viticulture, fruit production, cereal and other grain crops) compared to 25 km for the Northern Corridor, 33 km of the Northern Corridor Variation, and 33 km for the Central Corridor. The majority of the study area however is grazing agricultural land with the Northern Corridor containing 64 km to 67 km of grazing land compared to 59 km and 48 km for the Central and Southern Corridors respectively. Normal grazing activities can continue below a transmission line and as the majority of the land is used for grazing, the impact on land use is least along the Northern Corridors.

While the Central and Southern Corridors have less agricultural land than the Northern Corridors, the impact of the transmission line is considerably higher due to the viticultural activities along the corridors.

3.9.8 EMF

The effects of Electromagnetic Fields are described in detail in **Chapter 6**. The constraints identified during the development of viable corridors such as the number of homes, potential distance to the transmission line, number of properties, property sizes and visual impact will ensure that concerns with EMF are taken into consideration in the identification of viable corridors.

3.9.9 Threatened Species

The Central and Southern Corridors each potentially contain 10 threatened species, which is higher compared to the Northern Corridor options, each containing 5. The threatened species primarily occur in the eastern part of the study area in and around Goulburn River National Park and Munghorn Gap

Nature Reserve. By avoiding these areas the impacts on the threatened species will be minimised.

3.9.10 Vegetation

The Northern Corridor Variation contains 94 km of sparse/poor quality vegetation, which includes cleared land, while the Northern and Central Corridors both contain 88 km and the Southern Corridor 83 km of poor quality vegetation.

3.9.11 National Parks and Nature Reserves

The Northern Corridor and the variation would not traverse National Parks or Nature Reserves. The Central and Southern corridors both traverse Munghorn Gap Nature Reserve and each covering approximately 2.2 km of Nature Reserve.

3.9.12 Historical Heritage

The Southern Corridor contains 28 historical heritage items compared with 20 for the Central Corridor, 30 for the Northern Corridor, and 38 for the Northern Corridor Variation.

3.9.13 Aboriginal Heritage

The Northern Corridors contain more NPWS registered Aboriginal Heritage sites compared with the Central and Southern Corridors, however this is not a true representation of the distribution of artefacts in each corridor as more surveys have been carried out in the north. Based on discussion with the Aboriginal Land Council Groups, the number of creek and river crossings, and geology of the study area it is considered that all the corridors are likely to contain a similar distribution of Aboriginal heritage items. At present no land within the study area is subject to any Native Title claims.

3.9.14 Engineering Aspects and Costs

A notional alignment was established within each viable corridor by applying the social and environment constraints established during community consultation and investigation of the study area. The notional alignment was considered in the estimation of the construction cost of the transmission line along the viable corridors. For all viable corridors normal terrain conditions were generally assumed comprising terrain with light to moderate vegetation and having reasonable access from formed roads to transmission line supporting structures.

The estimated cost of construction of the transmission line including access to structures and easement acquisition was:

- ❒ Northern Viable Corridor: $67 Million;
- ❒ Northern Viable Corridor Variation: $67 Million;
- ❒ Central Viable Corridor: $68 Million; and
- ❒ Southern Viable Corridor: $66 Million.

3.10 Preferred Corridor Selection

Following extensive investigation of the viable corridors proposed, a "Corridor Selection Report" was prepared and placed on public display in October 2003. Following numerous submissions and further consideration, the Northern Corridor with the Variation was identified as the preferred Corridor.

The Northern Corridor with the Wollar Variation and subsequent Cadonia Estate variation is the focus of the environmental assessments contained in this document. The other corridors described above are not considered any further in the development of the project. The alignment shown on the Project Route Plans in Volume falls within the preferred corridor which is assessed in detail in this EIS/SIS.

3.11 Ecologically Sustainable Development

Ecologically sustainable development (ESD) may be regarded as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It calls for a balance between conservation and development and is related to using resources in a manner that provides quality of life, equity, biodiversity and maintenance of ecological processes.

Sustainability is essentially about developing a system which is not self-destructive and does not take from the world's future, but which takes account of social, environmental and economic factors in the decision making process. By integrating conservation practices and principles into the development process, a sustainable balance can be achieved between environmental and economic objectives.

The Federal Government released the *National Strategy for Ecologically Sustainable Development* in December 1993. This strategy provided a goal and core objectives relating to ESD.

The Goal

- ❒ Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The Core Objectives

- ❒ To enhance individual and community well being and welfare by following a path of economic development that safeguards the welfare of future generations.
- ❒ To provide for equity within and between generations.
- ❒ To protect biological diversity and maintain essential ecological processes and life-support systems.

The well being of our current community is associated with the ability to generate and supply electricity, which is essential to many facets of human life and well being. The application of these principles in the transmission line augmentation is discussed below.

3.11.1 Precautionary Principle

The precautionary principle, as defined by the EP&A Regulation (incorporating the *Intergovernmental Agreement on the Environment and National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia, 1992) definition), dictates:

.....that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The precautionary principle is based on the premise that many of the potential benefits of the natural environment may be unknown and it is prudent and ethical to keep options open for current and future generations (DUAP, 1997).

TransGrid has integrated the precautionary principle in the project along with adopting mitigation measures to prevent environmental degradation associated with the transmission line proposal. The primary mitigation strategy has been the avoidance of sensitive ecological communities throughout the route options analysis and in final alignment. Even down to placement of individual towers, the avoidance principle has been followed.

The studies undertaken prior to and during the preparation of this EIS in relation to the flora, fauna, electric and magnetic fields, soils, hydrology and flooding, Aboriginal and European heritage, and social and economic values have not indicated that there are threats of serious or significant irreversible environmental damage. However, where risk of potential degradation has been identified, mitigation measures have been developed to ensure that substantial adverse impacts do not occur. Consistent with the requirements of the precautionary principle, it has been assumed that threatened species may in fact be present at appropriate habitats, although not observed, and a comprehensive set of mitigation measures, summarised in Chapter 8, forms an integral component of the project.

TransGrid will act in accordance with the precautionary principle in ensuring that there is a suitable easement for the 330 kV transmission line where housing is not permitted. In addition, the transmission line route of the nominated alignment within the corridor has been selected to affect as few residents as possible.

3.11.2 Intergenerational Equity

Under the EP&A Regulation, the principle of intergenerational equity requires:

...that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The Rio Declaration on Environment and Development (Agenda 21) also adopted the principle that:

...the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

The principle of intergenerational equity identifies a need to ensure that the requirements of the present generation can be met without precluding options for future generations. The proposed transmission line will ensure that existing development in western NSW will continue to be supplied with power, while accommodating current and future development associated with the population growth.

The proposed power supply augmentation is an appropriate development for both current and future generations since it provides for both current and projected power requirements. Upgrading the existing electricity system in western NSW provides for a continued reliable electricity supply for the needs of future generations and giving them the same opportunities as the existing generation without significantly degrading the environment.

The construction of the transmission line will consume resources, however the main materials, are steel, aluminium and concrete and these are not scarce or in short supply.

Measures to protect and maintain items of historical or Aboriginal heritage value are also required under the principle of intergenerational equity. As part of the proposal, identified sites will be protected from disturbance and ongoing Aboriginal liaison will take place with the Aboriginal community in the area.

Mitigation measures to ensure that the environmental impacts associated with the line are minimised are also required under the principle of intergenerational equity. Mitigation measures to protect the soils and water of the area will contribute to meeting the requirements of intergenerational equity, protecting the quality of the environment for both the existing and future generations.

3.11.3 Conservation and Biological Diversity and Ecological Integrity

There is a need to maintain the biological diversity and ecological integrity of the flora and fauna in the western NSW region. Conservation of ecological integrity requires that natural processes continue to function. The proposal for the new transmission line includes measures to minimise reduction of existing forests and degradation of soil and water resources. The application of erosion and sediment control techniques will assist in minimising impacts on the soil and aquatic environments. These and other measures discussed in the EIS and SIS will assist in conservation of ecological integrity.

The route has been selected to minimise woodland clearing. Even in the detailed route definition, there have been several minor variations to avoid clearing of vegetation. For example, the route has been selected to skirt the Crown Reserve west of Wollar, deviates to the north of Cope State Forest, crosses bushland near Ulan largely in parallel to an existing line, and skirts the forested flanks of Blue Biddy. Retaining tree cover is of particular concern in areas of State Forest where Forests NSW has indicated that further clearing is to be avoided if possible. The protocols to be used will ensure that the impacts on threatened species are minimised in line with the strategies contained in the Species Impact Statement.

TransGrid has developed a sustainability package which includes specific ecological offsets for this project which are in addition to corporate policies and targets. These targets allow for the planting of significantly greater area of woodland than is removed by new transmission line projects undertaken by TransGrid.

3.11.4 Improved Valuation and Pricing of Environmental Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. In particular, scarce environmental resources will increase in value and this should be taken into account.

The environmental costs of the project are borne by government and the local community. The costs to the community include loss of some vegetation and habitat and increased visual impacts. These impacts have been identified and strategies to reduce and/or mitigate them as far as practicable have been incorporated into the project design, compensation and environmental offsets.