

**TRANSPower'S APPLICATIONS FOR INTERIM
GRID EXPENDITURE DATED 31 OCTOBER 2005
AND 16 DECEMBER 2005**

(Grid Development Proposals)

**Summary of submissions and responses and
Explanation of the Commission's final decisions**

March 2006

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1 INTRODUCTION AND PURPOSE

1.1 GDP Applications

1.1.1 On 31 October 2005, Transpower New Zealand Ltd (**Transpower**) applied to the Electricity Commission (**Commission**) for approval of interim grid expenditure (**IGE**) for a number of grid investment projects termed 'Grid Development Proposals' (**GDPs**) (**31 October Application**).

1.1.2 On 16 December 2005, Transpower applied to the Commission for **approval** of IGE for two additional GDPs (**16 December Application**). The two applications are referred to collectively in this paper as the **GDP Applications**.

1.2 Process

1.2.1 The rules relating to applications for IGE are contained in rule 16 of section III of part F of the Electricity Governance Rules 2003 (**Rules**)¹. Rule 16 gives the Commission authority, under certain conditions, to approve IGE before the first grid upgrade plan (**GUP**) is approved by the Commission.

1.2.2 The Commission completed a review of the GDP Applications and made indicative decisions for the purposes of consultation for each GDP at its 29/30 November 2005 and 20/21 December 2005 Board meetings. At these meetings, the Commission decided to consult with stakeholders about the Commission's indicative decisions in respect of both GDP Applications.

1.2.3 The Board also decided to seek further information from Transpower on a number of points in respect of both the 31 October Application and the 16 December Application. On 16 December 2005, the Commission wrote to Transpower requesting further information in respect of the 31 October Application, and on 22 December 2005, the Commission wrote to Transpower requesting further information in respect of the 16 December Application.

1.2.4 Also on 22 December 2005, the Commission published a paper for consultation in accordance with rule 16.4.2, entitled '*Assessment of Transpower's applications for interim grid expenditure dated 31 October and 16 December 2005*'² (**Consultation Paper**). That paper set out the Commission's approach to the tests under rule 16 and its indicative decisions for the GDP Applications. By the closing date of 8 February 2006, 10 submissions had been received.

1.2.5 On 1 and 7 February 2006, the Commission received further information from Transpower in respect of the 31 October Application. This information was published on the Commission's website as soon as it was received in order to make it available to potential submitters.

¹ References in this paper to rules are to rules in section III of part F of the Rules unless the context requires otherwise.

² <http://www.electricitycommission.govt.nz/consultation/gdpsconsult>

1.2.6 The Commission has now considered the submissions and the information received from Transpower and has made its final decisions on the GDP Applications.

1.3 Purpose

1.3.1 This paper:

- (a) summaries the information provided by Transpower;
- (b) summarises submissions received from interested parties; and
- (c) explains the Commission's final decisions with respect to the GDP Applications.

2 BACKGROUND

2.1 Rules

2.1.1 Rule 16 provides:

16 Transitional Provisions

16.1 Board may approve interim grid expenditure

The **Board** may approve interim **grid** expenditure proposed by **Transpower** having regard to the purpose and principles set out in rule 16.2.

16.2 Purpose and principles

16.2.1 The purpose of this rule is to allow the **Board** to approve interim grid expenditure proposed by **Transpower** before the Board makes final decisions on the first **grid upgrade plan**.

16.2.2 The **Board** must be satisfied that the proposed **grid** expenditure is additional to **Transpower's** normal ongoing **grid** expenditure.

16.2.3 The **Board** must also be satisfied that the proposed **grid** expenditure is:

16.2.3.1 reasonably prudent or necessary to meet **Transpower's** current grid reliability standards; ...

16.2.4 The **Board** is not required to undertake a formal cost/benefit analysis or apply the **grid investment test** when it decides whether or not to approve an interim **grid** expenditure proposed by **Transpower** under this rule.

2.1.2 The Commission has applied the requirements of rule 16 in its consideration and considers that the proposed expenditure must be:

- (a) IGE proposed by Transpower (rule 16.1) before the Commission makes final decisions on the first GUP (rule 16.2.1) (**Test A**);
- (b) additional to Transpower's normal ongoing grid expenditure (rule 16.2.2) (**Test B**); and
- (c) either (**Test C**):
 - (i) reasonably prudent or necessary to meet Transpower's current grid reliability standards (rule 16.2.3.1); or
 - (ii) prudent expenditure on preparatory work necessary for other grid expenditure that has not yet been approved in a GUP (rule 16.2.3.2); or
 - (iii) emergency expenditure (rule 16.2.3.3).

2.1.3 The GDP Applications were submitted under rule 16.2.3.1, so Test C(i) is the applicable test in this case.

2.1.4 Under each of the above tests Transpower must provide such information as the Commission considers is reasonably necessary to enable it to properly consider and decide whether or not to approve proposed interim grid expenditure (rule 16.3).

2.2 Categorisation of GDP Projects

2.2.1 The Commission assessed the information provided by Transpower in support of the GDP Applications against the three tests above and placed each of the GDP Projects into four categories, namely:

- (a) Category A (approve);
- (b) Category B (customer specific);
- (c) Category C (request further information); and
- (d) Category D (economic investments - decline).

1.1.1 Table 1 below contains a summary of this categorisation that was published along with the Commission's indicative decisions on 22 December 2005.

Table 1: GDP projects by Commission approval category 22 December 2005

Category	Description of Category	Affected GDPs	Total Amount Sought (million)
A	Approve IGE	2,3,4,6,7,8,10,11	\$66.4
B	Customer specific		\$0.0
C	Request further information	1,5	\$49.2
D	Do not approve (economic investment)	9	\$14.3
Total			\$129.9

3 ANALYSIS OF TRANSPOWER INFORMATION

3.1.1 In parallel with consulting with stakeholders about its indicative decisions, the Commission sought further information from Transpower in respect of the GDP Applications. This section of this paper analyses the further information received from Transpower in February 2006.

3.2 Test specific questions

Q1 Test A: IGE proposed by Transpower before the Board makes final decisions on the grid upgrade plan (rule 16.2.1)

3.2.1 The Commission considers that it cannot approve expenditure that has been already committed or incurred by Transpower as at the date of its application, as such expenditure is no longer 'proposed'. The Commission asked Transpower to confirm that none of the IGE for which Transpower is seeking approval has been incurred or committed.

3.2.2 In its response dated 1 February 2006 to the Commission's questions of 22 December 2005 (**1 February Response**), Transpower stated that "*only planning assessments have been completed*" in relation to the GDPs in the 31 October Application and that it is "*at present in the process of completing the conceptual design work for refining the cost and time estimates of the specific investments*".

3.2.3 Transpower further confirmed that none of the expenditure on the GDPs in the 31 October Application has been incurred or committed to date. The Commission notes that Transpower indicated in its original application material that final Transpower Board approval had not yet been given for the GDPs at the time of application, meaning that the final stage of committing the project from Transpower's perspective had yet to occur.

Q2 Test B: IGE proposed must be additional to Transpower's normal ongoing grid expenditure (rule 16.2.2).

3.2.4 The Commission asked Transpower to provide evidence that the IGE applied for in the 31 October Application is additional to normal ongoing grid expenditure (Q2).

3.2.5 Transpower stated that the 31 October GDPs "*are required to enhance the grid capacity's to reliably supply the anticipated future load*", rather than maintaining current capacity.

3.2.6 In the 1 February Response, Transpower referred to the '*Comprehensive Plan for Asset Management and Operation of the Grid*' (Vol 1, Grid Upgrade Plan 2005), in which the intended expenditure for replacing and refurbishing grid investments is described.

3.2.7 Transpower stated that it considers that "*normal ongoing grid expenditure is essentially required in order to maintain the existing capacity of the grid*". The augmentations that are required to reliably supply the future load growth

have been described in the Transpower planning document '*Transmission Plan Summary: Future of the National Grid 2005*' and that the GUP contains a subset of those anticipated investments.

Test C: proposed expenditure must be reasonably prudent or necessary to meet Transpower's current GRS (rule 16.2.3.1)

3.2.8 The Commission has previously stated that, in the context of rule 16.2.3.1, Test C is predominantly a technical test. Therefore, the further information asked of Transpower in this case is of a technical nature. The next section of this paper analyses the information provided by Transpower in relation to each GDP project.

3.3 Project-specific questions

Q3 GDP 1: Relative costs of Static Var Compensators

3.3.1 The Commission asked Transpower to supply information on the range of quotes Transpower has received from Static Var Compensator (**SVC**) manufacturers.

3.3.2 Transpower supplied the following range of quotes from SVC manufacturers. Transpower notes that in its comparison of alternatives and in its IGE application it sought approval for the upper range of the estimates. These quotes range from \$22 million to \$17 million.

Table 2: Manufacturers' estimates for an SVC

Item	Description	Manufacturer 1	Manufacturer 2	Manufacturer 3
1	Manufacturers budget estimate	\$ 19,250,000.00	\$ 16,200,000.00	\$ 14,700,000.00
2	Design	\$ 440,000.00	\$ 440,000.00	\$ 440,000.00
3	Civil Works	\$ 336,000.00	\$ 336,000.00	\$ 336,000.00
4	Other Installation Costs	\$ 230,000.00	\$ 230,000.00	\$ 230,000.00
5	Protection/SCADA	\$ 197,000.00	\$ 197,000.00	\$ 197,000.00
6	Noise Mitigation Measures	\$ 750,000.00	\$ 750,000.00	\$ 750,000.00
7	Transpower Project Management	\$ 710,000.00	\$ 710,000.00	\$ 710,000.00
Total		\$ 21,913,000.00	\$ 18,863,000.00	\$ 17,363,000.00

Note 1: The above cost estimates are in 2005 dollars and exclude allowances for project contingencies, financial contingencies (eg inflation) or interest during construction.

Note 2: Items 2 – 7 are associated with Transpower works outside the turn-key contract (manufacturers' budget estimates). These include site preparation, bay protection, 2020 kV disconnector, SCADA and design reviews of the SVC.

Q4 GDP 1: Further information on the scope of the proposed Reactive Power Controller

3.3.3 Although Transpower's description for GDP 1 includes a Reactive Power Controller (**RPC**³), the Commission wanted to ask Transpower some more

³ Essentially, an RPC automatically dispatches both static and dynamic sources of reactive power in a region to ensure that, firstly, steady state voltages in the region are maintained within prescribed

questions about the intended scope of that RPC because that information was not clear in the 31 October Application (Transpower consolidated the cost of RPC installation into the installation cost of the proposed Albany SVC (GDP1 - \$33.4 million)).

- 3.3.4 The Commission considered that the Auckland region could require an RPC which incorporates, and can control, the set-points of all dynamic and major static reactive resources in that region. Consequently, the Commission asked Transpower to further elaborate on the scope for the proposed RPC.
- 3.3.5 Transpower stated that it considered that the form and complexity of the RPC should be investigated as soon as approval for it is received from the Commission. It envisages the functionality could range from:
- (a) simple coordinated control of 100MVar capacitors together with a ± 100 MVar SVC at Albany; to
 - (b) a complex scheme with coordinated control of the set-points of all dynamic and major static reactive resources in the Zone 1 region, and the major transformer tap-changers.
- 3.3.6 Transpower stated it presently envisages that the RPC would be used for coordinated control of the proposed SVC, the synchronous condensers, and the major capacitor banks connected to the transmission system in the region, and that the estimated costs are based on this assumption that:
- “...in the event that the RPC capability is required to be extended beyond this level, a staged development is anticipated, and investment approval will be sought from the Commission for second and subsequent stages.”*
- 3.3.7 As an appendix to its 1 February Response, Transpower also provided a copy of a paper dated February 2006, entitled ‘Discission [sic] paper: reactive power controller for the Auckland region’ (**RPC Discussion Paper**)⁴. In its 1 February Response, Transpower noted that the RPC Discussion Paper states that Transpower is planning “to investigate the needs and specification of the functionality before calling for tenders for development and implementation”.
- 3.3.8 The Commission considers that the information supplied by Transpower is not sufficient for it to be reasonably satisfied that expenditure on the proposed RPC meets Test C. The Commission does, however, note that management of reactive power in the Auckland area will be increasingly important for maintaining grid security in future years.

limits, and secondly, under contingency, the optimal response of these sources can be maintained to avert either potential voltage collapse or over-voltage issues. Complex and sophisticated RPC systems have successfully functioned for a number of years at Transpower’s Haywards and Islington substations.

⁴ A copy of the RPC Discussion Paper is included as part of Appendix B to this paper.

3.3.9 Based on the information provided by Transpower (the manufacturers' quotes referred to in Table 2 above), the Commission has estimated that a cost of \$24.5 million should be allowed for provision of the SVC. This figure is determined from an average of the manufacturers' estimates plus contingency for escalation of costs between 2005 and 2007. A further \$1.5 million could be used to support investigation and preliminary design of an RPC. Therefore, in total, the Commission considers that approval of \$26 million for GDP 1 would allow the SVC to be installed and further investigation to be done into the size of the RPC.

Q5 GDP 2: Approach to managing the reactive power resources in Auckland and North Isthmus regions

3.3.10 The Commission asked Transpower to justify its estimate of the size for the capacitor (100MVar).

3.3.11 Transpower stated it has endeavoured "*to provide the most cost-effective solution for the voltage-related problems in the Auckland and North Isthmus regions*".

3.3.12 Transpower further stated that the "*100MVar capacitors together with the ±100MVar SVC at Albany are intended to provide voltage support for ensuring supply reliability to the region until 2010*". Transpower states it has used planning studies to determine that the correct location for the capacitor banks is at Albany 220kV. It also states that "*100MVar is the maximum size for a single capacitor unit at this location...based on engineering flexibility, power quality, voltage regulation and coordination with the proposed SVC*".

Q6 GDP 3: Investigation of improving power factor within distribution networks

3.3.13 The Commission considered an alternative to installing 2 x 12MVar capacitor banks at Kaitaia could be to improve the power factor within the distribution network, and asked Transpower to investigate if it is possible to improve the power factor within distribution networks. The power factor at Kaitaia is currently expected to approach 0.9pu by 2008 under some conditions.

3.3.14 Broadly, Transpower's response was that it is possible to improve the power factor within distribution networks, but investment within the distribution network would not provide the required response times to meet certain events.

3.3.15 Transpower stated that it made the following assumptions in assessing the requirement for additional reactive power compensation in the Auckland and North Isthmus regions:

- (a) The load power factors at the grid exit points (**GXP**s) in the Auckland and North Isthmus regions will remain at the current level (regional power factor of approximately 0.99). Power factor correcting capacitor banks (up to about 100MVar in total in year 2010) will be progressively installed, either within the distribution networks or at the GXPs.

(b) Up to a total of +260/-150MVAR of reactive power support from synchronous condensers can be procured through the system operator ancillary service procurement contracts by 2010.

3.3.16 Transpower believes that installing capacitor banks at Kaitaia (GDP 3) is a better option than improving the network power factor since the “*binary capacitors can be switched in and out quickly, and in steps of small quantities*”. Transpower stated that⁵:

“... voltage support in [this form] is required for:

- a. *improving the post contingency voltage recovery performance, within the entire region, and*
- b. *limiting the switching voltages during capacitor switching.*”

3.3.17 Transpower considers that adjusting the power factor at Kaitaia would be helpful, but would not eliminate the need for fast control action.

Q7 GDP 5: Bay of Plenty Upgrades – cost-breakdown

3.3.18 The Commission requested that Transpower provide further information about the cost break-down of the proposed upgrade. Transpower provided the following cost breakdown of the project:

Table 3: Cost breakdown for GDP 5

Investment Item	Costs
Lines:	
Reconducting TGA-HAI 110 kV	\$2.0 m
Substations:	
Switching station at HAI	\$9.9 m
Capacitor bank at TGA	\$1.0 m
Property (Note 1)	\$0.1 m
Project Management (Note 1)	\$0.5 m
Total (excluding allowance for financial (eg inflation) contingencies or Interest During Construction)	\$13.5 m
Note 1: As these projects are to be managed as a single project the costs have been consolidated for the overall project.	

Q7b GDP 5: Bay of Plenty Upgrades – managing of the contingent circuit overloads on the 110kV network in the Bay of Plenty subsequent to GDP 5

3.3.19 The Commission asked Transpower to provide information about how Transpower would manage contingent circuit overloads on the 110kV network in the Bay of Plenty subsequent to installing the Hairini switching station.

3.3.20 Transpower stated that GDP 5 creates a switching station at Hairini, which divides the 110kV line into a Hairini to Tauranga/Mount Maunganui section,

⁵ 1 February Response, answer to Q6.

and a Hairini /Te Matai to Tarukenga section. Transpower then discussed each of the two sections in turn.

Hairini to Tauranga /Mount Maunganui

- 3.3.21 With the Hairini switching station there are three circuits, one direct from Hairini to Tauranga, one direct from Hairini to Mount Maunganui, and a shared Hairini–Tauranga–Mount Maunganui circuit.
- 3.3.22 Transpower stated that the rating of both circuits to Tauranga must be increased by reconductoring to meet load growth at Tauranga.
- 3.3.23 Transpower also stated that load growth will eventually mean that, if the Hairini-Tauranga direct circuit has an outage, the shared circuit will overload and the circuit breaker will need to be opened. Transpower states that addressing this problem will require either:
- (a) installing a third circuit on Hairini-Mount Maunganui; or
 - (b) limiting the Mount Maunganui load and transferring the load growth to Te Matai (or a new GXP), supplied from Hairini.
- 3.3.24 Transpower, in conjunction with Powerco, is currently investigating the most viable and cost-effective solution.

Hairini/Te Matai to Tarukenga

- 3.3.25 Transpower stated that with the Hairini switching station, supply to the Bay of Plenty 110kV area would be through two direct Hairini-Tarukenga circuits and an indirect Hairini-Te Matai-Okere-Tarukenga circuit. From 2009, load growth could cause:
- (a) an outage of the Hairini-Tarukenga circuit to overload the Okere-Tarukenga circuit;
 - (b) the Tarukenga interconnecting transformers to overload; and
 - (c) increased voltage/reactive power support to be required due to supplying the Bay of Plenty load over long simplex circuits from the Wairakei/Whakamaru area.
- 3.3.26 Transpower considers the ultimate solution is supplying Hairini at 220kV from Tarukenga, with interconnecting transformers at Hairini. The Hairini-Tarukenga double circuit line was constructed at 220kV but is presently operated at 110kV, and converting it will require some line work. Transpower also considers extra reactive support will be required in the Bay of Plenty area.
- 3.3.27 Transpower stated it is investigating deferring this upgrade by thermally upgrading some lines in the area. The Hairini switching station is required as a pre-requisite for either option.

Q7c GDP 5: Improving power factor in the distribution network

- 3.3.28 Transpower stated that a capacitor at the GXP would allow the system operator to manage the power system in real time, which is not available by installing capacitors within the distribution network.
- 3.3.29 Transpower stated that it expects that, beyond 2009, there will be increasing need for voltage/reactive power support in the Bay of Plenty area. Transpower expects the best solution will be to improve the load to near unity power factor at all GXPs in the Bay of Plenty. Transpower expects, in addition to GDP 5, to replace the existing Tauranga 110/33kV supply transformers under a new investment contract between Transpower and PowerCo.
- 3.3.30 Transpower considered that the Bay of Plenty reactive power support should be developed like Auckland's, with embedded capacitors being installed after the transmission level capacitors and supply transformers with OLTC installed.

Q8 GDPs 6 and 8: Is the total cost \$9.2 million or \$4.6 million?

- 3.3.31 Transpower confirmed the total cost was \$9.2 million. The estimate includes allowance for financial (eg inflation) contingencies and interest during construction.

Q9 All GDPs: Breakdown of contingency calculations for each project

- 3.3.32 Transpower has calculated three different figures:
- (a) **Estimated Cost** – a mid-range cost estimate in 2005 dollars, which incorporates scope and quantity project contingencies;
 - (b) **Expected Cost** – nominal equivalent of Estimated Cost, incorporating adjustments for inflation, exchange rate (where available) and interest during construction. It is also a mid-range estimate; and
 - (c) **Approval Requested from EC** – an upper-bound estimate incorporating potential inaccuracies in the underlying cost estimates.
- 3.3.33 Transpower stated it has sought the upper-bound estimate for approval since it would avoid the potential delays, costs, and system and commercial risks associated with having to seek approval for additional project expenditure in the event that project costs exceed the expected costs estimate.
- 3.3.34 Beyond this, Transpower did not provide any detailed information about the source of each contingency or why the contingency levels vary from project to project.

4 ANALYSIS OF SUBMISSIONS

4.1.1 Submissions were received from the following parties by the closing date of 8 February 2006:

Table 4: Breakdown of Submitters

Retailer/ Generator	Distributors	Transmission	End Users
Meridian Energy Mighty River Power (MRP) Genesis Energy Contact Energy	Northpower PowerCo	Transpower	Comalco Carter Holt Harvey (CHH) Strata Consulting on behalf of the Major Electricity Users' Group (MEUG) Auckland Federated Farmers

4.1.2 This section sets out the Commission's summary and response to submissions.

4.2 Consultation Questions

4.2.1 Interested parties were asked to provide feedback on the following questions:

- Q1. Do submitters agree with the indicative decisions set out in this paper? Please outline your view and provide details of any analysis or your reasoning that supports that view.
- Q2. Can submitters recommend any alternatives to one or more of the GDPs? If so, please state the GDP and outline details of that alternative.
- Q3. Do submitters have any views, in particular, on whether GDP 9 is an economic investment or not?
- Q4. The costs given for Huntly East (GDP 10) are higher than expected and Transpower has proposed a double breaker configuration rather than a cheaper breaker and a half configuration. Do submitters have any views on the costs of the project?

4.3 General comments

4.3.1 Interested parties generally supported the Commission's indicative decisions. The main issues raised by submitters were:

- (a) transparency of information;
- (b) the relationship with Commerce Commission's investigation of Transpower; and

- (c) the impact of the GDPs on Transpower's proposed North Island 400kV project (**400kV Proposal**).

4.3.2 Those issues are addressed in turn below.

Transparency of information

- 4.3.3 Genesis requested the methods for applying Test C be made available to the public to increase the transparency and understanding of the decision-making process.
- 4.3.4 The Commission notes that Test C is a technical test that considers alternatives to the GDPs that also meet the N-1 security constraint. The Commission and its advisers have used high level power systems analysis, where appropriate, building on the case files made available on the Commission's website during the consultation on the Initial Statement of Opportunities (**Initial SOO**). While the case files from Power Systems Simulator for Engineering (**PSS/E**) can be made available when power systems analysis is undertaken, not all participants are able to make use of such files and run their own analysis.
- 4.3.5 However, this is only part of the application of Test C. The Commission's analysis also relies on the experience of staff and advisers in the engineering profession. The Commission has also modelled the proposed investment as part of the ongoing work on evaluating Transpower's 400kV Proposal⁶.
- 4.3.6 Furthermore, the consultation process is in itself part of the application of Test C as the Commission checks to see if there are alternatives to Transpower's proposal, which would mean that the expenditure is not prudent or necessary to meet Transpower's current GRS.

Relationship with Commerce Commission investigation of Transpower

- 4.3.7 MRP submitted that the Commission should be aware of the implications of the Commerce Commission's intimations that Transpower may have sought authorisation for expenditure that actually is 'normal ongoing expenditure', and therefore does not validly qualify for Commission approval.
- 4.3.8 The Commission notes the point but considers that there is sufficient information that the GDPs could be more than 'normal ongoing expenditure'. The Commerce Commission may carry out more extensive investigations into the justifications for Transpower's prices. In addition, the papers referred to in the Commerce Commission's current investigation concern the tactical transmission upgrade (TTU) Application made on 14 April 2005, not the GDP Applications.

⁶ PSS/E files that include this modelling will be released in April 2006 as part of the Commission's draft decision on Transpower's 400kV Proposal.

Impact of GDPs on 400kV Proposal

- 4.3.9 MEUG suggested that the Commission review the impact of the proposed GDPs on transmission and non-transmission projects it is considering as alternative projects in the application of the grid investment test (**GIT**) to Transpower's 400kV Proposal. MEUG recommended the Commission take an integrated view for the Auckland projects (including transmission alternatives) to improve understanding of the urgency and value of the GDPs.
- 4.3.10 Meridian raised concerns that proposals were 'quick fix' and not long-term solutions to security of supply issues. It, therefore, believed that it is important to progress Transpower's 400kV Proposal in parallel with the GDPs.
- 4.3.11 In response to MEUG's and Meridian's comments, the Commission notes that it has been considering the proposed GDPs and Transpower's 400kV Proposal at the same time. The power systems analysis being undertaken in relation to Transpower's proposed North Island 400kV project is considering various combinations of the GDPs, the 400kV project, and other alternatives. The GDPs need to be implemented as soon as possible, are highly effective when compared with other alternatives and, based on analysis completed to date⁷, will work well in conjunction with either Transpower's 400kV Proposal or any of the 'short short-listed' alternatives identified through the Commission's work to analyse the 400kV Proposal.

4.4 GDPs 1-3: Reactive support in the Upper North Island

- 4.4.1 Northpower is in favour of additional voltage support in the upper North Island until there is more generation north of Auckland, and believes that Auckland and Zone 1 customers should not meet the entire cost as there is benefit to the core grid.
- 4.4.2 Northpower questioned whether the two 100MVAR banks at Albany were additional to, or replacements of, the 100MVAR capacitors already in place in the region. Northpower states that these capacitors are nearing end-of-life and the consultation paper did not make it clear whether Transpower's proposals were additions or replacements.
- 4.4.3 The Commission understands that Transpower's proposal is for additional capacitors. A further discussion on the status of the in-service capacitors can be found on pages 34-36 of the '*Comprehensive Plan for Asset Management and Operation of the Grid*' Transpower New Zealand Limited, September 2005.

⁷ Please see the Commission's report '*Alternatives to Transpower's proposed Whakamaru-Otahuhu 400kV transmission line: alternatives analysis stage II*' on the Commission's website at the following address: <http://www.electricitycommission.govt.nz/consultation/auckalshort>.

Power factor within distributors' networks

- 4.4.4 Comalco, Northpower, and MEUG support discussion of distributed power factor correction possibilities.
- 4.4.5 MEUG submitted that it was not clear whether the Commission had considered this proposal in light of the possible implications of the non-transmission alternatives that it is developing for the Auckland and North Isthmus region.
- 4.4.6 Northpower believes that the overall power factor in the region has improved in recent years because of investment in capacitors in the Northpower network and by end use customers. Northpower consequently considers that installing capacitor banks in the Northpower network would not have a significant effect on the voltage in Kaitaia.
- 4.4.7 Contact and Comalco submitted that it is unclear whether power factor is a responsibility of Transpower or the network concerned. Contact requests clarification from the Commission on comments relating to the responsibility for power factor.
- 4.4.8 The Commission agrees with submitters' concerns, as discussed in paragraphs 4.4.6 and 4.4.7, and, in considering the issue of responsibility for distribution network power factors, believes that this should be considered in the development of the Benchmark (transmission) Agreements.

4.5 GDP 4: Thermal Upgrade of Whakamaru-Otahuhu 220kV circuits A and B

- 4.5.1 Contact commended the Commission on recognition of the difficulties associated with implementing this scheme. Northpower stated it was unable to comment on the merits of GDP 4 because the consultation paper did not elaborate on alternatives.

Easement costs

- 4.5.2 Auckland Federated Farmers and CHH raised concerns about the adequacy of the allowance for property costs. Auckland Federated Farmers considered that property costs should be addressed independently of GDP 4 project costs because long standing property rights and costs need to be addressed whether the lines are upgraded or not.
- 4.5.3 CHH requested clarification of Transpower's costing of property rights, and are uncertain whether the Commission's determination of a positive cost-benefit analysis in respect of GDP 4 is accurate.
- 4.5.4 The Commission notes CHH's and Federated Farmers' concerns about property costs. However, the Commission considers that resolution of any property right issues related to existing lines is outside the scope of its role.
- 4.5.5 Compensation for Transpower's use of land is a matter for negotiation between landowners and Transpower, and if these parties are unable to

reach an agreement, a matter for consideration under the Public Works Act 1981. Furthermore, the Commission considers that it is Transpower's responsibility to manage the costs of a project within its approved expenditure.

- 4.5.6 In response to CHH's point, the Commission notes that it has not carried out a formal cost-benefit analysis of GDP 4 (rule 16.2.4 specifically states that the Commission is not required to carry out such an analysis), but has instead assessed the project's technical desirability and carried out a more limited consideration of the likely alternatives to it. The Commission considers that, if land costs are so high that the project will become uneconomic compared to alternatives, Transpower is unlikely to continue with the investment.

N-2 and link to Commerce Commission regime

- 4.5.7 MEUG submitted that it is unlikely that there would be a price competitive non-transmission alternative. In addition, MEUG suggested that this project may have implications on Transpower's ability to charge for the investments under the Commerce Commission's price control threshold because the Commission regards the project as '*effectively meeting an N-2 contingent scenario*'.
- 4.5.8 MEUG noted that the implications of this statement were not explored further in the consultation document. MEUG considers that if the statement holds true, the investment (or part of it) would give rise to an increased service level above the current GRS, and that there may be implications for Transpower's ability to charge for investments under the Commerce Commission's price control threshold. MEUG believes it is important for the Commission to clarify its understanding regarding the service level that will be delivered by this project.
- 4.5.9 The Commission notes MEUG's concerns about the N-2 contingent scenario. The Commission's modelling identifies that, while Transpower has justified this GDP on an N-2 contingent scenario, by 2011 the GDP will address an N-1 contingent scenario.
- 4.5.10 Given the relatively low cost of GDP 4 and the high value of the potential cost of unserved energy, the Commission considers that it is unlikely that GDP 4 would result in reliability outcomes in excess of the GRS.
- 4.5.11 Furthermore, although the N-1 risks may not occur until 2011, given several risks around the implementation of this GDP, and in particular the ability to obtain outage windows of sufficient length to perform the upgrade, the Commission considers it is prudent to make the investment now.

4.6 GDP 5: Bay of Plenty upgrades

Assumptions about the availability of Kaimai generation

- 4.6.1 In order to evaluate GDP 5, Contact requested that assumptions about the level of Kaimai generation be explicitly stated. It also requested that Transpower and the Commission form a common assumption on the availability of generation in conjunction with the plant operator.
- 4.6.2 While the Commission has sufficient data to ascertain the availability of Kaimai generation plant (which is embedded at the Tauranga 33kV GXP), the impact of the plant on peak demand has yet to be analysed in sufficient detail for inclusion in the regional demand forecasts published by the Commission.
- 4.6.3 The Commission understands that Transpower considers the Kaimai plant may be able to generate a minimum of 14MW, although planning studies have also been carried out based on the assumption that it is not available during peak demand periods. The Commission considers that, since the Kaimai plant has not been explicitly modelled in the regional demand forecasts, the assumption that it is unable to generate is a prudent one at this stage.

GDP 5 is customer specific

- 4.6.4 MEUG questioned the categorisation of this project. It considers that there are specific benefits to customers in Tauranga and Mt Maunganui, so it may be more appropriate to consider the projects as customer specific.
- 4.6.5 MEUG also raised concerns with Transpower's statement that:
- 'A 25MVAR capacitor bank is also required at Tauranga to relieve the existing low voltage issues... following a circuit outage'.*
- 4.6.6 MEUG submitted that this statement implies the new 25MVAR capacitor bank may be normal expenditure because it is required to manage transmission outages rather than provide for future load growth.
- 4.6.7 MRP considered the project could be justified as a reliability investment, but also pointed to significant economic benefit for customers which it recommended the Commission take into account as part of the GIT.
- 4.6.8 The Commission notes that the relevant nodes are currently defined as interconnection assets in the existing transmission pricing methodology, and as such, the Commission considers that the GDP is not customer specific.
- 4.6.9 In relation to MRP's comment about taking economic benefits into account as part of the GIT, the Commission notes that the GIT is not being applied to GDP 5, since it has been submitted as IGE rather than as part of a GUP.

Extending the scope of GDP 5

- 4.6.10 PowerCo strongly supports GDP 5 because it considers that maintaining N-1 security in the region is already problematic. Given the period needed to design and construct the network upgrade and the operational difficulties already existing on the transmission network, Powerco has suggested that Transpower include in the plans the conversion of the Tarukenga-Hairini circuits to 220kV with Hairini being a 220/110 interconnecting station.
- 4.6.11 The Commission notes that Transpower intends to upgrade the Hairini-Tarukenga circuit to 220kV in the future and is designing the Hairini station with that in mind. The Commission would consider such further future upgrades if Transpower submits them for approval as part of a GUP.

4.7 GDP 6: Replacement of the 220/110kV inter-connecting transformers at Stoke and GDP 8: Replacement of the 220/110kV inter-connecting transformers at Kikiwa.

- 4.7.1 MEUG supports both these projects and considers they represent good value at approximately \$92,000 per MW. To gain the full benefits, MEUG considers that it is essential that GDPs 6 and 8 are both approved and commissioned.

4.8 GDP 7: 220kV bus security upgrade at Kikiwa

- 4.8.1 MEUG supports this project because it delivers reliability benefits at low cost.

4.9 GDP 9: Reconductoring the 220kV Aviemore-Waitaki-Livingston circuits

- 4.9.1 Genesis reiterated its concern about the Commission's application of Test C. Genesis requested that the information used and the results of the test be made available to increase the transparency of the approval process and enhance the Commission's accountability in decision-making. Genesis further considered that this would also assist parties to provide constructive feedback.

Economic investment categorisation

- 4.9.2 Contact, Meridian, and Transpower did not agree with the Commission's categorisation of this project as an economic investment. They consider the reconductoring to be an important security upgrade that will assist with security of supply into the lower South Island during dry periods. Meridian supplied a power flow analysis of GDP 9.
- 4.9.3 Meridian has also submitted that a deteriorating asset can also be a health and safety issue, in which case the project should be expedited.
- 4.9.4 MEUG agreed with the Commission's classification of the project as an economic investment on the assumption that the Commission's analysis is correct, and that generation will be able to be re-dispatched to relieve any constraint. MEUG considers the Commission's request that Transpower

- resubmit the proposal under a GUP to be appropriate and will probably lead to the investment going ahead in due course.
- 4.9.5 The Commission acknowledges Contact, Meridian, and Transpower's points, and appreciates the power flow analysis provided by Meridian. However, the material contained in submissions did not cause the Commission to change its view that it considers the investment is an economic investment. The following paragraphs explain this reasoning in more detail.
- 4.9.6 During dry years in the South Island, the hydro generators reduce their rate of electricity generation (compared to wet years) well before the lakes run dry. This is seen as part of the business strategy of such generators and is a key factor in their bidding and offering behaviour. Such generators make a trade-off between supplying electricity now, and the risk of running out of water and being unable to supply at all in the future.
- 4.9.7 From comments provided in Meridian's submission, it appears that the desire for the investment appears to have arisen through the improved opportunities provided by the duplexing of the Livingston-Islington circuits (currently being installed by Transpower).
- 4.9.8 If GDP 9 is implemented, this would allow hydro generators in the region to generate more and export more energy from the available hydro capacity in the lakes than they are currently able to due to the existing transmission constraint. However, such generators still have to manage their longer-term risks related to the availability of fuel, ie water, and the lake levels.
- 4.9.9 The installation of GDP 9 would, in theory, allow the hydro generators to reduce lake levels more quickly at the same level of risk, and so receive greater revenues from the increase in generation able to be exported from the region.
- 4.9.10 Meridian's power flow analysis assumes a contingent event on the ASB-TWZ circuit, which leads to the AVI-WTK-LIV circuit overloading in a dry year when electricity is being transferred south from Livingstone and Twizel. The analysis assumes that Clyde and Roxburgh are only producing at 300MW and 200MW respectively, but the Commission notes that the capacity of these two stations is 432MW and 320MW respectively, and they could supply at this higher capacity until the ASB-TWZ fault is fixed.
- 4.9.11 The Commission considers that there could be benefits to allowing hydro generators to reduce lake levels more quickly, but the investments that provide such benefits are more appropriately categorised as economic rather than reliability investments. Consequently, the Commission still considers that this GDP is an economic investment that it cannot approve under rule 16, the focus of which is reliability.
- 4.9.12 If GDP 9 is re-submitted as an economic investment in the GUP, it would be required to pass the GIT, ie maximise the expected net market compared to a number of alternative projects, before the Commission could approve it. If the investment passes the GIT, it would be likely to be approved and, as an

interconnection asset, be funded by off-take customers. If the investment does not pass the GIT, that will be because other measures are likely to be more economic. For example, it may be more economic:

- (a) for Transpower to contract with Meridian and/or Contact to retain water in the lakes for grid support; or
- (b) to simply rely on existing market incentives, given Meridian's current exposure as a major retailer in the South Island.

4.9.13 The Commission considers that Meridian's comment about health and safety issues should, in the first instance, be handled by Transpower as part of its normal ongoing grid expenditure. Such expenditure is unlikely to be considered for approval under rule 16.

4.10 GDP 10 Installing a 220kV switching station at Huntly East

4.10.1 Contact, Genesis, MEUG, Meridian, Auckland Federated Farmers, and PowerCo acknowledged that GDP 10 has merit as it will improve security of supply into Auckland.

Breaker configuration

4.10.2 Meridian and Genesis requested an explanation of what a double breaker configuration is, the advantages and disadvantages of it, and the cost.

4.10.3 PowerCo has suggested an alternative configuration. PowerCo believes the choice of substation configuration depends on which is considered more important: maintaining power flow from HLY to OTA, from WKM to OTA, from HLY to WKM, or all three.

4.10.4 PowerCo assumed that the flow from HLY to OTA is the main driver for the project given that Transpower's 400kV Proposal would provide the necessary path from WKM to OTA. It considers the breaker and a half substation design has served New Zealand well in the past. If failure of the half breaker on the OTA-WKM 3 circuit is considered too great a risk, PowerCo suggested that perhaps a hybrid of breaker and a half and double breaker configuration could be used, with OTA-WKM 3 circuit having double breaker configuration and the remaining circuits having breaker and a half configuration. PowerCo's alternative configuration depends on the 400kV Proposal being approved.

4.10.5 MEUG supported the Commission's action in questioning the costs of the project because they are not insignificant. Transpower submitted that, while costs are important, the Commission must also fully consider the resulting benefits of any project.

4.10.6 The Commission's focus in asking for comment on this question was largely in relation to cost. The Commission accepts that the benefits of a project must also be balanced against those costs. However, the Commission also notes that Transpower has not provided detailed cost-benefit or reliability

calculations to support its selection of the more expensive double breaker substation configuration.

- 4.10.7 On 7 February 2006, Transpower provided a brief explanation as to the merits of the double breaker proposal versus a breaker and a half substation configuration. A copy of that information is attached as Appendix C of this paper.
- 4.10.8 To assist in estimating the cost of the project, the Commission's adviser, Parsons Brinckerhoff Associates Limited (**PBA**), prepared substation plans for both the double breaker and breaker and a half arrangement, which are contained in Appendix D of this paper. These plans show that a breaker and a half substation is roughly 50% smaller in physical size than a double breaker substation⁸.
- 4.10.9 PBA has also prepared similar plans for an ultimate development of the substation with the WKM-OTA A and B circuits bussed. PBA has estimated the cost of completing GDP 10 at \$12 million (2010 dollars including contingency and interest during construction) based on a breaker and a half arrangement.
- 4.10.10 The PBA estimate of efficient costs is substantially different from Transpower's application of \$31.7 million for a double breaker arrangement. PBA's costs are based on those used for the Transpower ODV⁹ and have been well tested in recent years. Clarification sought from Transpower has revealed that due to the rapid initiation of the project application, a number of items had been factored in as risks. For example, site foundation condition and elevation data was not available so allowances have been made to cover geotechnical uncertainties; and the gross cost of the land purchased was included.
- 4.10.11 The Commission still has concerns that both the use of a double breaker arrangement and the cost proposed are well in excess of what is necessary. Rather than further delaying the consideration process or declining the application, the Commission has decided to delegate to the Commission's Chair the authority to approve the appropriate amount of expenditure on the project after receiving Transpower's agreement to provide a refined cost estimate.

⁸ Transpower's 400kV Proposal has a breaker and a half arrangement for both WKM and OTA substations at 400kV and OTA at 220kV.

⁹ The Optimised Deprival Value (ODV) is a method for valuing fixed assets. It is the lesser of Optimised Depreciated Replacement Cost (ODRC) and Economic Value (EV). The ODRC is the replacement cost of the existing system fixed assets at the Modern Equivalent Asset (MEA) value. The MEA valuation is an engineering optimisation which replicates the service capability but using the most up-to-date technology. Assets are then depreciated according to the age of the actual assets employed. The EV is the value of the least cost alternative to the asset. For instance, the EV value of a spur line may be valued at the cost of diesel generation (being the physical alternative to a connection to the grid). The ODV method was first specified in 1990 for the valuation of the fixed assets of Transpower and was adopted later for distribution businesses. It was designed to produce easily comparable valuations for network assets consistent with contestable market outcomes and providing a benchmark to compare returns.

Impact of GDP 10 on Transpower's 400kV Proposal

4.10.12 MEUG submits that it may be more correct to consider the project under the Commission's processes for transmission alternatives to the 400kV Proposal, because MEUG considers this project a stop-gap to manage any delays in commissioning the 400kV Proposal.

4.10.13 The Commission notes that GDP 10 has been considered under those processes.

4.11 GDP 11: Installing a 30MVar capacitor bank at Bombay

4.11.1 No submissions specific to this project were received.

5 COMMISSION'S FINAL DECISIONS

5.1 Summary of Decisions

5.1.1 The Commission has considered the issues raised in submissions, and the information provided by Transpower in support of the GDP Applications. On the basis of the information provided to it, the Commission's Board made the following decisions in respect of the GDP Applications at its 8/9 November 2005 Board meeting. The Board:

- (a) declined to approve interim grid expenditure for Category D GDP Project 9 under rule 16 as the Board considers that the expenditure is not reasonably prudent or necessary to meet Transpower's current grid reliability standards; and invited Transpower to submit the project as an economic investment as part of a grid upgrade plan;
- (b) agreed in respect of GDP 1 to approve \$26 million of interim grid expenditure that is related to the SVC and investigation and preliminary design for an RPC (subject to the qualifications set out in resolution d below), but
 - (i) deferred the decision in respect of the amount of interim grid expenditure required for the RPC until its scope can be more clearly defined; and
 - (ii) requested Transpower investigate the benefits of different RPCs and provide further information to the Commission on these benefits, noting that this investigation may take about 12 months to complete;
- (c) in respect of GDP 10:
 - (i) noted that Commission analysis shows that this is an urgent reliability investment that needs to be implemented as soon as possible;
 - (ii) noted its concerns about Transpower's cost estimate, which may include excessive contingency sums due to Transpower's understandably rapid preparation of this proposal;
 - (iii) agreed that Transpower be requested to agree to provide a more refined cost estimate after it has completed further investigations;
 - (iv) agreed that, on the information it has to date, it considers that expenditure on the project up to the lowest of Transpower's current cost estimate, Transpower's refined cost estimate, or the actual nominal cost of the project at the time of commissioning (ie the capitalised book value) is:

- additional to Transpower's normal ongoing grid expenditure; and
 - reasonably prudent or necessary to meet Transpower's current grid reliability standards.
- (d) agreed, in respect of GDPs 1,2,3,4,5,6,7,8, and 11, to approve the amounts of interim grid expenditure contained in the 'Amount approved' column of the table below. This approval included a note that the Commission considers that any amounts of interim grid expenditure approved under rule 16 would be the maximum amount on which customer charges could be based and, as such, customer charges would be based on the lesser of the approved amount or the actual nominal cost of the project at the time of commissioning (ie the capitalised book value).

Table 5: Approval Amounts

	Description	Approval requested from EC (\$m)	Start	Finish	Approval category	Amount approved (\$m)
GDP 1	Reactive support in the Upper North Island:	\$39.4	2005	2007	C/A	\$26.0
	– 100MVAR SVC at Albany (including RPC)					
GDP 2	– 100MVAR capacitor bank at Albany 220kV					
GDP 3	– 24MVAR capacitor bank at Kaitaia				A	\$2.6
GDP 4	Thermal upgrade of the 220kV Otahuhu-Whakamaru 1 and 2 circuits	\$13.5	2006	2008	A	\$13.5
GDP 5	Enhancement of the transmission network in the Bay of Plenty as follows:	\$15.8	2006	2008	A	\$15.8
	– New switching station at Hairini					
	– New 25MVAR capacitor bank at Tauranga					
	– Reconductoring the 110kV Hairini-Tauranga transmission line					
GDP 6	Replacement of 220/110kV interconnecting transformers at:	\$9.2	2006	2007	A	\$9.2
	– Kikiwa and					
GDP 8	– Stoke				A	
GDP 7	220kV bus security upgrade at Kikiwa	\$4.2	2005	2007	A	\$4.2

	Description	Approval requested from EC (\$m)	Start	Finish	Approval category	Amount approved (\$m)
GDP 9	Reconductoring the 220kV Aviemore-Waitaki-Livingstone circuits	\$14.3	2006	2008	D	0
GDP10	A new 220kV switching station at Huntly East	\$33.5	2005	2008	A	TBA
GDP11	30MVAR capacitor bank at Bombay	\$1.8	2005	2008	A	\$1.8
	Total	\$131.7	2005	2008		\$76.5

5.2 Explanation of Decisions

Test A: IGE proposed by Transpower before the Board makes final decisions on the grid upgrade plan

5.2.1 In reliance on the information provided by Transpower, the Commission is satisfied that Test A is met for these GDPs. The GDPs are proposed, and not yet committed to. The only expenditure that has been incurred by Transpower before the Commission's approval was the purchase of land based on a one-off opportunity, which can be sold if the GDP is not approved.

Test B: proposed grid expenditure must be additional to Transpower's normal ongoing grid expenditure (rule 16.2.2).

5.2.2 The Commission is satisfied, on the basis of the information provided by Transpower, that the proposed IGE is additional to Transpower's normal ongoing grid expenditure (since the GDPs are expanding current grid capacity, rather than simply maintaining it). On that basis, Test B is met.

Individual decisions on GDPs (after consideration of Test C, rule 16.2.3)

5.2.3 GDP 1 was partially approved. The Commission decided that there was not sufficient evidence to determine if the scope of the RPC component of GDP 1 passes Test C. The Commission notes that management of reactive power in the Auckland area will be increasingly critical to maintaining grid security in future years, so considers the remainder of GDP 1 (the instalment of the SVC) should be progressed now.

5.2.4 Based on the information provided by Transpower (the manufacturers' estimates referred to in Table 2), the Commission has estimated that a cost of \$24.5 million should be allowed for provision of the SVC. This figure is determined from an average of the manufacturers' estimates plus contingency for escalation of costs between 2005 and 2007. A further \$1.5 million could be used to support investigation and preliminary design of an RPC. Therefore, in total, the Commission considers that \$26 million is the amount that is reasonably prudent and necessary, and can therefore be approved, for GDP 1.

- 5.2.5 *GDP 2* was approved as the Commission's analysis is that this GDP is important for security of supply into Auckland.
- 5.2.6 *GDP 3* was approved as the Commission considers that there is need for some action on voltage support at Kaitaia. Transpower has provided sufficient information that the faster reaction speeds from capacitors at the GXPs mean that this proposal is likely to be the best alternative.
- 5.2.7 If distribution network investment is, in fact, more efficient, the degree of disbenefit will not be substantial as this investment could still occur at a later stage. The Commission also notes that it has no mechanism available to require efficient investment in distribution networks.
- 5.2.8 *GDP 4* was approved as it provides important support to Auckland, both if the 400kV Proposal is approved but delayed for any reason, or if it is not approved. The Commission supports beginning work on this project now due to possible difficulties in obtaining:
- (a) the necessary property rights and Resource Management Act consents; and
 - (b) an outage window of sufficient length as power demands in the upper North Island increase.
- 5.2.9 The Commission notes submitters' concerns about the costs of the property rights purchases, but considers this is best handled by Transpower and the property owners.
- 5.2.10 *GDP 5* was approved as the Commission's analysis indicates that these projects are necessary in the Bay of Plenty. Transpower has provided sufficient reason for installing capacitors at the GXPs, and for future upgrades of circuits after the installation of the switching station.
- 5.2.11 *GDPs 6 and 8* were approved now that Transpower has clarified the total project cost to be \$9.2 million. The Commission's own analysis indicates that the transformers are needed to stop overloading during peak periods in 2007.
- 5.2.12 *GDP 7* was approved as the Commission's analysis is that this approval increases reliability for minimal cost.
- 5.2.13 *GDP 9* was not approved, as the Commission still considers this is an economic investment, which the Commission does not have authority to approve as IGE under the Rules.
- 5.2.14 *GDP 10* has been approved in principle, but with approval of the actual amounts of IGE dependent on Transpower agreeing to provide a refined cost estimate. The Commission's own analysis is that this is an urgent reliability investment that needs to be implemented as soon as possible, but still has concerns about the cost estimate and the size of the contingency.

5.2.15 *GDP 11* has been approved as the Commission's own analysis indicates that it is important in the short term until further investment occurs in the 110kV network, and it will have long-term benefits in the Auckland region.

**Appendix A. Information Provided by Transpower, 1 February
2006**

Appendix B. RPC Discussion Paper

Appendix C. Information Provided by Transpower, 7 February 2006

Appendix D. PBA Substation Plans