



TRANSPower NEW ZEALAND LIMITED

Comments to the
Electricity Commission
on 400 kV Draft Decision

Volume I – Overview

June 2006

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Background

On 31 May 2006 Transpower informed the Electricity Commission that it intended to amend its Auckland 400 kV grid investment proposal as set out in its Grid Upgrade Plan (GUP) of 30 September 2005. Consequently, the Commission suspended its consideration of the GUP proposal on 1 June 2006 but confirmed that it would still like to have interested parties comment on:

- the alternatives considered in the GUP proposal;
- issues around a potential transmission corridor; and
- the Commission's Draft Decision on the GUP proposal including its application of the Grid Investment Test.

This submission is in response to the Commission's request for such comments. Transpower has commenced work on the proposed amendment to the 400 kV GUP proposal and anticipates that the amendment will be submitted in July 2006.

Document Structure

Transpower's submission is divided into three volumes:

- Volume I sets out an overview of the key arguments in favour of Transpower's proposal;
- Volume II contains the technical detail and argument supporting the overview contained in Volume I. This includes an appendix containing responses to each of the Commission's 36 specific questions; and
- Volume III contains the supporting documents and references used within the preceding volumes.

This is **Volume I**.

Executive Summary

Investment Context

Transpower has proposed a strategic investment in a 400 kV transmission line to ensure Auckland enjoys reliable electricity supplies. The 400 kV is a strategic investment because it conclusively:

- meets supplies and responds to increasing industry concerns about security and reliability in the short term;
- meets supplies for at least the next 20 years based on present load forecasts; and
- supports a more competitive and renewable generation market.

This project is consistent with the pattern of “lumpy” strategic infrastructure investments that need to be made every 40-50 years. Such strategic infrastructure investments in the last period of investment (i.e. 1950s-60s) provided the foundations upon which the nation has prospered since, and included:

- motorway systems in the major cities;
- new airports in the major cities;
- a HVDC link providing bulk electricity between the South and North Islands; and
- a 220 kV transmission backbone through the North and South Islands.

In many cases the investments made were farsighted – beyond the demands of the present need, but building capacity for future generations.

We have enjoyed the benefits of that farsighted investment, and now in the 21st century New Zealand is again facing the need to invest in infrastructure with a view to the future.

Every 40-50 years New Zealand is faced with making strategic decisions about its infrastructure.

In the 21st century New Zealanders need to make strategic infrastructure decisions again.

“We need to remove the infrastructure constraints which hold back world class performance in Auckland, our only city of international scale.”

Prime Minister Rt. Hon. Helen Clark, Statement to Parliament, February 2006

Transpower’s 400 kV Proposal

Transpower, as New Zealand’s owner and operator of New Zealand’s National Grid (the high voltage lines and substations that connect generation to areas of demand), submitted a proposal to the Electricity Commission (the Commission) on 30 September 2005 to construct a new 400 kV line between Whakamaru and Otahuhu, which signalled that the time had come for another period of significant investment in transmission.

Transpower is just like any other service provider tasked with ensuring a reliable service, in this case transmission of electricity, is maintained. Just

as local authorities plan for local facilities (like roading, parks, water etc) taking into account the likely social and economic development of the region, so too does Transpower in planning the transmission network serving the region. Notwithstanding the recent outage in Auckland, Transpower has a proud record of making timely prudent investment to provide a high standard of service.¹

The Commission in a Draft Decision on the proposal has indicated that it intends to not approve Transpower's proposal. This submission responds to that decision by

- supporting Transpower's project against a more appropriately applied Grid Investment Test (GIT);
- underlining the need for this or similar investment under a broader application of the GIT; and
- signalling an intention to submit an amended proposal recognising the benefits to be obtained from staging Transpower's project.

It is Transpower's view that the ultimate move to a 400 kV backbone is the type of strategic investment that New Zealanders made 40-50 years ago, and have to make again now for future generations.

The proposal to upgrade capacity to Auckland by 2010 is to meet a present need for investment in Auckland. The proposal to construct at a higher voltage than presently used is both an economic and strategic decision taking into account the needs of Auckland and Northland over an extended horizon.

Transpower has concerns with the approach adopted by the Commission in its Draft Decision. We consider this reflects a limited application of the GIT by the Commission. In particular, risks of project delay including cost, and the longer term benefits of Transpower's proposal against the 'alternatives' have not been adequately accounted for.

We consider this outcome is largely representative of the significant workload the Commission has been faced with since formation, which has not allowed a more robust set of inputs to be developed. Transpower welcomes the opportunity to progress this in a transparent manner with the Commission to ensure that all stakeholders are aware of how the GIT processes could work for the benefit of New Zealand.

Transpower's Proposal Supports Competition, Renewable Generation and Economic Growth

Transpower's proposed 400 kV solution provides critical infrastructure to support competition, renewable generation options and economic growth. Specifically, Transpower's proposal

- provides better real certainty to generators about capacity and timing of transmission – giving them the incentive to commit to their own generation plans;

Transpower's 400 kV proposal is a strategic investment underpinning New Zealand's economic growth over the longer term.

Commission's approach represents a limited view of the Grid Investment Test.

Transpower proposal supports competition, renewable generation and economic growth.

¹ A recent international benchmarking report had Transpower ahead of North American and European averages in terms of strength of supply compared to cost of service.

- provides long-term confidence to investors in industry and commerce that supplies will be reliable and without the fear of high prices due to limited competition;
- provides better access to the Auckland electricity market for generators south of Huntly compared to the Commission's 'alternatives';
- supports renewable generation from planned and present generation south of Huntly;
- provides significant long term benefits, well beyond the limited timeframe used by the Commission in its application of the GIT; and
- provides for greater diversity of supply at Otahuhu.

Reliability of Supply will be affected if Transpower's line is not built

Transpower does not support the alternatives or their timeframes as proposed by the Commission. We consider that reliability of supply to Auckland will be adversely affected if Transpower's proposal or similar project is not built because:

- planning to operate the system at the extremes of its limits is not prudent practice; and
- the costs to all New Zealand of investing too late are far higher than the costs of investing too early.

In other words, deferring a new line until 2017 is not prudent industry practice, and restricts economic growth of the Auckland region which impacts negatively on New Zealand's economy as a whole. We cannot afford another Auckland blackout.

The Commission's alternative projects do not reflect good electricity industry practice

Transpower believes that the Commission's alternative projects and incremental upgrades before major investment do not reflect "good electricity industry practice", because:

- these solutions will unnecessarily prolong an already critical situation (i.e. increasing risk) by running the system close to its absolute technical and operational limits for another ten or eleven years;
- these solutions are risky to deliver in that the incremental upgrades are sequentially inter-dependent and being provided "just in time";
- delays in any of the incremental upgrades could defer the 2017 projects, risking reliability and increasing costs;
- a 220 kV development plan provides less capacity over time, meaning more lines and easements would be required sooner. It would be socially irresponsible to secure an easement for a transmission line and then build a line with medium capacity at best;
- a HVDC solution is too inflexible, expensive to upgrade or adapt, and inherently less reliable than a comparable 400 kV line; and
- deferring a major line until 2017 is technically unacceptable. Voltage control in particular would become increasingly difficult if

Reliability of supply will be affected if Transpower's line is not built.

Commission's alternatives do not reflect good electricity industry practice.

not impossible before this date.

The Commission's application of the Grid Investment Test is too limited

In Transpower's opinion, the Commission has arrived at the conclusions it has around alternatives because of its limited interpretation of the GIT.

Specifically, the Commission's application of the GIT

- understates the risks of delaying a new line;
- understates the benefits of a robust transmission grid;
- overstates the costs of Transpower's proposal;
- defines the Grid Reliability Standards too narrowly; and
- has been undertaken without adequate engagement from industry and Transpower.

Commission has arrived at its conclusions because of a limited application of the GIT.

Transpower's Proposal can be staged to provide maximum benefit without impacting on reliability of supply

Now that it has had an opportunity to see the outcomes of the Commission's methodology and how it applies the GIT, Transpower can reduce the cost of its own proposal by changing the timings of certain capital expenditures without adversely affecting reliability.

Transpower can reduce costs of its project through implementation timing.

Transpower's staged proposal (to be submitted separately), will detail the following:

- construction of a 400 kV capable transmission line by 2011/2012;
- running the 400 kV capable line initially at 220 kV from 2011/2012; and
- operating the line at 400 kV at some later date.

Transpower considers that its staged proposal can be approved under the existing rules because it:

- reflects good electricity industry practice in meeting the grid reliability standards;
- complies with the processes set out in Part F of the Electricity Governance Rules; and
- meets the requirements of the GIT and can be submitted in response to the details of the Commission's application of the GIT finally being available.

Looking to the Future

This has been a new experience for both Transpower and the Commission, and it is unsurprising that issues have arisen surrounding each other's interpretation of Part F of the Electricity Governance Rules and the GIT specifically.

To provide certainty for the evaluation of future projects, Transpower would like to work with the Commission and industry on a:

For the future, Part F supports Transpower as transmission

- robust, transparent and repeatable GIT framework that all parties can apply with some confidence.
- A memorandum of understanding that clearly articulates the roles of Transpower and the Commission in relation to transmission planning and regulatory oversight.

planner, and the Commission as auditor.

A situation where the Commission continues holding and applying the GIT framework in the absence of robust industry review provides no certainty for Transpower or the industry as to the viability of any project proposed. This situation is untenable over the longer term.

By contrast, a memorandum of understanding between Transpower and the Commission would provide “role clarity”, engender a trust based relationship and avoid the current duplication of planning activities and technical design.

Transpower’s view is that Part F of the Electricity Governance Rules supports Transpower as transmission planner and the Commission as auditor/reviewer. This interpretation can be largely made within the existing legislative framework – no changes to the rules or legislation are necessary.

1 Reliability of supply to Auckland will be adversely affected if Transpower's line is not built.

Not building a line until at least 2017 will put more strain on an increasingly stressed power system. While a few dollars may be saved by getting the investment timing right, the consequences of being too late are unthinkable for Auckland consumers and New Zealand's economy.

All of the transmission alternatives released by the Electricity Commission with its Draft Decision of 27 April 2006 propose deferring a major line into Auckland until at least 2017.

Transpower strongly believes that reliability of supply will be compromised unless a major grid backbone upgrade into Auckland is completed well before 2017. We consider that deferral of a new line for at least another ten years:

- is not consistent with internationally accepted "good electricity industry practice" as required by Part F of the Electricity Governance Rules;
- means the power system in the upper North Island runs closer to absolute limits for an extended amount of time. This is not prudent transmission planning and will incur unnecessary risks in system operation until a major upgrade is completed; and
- overlooks the fact that the consequences of investing too late are far higher than the costs of investing too early.

These issues are discussed further below.

1.1 *Deferring a new line until 2017 is not good electricity industry practice*

A key requirement of any proposed investment or alternative under Part F of the Rules is that it meets "good electricity industry practice". The Commission has taken a narrow interpretation of this phrase – limiting it to the design, construction and commissioning of new assets.

By contrast, Transpower considers that the phrase applies to the complete process of planning, commissioning, operating, maintaining and even decommissioning of transmission assets. It also extends to consideration of the wider social, economic and environmental impacts. At each of these discrete stages, a prudent transmission operator needs to consider the accepted industry practice worldwide in setting its own standards and guidelines.

In following this more inclusive and best practice approach, Transpower considers that the Commission's alternatives that defer a new line until at least 2017 do not reflect good electricity industry practice. Some specific

Deferral until 2017 is not consistent with good electricity industry practice.

Good electricity industry practice is a much broader concept than set out in the Commission's Draft Decision.

aspects of this are set out below. More detail can be found in Volume II.

1.1.1 Planning N-1 without largest generator compared to normal N-1

For supplying a major load (such as Auckland), accepted international industry practice is to plan the transmission network so that a combination of a generator being out and another outage contingency is able to be withstood on the system without supply disruption to end users (i.e. N-1 without largest generator or N-2). Even the Commission's own consultants noted that:

“Given that at least two recent US blackouts resulted from the combined loss of generation and transmission, Transpower’s decision to evaluate combinations of a major generating plant outage and a credible single contingency in its planning process is a prudent approach”²

Despite this advice, the Commission considers that only an N-1 approach is needed under the Grid Reliability Standards (GRS), whereby only the loss of one element on the system is considered.³ This approach is risky, as international experience demonstrates that blackouts are often due to a sequence of low probability events on the system which go even beyond N-2 (e.g. two component outages at once or in close sequence). For example, in North America, a 1996 disturbance affected more than 7.5 million people, and the September 2003 blackout in Italy affected some 57 million people. The Auckland blackout of 12 June 2006 affected approximately 750,000 people and was caused⁴ by the failure of one metal connector.

Commission’s approach to the GRS is fraught with risk.

1.1.2 Implementation – 400 kV versus 220 kV

“Good electricity industry practice” extends to considering the impact of the proposal on connected parties, industry stakeholders, and affected parties (e.g. landowners and communities). In developing the 400 kV proposal to supply an expanded 220 kV network around Auckland, Transpower considered:

- the efficiency of the power transfer through the 400 kV system compared to 220 kV;
- the effect of a longer term solution recognising the value of the easement (400 kV) compared to a medium term solution which would require a greater number of lines over a longer period (220 kV).

Again, the Commission's consultants pointed out that... *“(i)t is increasingly difficult to permit and build new transmission lines.”* On that basis a 400 kV solution would be more reflective of good electricity industry practice.

A 400 kV solution is more efficient and utilises a scarce line easement better than a 220 kV solution.

² Letter from GE Energy to Electricity Commission, 12 April 2006.

³ The Commission only allows consideration of the largest generator being out in Auckland on an economic rather than a reliability justification. Transpower considers this distorts the type of investments then considered (i.e. economically justified investments are likely to be less robust and risk being “just enough” compared to a reliability justified investment).

⁴ The final determination of the cause is not available at time of writing, but it is thought that the connector holding the earth wire was the source of the problem.

1.1.3 Operation and Maintenance

One advantage of Transpower's 400 kV proposal is that it has been planned considering the future operation and maintainability of the new assets. The designed capacity and operation of the line allow for periods of necessary substation and line maintenance even after allowing for live line work.

The Commission's alternatives derive benefits from the *possibility* that generation in Auckland is built before a new transmission line is installed. In preceding years, the periods when generation has to be constrained on will increase over time, such that it will be almost impossible for the interim work the Commission envisages being able to be undertaken on the transmission system. As thermal generation and transmission line maintenance both utilise summer "windows", it will be increasingly difficult to identify any useful low risk maintenance windows. Consequently, this lack of access for essential maintenance will itself lead to higher risks of outages as well as public safety issues.

1.2 Planning to operate at the system's extreme limits is not prudent

The Commission's alternatives all involve employing more reactive support or compensation in the transmission system. The effect of this support is to increase the load able to be supplied, but at the risk of increasing the normal operating voltage beyond the nominal 220 kV voltage of the system.

The Commission's consultants already noted that the

*"high level of...compensation indicated....confirms the need for additional transmission into the (Auckland) area."*⁵

In a highly compensated system there are four main problems, each of which can lead to voltage collapse and consequential blackouts:

- Should it occur, the voltage collapse is rapid (i.e. there is no opportunity for the system to be managed as it would be in a normally compensated system where the voltage decline can be detected and responded to).
- The critical voltage (e.g. the point of voltage collapse) is raised to within the "normal" operating voltage. (already at Otahuhu, while the nominal voltage is 220 kV, it is currently operated between 225 and 230 kV – evidence of a system that is already highly compensated).
- As the critical voltage increases, the operating margin for the system compresses, meaning that there is less room to adequately manage the power system dynamically.
- Each reactive component adds its own complexities to the power system in terms of control (the operating rules for switching in and out each component become more complex and difficult to co-ordinate when the power system is under stress).

⁵ Letter from GE Energy to Electricity Commission, 12 April 2006.

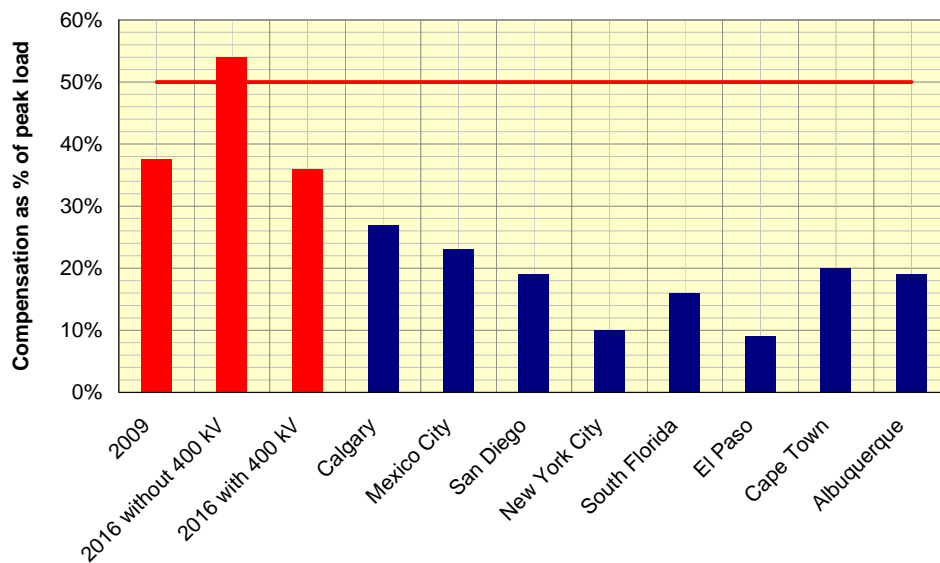
The Commission's alternatives devalue the importance of asset maintenance.

The Commission's alternatives all rely on operating the system closer to its extreme limits.

The immediate result of voltage collapse in the area would be total loss of the upper North Island load, with the majority of customer restoration estimated to take up to 12 hours (as restoration has to be co-ordinated between switching on generation and load). Transpower considers this risk to be unacceptable for New Zealand, both in terms of immediate consequences, but also long-term damage to New Zealand's international reputation.

Loss of voltage control could cause a total shutdown of the upper North Island for 12 or more hours.

On an international comparison, Auckland and Northland already have a highly compensated system, and this will become excessive (e.g. greater than 50% of peak load) by 2016 under any of the Commission's alternatives as shown in the chart below⁶:



Internationally, the upper North Island already has a highly compensated system. The Commission's alternatives will all exceed accepted levels of compensation.

A 50% compensation to peak load level is generally regarded as very high and accordingly good practice internationally avoids doing so for critical load areas, like Auckland.

1.3 The costs of investing too late are far higher than the costs of investing too early

Transpower strongly believes that there is a risk asymmetry to the security of the upper North Island's electricity supply that the Commission's analysis has not accounted for. In other words, the overall costs of investing too late are significantly higher than the costs of investing slightly early.

The costs of investing too late are far higher than the costs of investing too early.

By investing too early, there would be a small cost of foregone interest on early capital expenditure that could have been deferred. But the costs of investing too late are astronomical. If Transpower was to follow any of the Commission's proposed investment paths, and then found out in the interim period, that the original assumptions on forecast growth and installed generation were too conservative, then the upper North Island would be facing major supply reliability problems. Major transmission lines take

Transmission lines take seven to 10 years to build.

⁶ Review of Auckland 400 kV Plans in Regard to Good Utility Practice, KEMA, 14 June 2006.

seven to ten years to build (from consulting on routes through to final commissioning) and could not be built in time to avoid blackouts.

The public are also insisting on higher levels of reliability for their electricity supply. In a recent nationwide UMR survey of 750 people, respondents were asked which of two points of view was the closest to their own regarding the timing of when the next electricity transmission line should be built to supply power to Auckland,

- That of Transpower, the national grid company, who say a new line should be built in 2010, or
- That of the Electricity Commission, the industry regulator, who say a new line isn't needed until at least 2017.

54% of respondents said they supported Transpower's view, 25% the Electricity Commission, and 22% were unsure.

In Auckland, support for the 2010 date was even stronger. 59% percent supported Transpower's view, 24% the Electricity Commission and 17% were unsure.

Our stakeholders are also aware of the costs of investing too late, and accordingly place great weight on reliability of supply.

During May, an independent consultant was engaged to conduct one-on-one interviews with some of Transpower's key stakeholders, covering generators, lines companies, directly connected industrial plants, interest groups, government officials and consumer groups.

The stakeholder representatives were asked to rank what they saw as the key priorities for Transpower. By a substantial margin the top priority was Reliability of Supply, followed by Quality of Supply, and then Long Term Grid Planning. Together these accounted for 38% of all concerns. Value for Money only accounted for 7% of stakeholder concerns.

Transpower analysis shows that major disruptions to supplies occur more often than first thought. This analysis is consistent with overseas data and indicates that greater investment is required – and justified – to avoid major interruptions.⁷

The public support building a new line earlier rather than later.

Our stakeholders rank reliability of supply, quality of supply and long term grid planning as the key priorities for Transpower.

⁷ *Allowing for extreme events in transmission planning* G. Ancell, C. Edwards, V. Krichtal, 24 April 2006.

2 A new line provides critical infrastructure to support competition, renewable energy and economic growth

Transpower’s 400 kV proposal has significant strategic benefits which have not been adequately accounted for in the Commission’s limited application of the Grid Investment Test in its Draft Decision.

2.1 Generation investment needs robust transmission

The New Zealand electricity market relies on a competitive generation sector. Congestion of the transmission system provides risks for new generators. Generation investments are made for a long outlook – usually 20-40 years. Generators need some confidence that they will not become victims of a bottle necked system before they invest. A robust transmission network provides them with that confidence.

Transpower has recently published its plans for transmission development over an extended timeframe (10+ years) through its Annual Planning Report. In theory this now provides generators with greater certainty about transmission planning than they have ever had in the past. However, the Draft Decision on the 400 kV project and the complexities of understanding how the Commission applied the Grid Investment Test, leave not only Transpower, but also generators none the wiser for the future. Without knowing in advance which projects will meet the Commission’s version of the Grid Investment Test, neither Transpower nor generators are able to plan with confidence over the longer term.

Uncertainty about transmission system capability can lead to inefficient generation investment. Since generation can cost more than five times the cost of transmission, lack of transmission can have a significant impact on the overall efficiency of the market.

2.2 Generation competition needs robust transmission

Generation competition also needs robust transmission. There are only two major generator owners represented in Auckland – and their generation plant has a significant impact on the upper North Island’s power system. Without strong transmission coming into Auckland, competition will remain limited and reduce further.

2.3 Renewable generation needs robust transmission

Transpower’s proposal facilitates and encourages generation south of Huntly. Most of the existing and potential generation south of Huntly is renewable in nature (e.g, hydro, wind, geothermal). This means Transpower’s project encourages the development of renewable generation compared to the Commission’s alternatives which all rely heavily on thermal generation from Otahuhu and particularly from the fossil-fuelled Huntly plant.

Generators need confidence that they’re not going to be on the wrong end of a transmission bottleneck.

Uncertainties over how the Commission applies the Grid Investment Test leaves investing generators uncertain too.

Transpower’s proposal encourages renewable generation.

The Ministry of Economic Development in its January 2006 Energy Data File advise of the following possible North Island generation projects over the next few years, greater than 10 MW in size:

Proponent	Location	Type	Size	Commissioning
Mighty River Power	Southdown	Gas	45 MW	2006
Contact Energy	Tauhara	Geothermal	15 MW	2006
New Zealand Windfarms	Te Rere Hau	Wind	49 MW	2006
Genesis	Huntly e3p	Gas	365 MW	2007
Contact Energy	Poihipi	Geothermal	25 MW	2009
Trustpower	Tararua III	Wind	93 MW	2007
Genesis	Awhitu	Wind	18 MW	2008
Hawkes Bay Windfarms	Te Pohue	Wind	225 MW	2008
Meridian Energy	Makara	Wind	210 MW	2008
Top Energy	Ngawha	Geothermal	15 MW	2008
Mighty River Power	Kawerau	Geothermal	70 MW	2008
Unison Networks	Tittiokura	Wind	48 MW	2008
TOTAL			1178 MW	

As can be seen, of the 1178 MW of possible new generation in the North Island, only 35% is generation at or north of Huntly, and of that 35% only 3.7% is renewable generation (at Ngawha). South of Huntly, all of the possible generation projects are renewable. Transpower's proposal supports access for these renewable projects along with other similar sized projects that are in the process of being permitted.

All possible generation south of Huntly over the next few years is likely to be renewable.

A key point about renewable generation is that it has to be located where the fuel source is – water, geothermal pressure and wind cannot be transported to the areas of demand. So other than in rare circumstances where demand and renewable fuel source coincide (like Wellington for wind), New Zealanders will need a robust transmission grid to carry that generation from places where it is located to the major population areas.

2.4 Transpower's proposal has strategic as well as direct benefits

Because Transpower's proposal involves a step change in voltage, it contemplates the beginning of an eventual migration from a 220 kV transmission backbone to a 400 kV backbone. While the current proposal can be costed and assessed against other alternatives, it is difficult to quantify the strategic value of moving to 400 kV as the benefits accrue over a long period – 30 years and beyond.

Transpower's proposal is strategic and economic.

History and international experience show that such strategic moves are generally looked back upon as positive.

When New Zealand made the move to construct the country's transmission backbone at 220 kV in the 1950s instead of the then highest voltage of 110

kV they must have thought well beyond the needs of the country at the time which was only using about 3700 GWh of electricity compared to 40,000 GWh today. New Zealand would now be barely recognisable under a cobweb of 110 kV transmission lines if the move to 220 kV voltage had not been made.

For the last 50 years, New Zealanders have enjoyed the benefits of the excess capacity that system delivered. It is now time for today's generation to lay the foundations for the next 50 years of electricity use – by taking the tough decisions our grandparents took. This does not mean an inter-generational transfer, however, as the capital costs of such investments are spread over the lifetime of the investment.

Other countries have faced similar decisions. In Victoria, Australia, the transmission planners made the decision 30 years ago to overlay Victoria's 220 kV transmission system with a 500 kV system. In Ireland, a country of a similar size to New Zealand, a strategic decision to move to 400 kV transmission for the backbone network was made in the 1980s.

Moving to a higher voltage is an accepted practice internationally.

The proposed move to 400 kV for a new line between Whakamaru and Auckland is another strategic investment that the country needs to make for continued economic growth and improved standard of living.

A new timely 400 kV line also sends the right investment signals to business and industry. It positively positions Auckland's power supply as an underlying strength of the regional economy rather than its current perception as a weakness – something that would continue if “just in time” incremental approaches as proposed in the Commission's alternative projects were followed.

Any proposal that might be regarded externally as only “just in time” and only “just enough” sends the wrong signals to investors. Such an approach suggests a key infrastructure project may not proceed if prevailing conditions change in the short term. It carries with it unnecessary uncertainty which will be reflected in the investment decisions made by businesses. Electricity-intensive industries – steel and other heavy manufacturing – are particularly sensitive to the possibilities of shortages and or constraint-induced price spikes. Commercial enterprises want certainty of electricity supply and in today's global market are quickly able to move locally and internationally, relatively easily to find it. If the lack of a line is perceived to impact on that reliability – and Transpower considers it will – then such industries will naturally invest conservatively until firm approval for the next line is finally granted. This will have a negative impact on economic growth as industry delays investment to reflect perceived risks.

A delayed major line into Auckland creates uncertainty for business investment and economic growth.

The continuing question mark hanging over Auckland's infrastructure including electricity supply could to some extent explain how the national economy grew at an average of 3.5% between 2000 and 2004, while Auckland's economic growth over the same time frame averaged only 3.1%.

3 The Commission's alternative projects do not reflect good electricity industry practice

Using a less than robust computer model, the Commission has arrived at alternatives which fall shy of being credible alternatives to Transpower's proposal. They are exposed to greater risk in delivery and operation compared to Transpower's proposal.

3.1 *The Commission's projects would be risky to deliver*

Transpower has several concerns around the delivery of the Commission's alternatives. In particular, these projects appear to rely on a collection of intermediate investments that are collectively interdependent, meaning that any delay to any one of the projects causes significant increase in risk to the overall reliability into Auckland. Transpower refers to this as a "house of cards" approach, where failure or delay of any one project affects the whole structure.

The Commission's alternatives create significant risk to timely delivery.

3.1.1 *Example 1: Arapuni-Pakuranga 110 kV Line Status*

The Electricity Commission's alternatives assume the use of the corridor Transpower has identified for a 400 kV line. However, the Commission has not taken into account that much of the route identified will replace the existing Arapuni-Pakuranga line, which Transpower would need to decommission before construction of any asset using this corridor.

It is by no means certain that Transpower can meet the timings for the intermediate work required to underpin the Commission's alternatives.

Using the Transpower identified corridor for the alternatives would require the 110 kV line between Arapuni and Pakuranga to be dismantled 30 months ahead of a 2017 construction – before the 2015 winter. Accordingly, the resulting transmission system at that time would not meet the Grid Reliability Standards of an n-1 design criteria without the largest generator.

The Commission has suggested that this could be worked through operationally by either:

- staging the construction of the new line through the use of temporary bypasses to allow the Arapuni to Pakuranga line to continue uninterrupted; or
- relocating the line to avoid construction issues with the existing line.

The first of these has significant project and regulatory risks attached to it that have not been accounted for by the Commission. There are some seventeen sections of the proposed 400 kV line that physically conflict with the Arapuni to Pakuranga line and each of these is an average of over four kms long. There are also ten crossings over the existing line. Leaving

Risky to build a new line around the existing Arapuni-Pakuranga line.

aside the question of cost (which would be substantial), significant delays and risks are likely to be encountered in the Resource Management Act and easement purchase process. Despite the work being temporary, Transpower would still need to obtain resource consents (and potentially a designation under the Resource Management Act), as well as purchase easements for the temporary bypass. These processes are fraught with risk of delay because of the opportunities afforded to objectors to block and appeal at each step.

Relocating the line is similarly fraught with risk. The proposed route identified by Transpower has taken many months of in-depth consultation and investigation. Any other route is inherently a less optimal route, and accordingly difficult to support from an environmental perspective. This will have substantial impact on timings and cost.

3.1.2 Example 2: Duplexing the existing Whakamaru to Otahuhu A & B lines to delay a major line until 2021.

A second example underlining the risks to delivery of the Commission's alternatives is the Commission's proposal that the existing Whakamaru to Otahuhu A & B lines could be duplexed (i.e. adding new wire/conductor per phase) in 2010 to delay a major new line until 2021.

Transpower believes this work can only be undertaken using temporary bypasses – as there will be no usable outage windows to allow these lines to be removed from service. Like the example above, this will almost certainly require environmental consents and property easements which will make the 2010 date unachievable.

Both these overhead lines run directly to Otahuhu substation over an intensive residential area in South Auckland.

The Commission appears to have assumed that people affected in the high density areas of South Auckland will not object to the increased capacity of the lines overhead. Given the increasing concern that people have over these lines today, this is an overly optimistic assumption. It is unlikely work could occur without significant objections, risking significant delay.

For its part, Transpower's philosophy is not to build new line over existing dwellings or allow any dwellings upon any line easement. This has been made clear throughout its consultation process for the 400 kV proposal. This is consistent with good electricity industry practice overseas where under-building in transmission easements is forbidden. New Zealand's existing situation is an anathema.

Impossible to defend a new route for a line given that Transpower's proposed original route was identified as the best route.

The Commission has ignored that the critical path for projects like these lies with the environmental and property processes.

Transpower could not countenance building new lines over existing dwellings.

3.1.3 Summary of Delivery Risks

In summary, for each incremental project proposed by the Commission to meet the needs of the upper North Island before a major line is needed, there is an increased risk to the security of that system, and therefore the robustness of the alternative project. As projects are delayed, the availability of resources between projects becomes critical. Transpower has already signalled the likely upgrade work it believes necessary on the rest of the National Grid between 2010 and 2017. Consequently, delays in the incremental projects for the Commission's alternatives could have delay and cost implications to the other projects required over this time.

Any delays in the incremental projects have consequences in terms of risk to Auckland's power supply.

By contrast Transpower's 400 kV project is not contingent on projects other than the establishment of Huntly East substation. In this case as Transpower owns the relevant land, this is considered a low risk project.

Transpower's proposal is not contingent on any other project.

3.2 The Commission's projects would be risky to operate

The incremental upgrades are not only at risk of delivery, they would also prove to be risky to operate. This is because:

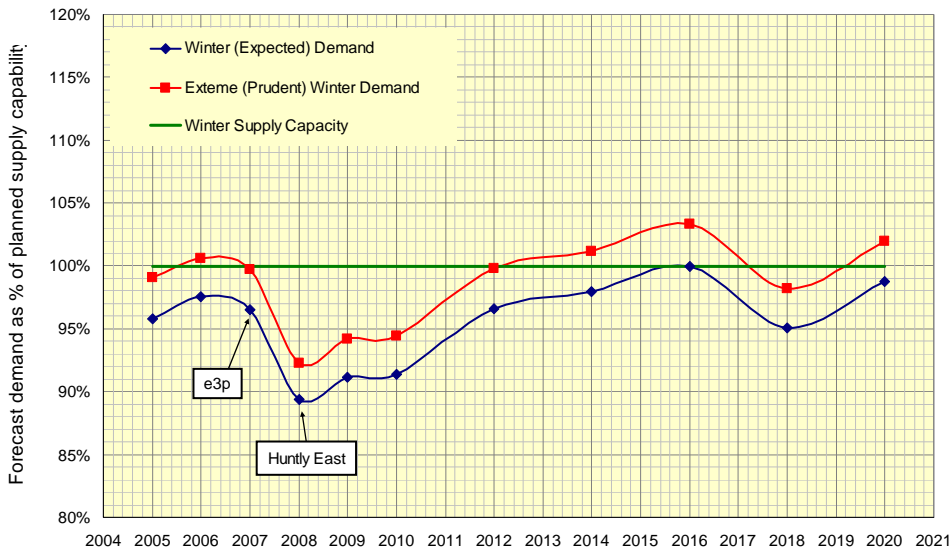
- The Commission's alternatives all rely on the power system running precariously 'hotter' (i.e. closer to the system's ultimate capacity) from 2010.
- Best practice for operation of a power system 'close to the cliff edge' is to use greater 'safety' margins for the load supplied.
- It will be increasingly difficult to take assets out of service in order to implement the series of intermediate upgrades envisaged by the Commission.

These concerns could manifest as reduced reliability and supply interruptions to Auckland and further north.

3.2.1 The Commission's alternatives all rely on the power system running 'close to the cliff edge' from 2010.

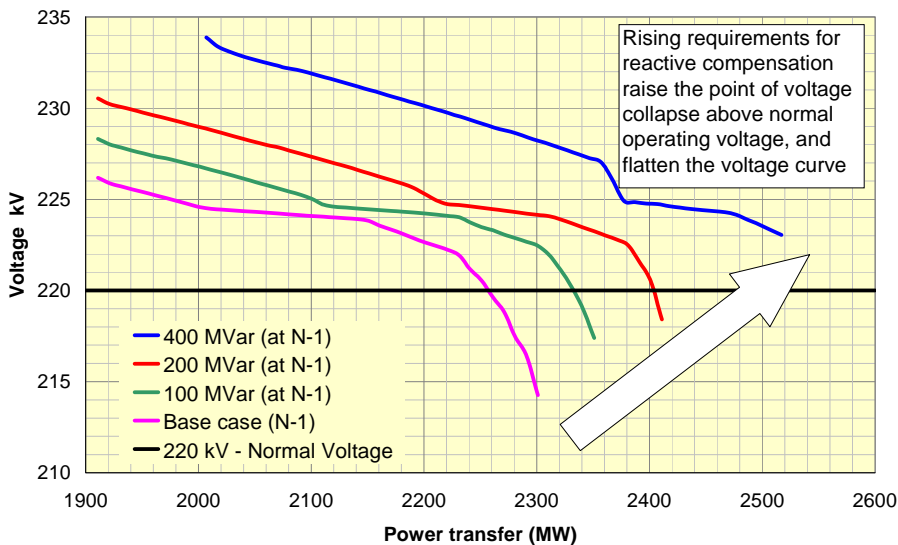
Good electricity industry practice is to run the power system recognising that the point of voltage collapse is difficult to ascertain. This means keeping at least five percent away from the voltage collapse point. However the Commission's projects rely on running closer to the voltage collapse cliff edge up until 2017. The graph below illustrates this concept, and how an extreme winter scenario (not unlike the winter storms of June 2006) can push the system beyond what it is capable of delivering. Without greater capacity in the network, cold showers and forced power cuts over peak periods may become the norm for some consumers.

Commission's alternatives rely on running the power system hotter.



The Commission's alternatives push the system closer to maximum capacity until 2017.

A perverse outcome from the Commission's alternatives is that Transpower would be required to maintain an increasingly higher voltage on the existing 220 kV system between 2010 to 2017 to avoid power system collapse. The graph below illustrates how voltage rises as more compensation is added, while the voltage profile becomes flatter (and so harder to detect) leading up to voltage collapse.



In later years the Commission's alternatives would require Transpower to maintain a voltage on the 220 kV network higher than 220 kV.

3.2.2 Prudent operation of a near capacity power system is to use greater 'safety' margins for the load supplied.

A consequence of running the power system close to the edge, is that a prudent operator would need to use greater safety margins in supplying load. Transpower calculates that in operating the power system, it would need to reduce the amount of load supplied by about 2% below that assumed by the Commission in its reliability modelling and application of the Grid Investment Test. The concept of a safety margin was also suggested by the Commission's consultants:

*"Some of the....results....suggest the system is so severely stressed....that....discounting the last 1-2% of margin would be reasonable."*⁸

Operating a heavily compensated system (which forms part of all the Commission's alternatives), would require unproven advanced power system operational capabilities.⁹ These capabilities have yet to be developed beyond theoretical studies – and the technology has not been tested operationally anywhere in the world and is not available commercially. Transpower does not consider Auckland's power supply should be the guinea pig for possibly bleeding-edge power system technologies. On this point, international experts warn on the increased reliance of automatic measures to control the power system.¹⁰

Further, the Commission's alternative projects will require an intricate, interdependent sequence of upgrades for existing assets, which must be completed on time if the narrow security margins are to be maintained. They will also rely on highly automated control schemes – again contrary to leading expert advice¹¹ to operate successfully.

3.2.3 Incremental upgrades at risk on a heavily loaded power system

With the system running at near capacity there are a number of practical limitations affecting the feasibility of some of the incremental work and equipment required as part of the Commission's alternatives. Such work requires outage windows on the system sufficient enough to undertake each upgrade. These will be increasingly difficult to secure.

3.2.4 Regular maintenance at risk on a heavily loaded power system

Not only are the incremental upgrades of concern, but regular asset maintenance on a heavily loaded power system also becomes more difficult. This is because, commonly, assets need to be removed from service in order for maintenance work to be undertaken. As the system would be working near the top range of its capacity it would be increasingly difficult to secure 'outage windows' sufficient to undertake some of this work – without unacceptable levels of risk to the power system.

On heavily loaded systems, a greater 'safety margin' is needed.

Commission's alternatives rely on power system technology that is untested and unavailable commercially.

Outage windows to undertake incremental investment and normal maintenance will be difficult to secure on a heavily loaded power system.

⁸ Idem.

⁹ Fully automated and real-time control technologies, techniques and instrumentation would be required.

¹⁰ Bill Ackerman Keynote Address to EEA Conference 2006, 16-17 June 2006, Auckland

¹¹ Idem

3.2.5 Circuit concentration at Otahuhu

The recent outage of large parts of Auckland due to a failure of a minor component at Otahuhu substation has underlined the reliance of this city on this substation. None of the Commission's alternatives would improve the diversity at or near Otahuhu substation.

By contrast, Transpower's proposal as submitted recognised the need for diversity at Otahuhu:

"In order to provide diversity of supply at Otahuhu substation, the 400/220 kV interconnector transformers will be connected to a new 220 kV busbar which is physically separate from the existing 220 kV bus"

The decision to diversify at Otahuhu was reached after considering the wider question of whether another substation (Pakuranga or Penrose) might be more appropriate for termination of the proposed line.¹²

3.3 A 400 kV line is ultimately required.

The Commission's alternatives include the possibility of a 220 kV line or a High Voltage Direct Current (HVDC) link. Transpower believes strongly that a 400 kV line is ultimately required.

3.3.1 A new 220 kV line is not sensible for the future

Using a voltage that New Zealand began using nearly 60 years ago as a basis for significant investment in transmission in the 21st century would appear to be somewhat short-sighted. 220 kV is ultimately yesterday's solution.

New Zealand is not alone in proposing a step change in voltage to 400 kV or higher voltages. As mentioned earlier, Ireland, a similar sized electricity market to New Zealand, has already made this move. Other larger countries use voltages up to 765 kV as their transmission backbones.

It is nearly 60 years since the first 220 kV lines were built in New Zealand. That began a period of significant investment to make New Zealand's entire transmission backbone 220 kV. Back then we used less than 10% of the electricity we use today.

Using a standard calculation of capacity, a 400 kV line has the potential to provide up to four times the capacity of a 220 kV line, before a new line needs to be considered. Therefore, over an extended timeframe more 220 kV lines through the Waikato to Auckland would be required sooner, than with a 400 kV development path.

Even more importantly, securing a greenfields easement upon which only a medium capacity line is then built is not economically, socially or environmentally responsible.

Only Transpower's proposal provides needed diversity at Otahuhu substation.

220 kV technology is yesterday's solution for tomorrow's problem.

When the first 220 kV lines were built in New Zealand we consumed less than 10% of the electricity that we use today.

400 kV is thus the preferred 'long term' solution.

Securing an easement for only a 220 kV line is not socially or

¹² *Security of Supply into Auckland – Assessment of Alternative Solutions*, October 2004, - Supporting Document Grid Upgrade Plan Volume 2, September 2005

As securing routes and easements in the future is expected to become increasingly more difficult, New Zealanders would not want to lump future generations with the public angst and turmoil caused by this sort of investment decision on a more regular basis.

3.3.2 HVDC technology is not sensible for the future

While the use of HVDC technology is a well tested technology here and overseas, it is not appropriate for a line between Whakamaru and Otahuhu. This is because it is:

- more susceptible to sudden forced outages than an equivalent alternating current (AC) solution;
- less flexible and more expensive to adapt for future configurations (such as extensions to the south and/or west); and
- best used as a bulk transfer of energy over much longer distances.

We note support from the Commission's own consultants on this aspect:

"The lack of flexibility inherent in an HVDC Link, either conventional or IGBT-based, make that option less attractive"¹³

An HVDC solution is less reliable and less flexible than an equivalent AC solution.

Transpower's own experience with the HVDC link between the North and South Islands backs up the availability discrepancy. The newer technology used in Pole 2 of the HVDC link is equivalent to what would be used for an HVDC link from Whakamaru to Otahuhu. The actual availability of Pole 2 in the 2004/05 year was 97.7% compared to actual availability of the HVAC system of 98.9%.

HVDC technology is the 'railways' of transmission planning – very good at bulk movement, but complex and expensive to interface with the interconnected 'state highway' HVAC system. Over time as the load grows a more extensive higher voltage network will be required – only an HVAC system lends itself to network development. Transpower's views are also supported by a local but internationally recognised academic.¹⁴

3.4 A new line is needed well before 2017

Deferring a new line until at least 2017 is not technically acceptable. There is scope for commissioning a new line marginally later than 2010 but not beyond 2012. Key problems with the Commission's alternative investment paths are:

- The operating margins beyond about 2013 would be unacceptably narrow – making it difficult for the system to be managed.
- Reactive compensation would be very high and as a proportion of load would be beyond good electricity industry practice.
- The transfer capacity that the Commission expects until 2017 relies on the completion of the "house of cards" projects on time and in sequence (without consideration of delay risks).

¹³ Letter from GE Energy to Electricity Commission, 12 April 2006.

¹⁴ *Use Of HVDC Multi Terminal Options For Future Upgrade Of The National Grid* Jose Arrillaga, 2 June 2006.

3.5 *A “universal corridor” would be difficult if not impossible to secure under the current regulatory framework*

The Commission has asked feedback in its Draft Decision on the concept of a universal corridor, whereby Transpower is able to secure an easement for a yet to be specified (in terms of either technology or voltage) transmission line or lines.

While Transpower agrees there could be significant benefits in having such a corridor, we consider that the current environmental and property regulatory frameworks present too many risks in a practical sense to its successful establishment. More detail on the environmental and property risks is available in Volume II.

Universal Corridor introduces significant project risks into negotiations with landowners for easements, and both the Resource Management Act and Public Works Act processes.

4 The Commission’s application of the Grid Investment Test is too limited

The analysis undertaken by the Commission does not meet the rigour and comprehensiveness required under the rules for a proposal of this size. While some assumptions have been detailed and calculated to an accurate level, others are too broad to reflect serious operational issues. This has tended to bias the result through understating the risks of deferring a new line and understating the benefits of Transpower’s proposal.

4.1 Regulatory Process

Part F of the Electricity Governance Rules requires Grid Investment Test (GIT) analysis to be of a standard of rigour and comprehensiveness that is commensurate with the capital expenditure of the proposed project.

While the Commission has on the surface created a model of significant complexity – further investigation finds that the underlying assumptions in some cases are weakly defined and measured. Often the argument supporting such weak assumptions is that the benefits or costs across the alternatives and the proposal are similar – and yet without doing the detailed work, such a conclusion is unsupportable.

4.2 The Commission’s application of the Grid Investment Test understates the risk to reliable supply

The challenge of creating a probabilistic computer model to assess the impact of real life investments is to capture and value the risk of actual consequences of actions in a theoretical framework. It relies on the credibility of historic data to predict the impact of multiple events or cross-linked outages on an increasingly stressed system in the future.¹⁵

Transpower’s concern with the Commission’s probabilistic analysis is that:

- some significant risks have not been accounted for;
- most risks identified by the Commission are then treated as ‘sensitivities’ rather than being actively managed; and
- the consequences of failures of various transmission elements can result in significantly different outcomes.

These issues are discussed below.

4.2.1 Commission’s analysis fails to account for some significant risks

A particular problem in the Commission’s analysis is in how it values a multiple event (i.e. several contingencies happening at the same time) on

Commission’s application of the GIT for the Draft Decision has been inconsistently applied.

Probabilistic models can only work on reliable data, especially from multiple-impact events.

Commission’s analysis does not account well for

¹⁵ The recent outage of supply to Auckland, underlines how difficult it is to identify all the possible outcomes from various events.

the system which, while there is a low probability of such an event occurring, when it does, may have catastrophic consequences in terms of real and social cost.

multiple events or cross linked outages occurring.

This is particularly important for the Commission's alternatives, because each of them relies on running the system closer to maximum from 2010 until at least 2017. Transpower considers that this increases the probability of such multiple-events occurring more often, and as such does not represent good electricity industry practice.

Theoretical probabilistic planning frameworks that attempt to weigh and quantify this risk are almost always accompanied by an underestimation of the consequences of failure.

Reliability of a Boeing 747's engines provides an applicable analogy. If one of a 747's engines fails on taking off from Auckland for a flight to Los Angeles, the narrow economic analysis (as used in the Commission's approach) would suggest that:

- the failure of an engine is very low;
- the probability of a second engine failure also occurring is therefore infinitesimally small;
- the economic cost of delaying both passengers and aircraft is high and uncertain; and
- the plane can fly safely on three engines.

Like a 747 with an engine failure, while the probability of another failure may be low, the consequences of that failure are very high.

Therefore the economic plan would be for the plane to fly onto Los Angeles. Yet we know that the prudent pilot and airline would both require that the plane return to Auckland for the engine to be fixed.

4.2.2 Most risks identified by the Commission are then treated as 'sensitivities' rather than actively managed

As well as not adequately dealing with the consequences of multiple failure across the transmission system, the Commission has assumed that other risks can be accounted for by sensitivity analysis at the end of the calculation rather than by actively managing them within its model.

Transpower appreciates that the Commission has been working under tight timeframes and that developing a model that incorporates the sensitivities directly may take some time. Nevertheless, we consider that this would be time well spent in ensuring that the Grid Investment Test is as robust as possible.

The capital cost of the project is an example of where a broad sensitivity assumption was applied. The Commission's own consultants noted that the 17% discrepancy between their estimated cost of conductor for the 400 kV line and Transpower's estimated cost for the same component probably comes down to "substantial recent increases in the cost of conductors" over the last year. The Commission has dealt with this possibility at the end of the process by allowing for a 10% increase in the cost of capital as a sensitivity to the original cost.

The Commission has not actively managed the real risk of cost escalation to the project.

But if the cost can rise by 17% in one year for one component, it would seem likely to occur again over the next ten years (given the growing demand for metals from China at least) for more or all of the other components. If over ten years a marked increase (say greater than 15%) happens two or three times for all components then the resulting total capital cost will be well in excess of the 10% margin the Commission has used as a sensitivity. Cost estimates for a project in the near term are nearly always likely to be more reliable than projects further out in the investment horizon.

4.3 The Commission's application of the Grid Investment Test understates the benefits of a robust transmission grid

Transpower considers that the Commission's analysis tends to underestimate the following benefits:

- Capital deferral benefits of deferring generation
- Competition benefits
- Fuel cost savings
- Loss savings
- Reliability benefits

Transpower believes that when these distortions are corrected, its 400 kV proposal is the most beneficial for New Zealand. Further discussion on each of these points is provided below.

4.3.1 Capital Deferral Benefits of Transpower's Proposal

The Commission's analysis only values the benefits of deferring transmission investment and does not look at the benefits of deferring the significantly more expensive per unit cost of generation investment. In particular, as Transpower submits in its 400 kV proposal, transmission investment allows for not only generation deferral, but also a more efficient generation investment. The more efficient investment in equipment, like generation, is known as dynamic efficiency.

4.3.2 Competition Benefits

The Commission's view is that competition benefits are small and apply to both Transpower's proposal and its list of 'alternatives'. Transpower does not share this view regarding the Commission's alternatives. Our analysis demonstrates that between the period 2010 and 2017, all the Commission's alternatives will rely heavily on fossil-fuelled generators at Huntly and Otahuhu.

As the electricity market in the upper North Island becomes more reliant on Otahuhu and Huntly, so too will this increase the market power of these generation stations over time. This is likely to lessen the competition at the retail level even if this latent market power is not abused. If it is, the prices in the Auckland region could be manipulated for increasing periods of time to the detriment of consumers.

The Commission points to past practice to establish that market power will

The Commission's approach in its Draft Decision has tended to understate the benefits of a robust transmission grid.

Transpower's proposal improves dynamic efficiency.

The Commission's alternatives increase the market power of local generators at the cost of the end user.

not be used in the future. Transpower considers this to be an overly optimistic assumption that assumes unconstrained transmission over the 30-40 year outlook period that should be considered for long term strategic investments. Generator businesses will naturally seek to continue being profitable businesses, and can be expected to do so within the bounds of competition law. Charging higher prices in times of shortage is not illegal or unexpected – the cost of holiday accommodation during school vacations is a good parallel.

4.3.3 Loss Savings

In transmission networks, the higher the voltage the lower the losses that naturally occur over a line as electricity is transported from where it is generated. Doubling the voltage, as Transpower is proposing with its new 400 kV line reduces average losses by a factor of about four times. As none of the Commission’s alternatives contemplate a new line before 2017, the value in the loss savings for Transpower’s project is significant.

Transpower’s proposed 400 kV line reduces losses by a factor of about four times.

However, the Commission values the loss reduction differently from Transpower. Specifically, it only values losses based on the cost of generation fuel to supply the average daily losses. However, Transpower (and international best practice) includes a value representing the costs of the generation plant itself. This recognises that losses vary according to the square of the current in the lines and accordingly exacerbate the peaky shape of the daily load curve. In many cases, it is not just a case of purchasing more gas or coal, but to avoid load shedding, losses usually need to be supplied from new generation plant.

4.3.4 Reliability Benefits

As detailed earlier, the Commission’s incremental projects (between 2010 and 2017) before a new line, all rely on pushing the existing power system very close to the maximum capability. The extra capacity provided by the two additional 400 kV circuits provides a significant increase in the system’s resilience to major power system problems. Transpower does not believe that this has been appropriately accounted for in the Commission’s analysis.

Transpower’s proposal provides greater reliability benefits than the Commission’s alternatives.

4.4 The Commission has interpreted the Grid Reliability Standards too narrowly

As well as meeting the Grid Investment Test, Transpower’s proposal must also meet the Grid Reliability Standards (GRS). We believe that the Commission’s interpretation of the Grid Reliability Standards in the Draft Decision is not consistent with the Electricity Governance Rules, nor has it been explained consistently by them.

Transpower considers that the Grid Reliability Standards require of it to plan the system to meet an n-1 criteria without the largest generator (in other words to withstand the loss of a transmission element without the largest generator in service). The Commission has taken a bet both ways.

The Commission has been inconsistent on in its position on the GRS.

Specifically, in separate public and technical briefings the Commission staff have stated that

- The GRS in this case mean n-1 without largest generator and that this is an appropriate standard for a city of the size and relevance of Auckland;
- The GRS mean planning to an n-1 standard only with any further investments to strengthen the system only allowed if economically justified.

Transpower strongly believes that the only sensible interpretation of the Grid Reliability Standards for Auckland is n-1 without the Otahuhu combined cycle gas turbine plant. Using an economic test for justifying investment beyond an n-1 standard as the Commission effectively do in their Draft Decision¹⁶ will cause:

- Increased uncertainty for investors as to how the system would be operated as there would no longer be consistency between the way the system is planned and operated;
- The adoption of low cost patches, in the form of special protection schemes, instead of more rigorous solutions delivered by sensible planning outcomes; and
- A lowering of the level of reliability as a result of a higher propensity to take on risk that is inherent in the Commission's interpretation.

4.5 The Commission has developed its Grid Investment Test application without Transpower or industry engagement

Neither Transpower nor other members of the electricity industry have been involved with the model that the Commission has developed to apply the Grid Investment Test (GIT) in its Draft Decision.

Transpower's engagement with the Commission before the Draft Decision was limited by the Commission to providing information to the Commission on an as required basis. The Commission during this phase was disinclined to provide any information to Transpower on how it was applying the GIT, in order to preserve the "probity" of its process. Transpower specifically requested details from about October 2005 onwards on how the GIT was to be applied but the first detailed information was only received in mid-March 2006.

The gradual public unveiling of the Commission's application of the GIT in the Draft Decision (the final consultative document forming part of the decision was not released on the website until a month after the initial Draft Decision) has only now allowed a more robust analysis to begin on the Commission's approach. Even now however, that analysis is handicapped by a limited disclosure by the Commission.

Transpower's interpretation of the Grid Reliability Standards allows the delivery of more rigorous solutions.

Transpower has attempted to engage with the Commission on how it would apply the GIT since October 2005.

¹⁶ The Commission incorrectly consider that there is no practical difference between Transpower's interpretation and its own, because assuming the largest generator out in this case was economically justified. However, an economically justified investment is likely to be of lesser quality than a reliability investment.

Specifically, the material released as part of the Commission’s website could not be used to reproduce or validate the Commission’s assumptions as some of the models were prototypes and data was released only for certain modelling runs. Additionally, for some inputs into the GIT, the Commission has developed its own models and the extent to which these have been checked and validated is unclear.

Not only has this lack of engagement impacted on the robustness of the analysis, it has also been a main reason for the Commission and Transpower being at completely different ends of an investment spectrum. Specifically, Transpower was considering amending its proposal from February onwards but felt it did not have enough information to understand how its proposal would be dealt with or how it would rank against the Commission’s alternatives.

The lack of engagement is, in Transpower’s view, the main reason that Transpower and the Commission brought such differing views into the public arena, potentially bringing the regulatory regime and industry credibility into question.

New Zealand cannot afford to develop critical regulatory practice “on the fly” in any area, let alone something so crucial to economic security as electricity transmission. It is imperative that the Grid Investment Test is robust in the eyes of not only Transpower but other industry investors and the general public.

New Zealand cannot afford to have a prototype GIT that is untested, and unrepeatably by anyone other than Commission experts.

5 Staging the Transpower project will maintain reliability of supply into Auckland at least cost

Now that it has had the opportunity to examine the Commission's application of the Grid Investment Test, and how it overvalues deferral, Transpower has begun work on a staged version of its original proposal, which we will submit to the Commission in July or August.

5.1 *Deferral of capital cost would have benefits under the Grid Investment Test*

Transpower largely put together its original proposal in the absence of knowing how the Commission would develop its version of the Grid Investment Test (GIT). Having now seen also how the Electricity Commission has applied the GIT, Transpower is better able to critically review its proposal and amend it accordingly, if this is appropriate.

A particular aspect of Transpower's proposal that can be amended is the timing at which certain capital expenditures are made. Specifically, recognising the near 40% increase in substation equipment (and in particular 400 kV interconnecting transformers) in the last 18 months, Transpower can defer the major cost of those transformers until they are needed. Significant works at substations to accommodate the 400 kV connection equipment can also be deferred for a number of years.

This can be achieved without significantly altering the security of supply to the upper North Island, and without sacrificing the strategic nature of the investment. Some concerns remain because of project risk and the delaying of the project to a "just in time" date.

5.2 *With some small interim investments the commissioning date could be extended*

Transpower has identified that the commissioning date of the proposal could be deferred without unacceptably reducing reliability. This can be achieved through

- commissioning of a new substation (Huntly East) tapping into one of the existing Whakamaru to Otahuhu circuits, and
- increasing the thermal capacity of two of the existing Whakamaru to Otahuhu lines.

Transpower believes that these projects together would provide for additional capacity to meet demand until 2011 or 2012, with the slightly higher risk profile of building later being mitigated by Transpower where it is able to do so. However, delays in the projects would increase risks.

5.3 *The 400 kV line could be operated at 220 kV initially*

A significant amount of Transpower's proposed expenditure can be deferred.

Some interim projects and risk mitigation allows a date of either 2011 or 2012 to be achieved for a new line.

Transpower's staged proposal (to be submitted separately), will detail the following:

- construction of a 400 kV capable transmission line by 2011/2012;
- running the 400 kV capable line initially at 220 kV from 2011/2012; and
- operating the line at 400 kV at some later date.

6 Lessons learned: Improving the process for the future

For the future, Transpower, the Commission and the electricity industry need to agree on how the Grid Investment Test (GIT) is to be applied so that there is greater certainty in the market.

6.1 *Alternative interpretations and approach*

There are a number of areas where Transpower considers that a different interpretation of the existing Rules by the Commission would have led to an outcome that delivered security of electricity supply to the upper North Island.

We agree with the Commission's consultants reviewing the process who noted that:

"the rules requirements....should only be considered a starting point for the Commission. The extent to which Transpower (rather than the Commission) will be clearly accountable for the analysis and completeness of its investment proposals depends upon the Commission making Transpower fully aware of what is required in advance."¹⁷

Both the Commission and Transpower have had to land the 400 kV proposal on a regulatory runway under construction.

In the case of this investment proposal, both Transpower and the Commission have had to land the North Island 400 kV upgrade proposal on a regulatory runway which was still under construction.

Now that the regulatory framework has greater clarity, both Transpower and the Commission need to clarify how future investment proposals are tested and assessed within that framework.

6.1.1 *GIT Analysis*

A problem with any economic analysis is that in order to attempt to capture the workings of real life in a computer model, the model itself becomes very complex to follow. Consequently the attention turns to what the answers are at the end, rather than on ensuring the assumptions that were used to create it are robust.

The answers coming out of a computer model can only be as good as the assumptions going in.

Transpower considers that for the Draft Decision, the interpretation the Commission has given to its inputs into the Grid Investment Test has delivered an inappropriate outcome. A wider examination of some of these assumptions would prove beneficial for future proposals. Some examples of how interpretation could be improved are found below. More detail is available from Volume II.

¹⁷ *Consideration of Transpower's Auckland 400 kV grid investment proposal – Review of regulatory process, economic issues and Draft Decision, 29 May 2006, The Allen Consulting Group*

a) Price Reference Dates

New Zealand and good electricity industry practice is to use price references from the date a proposal is submitted. New Zealand Treasury advise that:

*“Costs and benefits should be valued in real terms (constant prices) as opposed to nominal terms (prices at the time the goods or services were provided)”.*¹⁸

Using a 2010 date, as the Commission has in its analysis, tends to artificially inflate construction costs and diminish project benefits to exaggerate net differences.

b) Treatment of Contingencies

For an expected net market benefit test like the GIT, best practice is not to include cost contingencies. This is because including those contingencies means the costed proposal represents the ‘worst case’ cost path as opposed to the ‘expected’ cost path. Including contingencies will tend to favour projects with a lower capital cost (given that contingencies are normally expressed as a percentage of the expected cost). Again, the Commission’s approach to date is contrary to the New Zealand Treasury’s advice on this, and different to other regulatory regimes, like Australia.

c) Assessment Period

The use of a 20 year assessment period must be applied consistently. In the case of Transpower’s proposal, the assessment was over a full 20 year period to 2030. However, for the alternatives which all were to occur later (and in one case up to 11 years later), the assessment period was terminated at 2030. This is not consistent with good electricity industry practice, or with the approach of New Zealand Treasury and Land Transport New Zealand among others.¹⁹

The Commission’s approach should be aligned with New Zealand and international best practice.

Assessment periods between the proposal and any alternatives must be consistent.

6.2 Transmission planning: Transpower as information provider, Commission as auditor and reviewer

During the process for assessing Transpower’s proposal, the Commission requested a significant amount of very detailed information from Transpower, including at one point the steel bolt schedules for its proposed transmission towers. The need for such detailed and largely irrelevant information has never been explained.

This sort of strategy places unacceptable duplicative costs on New Zealand’s taxpayers if the Commission intends to reconstruct transmission alternatives to every one of Transpower’s major investment proposals in the future. Even the Commission’s own consultants were incredulous that instead of using the time to develop a robust and transparent assessment methodology, the Commission instead decided to duplicate Transpower’s

New Zealand cannot afford to maintain two transmission planners.

¹⁸ *Cost Benefit Analysis Primer*, Version 1.12. New Zealand Treasury, December 2005

¹⁹ Refer to Volume II for further information.

role and construct alternatives:

“Potentially, the Commission has foregone an opportunity to consider the views of the wider stakeholders on a range of critical conceptual issues not canvassed in the process to identify alternative projects prior to the publication of its Draft Decision. These issues include the appropriate application of the grid reliability standards....scope of costs and benefits....and the types of modelling”²⁰

A better approach for the future is for the Commission to audit and review Transpower’s proposals. Again the Commission’s own consultants are instructive in this respect:

Ideally, the Commission would remain within its own accountabilities to review, verify and approve/reject material put forward by Transpower because:

- *Substantial information asymmetry means that Transpower is usually better placed to do the most detailed analysis;*
- *It is time-consuming and inefficient for two organisations to conduct separate analysis – and can lead to arbitrarily different results and unpredictable decision making; and*
- *Commission staff have limited ability to maintain strategic oversight of the regulatory process – its interactive requirements and deadlines – while conducting their own...technical analys(e)s.²¹*

A preferred approach recognised by the Commission’s own consultants is for the Commission to be more of an auditor than alternate transmission planner.

Transpower agrees with these comments in particular on the issue of technical analysis, where we believe we have the preferred technical expertise as the owner and operator of the transmission network. The role of the Commission should then be in the form of an auditor – to check that Transpower’s assumptions and calculations are valid based on the information presented.

A first step in achieving greater role clarity would be for the Commission and Transpower to enter into a memorandum of understanding setting out the responsibilities and accountabilities of each party with respect to future transmission investment proposals.

²⁰ *Consideration of Transpower’s Auckland 400 kV Grid Investment Proposal – Final Report, 29 May 2006, The Allen Consulting Group, p.40.*

²¹ *Ibid, p.38.*