

## Transpower's proposed North Island Grid Upgrade Proposal

### Overview of decision 31 January 2007

#### Introduction

The Electricity Commission (**Commission**) has given notice of its intention to approve an investment (**Proposal**) proposed by Transpower for the supply of electricity into, and north of, Auckland. The purpose of this note is to explain key aspects of the context as background to the decision, as well as the decision itself.

Now that the Commission has issued its notice of intention<sup>1</sup>, a designated transmission customer, an authorised representative of parties substantially affected by the Proposal, or Transpower, may request that the Commission hold a public conference in order to provide a final opportunity for comment in relation to the Proposal.

The Commission intends to agree to a request for a conference, and anticipates holding one in late April or early May 2007. In order to make the process as transparent and efficient as possible, the Commission would invite interested parties (whether intending to present at the conference or not) to provide a written submission in advance of the conference in order to assist the Commission in making its final decision.

Following the public conference, if one is held, the Commission may confirm or amend the Proposal. If no public conference is held, (ie, because no-one requests one) the Commission's decision, as set out in the notice of intention, is final.

The Commission will soon release a detailed decision document describing the reasons for its decision as set out in the notice of intention.

#### Context

The Electricity Governance Rules 2003 (**Rules**) that govern the electricity industry contain provisions for the approval of proposals to invest in New Zealand's transmission grid. To summarise, the purpose of the Rules is to facilitate timely investments in transmission in an efficient and cost-effective way.

The underlying aim of the Rules is to ensure that New Zealand has a reliable transmission network, but that this is balanced with the need to avoid over-investment (ie investing too early, or in excess of need) by Transpower. Over-investment imposes avoidable costs on those required by the Rules to pay for such investment, and ultimately, on consumers of electricity.

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<sup>1</sup> <http://www.electricitycommission.govt.nz/opdev/transmis/auckgridinvest/Decision/view>

Making decisions on major investment in transmission is complex because of the nature of the assets required and the range of factors that must be considered.

Transmission connects the centres of electricity demand with centres of electricity supply. In New Zealand, the major centre of electricity demand (Auckland) is far from the major centre of electricity supply (the South Island). Although the cost of transmission is only about an eighth of the final cost of electricity for individual consumers, construction of New Zealand transmission lines and associated substations requires very large investment. In New Zealand, the remoteness of the major demand centres from major supply centres adds to the investment cost. However, transmission infrastructure lasts for a long time, and can provide service for many decades, provided it is maintained and upgraded when necessary.

Given the above, judging the amount of investment that is required, where it is needed, and when it is needed, is a challenging process. The decision requires the decision-maker to consider the rate of growth in electricity demand, the location of the growth, the location of existing and possible future supply sources, and trends in technology.

Each of these aspects is in turn influenced by variable and often unpredictable events, for example, the discovery of a new source of fuel and changing government policies. Further, each of these aspects need to be considered and assessed a long way into the future: the Rules themselves require that the costs and benefits of an investment proposal are assessed over a 20-year period from commissioning of the relevant transmission asset, as well as allowing consideration of any significant costs and benefits that may arise after that 20-year period.

Decisions on transmission investment must also be made well in advance of need, as it may take many years to plan, gain consents for, and construct, new transmission assets such as lines and substations.

Because different experts will have different views of the future and of the anticipated costs and benefits, the approval of transmission investment requires the exercise of judgment. The eventual view adopted as to the most appropriate view of the future, and estimated costs and benefits, translate into the inputs and assumptions used in applying the regulatory tests to Transpower's grid investment proposals.

Different judgments as to the inputs and assumptions lead to different conclusions emerging from the relevant regulatory tests.

### *The regulatory regime*

The specific regulatory regime in New Zealand sets out a process for considering upgrades to the transmission grid and requires an investment proposal to meet stringent standards.

First and foremost, an investment proposal that is needed to ensure that the grid is reliable must itself meet, and continue to meet, the overall requirements set out in the Rules for a reliable grid.

An investment proposal must also be technologically “robust” and so reflect good electricity industry practice.

Once both of these standards have been met, the Commission must confirm that the investment proposal meets the third standard, that is, the investment proposal must deliver the greatest net market benefit, or minimise the net market cost, compared with alternatives to the investment proposal.

It is important to stress that the process to approve an investment proposal does not seek out the *cheapest* option for transmission grid enhancement. It seeks out investments that meet essential reliability criteria, are technologically robust, and, if there are a number of alternatives, are the most cost-effective.

Transpower plans transmission services and proposes transmission investments. In the first instance, Transpower is responsible for applying the standards above to investment proposals that it is considering and to the alternatives it has identified. Transpower then proposes investments that it considers meet the required standards.

It is then the Commission’s responsibility to review Transpower’s investment proposals and the alternatives, to verify that the proposed investments meet the required standards. In doing this, the Commission is able to ask questions of Transpower, undertake inquiries, appoint experts, and consult with affected parties if the Commission thinks it will help with its review.

In this context, the Commission emphasises that the process is not a linear one. The Commission’s review can, and should, provide feedback to Transpower, which may lead Transpower to amend a proposed investment. This reflects that both Transpower, as planner, and the Commission, as reviewer, may have access to different experts, which may lead to new information or approaches to determining the inputs and assumptions used in analysing an investment proposal.

### **Earlier experience with the investment approval process**

To date, Transpower has proposed, and the Commission has approved (in whole or in part), close to 40 investment proposals designed to improve the reliability and economic efficiency of the transmission system, involving in total some \$245 million of additional investments throughout New Zealand.

The approvals have been given under the transitional provisions of the Rules that will lapse when Transpower’s first Grid Upgrade Plan is approved.

Transpower’s first Grid Upgrade Plan was submitted on 30 September 2005. That Grid Upgrade Plan included a proposal to upgrade the part of the national grid that connects Whakamaru, just north of Taupo, to Auckland (Otahuhu) (**Original Proposal**).

However, after reviewing the Original Proposal, the Commission gave notice in April 2006 of its intention to decline to approve it. In May 2006, Transpower informed the Commission of its intention to amend the Original Proposal. Transpower later advised the Commission that it intended to provide another proposal for the

Commission to consider and that it no longer wished to progress the specific Original Proposal to which the notice of intention issued in April 2006 related.

Although the Original Proposal was not progressed further, Transpower, the Commission, industry participants, and other affected parties, learnt a significant amount in the process.

In particular, the previous experience has led to substantial improvements being made to the comprehensiveness of Transpower's planning for upgrading the transmission grid, in both the short and medium terms.

The process of considering the Original Proposal has generated real, lasting, and major, net national benefits, as discussed below.

First, in addition to six investments already proposed by Transpower<sup>2</sup>, when the Commission was considering whether the Original Proposal met the reliability standards set out in the Rules, it became clear that there were a number of other investments<sup>3</sup> that would improve reliability of the grid in the short term and provide flexibility in responding to potential pressures on capacity in the medium term. These included:

- ±100MVAR Static VAR Compensator (SVC) at Albany (GDP 1)
- 100MVAR capacitor bank at Albany (GDP 2)
- 24MVAR binary capacitors at Kaitaia (GDP 3)
- Thermal upgrade of the 220kV WKM–OTA circuits A&B (GDP 4)
- 220kV switching station at Huntly East, near the deviation of 220kV WKM-OTA C line that connects to the existing Huntly substation (GDP 10)
- 30MVAR capacitor bank at Bombay (GDP 11)

All of the above investments have been approved since Transpower submitted its first Grid Upgrade Plan and are currently in the process of being implemented. Further, as part of its Proposal, Transpower has included further short and medium-term measures which are being considered as part of a suite of measures to ensure grid reliability as demand grows.

Second, the significant outage in the Auckland area on 12 June 2006 also highlighted the level of reliance on the Otahuhu substation as a principal point of access to (and, perhaps more importantly, through) Auckland. In contrast, the Grid Upgrade Plan now includes upgrading lines through Pakuranga (as part of the Proposal) as well as a separate investment proposal to upgrade the Otahuhu substation. These investment proposals together offer route diversity into Auckland, and ultimately allow for this to

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<sup>2</sup> Transpower's Tactical Transmission Upgrade (TTU) application submitted to the Electricity Commission for approval April 2005, details of which can be found at <http://www.electricitycommission.govt.nz/opdev/transmis/tacttransupgrade> contained six investments relevant to the Auckland region – TTU projects 1-6.

<sup>3</sup> GDP – Grid Development Proposals submitted to the Electricity Commission for approval October 2005, details of which can be found at <http://www.electricitycommission.govt.nz/opdev/transmis/gdps>

continue through to Penrose and onwards to the North. This route diversity will provide enhanced reliability and improved flexibility.

Finally, in the Proposal, Transpower has deferred energising the proposed new overhead line to its capacity rating of 400kV for some decades, deferring nearly three hundred million dollars of expenditure well into the future, and avoiding unnecessary costs being imposed on electricity consumers in the intervening period. Further, compared to the Original Proposal, design optimisation has almost doubled line capacity for a small increase in cost, both for the current Proposal and the 220kV alternative.

It is important to recognise that experience with the investment-approval process has, to date, generated major reliability advances, as well as avoiding unnecessary costs.

### **Other outcomes of previous approval process**

Applying the standards set out in the Rules to the Original Proposal was in many respects a journey into uncharted territory for both the Commission and Transpower.

As stated above, both the Commission and Transpower have learnt from that process. Specifically, there is now a much better understanding by the Commission of the rationale for some of Transpower's investment proposals, and by Transpower of the Commission's method of applying the cost/benefit test (the **grid investment test**) set out in the Rules.

In particular, there is a substantial level of understanding and agreement between Transpower and the Commission in relation to identifying and analysing alternatives to the Proposal.

This has greatly assisted the Commission in reviewing the inputs and assumptions used by Transpower, and in evaluating the merits of possible alternative inputs or assumptions that may be proposed by experts and used by the Commission when it is reviewing the Proposal and the alternatives.

### **Considering the Proposal**

#### *Comparing the Proposal with alternatives*

The Rules require the Commission to be satisfied that an investment proposal has a greater expected net market benefit (or a lower expected net market cost) compared with a number of alternative projects.

Potentially, a large number of alternatives could be considered. However, to make the process manageable, Transpower, building on earlier work, and in consultation with the Commission, identified eight transmission and three non-transmission projects.

Transpower then applied a screening process to pinpoint the projects that were most likely to match the Proposal, resulting in a shortlist of alternatives comprising three transmission projects and one non-transmission project.

The application of the grid investment test identified that one of these alternatives, namely the 220kV alternative<sup>4</sup>, very closely matched the Proposal in terms of providing the necessary reliability at a similar cost.

The Commission notes that a significant number of comments received during October and November 2006 supported further investigation of HVDC options or increasing the capacity of existing lines by duplexing with conventional or high temperature conductors. There is some support within the Commission for these views, but it would take a considerable length of time to properly investigate the HVDC options, and there is also some uncertainty about the acquisition and costs of property rights for the duplexing options. A full investigation of these options would not enable the Commission to make a timely decision on the Proposal before it, as it is required to do in accordance with the Rules and GPS. The Commission considers that it is incumbent upon it to make a decision on the basis of the best information currently available.

In light of the above, much of the review of the Proposal has concentrated on a comparison of the Proposal with the best alternative, and the appropriate inputs and assumptions that should be used in applying the grid investment test to the Proposal and the best alternative.

The capacities of the Proposal and the best alternative are substantially equivalent. The Proposal comprises a 400kV-capable transmission line that is initially energised at 220kV, and later, when load growth requires it, modelled to be operated at 400kV following the construction of additional substations. The best alternative comprises initially one 220kV transmission line, with a second line modelled to be constructed when load growth requires it. The new transmission line included in the Proposal provides for significant additional capacity without the need to build a second line.

It is important to note that Transpower's Proposal does not seek approval for the upgrading of the proposed transmission line to 400kV. Transpower's intention is that approval for this step would be sought in a future Grid Upgrade Plan. The Commission's consideration for approval has, therefore, been limited to the first stage of Transpower's plan but with the benefit of the future opportunity to upgrade taken into account in assessing the Proposal.

The inputs and assumptions used in applying the grid investment test to the Proposal and the best alternative affect their “ranking” (in net present value terms). Thus different inputs and assumptions result in a different ranking of the Proposal and the best alternative. In this case, there is sometimes significant divergence in the inputs and assumptions that various experts think appropriate. It is the role of the Board of the Commission to determine which set of inputs and assumptions it wishes to adopt given that each set may be equally credible.

Focusing on the areas of divergence runs the risk of not acknowledging the significant level of agreement between the Commission and Transpower regarding the key

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<sup>4</sup> The 220kV alternative consisted of building a new 220kV double circuit transmission line between Whakamaru and the South Auckland urban boundary with 220kV underground cables from the South Auckland urban boundary to Pakuranga.

features of the Proposal, and the inputs and assumptions that should be used in analysing it.

It is, however, important for the Commission Board to consider possible divergent inputs and assumptions used in the grid investment test that lead to different results under that test before reaching its view on what inputs and assumptions should be applied.

The Commissioners are in agreement regarding the need for, and key features of, a timely upgrade to the transmission grid.

### *Divergent assumptions and judgments*

In applying the grid investment test, Transpower concludes that the Proposal generates a net present value cost that is approximately \$10 million less than the best alternative. In response to suggestions from the Commission, Transpower subsequently improved its modelling of transmission losses, which has resulted in a revised estimate of just under \$12 million. That is, Transpower's modelling concludes that the Proposal minimises expected net market cost compared with the best alternative by an amount of approximately \$12 million.

In the context of the scale of the investment (which amounts to approximately \$824 million (including contingencies) in 2011 dollars), this difference is small having regard to:

- the long time-frame over which costs will impact and benefits will accrue;
- uncertainties associated with forecasting demand and supply;
- the need for judgment in relation to issues such as estimating exchange rate impacts and the discount rate that should be used to convert future costs and benefits into present day values; and
- the project implementation risks associated with constructing such an investment.

Statistically, the numerical result is within a range that is very small in modelling terms.

Nevertheless, the analysis provided by Transpower suggests that the Proposal meets the relevant statutory tests and, therefore, that it is open to the Commission to approve it.

However, as recognised above, inputs and assumptions used in the grid investment test affect the results of that test, and determining the appropriate inputs and assumptions requires a significant level of judgment that requires evaluating divergent views. In this regard, the ultimate decision on the appropriate inputs and assumptions may be a finely balanced one.

In reviewing the Proposal, the Commission used its own staff and external experts to review Transpower's design and costing of the Proposal and each alternative, as well as reviewing how Transpower had applied the grid investment test.

In the Commission's draft decision about the Original Proposal, the magnitude of such differences was large and did not need to be more precisely analysed. In this decision, the differences between the Proposal and the next best alternative project are relatively small. Therefore, more detailed consideration of a range of factors is more important when the likely results of the analysis are so close.

Commissioners considered a range of issues, including:

- the likely cost of installing underground cables that would be required to allow full use of the transmission capability of the 220kV alternative;
- the likely costs and benefits of the use of an alternative conductor for the 220kV alternative;
- the strategic benefit of the Proposal that Transpower attributed to savings in the number of transformers needed that could occur as a result of an extension of a 400kV line through the southern North Island;
- the allowance by Transpower for possible construction delays if a second 220kV line were required (in relation to the 220kV alternative); and
- the analysis period and the market development scenarios, particularly in view of the Government's recent changes to the Government Policy Statement on Electricity Governance that strongly focuses on the facilitation of future generation from renewable energy sources.

The Commission Board also sought advice on several further issues. On the one hand, it wanted to test the reasonableness of the assumption used in the analysis that, in future, a second additional substation would be required in the South Auckland area which would be connected by underground cables. It also sought advice on the advisability of relying on a single, large-capacity line for the future security of supply to Auckland.

On the other side of the ledger, the Board sought clarification on the likely magnitude of further benefits that might arise from the Proposal. First, there was a question of the extent to which the economy might benefit from improved business confidence if a higher capacity line was built, and/or whether there were capacity benefits associated with a 400kV line compared with a 220kV alternative. Secondly, there was uncertainty about whether grid reliability and resiliency could be enhanced in the medium term (before energising the larger line at 400kV versus constructing a second 220kV line). Finally, Transpower had suggested that there were risks that, during the period before the construction of the (modelled) second 220kV line, land price rises and urban encroachment could push up the costs of acquiring land and easements.

None of these issues (either in favour of the Proposal or of the 220kV alternative) has been resolved to the satisfaction of the Board. The Board has taken the view that where there is significant uncertainty surrounding either the likely emergence of these

further costs or benefits, or the value that can reasonably be attached to them, it would be imprudent to incorporate them as inputs in an application of the grid investment test.

Consideration of the points noted above has led Commission Board to the majority view that the Proposal meets the requirement of the grid investment test with a result of similar magnitude to that described by Transpower in its application (\$11 million), albeit for a range of slightly different reasons.

### *Sensitivity of results from the application of the grid investment test*

Applying the grid investment test to the Proposal requires the Commission to exercise judgment in order to set various inputs and assumptions.

Once the Commission has determined these matters, the appropriate values are included in the model used to calculate the net present value of the Proposal and the alternatives. The model will yield an exact net present value number. However, that number may give a false sense of precision as to the expected net market cost, or expected net market benefit, of a proposed investment or alternative project because of the possible range of credible inputs and assumptions that may be used.

In the context of this decision, the Commission has acknowledged that the grid investment test may result in a range of results, driven by differences in the assumptions and inputs used in applying the grid investment test.

To better assess the robustness of the decision, based on a range of possible values for a number of key inputs, and as required by the Rules, a comprehensive sensitivity analysis was undertaken. The sensitivity analysis established that the results of the test were robust to almost all of the sensitivities applied.

### *Exercising judgment*

In exercising judgment in relation to the inputs and assumptions that should be used to apply the grid investment test, the Commission must have in mind a number of statutory instruments, specifically:

- the Commission's statutory functions, objectives, and outcomes, and the principal objectives of the Commission, all as set out in the Electricity Act 1992 (**Act**);
- the objectives and outcomes specified in the Government Policy Statement on Electricity Governance October 2006 (**GPS**); and
- the purpose of the Rules against which the Proposal must be assessed.

None of these statutory instruments are determinative. Inherent in them is a tension between producing a reliable supply of electricity and investing in an efficient and cost-effective way.

The Commission considers that both the Proposal and the 220kV alternative would be consistent with meeting its principal objectives under the Act. Both meet the purpose of

the grid upgrade and investment rules in section III of part F of the Rules. Both achieve the outcomes sought in the GPS, although the Proposal has a slight advantage in this respect.

The Commission has also taken account of comments about the Proposal that it received in October and November 2006. They reflect the tension inherent in the judgment that the Commission is required to exercise when considering the costs and benefits of the Proposal.

On the one hand, there is a convergence between the comments received and the priorities expressed in the revised GPS for timely decision-making, business confidence arising from more certainty around long-term planning and infrastructure development, adequate capacity to allow for the development of renewable generation in as yet unspecified locations, and the priority to be given to reliability over cost where there is an element of uncertainty.

On the other hand, there is a recognition that adequate reliability may be able to be secured by more than one form of transmission upgrade, and that there may be avoidable costs associated with an alternative to a very large upgrade in grid capacity.

Finally, land owners and residents in the areas to be traversed by the transmission line to which the Proposal relates expressed strong opposition. Many of their concerns were in relation to the environmental effects of the lines. However, the environmental effects of the lines are primarily a matter for territorial local authorities and the Environment Court, not the Commission. However, the concerns expressed about the effects the proposed line would have on farming operations were noted by the Commission, especially in relation to the compensation costs assumed by Transpower.

### *Decision*<sup>5</sup>

In relation to this Proposal, individual Commissioners have some divergent views as to the appropriate inputs and assumptions that should be used in applying the grid investment test. As noted earlier, the majority agree that the Proposal meets the requirements of the grid investment test.

One Commissioner concluded that the Proposal does not meet the requirements of the grid investment test.

He differs from the majority on the issue of how the market development scenarios have been constructed (particularly in regard to Upper North Island generation). He also considers that the advantages arising from future 400/220kV transformer rationalisation are not likely given that, in his view, Transpower has not been able to reasonably demonstrate the need for a 400kV Grid Vision.

He also has reservations that a number of unresolved issues may materially affect the decision. An elaboration on these issues and further reasons for his position will be

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<sup>5</sup> Commissioner Rodger did not participate in deliberations or vote on this issue given his recent tenure as Deputy Chair of Transpower.

provided at the time that the statement of reasons for the decision is published in mid-February 2007.

All Commissioners agree that at least some of the unresolved and uncertain issues mentioned earlier should be further investigated, to the extent possible, prior to the public conference.

In the context of the minority opinion, the Commission wishes to restate earlier comments that:

- all Commissioners and Transpower agree that maintaining a reliable supply of electricity into and through Auckland requires a substantial upgrade of the transmission grid from South Waikato to Auckland;
- many of the elements of the upgrade are agreed, and are not considered controversial;
- substantial improvements in reliability and benefits have already been captured as a result of the review process that was undertaken since the Original Proposal was submitted as part of the Grid Upgrade Plan in September 2005.

### ***Conclusion – decision***

The decision of the Commission is, therefore, to approve the Proposal.