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16 DEC 2005
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15 December 2005

Roy Hemmingway
Chair
Electricity Commission
PO 10041
WELLINGTON
New Zealand

Dear Roy

Proposals for approval under the Transitional Provisions

Please find enclosed a document containing additional grid development proposals for approval by the Electricity Commission under the transitional provisions of Part F of the Electricity Governance Rules.

The proposal submitted is for the establishment of a new switching station at Huntly East and the installation of capacitors at Bombay substation to provide additional transmission capacity into Auckland.

Transpower is currently assessing additional projects that will increase the voltage stability limit into Auckland. Transpower expects to make a further submission for the additional projects under the transitional provisions early in 2006.

I trust that the information provided is sufficient to allow the Commission to undertake a full assessment of the proposals provided. In the event that you need to clarify or seek further information, please do not hesitate to contact me.

Yours sincerely

Dr Ralph Craven
Chief Executive

1 Huntly East Switching Station and Bombay Capacitors - Enhancement of 220 kV Transmission Capacity to Auckland

Proposal Summary

Transpower proposes to:

- construct a new 220 kV switching station at Huntly East, near the deviation of 220 kV Otahuhu – Whakamaru C line that connects to the existing Huntly substation, and
- install voltage support capacitors of 1x30 Mvar at Bombay.

These developments are required to provide additional security to Auckland and the North Isthmus region, when a major generating station is out of service in Auckland, up until the time that the proposed 400 kV transmission development is completed.

Together with a thermal upgrade of the OTA-WKM 1&2 circuits, this proposal will increase the maximum demand that can be supplied in the upper North Island to 1970/2490 MVA (summer (February) /winter) with a major generating station out of service in Auckland.

This is a core grid reliability investment and the proposal is justified against Transpower's current Grid Reliability Standards.

The table below provides the estimated cost of the project:

Project	Cost Estimated, $m 2005 (1)	Approval sought from Transpower Board and EC, $m (2)
Huntly East Switching station	27.2	31.7
Bombay Capacitor bank	1.5	1.8

(1) represents the mid-range estimated cost, in $m 2005, including allowance for project contingencies but excluding allowance for financial (eg inflation) contingencies;
(2) represents the upper-range (5% Probability of Exceedance) estimated costs, $m dollars of the day, including allowance for project and financial contingencies(eg inflation). These represent the costs that Transpower will be seeking to recover and form the basis of the submission to the EC.

The environmental and property investigations for the above project are not yet completed and are likely to have a significant impact on the feasibility and cost of the project. In the event that the investigations reveal that the project cost could vary significantly from the above estimate, Transpower reserves the right not to proceed with this project or to provide an updated proposal for approval as a variation to this proposal.

1.1 Planning Assumptions

1.1.1 Generation Scenarios

Only existing generation and committed new generation has been considered in determining the level of security to the region.

It is also assumed that the following transmission and generation developments take place:

- New capacitor banks are installed in Hepburn Road and Penrose by winter 2006 (under construction).
- The new combined cycle gas turbine (CCGT) unit (E3P) is commissioned and in service in Huntly by winter 2007 (under construction).
- The new cooling tower in Huntly is available by summer 2005/2006, enabling generation of at least 320 MW from Huntly units 1- 4 during critical summer periods (under construction).
- The load at Western Road has been transferred to Huntly 220 kV bus and the Western Road Grid Exit Point (GXP) decommissioned (planned).
- The Arapuni – Pakuranga 110 kV line has been decommissioned so the proposed Otahuhu – Whakamaru 400 kV transmission line can be constructed on the same line route (planned).

Recognising the uncertainty of generation availability in the region (e.g. prolonged outage of a generating unit due to an unplanned repair), it is assumed that the most significant generating unit (i.e. Otahuhu CCGT unit) is not available in assessing the transfer capability into Auckland.

Winter peak conditions reflect a wet Waikato generation dispatch, and summer peak conditions reflect a normal Waikato generation dispatch.

1.1.2 Load Forecasts

Transmission to Auckland is constrained during both winter peak conditions and hot summer conditions (mid January – mid March afternoons). Accordingly, the power system studies were based on both winter and summer peak loads. Transpower utilised the Electricity Commission's 2005 national electricity consumption 40 year forecast as the basis for creating the necessary demand forecasts for the power system analysis[1].

The half hour average regional load forecast is as shown in Table 1-1 below:

[1] For further information, please refer to the Grid Upgrade Plan 2005, Vol 2, Part II.

Year	Winter load (MW)		February load (MW)	
	Auckland/Isthmus	North Island	Auckland/Isthmus	North Island
2005	1958	4288	1594	3743
2006	2024	4406	1650	3849
2007	2093	4528	1708	3957
2008	2164	4652	1766	4066
2009	2236	4777	1824	4174
2010	2305	4901	1882	4283
2011	2373	5017	1940	4392
Note: The estimates for the Auckland/North Isthmus regional load include 40 MW for possible seasonal variations above the medium average forecast load growth.				

Table 1-1: Hot Summer and Winter Load forecast for Auckland and North Isthmus

1.1.3 Planning Criteria

The transmission system has been planned in accordance with Transpower's current Grid Reliability Standards[2].

The proposal deals with the adequacy of the capacity provided by the transmission network supplying the upper North Island. The transmission network is considered to provide adequate capacity and reliability if the entire connected load can be supplied during and following any single credible contingency event occurring in the transmission network, with all the assets that are reasonably expected to be in service. Transpower considers that it is reasonable to assume and plan on the basis of the largest generation unit in the region not being in service during the peak periods due to an unplanned outage.

[2] Transpower Main Transmission Planning Criteria, Grid Upgrade Plan 2005, Vol 2, Supporting Document No. 6

1.2 Description of the Transmission Asset and Present Capacity

The configuration of the existing network between Otahuhu and Whakamaru is illustrated in the diagram below Figure 1-1.

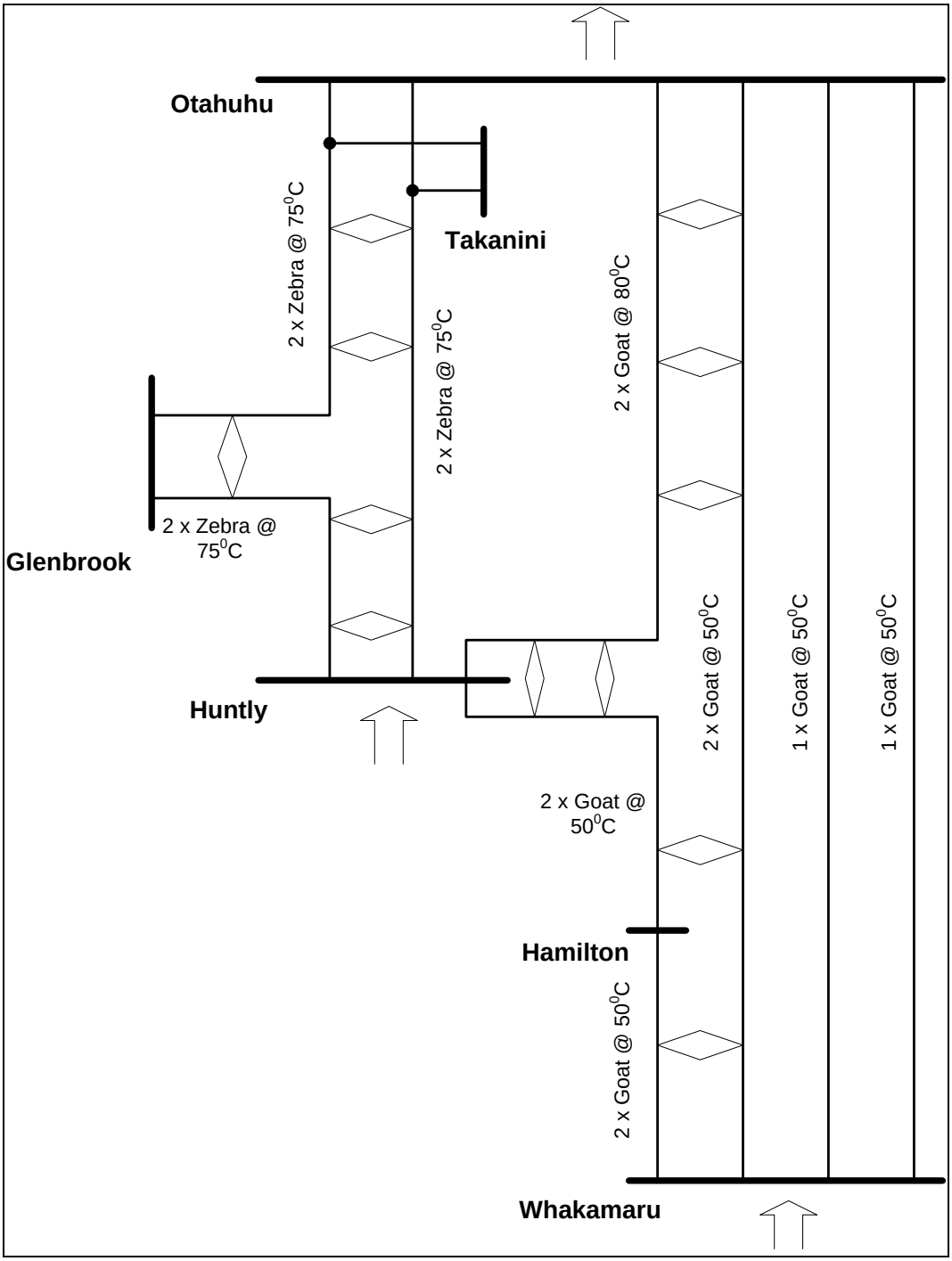

Figure 1-1: Simplified Diagram of Whakamaru to Otahuhu Transmission Network

Auckland is primarily supplied from the south through western and central paths. The western path consists of three 220 kV circuits from Huntly to Otahuhu. The central path consists of three 220 kV circuits from Whakamaru to Otahuhu.

Auckland is also supplied by two 110 kV circuits from Bombay and a 110 kV circuit from Arapuni. However, their contribution is minor compared to the 220 kV circuits.

The existing ratings of the 220 kV circuits supplying Auckland from the south are as per Table 1-2:

Circuit	Summer rating	Winter rating
Huntly-Takanini-Otahuhu 2	694 MVA (HLY to OTA)	762 MVA (HLY to OTA)
Huntly-Glenbrook 1 and Glenbrook-Otahuhu 1	694 MVA (HLY to OTA)	762 MVA (HLY to OTA)
Huntly-Otahuhu 1	615 MVA (HLY to OTA)	670 MVA (HLY to OTA)
Otahuhu – Whakamaru 1	201 MVA	246 MVA
Otahuhu – Whakamaru 2	201 MVA	246 MVA
Otahuhu – Whakamaru 3	403 MVA	457 MVA

Table 1-2: Circuit Ratings for Circuits Supplying Auckland from the South

1.3 Need Analysis

In the event of a prolonged outage of a major generating unit in the Auckland region, the following contingencies and generation dispatch patterns govern the loading of the 220 kV circuits supplying Auckland from the south:

- during high winter load periods, an outage or loss of the 220 kV Huntly-Takanini-Otahuhu circuit will cause the Hamilton-Bombay 110 kV circuit to overload.
- during hot summer periods, an outage or loss of the 220 kV Otahuhu-Whakamaru 3 circuit will cause the 220 kV Otahuhu-Whakamaru 1 and 2 circuits to overload. Further, the same contingency increases the transmission through Bombay – Hamilton 110 kV circuits closer to its thermal capacity.

With the existing transmission system, the maximum upper North Island demand that can be supplied is limited to approximately 2100 MW in the winter and 1650 MW in the summer. This would be marginally adequate for meeting the demand in the region in 2006. The overloads can not be relieved by generation re-dispatch and load curtailment would be necessary.

Under the above operating conditions, following an outage of a transmission component or a generator, management of the system voltage would become an issue and voltage instability would result.

The planned 400 kV transmission development between Otahuhu and Whakamaru will increase the transmission capacity and provide adequate supply reliability to the loads in the region.

1.4 Investment Proposal

To address the shortfall in the transmission capacity for meeting Auckland demand from 2007, it is proposed that:

- a switching station is built at Huntly East, (near 220 kV Otahuhu – Whakamaru C line deviation to Huntly), bussing the existing 220 kV Hamilton –Huntly 1 , Huntly– Otahuhu 1 and Otahuhu – Whakamaru 3 circuits.

- 1 x 30 Mvar (nominal) capacitor bank is installed at Bombay to provide voltage support for the Bombay load when the 110 kV system is split north of Bombay

An illustration of the proposed investment is shown in red (solid) in Figure 1-2. In order to ensure supply reliability during all credible contingencies, including a bus fault at Huntly East, the station design will be based on a double breaker switching configuration.

The proposed grid upgrade[3] together with the:

- temperature upgrade of the Otahuhu – Whakamaru circuits 1 and 2 to 75°C[4], and

- installation of post contingency 110 kV system splitting scheme north of Bombay for the hot summer periods,

will increase the thermal capacity of the transmission system enabling it to supply maximum upper North Island demand of up to 2490 MW during winter and 1970 MW during hot summer peak periods. As shown in Figure 1-3 and Figure 1-4, the transmission capacity would be adequate for meeting the 2010 summer and winter demand. Post-contingency splitting of the 110 kV transmission system north of Bombay (by opening of 110 kV Bombay Otahuhu circuits at Bombay) will reduce the loading on these circuits. Management of voltage at Bombay under these conditions will require installation of 1x30 Mvar (nominal) capacitor at Bombay. The final Mvar rating of the capacitor bank will be based on the acceptable voltage step at Bombay which will be optimised as part of the detailed design.

[3] The switching station alone will increase upper North Island load limit to 1770 MW in summer and 2360 MW in winter.

[4] This project was submitted to the Electricity Commission for approval as part of the Grid Development Proposals submitted under the Transitional Provisions on 31 October 2005.

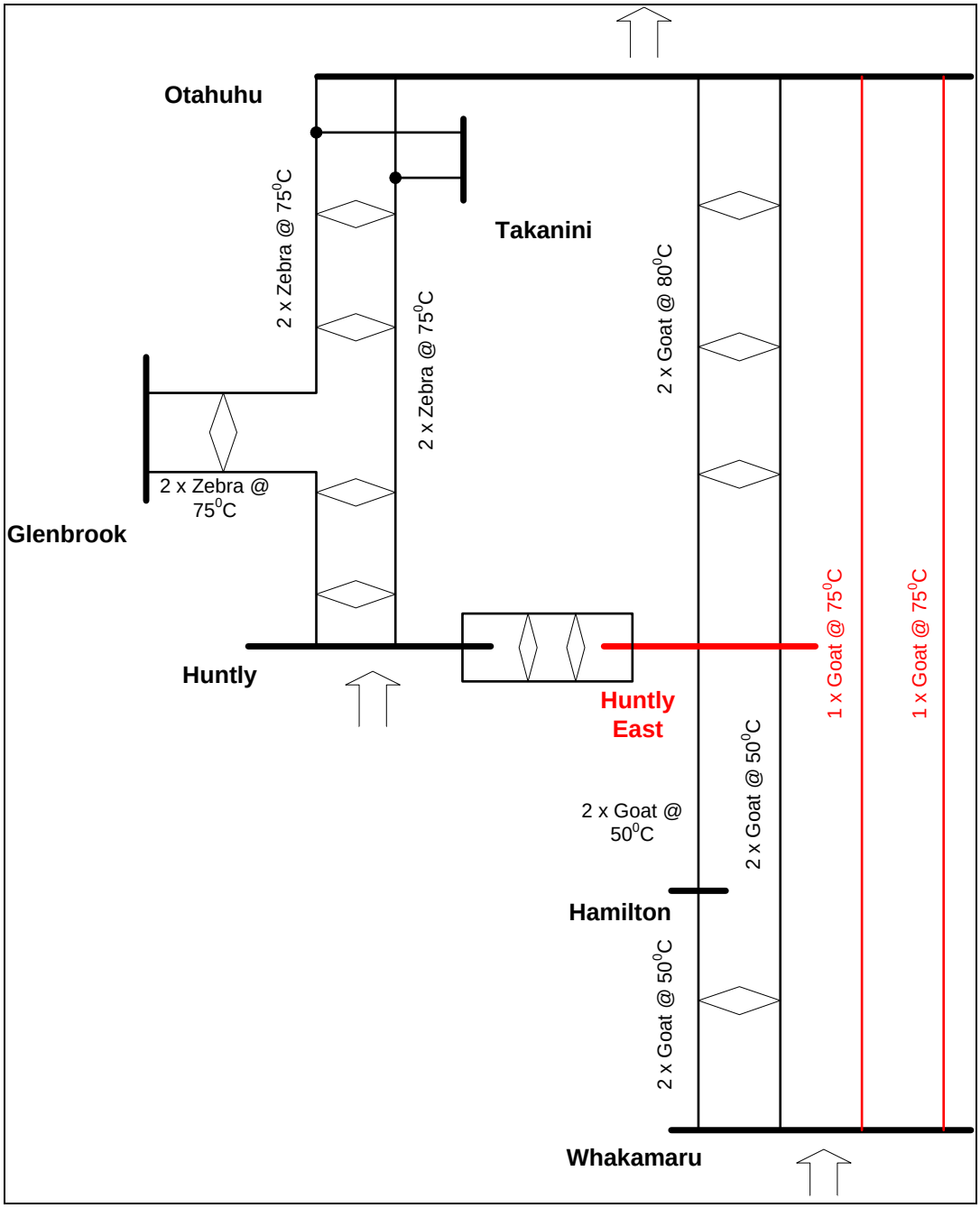

Figure 1-2 Simplified diagram of Whakamaru to Otahuhu transmission system following investment.

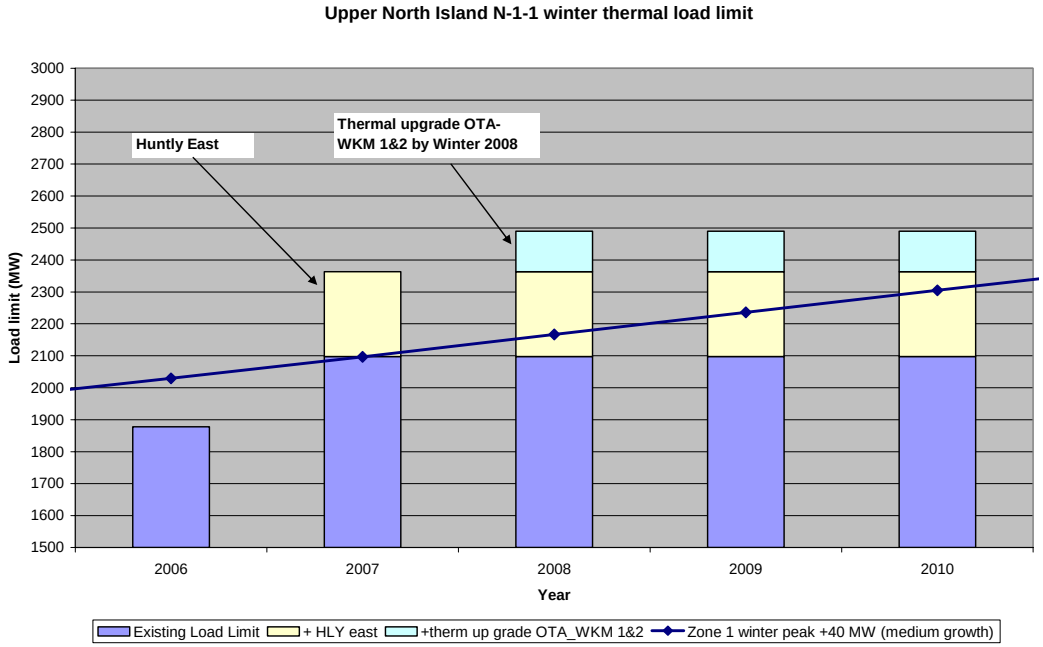

Figure 1-3: Upper North Island Winter Thermal Load Limit

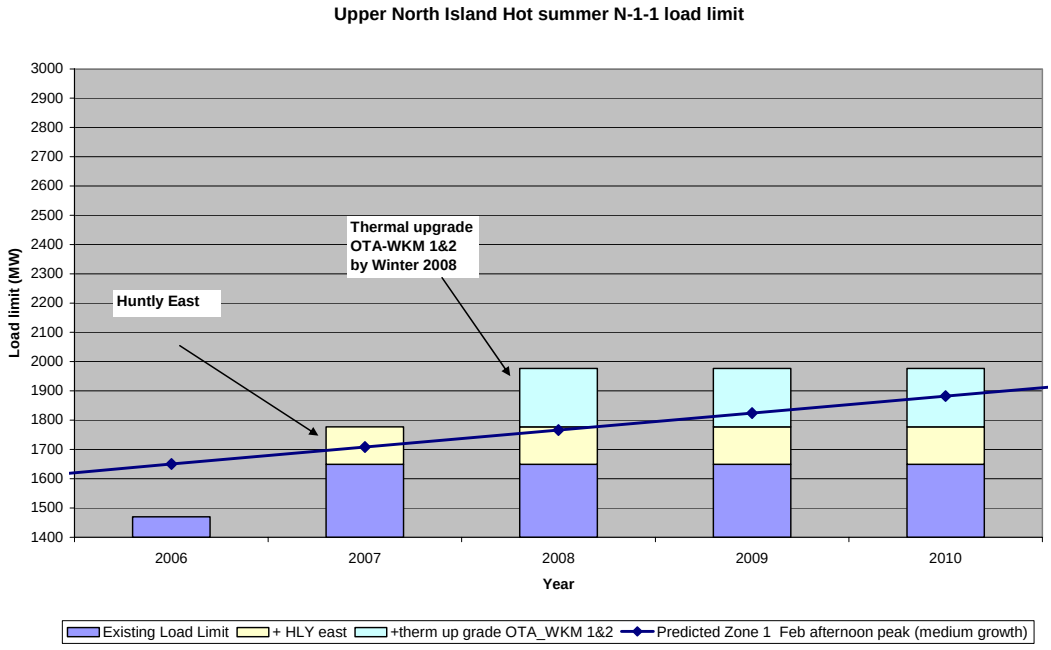

Figure 1-4: Upper North Island Summer Thermal Load Limit

Approximately 700 Mvar of additional reactive power support is required in Auckland to maintain the voltage stability of the power system by 2010. The reactive support is likely to comprise of:

- **Projects already submitted to the Electricity Commission for approval:**

  a) A new Static Var Compensator (SVC) of capacity ± 100 Mvar at Albany 220 kV by 2007
  b) A new capacitor bank of capacity 100 Mvar at Albany 220 kV bus by 2007
  c) Binary capacitor banks (2x12 Mvar blocks) at Kaitaia 33 kV bus by 2007
  d) A reactive power controller

- **Projects currently being investigated**:

  e) 100 Mvar Static Var Compensator at Otahuhu by 2008 (or increasing the proposed ALB SVC to +200 Mvar,)
  f) 2 x 100 Mvar of capacitors at Otahuhu by 2008,
  g) 1x100 Mvar of synchronous condensers at Albany, Henderson, or Otahuhu by 2008,

- **Reactive support assumed to be available via contracts**:

  h) Installation of new distributed capacitor banks totalling 100 Mvar in the distribution systems (contracted with the distribution companies) by 2008,
  i) Up to +260/-150 Mvar from synchronous condensers procured through the System Operator ancillary services procurement contracts by 2008,

A development proposal for the installation of additional reactive power in the region will be submitted to the Electricity Commission in the near future.

1.5 Property Requirements

As already communicated to the Commission, an opportunity recently arose to purchase the property at the deviation point on the OTA-WKM C line and Transpower has purchased the property. Transpower staff were inspecting the area when they discovered that the property directly under the deviation was for sale, and, even though the tenders for the property had already closed, there was what is considered to be a 'one-off fortuitous opportunity' for Transpower to enter negotiations on a willing seller willing buyer basis to purchase the property. This fortuitous purchase has obviated the potential need for compulsory acquisition and the associated delays associated with that process.

The property is approximately 150 Ha in size, comprising three titles, and although Transpower only requires a proportion of the property the owner would only sell them as a package. Transpower's intention is to:

- portion off the proposed substation site; and
- establish easements for the three 220 kV transmission lines (Whakamaru-Otahuhu A, B, and C) that cross the property.
- on-sell the parts of the property that are no longer required.

1.6 Environmental Impact

Acquisition of the property directly under the deviation has avoided potential adverse effects of new line works (to connect the substation) and ensures a sufficiently large site to ensure optimal orientation of structures to mitigate potential adverse effects. Potential adverse environmental impacts of visual amenity, noise, earthworks and hazardous substance storage will require mitigation through design. Some bridge strengthening or access works may be required to transport heavy equipment.

A full environmental risk assessment has not yet been prepared for this project but will be carried out in conjunction with the engineering investigation. The cost and programme assumes no appeals to the Courts.

1.7 Estimated Cost

Cost estimates have been prepared using the approach described in Appendix A of the "Grid Development Proposals 2005" submitted to the Electricity Commission on 31 October 2005.

Table 1-3 below summarises the cost estimates for the major components of the project.

Category	Cost Estimated $m (2005)[1]
Line capital costs	0.7
Substation capital costs	23.2
Property	3.1
Dismantling Costs	0
Project Management costs	1.1
Approval Costs	0.7
Investigations	0
Total	28.7

Notes:
1. Mid-range estimated cost, $m (2005), includes allowance for project contingencies but excludes allowance for financial (eg inflation) contingencies or Interest During Construction
2. The property cost shown is the purchase price of the property but it is planned to on sell surplus land in the future.

Table 1-3: Estimated Capital Expenditure for Huntly East Switching Station and Bombay Capacitors

The timing of capital expenditures is shown in Figure 1-5. Approximately 76% of the expenditure occurs in the final year of the project.

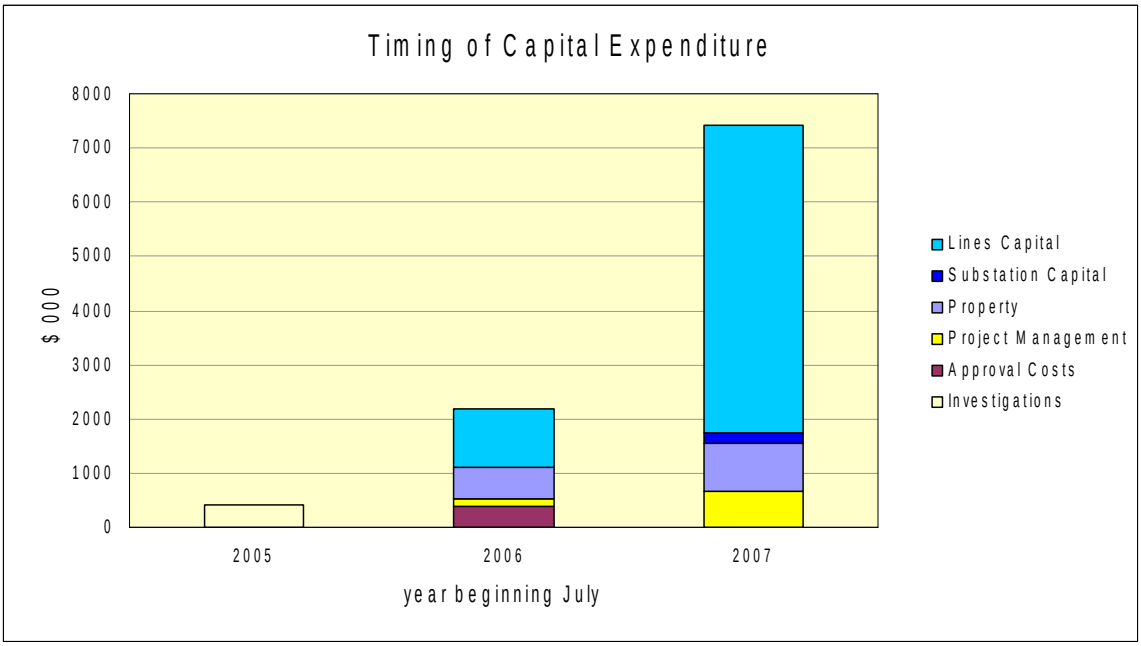

Figure 1-5: Anticipated Incidence of Expenditure on the Proposed Huntly East Switching Station

1.7.1 Contingent Amounts

Table 1-4 provides a summary of the various contingent amounts that have been discussed in this section.

Cost Category	Estimated Cost $k (2005)[1]	Inflation $k	Exchange Rate $k	IDC $k	Expected Cost $k[2]	Cost Contingency $k	Approval Requested from EC $k[3]
Lines	688	21	0	35	744	64	808
Substations	23227	697	0	1196	25120	2144	27263
Property	3100	0	0	481	3581	0	3581
Dismantling	0	0	0	0	0	0	0
Project Management	1072	32	0	55	1159	0	1159
Approval	650	20	0	33	703	0	703
Investigation	0	0	0	0	0	0	0
Total	28737	769	0	1801	31307	2207	33514

Notes:
1. Mid-range estimated cost, $m (2005), includes allowance for project contingencies but excludes allowance for financial (eg inflation) contingencies or Interest During Construction
2. Mid-range estimated cost in nominal $ including allowances for financial (eg inflation) contingencies and Interest During Construction
3. Upper-range estimated cost in nominal $ including allowances for financial (eg inflation) contingencies and Interest During Construction
4 The property cost shown is the purchase price of the property but it is planned to on sell surplus land in the future.

Table 1-4: Relationship between Project Costs in Real and Nominal Terms.

The difference between estimated capital costs and nominal costs including contingencies is approximately $3.5 million. Interest during construction and inflation

(which do not affect the economic merits of the project) represent $1.4 million of this difference. Cost contingencies are 21% of real capital costs.

Transpower wishes to recover the actual costs of the proposed investment. The nominal cost estimate including contingencies represents a good faith estimate of what those actual costs might be.

1.7.2 Total Cost of Grid Developments

As described in section 1.4, to ensure the supply security to Auckland is maintained during a prolonged outage of a major generating unit in the region, a number of transmission investments are required. The estimated approximate costs of these developments are shown in Table 1-5:

Investment		**Approximate Costs (Note 1)**
This investment proposal		
1	Switching station at Huntly East and 1x30 Mvar capacitor at Bombay	$33.5m
Investments already submitted to the Electricity Commission for approval.		
2	Upper North Island reactive support (100 Mvar SVC and 100 Mvar capacitors at Albany, 2x12 Mvar capacitors at Kaitaia and a reactive power controller)	$39.4m
3	Thermal upgrade of the 220 kV Otahuhu – Whakamaru 1 & 2 circuits	$15.8 m
Projects currently being investigated		
4	Additional reactive support in the upper North Island on order to meet supply reliability during a prolonged outage of a major generating unit in the region (an additional 100 Mvar of SVC, 2x100 Mvar capacitors, 1x100 Mvar synchronous condensers)	Approximately in the range of: $30m - $56m
Note 1: Upper-range estimated cost in nominal $ including allowances for financial (eg inflation) contingencies and Interest During Construction		

Table 1-5: Investment Projects

1.8 Transmission Alternatives

A number of transmission solution were investigated and the five of the options that would provide approximately the same transmission capacity are shown in table 1-6.

	Option	Maximum February Load (MW)	Maximum Winter Load (MW)
1	Huntly East Switching Station together with thermal upgrade of the 220 kV Otahuhu – Whakamaru 1 & 2 circuits (proposed solution)	1970	2490
2	Huntly East switching station together with series reactors on the 220 kV Otahuhu – Whakamaru 1 & 2 circuits	1870	2440
3	Huntly East switching station together with phase shifting transformers on the 220 kV Otahuhu – Whakamaru 1 & 2 circuits	1870	2440
4	A new 220 kV switching station at Glenbrook deviation together with thermal upgrade of the 220 kV Otahuhu – Whakamaru 1 & 2 circuits and reconductoring of the 110 kV Arapuni-Bombay and Bombay-Hamilton circuits.	2010	2430
5	Series capacitor compensation on the 220 kV Glenbrook –Huntly line, together with thermal upgrade of the 220 kV Otahuhu – Whakamaru 1 & 2 circuits and reconductoring of the 110 kV Bombay – Hamilton circuits.	2010	2410

Table 1-6: Comparison of Huntly East Switching Station against Transmission Alternatives.

The options listed above are divided between those that require Huntly East switching station and those that do not.

Of the three options that require Huntly East (Options 1, 2 and 3), Option 1 provides the highest capacity increase and greatest long term benefit as it provides a thermal increase rather than just altering the impedances of the parallel paths without changing thermal ratings, as is the case with Options 2 and 3.

Options 4 & 5, while not requiring a switching station at Huntly East, would require a combination of developments, including upgrades of the following transmission lines:

- 220 kV Otahuhu–Whakamaru A & B single circuit lines (i.e. circuits1 & 2) and
- The three 110 kV circuits from Arapuni - Hamilton - Bombay.

Although Options 1, 4 and 5 all provide increased transmission capacity, only options with the switching station at Huntly East will provide significant flexibility for future transmission developments, including increased transmission capacity for connecting more generation from Huntly.

Hence, considering the transmission options available, construction of a switching station at Huntly East is preferred over the alternatives because of the following reasons:

- limited and localised environmental impact,
- the flexibility for future transmission development,
- least cost of development.

The only viable and enduring transmission alternative is to enhance the transmission capacity between Otahuhu, Huntly and Whakamaru by building a new transmission circuit, such as that described in the North Island 400 kV transmission upgrade proposal (Volume 2 of the 2005 GUP). However, it is unlikely that any new transmission lines or major upgrade of transmission between Otahuhu and Whakamaru could be implemented within the required short time period.

1.9 Non-transmission Alternatives

Non-transmission alternatives available are:

(a). Installation of new generation locally

At present there are no firm proposals for installing new generation in the region in the near future.

(b). Demand management initiatives

The load growth in the Auckland region is higher than the national average and it is unlikely a viable scheme could be implemented within the required time frame. Demand management in the form of controlled load such as water heating is already used extensively and not likely to offer sufficient additional benefits.

Transpower is not aware of any committed demand management project that has the potential to obviate the need for the proposed transmission project.

1.10 Project Timeline

A project of the proposed investment's magnitude would normally be expected to take between two and two and a half years from approval to proceed to final commissioning.

Transpower has identified that the earliest date the proposed investment can be in place is mid 2008, provided investigation and planning commences now[5].

A tentative timeline for the project is shown below in Figure 1-6:

[5] This timeline assumes there will be no appeals to the courts.

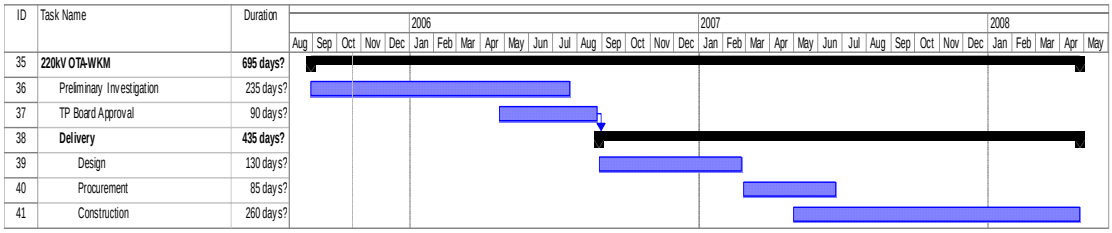

Figure 1-6: Indicative Project Timeline

Any delay in project commencement will result in delay through the project and consequently, prolonging the period of reduced security of supply to Auckland and the North Isthmus regions.