CAPITAL EXPENDITURE FORECASTS

EnergyAustralia's capital program for transmission in the period 2004-09 is driven by the need to maintain levels of customer service. There are two major streams of investment required to maintain customer outcomes:

- demand driven expenditure necessary to maintain capacity to meet growing demand; and
- replacement driven expenditure necessary to replace equipment which has exceeded it economic life.

Table 1 sets out the proposed capital spend on transmission system assets for the period 2004-09.

Table 1 - Total Transmission Capex ($2003/04 millions)

	2004/05	2005/06	2006/07	2007/08	2008/09	Total
Demand	12.7	14.3	7.7	9.9	10.8	55.3
Replacement	7.5	9.8	29.9	20.7	11.9	79.8
Total	20.2	24.1	37.6	30.6	22.7	135.1

From the above table it can be seen that approximately 40% of the proposed expenditure is due to growth in demand and 60% is related to the retirement of aging assets.

Demand Related Expenditure

Forecast

The demand related expenditure is based on an expected increase in Summer Demand growth of 2.9% pa over the period 2004-09. This forecast rate of growth compares with 3.2% pa projected for NSW in TransGrid's 2003 NSW Annual Planning Report. The majority of Energy Australia's load is supplied to the coastal half of the Sydney metropolitan area. This area is already extensively developed, and whilst load is still increasing due to urban renewal and consolidation, demand growth in this area is less than other areas of NSW. These factors have resulted in EnergyAustralia's demand forecast being lower than the total NSW forecast.

Network analysis used to identify future network constraints requires a spatial demand forecast. Each year EnergyAustralia produces a spatial forecast covering peak Summer and Winter demands at each zone and subtransmission substation. Individual forecasts for each major substation are based on historical load growth, committed changes in loads or embedded generation and other influencing factors[1].

Capacity analysis for transmission exit points (both zone and subtransmission substations) considers the undiversified forecast for that substation.

For transmission network planning, the spatial forecasts for each transmission exit point (whether zone or subtransmission substation) are diversified and then aggregated into a spatial Transmission forecast. The aggregated loads within the spatial transmission forecast are compared against the medium global forecast. Where major differences exist, adjustments may be made to the spatial forecast to provide alignment with expected economic activity. The resultant spatial forecasts are used in the development of EnergyAustralia's load flow models and are forwarded to TransGrid for their use in developing a state load forecast.

Loadflow Analysis

The load flow models used for system analysis cover a ten year period and are developed in conjunction with TransGrid. EnergyAustralia's loadflow model is produced by merging TransGrid's NSW transmission system model with a detailed model of EnergyAustralia's transmission and subtransmission system. Loads and generation patterns external to EnergyAustralia's system are provided via TransGrid's system model.

Whilst the load flow model used provides a detailed representation of EnergyAustralia's system it is not a detailed representation of the overall state system. In particular it considers only a pattern of generation corresponding to a typical high load dispatch.

[1] A full description of the process is contained in the "Network Substation Spatial Demand Forecast Processes".

The model uses ratings corresponding to seasonal recurrent cyclic ratings. Sustained cyclic emergency ratings are considered during outages.

The following considerations are used in determining ratings

- Transformers - cyclic ratings in accordance with IEC
- Overhead lines - emergency ratings are normally constrained by ground clearance considerations with ASCR conductors typically operated to 120C and AAC conductors operated to 100C under emergency conditions subject to clearances being maintained.
- UG feeders - complex rating process considering soil resistivity and mutual heating from adjacent cables. Oil cables are operated to 85C.

Planning Criteria

The planning criteria used in determining the capex proposal are aimed at ensuring that the cyclic rating of equipment is not exceeded under normal system conditions and that credible forced or planned outages will result in:

- at most a momentary interruption to customers;
- acceptable voltage levels being maintained on the secondary busbars of transformers; and
- loading of the remaining in service network elements remaining within accepted limits.

The main thrust of the criteria is outlined below for each part of the network.

Transmission Exit Points (zone and subtransmission substations)

Augmentation is considered when the cyclic rating of equipment is exceeded on a daily basis or where the annual probability of failures which require load shedding to prevent equipment damage exceeds 1%.

Transmission Network

The applied criteria vary with location.

For the inner metropolitan system augmentation is considered when:

- the cyclic rating of equipment is exceeded on a daily basis;
- after operator action following the simultaneous outage of a 330kV cable and any other 132kV element;
    - acceptable voltage limits are not maintained on the secondary busbars of connected transformers;
    - loading of the remaining 132kV feeders exceeds 95% of their sustained emergency cyclic rating;
    - loading of 330/132kV transformers exceeds their cyclic overload rating.

Other parts of the EnergyAustralia system augmentation is considered when:

- the cyclic rating of equipment is exceeded on a daily basis;
- following the outage of one network element, the loading on any remaining element exceeds the short time emergency rating of that element whilst operator actions, are taking place;
- After operator actions following a the outage of one network element;
    - acceptable voltage limits are not maintained on the secondary busbars of connected transformers;
    - loading of any remaining system elements exceeds the sustained emergency rating.

In assessing performance outages of GIS busbar are considered, but outdoor busbar outages are excluded.

The implications of the above are that capex projections have been based on providing:

- a slightly enhanced N-1 criteria for the inner metropolitan area;
- an N-1 criteria elsewhere on the transmission system.

(Note EnergyAustralia's policy is to provide limited emergency backup capacity to cater for double circuit outages of double circuit overhead lines or cable banks. There is no allowance in the transmission capex projections for expenditure associated with such capacity).

Mitigation of Impacts of Summer Demand

EnergyAustralia see that there is little prospect of mitigating the impact of increasing summer demand.

Mitigation via Demand Management (DM)

EnergyAustralia has significant obligations to undertake DM studies as part of its distribution and transmission businesses.

One of the main drivers of increasing summer demand is domestic air-conditioning which can be readily mitigated by DM initiatives. EA is attempting to introduce demand response via distribution tariffs.

The only likely significant impact of DM on the transmission network would be the establishment of substantial embedded generation. To have a significant impact on the capex in the inner metropolitan area generation of more than 100MW capacity would be required. Any project would face significant environmental approval issues. At this stage the probability of a generator of this size establishing before 2009 would seem unlikely.

Mitigation via System Operating Options

The ability to defer capex via system operating initiatives will depend on the nature of the system. In EA's case it is necessary to consider two cases:

- Predominantly UG metropolitan area; and
- Central Coast and Hunter OH areas.

UG Metropolitan Area

EA's system in the metropolitan area is characterised by a significant cable system which has significantly different maintenance & operating requirements to an OH system. These factors mean that many of the strategies that can be used to mitigate expenditure on OH systems are no longer appropriate.

Generally the forced outage rates of cables is low, however oil filled cable systems require extensive down times for maintenance and when outages occur repair times can be very lengthy (typically weeks) . EA have traditionally mitigated the impact of cable maintenance on system performance by scheduling planned work for autumn and spring when loads are relatively low and the impact of outages on network security is minimised. EnergyAustralia does not consider there is scope to defer capex by changing the timing of its maintenance.

The characteristics of a cable system also tend to work against major increases in capacity arising from dynamic ratings unless the cable systems are fitted with DTS technology. Whilst EA is installing DTS with new 132kV cables, this technology is not present in its existing transmission system. Whilst opportunity is taken of the short time overload capacity of the cable system, to avoid load shedding whilst switching is carried out following a forced outage, dynamic rating of UG circuits cannot be used as a long term substitute for capacity without compromising the life and integrity of the system.

There is a small amount of capex ($4m) allowed within the metropolitan area for OH construction. This expenditure is targeted at uprating a line between Potts Hill and Chullora to provide a strong connection between a proposed new TransGrid supply point and EA's metropolitan system. This work is aimed at doubling the capacity of an existing line running through an urban area. It considered unlikely that such a large increase in capacity is achievable via dynamic rating.

Central Coast and Hunter OH areas

As with the metropolitan area maintenance in OH areas is targeted for times of light load where the impact of outages on system security will be minimised. EnergyAustralia do not consider there is scope to defer capex by changing the timing of maintenance.

EnergyAustralia does not presently use dynamic ratings on the transmission system. EnergyAustralia would need to gain experience with such techniques before applying them to our system, particularly as a deliberate means of deferring capex. If application of dynamic rating was applied some deferral of expenditure may be possible. However the overall expenditure involved is small ($8.5m) and occurs in the middle of the regulatory period. The impact on the overall capex would not be significant.

Proposed Capex Program

The proposed costs and timing for forecast capex was included in the previously supplied pro-formas.

Information for demand related programs is duplicated below.

	2004/05	2005/06	2006/07	2007/08	2008/09	Total
Haymarket & Campbell St	0	0	0	0	0	0
Inner Metropolitan	2.0	10.1	6.4	8.6	9.4	36.5
East Maitland/ Tarro	5.6	0.3	0.0	0.0	0.0	5.9
Lower Hunter 132kV	5.1	3.9	1.0	0.5	0.0	10.5
Newcastle W Corridor	0.0	0.0	0.3	0.7	1.4	2.4

Haymarket & Campbell St Zone

Project under construction .
For Project details see information about past capex.

Inner Metropolitan Area

Action will be required between 2006 and 2009 to avoid overloading the interconnected 132kV system supplying the inner metropolitan area. The likely constraint in this network will be loading on TransGrid's Cable 41 when the proposed Cable 42 is out of service. Joint planning to alleviate this constraint is presently in progress. Options include:

- optimisation of Power flows in EnergyAustralia's network through the installation of series reactors and phase shifting transformers;
- establishment of an additional TransGrid 330/132kV substation; or
- large scale embedded generation.

In the short to medium term optimisation of power flows by EnergyAustralia in conjunction with increased transformer capacity by TransGrid at Sydney South is anticipated to be the most cost effective network solution.

In the longer term it is anticipated that TransGrid will need to establish a new 330/132kV substation in the Homebush/Chullora area. In conjunction with this work modification and augmentation of EnergyAustralia's system will be required.

East Maitland/Tarro

Project under construction. Substantial expenditure incurred during the 2000-04 period
For Project details see information about past capex.

Lower Hunter 132kV

This project provides for the establishment of new 132kV feeders in the lower Hunter and some minor upgrading/replacement work at transmission substations.

The major work involved is:
- Tomago 132kV feeder augmentation
- Beresfield 132kV feeder augmentation

Tomago 132kV Feeder Augmentation –

A new 132kV feeder is proposed between TransGrid's Waratah West substation and Tomago. This will provide capacity to meet increasing load at Tomago and Port Stephens and provide a second circuit to Tomago after TransGrid convert Waratah West to full 330/132kV operation.

Beresfield 132kV Feeder Augmentation –

A new 132kV feeder is required from TransGrid's Newcastle substation to Beresfield to provide for increasing demand and to support Taree load after TransGrid converts Waratah West to full 330/132kV operation. The new feeder may be arranged to provide a connection to the proposed West Wallsend substation discussed below.

Newcastle Western Corridor

This is a project to service growing development around Edgeworth, West Wallsend and Estelville and involves the development of a new 132/11kV zone substation in the Cameron Park industrial area near West Wallsend. The substation is proposed to be connected to the existing transmission feeder 9NA .

Capex Forecasts

The capex forecast presented to ACCC is a forecast, based on EnergyAustralia's best estimates of its capital requirements over the next regulatory period. Like any forecast it will be subject to change for a variety of reasons.

Project Costs

The project costs used in EnergyAustralia's forecasts are in many cases based on engineering estimates and are for projects at the conceptual design stage of development. There is considerable potential for the project scope to change through issues such as community pressure/ environmental issues etc. An example of scope changes occurred in the development of a 132kV line from Ourimbah to Gosford, community opposition to reconstruction of a 33kV line between these points to 132kV construction resulted in a the adoption of a new route which was almost 50% longer than that envisaged originally. EA have several major projects planned with high sensitivity to community and environmental issues. Therefore, EA expects some significant variability in its capital cost estimates.

Changes in Forecast Growth Rates

Approximately 40% of the capex program is driven by demand. EA have assumed a 2.9% increase in summer demand. Variations from this rate of growth will impact on project timings, resulting in changing the capex profile required during the 2004 Determination period.

Changes in Project Classification Between Distribution and Transmission

Unlike other TNSP's EnergyAustralia operates both a distribution and transmission system which are regulated by two different parties. The present definition of what constitutes transmission asset means that the allocation of projects to distribution or transmission may vary depending on the arrangement of connections.

For example EnergyAustralia are presently planning to upgrade a substation on the Central Coast (Berkeley Vale) from 33/11kV operation to 132kV operation at a cost of about $15m. There are several options available for 132kV supply:

1. Install two new 132kV feeders from TransGrid's Tuggerah substation;
2. Install one new 132kV feeder from Tuggerah and interconnect with an existing transmission feeder.

Under option 1 the project would be regarded as Distribution, whilst under option 2 the project would be regarded as Transmission. At this stage it appears that the most cost effective solution would be option 1 and the project has accordingly been included in EnergyAustralia's distribution system submission. The project is still at the conceptual design stage and environmental requirements with respect to the line construction may result in Option 2 being adopted. This would result in an increase of $15m in transmission capex, with a corresponding reduction in distribution spend.

Acceleration of Replacement Expenditure

Replacement driven is driven by equipment condition and regulatory requirements. There is a major uncertainty within this program arising from changing environmental and safety issues.

Other environmental and community issues include

- Noise – particularly where urban development is resulting in high density residential development around transmission substations;
- Safety security – recent coronial findings has required a major upgrade of security;
- Fire mitigation – this is a growing concern in some areas affected by urban encroachment.

Appropriateness of Capex Incentives

An incentive design placed on capex would not be appropriate at this stage due to the large uncertainty in the program. Whilst the objectives of encouraging efficiency through incentives is supported, EA does not consider it equitable to obtain incentives as a result of inaccuracies in project estimates or factors such as project delays.

EA has a relatively small capital program, which is characterised by a small number of significant projects. Variations in one or two projects can therefore have a significant impact on the overall program. This sensitivity to a few projects makes an incentive mechanism placed on capex much more subject to risk than if an incentive mechanism were applied in the context of a larger, more diverse program.

There is sufficient uncertainty in EA's proposed capital program, to make the introduction of a capital based incentive program undesirable.