

BEFORE THE BOARD OF INQUIRY

IN THE MATTER of the Resource Management Act
1991

AND

IN THE MATTER of applications for resource consent
and notices of requirement by
Transpower New Zealand Limited for
the North Island Grid Upgrade Project

**STATEMENT OF EVIDENCE OF TIMOTHY ANDREW GEORGE FOR
TRANSPOWER NEW ZEALAND LIMITED
(Process in selecting the 400 kV capable line option)**

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INTRODUCTION

Qualifications and scope of brief

1. **MY** name is Timothy Andrew George. I am employed by Transpower New Zealand Limited (**Transpower**) as Group Manager Grid Investment. I have been working in that role since I joined Transpower in August 2005. I was recruited to this position to set up a new transmission planning division within Transpower, with the explicit mandate to formalise Transpower's internal transmission planning processes in line with the new regulatory regime being established (i.e. the Electricity Commission).
2. I have been working in the electricity industry since 1978 and, prior to joining Transpower in 2005, I worked in Australia in transmission planning roles for 23 years.
3. I hold the following qualifications:
 - (a) BSc (Electrical Engineering), University of Cape Town; and
 - (b) MSc (Electrical Engineering), University of Cape Town.
4. **MY** role at Transpower involves the following duties/responsibilities:
 - (a) Managing around 35 persons, that undertake engineering and economic analysis of New Zealand's electric power systems;
 - (b) Undertaking reviews and reporting on the adequacy of the New Zealand transmission system to meet the predicted future demands for electricity (in Transpower's Annual Planning Report);
 - (c) Proposing transmission and/or non-transmission investments to meet the required reliability standards; and
 - (d) Obtaining approvals from the Electricity Commission in accordance with the Electricity Governance Rules 2003 (**Rules**) to undertake investments.
5. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court Consolidated Practice Note

(2006). I have approached the preparation of this evidence in the same way that I would for the Environment Court. Thus, except where I state that I am relying on the specified evidence of another witness, my evidence in this statement is within my area of expertise.

6. **IN** this statement of evidence I comment on the need for the North Island Grid Upgrade Project (**Upgrade Project**). In doing so, I summarise:
- (a) the background and context to this statement of evidence;
 - (b) Transpower's responsibilities as a State Owned Enterprise and the role conferred on it by the Government;
 - (c) the role of transmission within the New Zealand power system;
 - (d) Transpower's transmission grid planning processes;
 - (e) the role of the Electricity Commission and the rules relating to submission and consideration of transmission investments;
 - (f) the need for investment in the transmission grid supplying the upper North Island;
 - (g) the development of options and selection of a preferred solution for the Upgrade Project; and
 - (h) the Electricity Commission decision in relation to the Upgrade Project.

BACKGROUND AND CONTEXT

7. **IN** order to put my statement of evidence into some context, it is helpful to briefly outline matters which will be addressed in further detail later in this evidence.
8. **THE** first issue which needs to be understood is that the proposal which is the subject of this hearing is a revised and updated version of an earlier proposal. The current Upgrade Project (referred to as the Amended Proposal in this evidence) is that which was approved by the Electricity Commission in July 2007, which is an updated proposal following the Commission's draft determination in April 2006 to decline an earlier upgrade (referred to in this

evidence as the Original Proposal). The essential differences between the Original and Amended Proposal are:

- (a) the maximum capacity of the new lines to be implemented (i.e. capacity increased from 1200MVA to 2700MVA per circuit); and
- (b) the staging of the proposed investment - while the Amended Proposal involves implementation of a new 400kV capable transmission line and associated works, under the Approval granted it will only operate at 220kV. To operate the line above the 220kV capacity, Transpower will need to gain further approval from the Electricity Commission to invest in the additional infrastructure required to operate the line at 400kV.

9. **THE** second matter which it is helpful to address at this point is the Electricity Commission's approval of the Upgrade Project. As I will outline in further detail later in this evidence, the relevance of approval from the Electricity Commission for the Upgrade Project is that if an investment is approved by the Electricity Commission, Transpower can recover the approved costs of the investment from designated transmission customers with a rate of return determined in accordance with the proposed administrative settlement between Transpower and the Commerce Commission. Transpower's pricing is subject to regulation by the Commerce Commission and because Transpower has in the past overshot its price threshold set by the Commerce Commission, Transpower has proposed an administrative settlement as an alternative to the Commerce Commission exercising control over Transpower's pricing.

10. **TRANSPOWER** will also be able to recover the costs of certain other types of investment (currently not subject to Electricity Commission approval under Part F of the Rules (**Common Bundle of Exhibits, tab 2**)) under its administrative settlement with the Commerce Commission or alternatively Transpower can incur the expense itself with the consent of its Government shareholder. However, given the nature and the size of the investment Transpower will ordinarily seek approval from the Electricity Commission, and has done so in this instance.

11. **THIS** evidence is based on the fact that Transpower has sought and obtained Electricity Commission approval for the Upgrade Project. It is worth emphasising that it is not however a necessary legal requirement or prerequisite for Transpower to obtain Electricity Commission approval for an investment before deciding to pursue it. In that respect, Transpower could still seek Resource Management Act 1991 (**RMA**) approvals and acquire necessary interests in land for the Upgrade Project irrespective of such approval. The key implication of the absence of Electricity Commission approval is that Transpower may not then be able to recover the costs of its investment under the Rules (i.e. from designated transmission customers).

RESPONSIBILITIES AS A STATE OWNED ENTERPRISE

12. **AS** a State Owned Enterprise (**SOE**), Transpower has statutory responsibilities under the State Owned Enterprises Act 1986. While section 4 of that Act provides that the principal objective of an SOE is to operate as a successful business, Transpower is also required to be:
 - (a) as profitable and efficient as comparable businesses that are not owned by the Crown;
 - (b) a good employer; and
 - (c) an organisation that exhibits a sense of social responsibility by having regard to the interests of the community in which it operates and by endeavouring to accommodate or encourage these when able to do so.
13. **PART** Three of the SOE Act also sets out various accountability and reporting requirements regarding the operation of SOEs, including half-yearly reports to shareholding Ministers and the provision of a range of information regarding the operation and performance of SOEs to Parliament on an annual basis. The Auditor-General is responsible for auditing Transpower. My understanding is that the purpose of these requirements is to ensure that SOEs are accountable and, by and large, conduct their business in a transparent manner. It should be noted that there are other reporting and accountability requirements that Transpower must comply with including under the Rules, which I discuss later in my evidence.

AN OVERVIEW OF THE ROLE OF THE TRANSMISSION GRID

14. A secure, stable central transmission grid (national grid) forms the backbone of a modern electricity system. In New Zealand, the national grid transmission grid comprises over 12,000 kilometres of high voltage transmission, linking generation sources to substations where customer loads are supplied. A high voltage direct current (**HVDC**) link enables energy transfers between the North and South Island. Both northward and southward transfers occur on this link, in response to market requirements. The remainder of the transmission system uses high voltage alternating current technology (**HVAC**).

15. **THE** Rules require Transpower to ensure the reliability of the transmission system. The basic requirement is to provide a core transmission grid that can withstand the loss of any one component (e.g. a circuit) and still meet peak load demand. This level of security is often referred to as an "N-1" security criterion. The power system must be operated in such a way as to provide "N-1" security, providing resilience should one element fail. This security criterion limits the extent to which lines can be taken out of service (either under fault conditions or planned outages required for activities such as inspection or maintenance). It also dictates, to some extent, the level of investment required in the national grid.

16. **THE** transmission grid provides the following critical and essential functions for New Zealand. It:
 - (a) transports electricity across the country (connecting generation with load), which supports New Zealand's national and regional economic growth;
 - (b) plays an essential role in maintaining reliability and security of supply;
 - (c) delivers investor confidence to both the suppliers and consumers of electricity, provided the transmission grid continues to be maintained and developed to meet the standards specified in the Rules;
 - (d) provides a platform for facilitating competition between the suppliers and retailers of electricity thereby assisting in exerting downward pressure on delivered electricity prices; and

- (e) facilitates the development of new electricity generation technologies, including renewable energy, by providing access to markets.

17. **THEREFORE**, "*investment*" in the transmission grid provides the following benefits. It facilitates:

- (a) both the maintenance and improvement of the reliable supply of electricity;
- (b) the efficient transfer of energy through a reduction of losses;
- (c) opportunities to maintain the existing transmission system;
- (d) the continued reliable utilisation and further development of existing electricity generation sources;
- (e) the efficient development and utilisation of new generation, including new renewable generation which assists in the management of the effects of climate change;
- (f) enhanced competition in the supply of electricity through removal of points of congestion; and
- (g) economic growth and business confidence.

18. **THE** physical location of the grid is largely determined by the location of supply points (i.e. generation) and connection to areas of consumption, referred to in the industry as demand. The physical distances between the supply points and areas of consumption sometimes require transporting generated electricity over long distances (for example, the HVDC link can transport over 700MW from Benmore in the South Island to Wellington in the North Island). The existing transmission grid, and the future new additions to it, are therefore not influenced to any real degree by local authority boundaries, but by the need to link generation to areas of demand. Most transmission lines, for example, will not be contained within the boundaries of a single local authority and many will pass through the jurisdiction of several local authorities.

INFLUENCES ON TRANSMISSION PLANNING

19. **THERE** are a number of variables that influence how the grid is developed to meet the requirements of the Grid Reliability Standards defined in the Rules (I discuss these standards later in my evidence). The main drivers of grid development are demand growth and the development of new generation sources.
20. **OTHER** influences on the development of the grid include economic drivers to enhance competition by removing points of congestion on the grid and investment in non-transmission alternatives that can act to defer transmission investment. The key point is that these particular variables *influence* the development of the transmission grid, but do not *replace* the need for the grid. These variables are described here in more detail.

Demand Growth

21. **IN** the first instance, transmission planning is determined by demand growth. Transmission planning requires an analysis of the transmission grid's adequacy in terms of meeting a forecast of peak *demand*, rather than energy. Energy is not necessarily consumed at the same rate, either from day-to-day, or from hour-to-hour. For example, in homes, much more energy is consumed between the hours of 7.00-9.00 am and 5.00-8.00 pm than at any other time of the day, due to heavier domestic appliance use. Because electricity cannot be stored practically in the quantities required, meeting electricity demand means having sufficient capacity in the electricity supply system (generation, transmission and distribution) to meet the highest (peak) demand that may occur approximately one year in ten. The assessment of the peak demand takes into account the historical extent of load control practiced by the local lines companies.
22. **DEMAND** forecasting is undertaken by the Electricity Commission at a national level. The Commission uses an econometric model to forecast national demand, based on forecasts of the following main variables:
 - (a) Economic activity, measured by a range of factors including forecast gross domestic product (**GDP**);

- (b) Demographics, including forecast population growth and household number trends; and
 - (c) Estimates of future electricity prices and possible demand response to price.
23. **TRANSPower** also undertakes its own demand forecasting which it reviews in light of the Electricity Commission's results. If Transpower wishes to rely on its forecast demand in analysing a particular investment and not those developed by the Electricity Commission, those forecasts must be justified as reasonable to the Electricity Commission.
24. **TRANSPower** then derives regional energy forecasts by allocating the Commission's national energy forecasts across thirteen regions across both islands, based on regional population forecasts provided by Statistics New Zealand. Transpower converts those regional energy forecasts into a maximum regional demand forecast. Transpower can modify these forecasts if it becomes aware of load changes in the region. As noted above, modified forecasts must be justified as reasonable to the Electricity Commission if they are to be used in the application of the grid investment test. The development of regional forecasts takes account of known distributed generation (locally connected generation, embedded within local distribution grids), and line losses in the transmission grid.

Generation Sources

25. **SECONDLY**, transmission planning is affected by the location, size and type of generation sources. The Government Policy Statement (**GPS**) on Electricity Governance, the recently released New Zealand Energy Strategy (**NZES**), and Government strategy for managing climate change, all prioritise a transition to greater renewable energy generation, with wind and geothermal energy likely technologies. A robust national high voltage transmission line grid is required to achieve the renewable energy goals set by the Government.
26. **IN** particular, the likely increase in energy supply from wind sources may require augmentation (i.e. an increase in capacity) of existing lines, or new lines, to ensure output or production can be transported to market. Augmentation is also likely to be required to allow for variations in power flow

that will arise from the large scale adoption of intermittent power sources like wind, or tidal generation (should it become commercially and technically viable). Some renewable generation sources are likely to be developed at locations currently not served by the existing transmission grid and these will require new lines.

27. **THE** Electricity Commission develops and publishes possible future generation scenarios in its Statement of Opportunities. These generation scenarios are intended to examine a range of generation investments, including renewable and distributed generation. Transpower must have regard to those generation scenarios in the application of the grid investment test to assess the robustness of potential transmission investments. Transpower can vary these scenarios provided it can justify to the Electricity Commission any changes that are made.

Transmission Investment

28. **THIRDLY**, demand management and/or the use of local distributed generation can be an effective tool to potentially defer some transmission investment. Transpower is developing a concept of a Grid Support Contract product. This product may allow the deferral of transmission investments or manage delivery risk of approved projects if the equivalent of at least one year of demand increase can be contracted for at an economic value. Transpower has initiated a pilot Demand Side Participation Trial in the Upper South Island for the winters of 2007 and 2008. This trial involves the assessment of the effectiveness of contracting to reduce peak electricity demand in that region to potentially defer possible future transmission investment. Transpower will use the results of the trial as an input to the development of its Grid Support Contract product.
29. **FINALLY**, grid planning is influenced at a smaller scale by delays in achieving upgrades or routine maintenance works. The integrated nature of the grid means that changes to demand or capacity on one line at one particular location may affect capacity along a different line, at a distant location. Thus, the inability to undertake works required to meet capacity may mean capacity at a different location is affected. The implications of delayed or stalled upgrades on transmission lines can be significant, including forced load shedding (reduction in available electricity), or deliberate reductions in load

(power cuts) to industry or towns to preserve the security of the greater power system. Provision is therefore made in the planning process to try and ensure adequate 'windows' exist where maintenance can be undertaken on transmission equipment.

30. **TRANSPOWER** recognises and takes into account in its planning processes that a range of options, including demand management, distributed generation and different forms of generation including renewable, can contribute to the dimension and capability of a transmission grid in an integrated electricity power system. However, it is important to recognise that these options *complement* rather than *replace* the need for maintaining and expanding the capacity of a high voltage transmission grid.

TRANSMISSION GRID PLANNING PROCESS

31. **HAVING** considered the need for the transmission grid and the key factors that influence its development, I now turn to the process for planning and approving upgrades to, or augmentations of, the grid. For major investments in the grid Transpower will always seek approval from the Electricity Commission, unless, with the consent of the Government shareholder, unusual circumstances arise where Transpower's costs can be underwritten by the shareholder.
32. **EACH** year Transpower publishes an Annual Planning Report. This Report includes the Grid Reliability Report, which is a requirement under the Rules. The Annual Planning Report has an outlook of ten years and identifies those parts of the transmission grid that require attention if supply reliability is to be maintained. The Annual Planning Report considers each of thirteen geographic regions and the backbone grid that connects these regions. Periodically, Transpower conducts a long-range planning investigation with a longer outlook period to assess high level strategies for meeting future generation and demand forecasts.
33. **THE** outputs of the planning process are published to allow interested parties to consider how they might be impacted. The plans are also intended to provide confidence to existing and potential participants in the wholesale electricity market that the transmission grid is being well managed and that the expected standards will be maintained. Investors may also consider whether

they can provide more cost-effective alternatives that will reduce or remove the drivers for potential new investments.

34. **WHERE** it is determined that projected demand for electricity is going to exceed existing transmission capacity, a process of identifying solutions begins sufficiently in advance of the need date to allow potential investments to be constructed. This process must comply with the requirements of Part F of the Rules (**Common Bundle of Exhibits, tab 2**). (I discuss these requirements in more detail later in my evidence.) The processes, some of which are still under development, involve seeking input from industry on the needs analysis and seeking proposals for non-transmission alternatives such as generation or demand management options.
35. **NON-TRANSMISSION** alternatives must be practicable, technically feasible and must be able to defer (or replace) any proposed transmission investment proposals by at least one year. They must also be of comparable reliability to a transmission investment in order to maintain operational security.
36. **INDUSTRY** input can also be provided on the appropriateness (or otherwise) of transmission options to address the need.
37. **THESE** requirements all determine how transmission upgrade projects are identified to address a reliability or congestion issue in a particular part of the transmission grid. The *location* of the solution is also relatively fixed as it is predetermined by the location of generation sources, demand nodes, and the existing transmission grid.
38. **WHERE** it is confirmed that the transmission capability must be increased, Transpower assesses the potential capacity of the existing infrastructure. Upgrading existing infrastructure is always considered as the first option because it is usually the most cost effective. Typically, consideration would be given to the following generic transmission options:
 - (a) reconfiguring existing substations;
 - (b) replacing or adding equipment at substations;
 - (c) the building of new substations or generation connections;

- (d) augmenting the capacity of existing transmission lines; and
 - (e) building new transmission lines.
39. **IN** developing options, Transpower also considers the cost implications of the consenting, environmental and property issues. For example, high property costs in a built up area may mean that an underground cable becomes preferable, rather than an overhead line option.
40. **THE** regulatory control, where approval is sought from the Electricity Commission for major investments in the transmission grid, is designed to ensure that projects represent the most cost-effective investment to meet communities' identified electricity needs.

ELECTRICITY COMMISSION PROCESS

41. **THE** Electricity Commission was established in September 2003. It is a Crown entity set up under the Electricity Act 1992 (**Electricity Act**) to oversee New Zealand's electricity industry and markets.
42. **THE** Electricity Commission's principal objective, as set out in the Electricity Act, is to ensure that electricity is produced and delivered to all classes of consumers in an efficient, fair, reliable and environmentally sustainable manner. The Electricity Commission is also required to promote and facilitate the efficient use of electricity.
43. **THE** Electricity Act also established the Government Policy Statement (**GPS**), which sets out the Government's *objectives and outcomes* that the Commission must take account of, when, among other things, it is making decisions whether or not to approve transmission investments. In contrast, investment decisions by electricity generators do not require Electricity Commission approval.
44. **THE** GPS outlines the New Zealand government's expectations for the effective operation of the electricity market and identifies three priority areas:
- (a) Security of supply and reserve generation;

- (b) Priority investment in the transmission grid; and
- (c) Hedge market arrangements and demand-side participation.

The most relevant consideration for the Upgrade Project is that described in paragraph (b) above.

- 45. **FOR** reliability investments the Electricity Commission approves *individual* transmission investment proposals in accordance with prevailing standards for transmission grid reliability, good electricity industry practice and economic merit, as established through the Grid Investment Test (**GIT**).
- 46. **THE** GIT is an economic test designed to select the investment option that provides the greatest expected net market benefit when compared to a number of alternatives. The robustness of the economic analysis is assessed by considering a range of sensitivities to key inputs to the analysis. The GIT is not a national benefit assessment, but rather assesses the costs and benefits that accrue to market participants. Environmental, cultural and other social impacts can be taken into account to the extent that they are, or are forecast to become, costs to the industry. The effect of the GIT is to ensure that only investments that can be economically rationalised are approved. This prevents, for example, over-investment by Transpower. (I discuss the GIT in more detail later in my evidence).
- 47. **THIS** regulatory framework means that transmission grid upgrades (including new lines) are only approved by the Electricity Commission when there is a clear, demonstrable need (assessed by compliance with various statutory tests). If the Electricity Commission approves an investment, Transpower can recover the costs of the investment from designated transmission customers with a rate of return determined in accordance with Transpower's administrative settlement with the Commerce Commission.
- 48. **ACCORDINGLY**, Transpower's investment decisions which are considered under the Rules are constrained by Transpower's ability to obtain the approval of the Electricity Commission. As I have identified at the outset however, in theory there is no legal barrier preventing Transpower from pursuing a project or investment which has not been approved by the Electricity Commission. However, given the large capital expenditure required to implement the

Amended Proposal, Transpower is unlikely to undertake such an investment without either the approval of the Electricity Commission (as in this instance) or the consent of the Government shareholder.

49. I discuss the Electricity Commission process in more detail later in my evidence.

LEAD TIMES FOR INVESTMENT IN TRANSMISSION

50. **INVESTMENT** in new transmission assets may have significant lead times. It needs to be planned well in advance to allow for the:

- (a) reporting and consultation processes undertaken by Transpower;
- (b) regulatory approval processes and consultation undertaken by the Electricity Commission;
- (c) public consultation and RMA authorisations to be secured;
- (d) property rights to be negotiated; and
- (e) sufficient time for equipment procurement and construction of the asset.

51. **INVESTMENTS** that occur in Transpower owned substations will generally have a lead-time of two years. For example, the Albany static var compensators (**SVC**) project of \$30 million, which is intended to support voltage through installation of reactive plant, has a lead time of 2 years. This lead-time can be affected by world demand for power system equipment, as is currently the case with the rapid development of power systems in China and India. In this regard, Transpower is currently experiencing difficulties in sourcing transformers. This is a global demand issue. Accordingly, transmission investment projects that rely on sourcing transformers may experience greater than 2 year lead times to implement.

52. **INVESTMENT** in new transmission lines may have lead-times of five to seven years to take account of the designation, consenting and property rights acquisition processes. Although no major new lines have been built under the RMA regime (noting that some "spur" lines have been built), the Original Proposal submitted in 2005 anticipated construction of a new line to be

completed by 2010 (i.e. a 5 year time period) and the Amended Proposal, submitted in 2006, anticipated construction of a new line to be completed by 2011 with an acknowledgement that it may not be achievable till 2013 (i.e. a 5 - 7 year time period). Ultimately, the 5 - 7 year lead time is based on Transpower's and its advisors best estimates.

53. **DURING** the investment project lead-time, changes can occur in the factors driving the preferred transmission technology and the factors underpinning the design of the proposed asset. These changes might arise from:
- (a) increases or decreases in the expected load;
 - (b) emergence of new transmission technologies;
 - (c) landowner requests for changes as a result of changes in their land use patterns;
 - (d) discovery of unfavourable geology or soil conditions; and
 - (e) changes in land use (e.g. rural land being subdivided for urban development).
54. **GENERALLY**, investment decisions are robust to changes because of the wide range of sensitivities that are considered in the analysis and approval framework. In addition, Transpower identifies opportunities to stage its projects to optimise, where practicable, the timing of specific capital spend if there are changes to underlying assumptions. Later stages of projects can only be approved by the Electricity Commission if and when they are justified under the Rules.

ELECTRICITY COMMISSION PROCESS AND TEST

55. I have previously provided an overview of the Electricity Commission process. I discuss this process in greater detail in this section of my evidence.

Process

56. **PART F** of the Rules (as set out in rule 13, section III of Part F of the Rules) sets out the process and test that the Electricity Commission must apply in approving investments proposed by Transpower. The Rules define a separate

process for investment classified as reliability investments and those classified as economic investments.

57. **RELIABILITY** investments are defined under the Rules as follows:

“investments by Transpower in the grid, or alternative arrangements by Transpower, the primary effect of which is, or would be, to reduce expected unserved energy” (emphasis as set out in the Rules).

58. **THE** definition of “expected unserved energy” under the Rules is as follows:

“a forecast of the aggregate amount by which the demand for electricity exceeds the supply of electricity at each grid exit point as a result of likely planned or unplanned outages of primary transmission equipment”.

59. **IN** turn, primary transmission equipment is defined in the Rules as follows:

“any plant or equipment forming part of the grid which enables the bulk transfer of electricity, including without limitation transmission circuits, busbars and switchgear”.

60. **UNSERVED** energy results where the demand for electricity cannot be securely supplied, i.e., the demand is not serviced. In this matter, Transpower’s Upgrade Project is for an investment required to ensure that the supply of electricity to the upper North Island region will meet the growing demand for electricity in that area, without the need to shed load at times of high peak demand. If Transpower was required to shed load to the upper North Island, unserved energy would result. Accordingly, Transpower’s Proposal is a reliability investment as defined by the Rules.

61. **THE** Rules then provide a catch all for economic investments which are defined under the Rules as any investment in the grid that meets the grid investment test that is not a reliability investment.

62. **THE** Rules dictate that the process for consideration and approval of reliability investments follows the steps below:

- (a) the Electricity Commission receives the application for approval of the transmission investment (Transpower’s Application for Approval);
- (b) the Electricity Commission publishes Transpower’s Application for Approval and requests comments, including requests that the

Electricity Commission consider alternatives to the individual transmission investment;

- (c) the Electricity Commission analyses any comments or requests received in response to Transpower's Application for Approval;
- (d) the Electricity Commission may ask questions or request clarifications from Transpower on any part of Transpower's Application for Approval;
- (e) the Electricity Commission publishes a notice of intention to approve or decline Transpower's Application for Approval including reasons for that intention;
- (f) affected parties (i.e. parties that the Electricity Commission determines, in consultation with Transpower, are persons representative of person likely to be substantially affected by the transmission investment) may request a public conference within 10 business days of publication of the notice of intention;
- (g) the Electricity Commission considers whether to hold a public conference;
- (h) if no public conference is held, the notice of intention becomes the final decision;
- (i) if a public conference is held, the Electricity Commission arranges and holds the public conference, considers all submissions from the public conference and publishes its final decision.

63. **ACCORDINGLY**, parties had up to three separate opportunities under the Rules to provide comments to the Electricity Commission (i.e. under the Electricity Commission's formal request for comments on Transpower's Application for Approval, in response to the Electricity Commissions publication of its notice of intention and, if requested and held, as part of a public conference).

64. **IN** addition to any consultation required as part of the Rules, the Electricity Commission and Transpower separately sought feedback and comment on the Upgrade Project. The Electricity Commission sought feedback and

comment on the need for investment and, at the request of the Minister of Energy, the identification of alternatives prior to Transpower's submission of an investment proposal. Transpower, through its Annual Planning Report, sought feedback and comment on the Upgrade Project. Transpower then worked with the Electricity Commission to determine the assumptions to be used in the analysis that were consistent with the feedback and comment received by the Electricity Commission and Transpower.

65. **FINALLY**, there is no restriction on parties approaching the Electricity Commission to provide feedback outside of the formal processes set out in the Rules.

Test for reliability investments

66. **PART F** of the Rules also sets out the tests that the Electricity Commission will apply in approving investments proposed by Transpower.

67. **FOR** the investment proposed for the upper North Island region, i.e., a reliability investment, the tests for approval (as set out in rule 13.4, section III of Part F of the Rules (**Common Bundle of Exhibits, tab 2**)) are that the proposed investment must:

- (a) reflect good electricity industry practice in meeting the grid reliability standards;
- (b) comply with the processes set out in the Rules; and
- (c) meet the requirements of the grid investment test.

Grid reliability standards

68. **THE** grid reliability standards are contained in Schedule F3 of the Rules, which states that the grid satisfies the grid reliability standards if:

"4.1 *the power system is reasonably expected to achieve a level of reliability at or above the level that would be achieved if all economic reliability investments were to be implemented; and*

4.2 *with all assets that are reasonably expected to be in service, the power system would remain in a satisfactory state during and following any single*

credible contingency event occurring on the core grid."

69. A "single credible contingency event" is defined in the Rules as follows:

"an individual credible contingency event comprising any one of the following:

- (a) a single transmission circuit interruption;*
- (b) the failure or removal from operational service of a single generating unit;*
- (c) an HVDC link single pole interruption;*
- (d) the failure or removal from service of a single bus section;*
- (e) a single inter-connecting transformer interruption;*
- (f) the failure or removal from service of a single shunt connected reactive component "*

70. IN turn, "satisfactory state" is defined in the Rules to mean:

"that none of the following occur on the power system:

- (a) insufficient supply of electricity to satisfy demand for electricity at any grid exit point;*
- (b) unacceptable overloading of any primary transmission equipment;*
- (c) unacceptable voltage conditions; and*
- (d) system instability".*

71. AS set out earlier, the basic requirement is to provide a core transmission grid that can withstand the loss of any one component (e.g. a circuit) and still meet peak load demand, the "N-1" security criterion.

Good electricity industry practice

72. THE Electricity Commission, in its final decisions for the North Island Grid Upgrade Project, and subsequently for the North Auckland and Northland Grid Upgrade Project and the Otahuhu Substation Diversity Project, adopted the following definition of good electricity industry practice:

"The exercise of that degree of skill, diligence, prudence, foresight and economic management, as determined by reference to good international practice, which would reasonably be expected from a skilled and experienced asset owner engaged in the management of a transmission grid under conditions comparable to those applicable to the relevant grid assets consistent with applicable law, safety and environmental protection. The determination is to take

into account factors such as the relative size, duty, age and technological status of the relevant transmission grid and the applicable law."

73. **ACCORDINGLY**, "good electricity industry practice" requires consideration of a complex matrix of sometimes conflicting imperatives, requiring technical experience and good judgement.
74. **TRANSPOWER'S** knowledge, past experience and professionalism assists in ensuring that the Amended Proposal, and in fact any proposed investment in the grid, will meet good electricity industry practice. In my opinion, the good performance of the grid to date demonstrates that Transpower is currently meeting good electricity industry practice.

Grid investment test

75. A reliability investment must meet the requirements of the grid investment test if it is to be approved by the Electricity Commission. For an investment required to meet the N-1 security criterion:

"A proposed investment satisfies the grid investment test if the Board is reasonably satisfied that: ...

4.1.1. the proposed investment maximises the expected net market benefit or minimises the expected net market cost compared with a number of alternative projects; and

4.1.2. if sensitivity analysis is conducted, a conclusion that a proposed investment satisfies clause 4.1.1 is sufficiently robust having regard to the results of that sensitivity analysis. "

76. **THE** Upgrade Project was, therefore, required to maximise the expected net market benefit or minimise the expected net market cost compared with a number of "alternative projects" and in a robust manner with respect to sensitivity analysis. The results of Transpower's application of the GIT were published in the Original Proposal and the Amended Proposal and the Electricity Commission's application of the GIT was published in its decision.

TRANSPOWER IDENTIFICATION OF INVESTMENT NEED

77. **THE** purpose of the Grid Upgrade Project is to provide additional transmission capacity from the generation in the Lower and Central North Island to the load

centres in the Upper North Island. The Waikato region also benefits from the Grid Upgrade project as the same 220 kV circuits that supply the Upper North Island area also supply the Waikato area via a 220kV to 110 kV interconnection at Hamilton Substation.

78. **AS** outlined earlier in my evidence, the main external factors that determine the need for the transmission augmentation are the future demand in the Upper North Island, the location of the future generating plant, and the technical analysis criteria.
79. **THE** need to augment transmission capacity into the Upper North Island was identified as early as 2002, as referred to in Mr Coad's evidence. Much of the detail on need for the project and the date when the project would be required, demand forecasts, generations scenarios, and assumptions used in analysing the options to address the problem is covered in the evidence of Mr Boyle. Nevertheless, it is useful to provide a brief overview of the identification of the need for a new transmission investment.
80. **IN** summary, a wide range of matters were considered and were relevant to the identified need for and timing of augmentation of the transmission grid, including:
- (a) a project assumptions list developed by Transpower and the Electricity Commission;
 - (b) prudent peak demand forecasts provided by the Electricity Commission;
 - (c) historical load growth data for the Upper North Island and consideration of the capability of the transmission grid;
 - (d) consideration of committed generation projects, including their nature and location;
 - (e) a range of generation scenarios which consider possible future generation investments;
 - (f) grid reliability standards; and
 - (g) the impact of interim investment options such as upgrades or improvements to the existing grid.
81. **TRANSPOWER'S** analysis showed that a load of approximately 2500 MW is the maximum load that can be reliably supplied to the upper North Island

region with the existing assets, even with interim improvements and upgrades to the existing grid, as described in Mr Coad's evidence. The peak winter load for the upper North Island could exceed that 2500 MW maximum in 2013. Accordingly, the analysis showed that there would be a real risk of electricity demand not being able to be reliably supplied to the Upper North Island region at times of peak loading from 2013. It was therefore concluded that new investment was required to maintain reliability of the supplies into that region.

82. **IN** summary, Transpower identified a need for increased transmission capacity to the Upper North Island and, as outlined later in my evidence, it was accepted by the Electricity Commission that this would require a new line to be constructed. The Upgrade Project is required to ensure that the growing demand for electricity in the upper North Island is able to be met:
- (a) reliably, so all consumers can be supplied; and
 - (b) securely, so the power system is robust to withstand credible contingencies.

83. **THESE** matters are discussed more fully in the evidence of Dave Boyle.

IDENTIFICATION AND CONSIDERATION OF OPTIONS

Identifying options

84. **THE** Rules require Transpower to consider a range of options to meet the identified need. These options are then screened and shortlisted before the economic grid investment test is used to select the preferred option.
85. **AS** identified earlier in this evidence, broad alternatives to implementing a new transmission line are:
- (a) augmenting existing assets (this alternative looks to gain more capacity from the existing assets);
 - (b) demand side participation which aims to reduce the peak load and thereby reduce the constraint of the system; and
 - (c) implementing new generation plant which, if operated at the time of peak demand, reduces the energy flow on the existing transmission lines.

Original Proposal

86. **TRANSPOWER'S** Original Proposal, as set out in the 2005 Application for Approval, was for the construction of a 400 kV transmission line between the existing Whakamaru and Otahuhu substations and related works.
87. **IN** proposing the 400 kV line option as a solution, Transpower reported on 11 options that were technically feasible to meet the need, including combinations of 220 kV line, 330 KV line, a 400 kV line, a 500 kV line as either underground cables or overhead lines, two HVDC technology options and peaking generation (i.e. generation being made available during times of peak demand only).

Original Proposal options

88. **AS** a result of Transpower's analysis and screening process, Transpower identified two short list options which it considered met the definition of "alternative projects" under the Rules, i.e., the 220 kV overhead line and the 400 kV overhead line. Those two short list options were used in the grid investment test to select Transpower's preferred solution (i.e. the 400 kV overhead line) that formed the basis of the Original Proposal.

Electricity Commission consideration of Original Proposal

89. **THE** Minister of Energy wrote a letter to the Chair of the Electricity Commission on 13 April 2005, in which he confirmed the Government's expectations regarding the Electricity Commission's decision-making process for approving grid upgrade proposals. The Minister requested that when the Electricity Commission considered the Upgrade Project, it should, among other things:
- (a) consult widely with affected parties, including land owners and communities that would be affected by a new line; and
 - (b) undertake a thorough investigation of alternatives to the proposal, including alternative generation and demand-side options and alternative transmission options, such as alternative voltages, direct current versus alternating current, alternative termination points,

underground lines, up-rating existing lines, and upgrading or replacing lines in existing line routes.

90. **AS** a consequence, the Electricity Commission consulted widely on alternatives to the Original Proposal. The Electricity Commission prepared a consultation paper entitled "*Alternatives to Transpower's Proposed Whakamaru-Otahuhu Transmission Upgrade*" which requested submissions on alternatives to the Original Proposal.
91. **THE** Electricity Commission received 135 submissions in response to its request for submissions. In addition to the Electricity Commission's own review and the submissions received, the Electricity Commission commissioned independent expert reports to assist in its consideration of submissions. These reports considered demand-side and renewable generation options.
92. **THE** Electricity Commission also conducted public briefings in June, September and December 2005 in Waikato and South Auckland, where communities would be most affected by Transpower's Original Proposal, and also met with affected iwi in November 2005 and February 2006.
93. **THE** Electricity Commission identified and considered in excess of 40 separate alternatives to the Original Proposal. The Electricity Commission produced a further consultation paper entitled "*Alternatives to Transpower's proposed Whakamaru-Otahuhu 400 kV transmission line: Alternatives analysis stage II*" which requested feedback on the Electricity Commission's analysis and screening of the alternatives to arrive at 15 alternatives it termed as the "*short short list*" of alternatives.
94. **THE** Electricity Commission considered and ultimately narrowed the short short list of alternatives to Transpower's Original Proposal to a set of 3 options against which the Original Proposal (i.e. 400 kV line) was compared - a 220 kV line, 220 kV duplexing of existing lines and a HVDC option.
95. **THE** Electricity Commission's draft determination for the Upgrade Project, dated 27 April 2006 preferred the 220 kV overhead line and the Electricity Commission's then view was to decline the Original Proposal.

96. **THE** key reasons for declining the Original Proposal were that, in the Electricity Commission's opinion, the need date for the investment was 2017 rather than 2010, and that a 220kV option was more cost effective than Transpower's 400kV proposal.
97. **THE** Electricity Commission's draft determination did confirm that unless there was a reduction in the growth in demand or new generation near Auckland, substantial transmission upgrades would be required.
98. **TRANSPOWER** notified the Electricity Commission that it intended to amend the Original Proposal and requested the Electricity Commission suspend its consideration of the Original Proposal.

The Amended Proposal

99. **TRANSPOWER'S** 2006 Amended Application for Approval built upon the analytical results obtained in the Electricity Commission's draft determination. Transpower amended its Original Proposal in the light of the reasons given by the Electricity Commission for declining the Original Proposal and because Transpower believed that technical revisions to the Original Proposal would make it a better solution.
100. **TRANSPOWER'S** Amended Proposal, as set out in the 2006 Amended Application for Approval, was for the construction of a 400kV capable transmission line between the existing Whakamaru and Pakuranga substations (and related works) which, until subsequent approval was obtained, would be operated as a 220 kV line.
101. **IN** proposing the 220/400 kV staged line option as a solution, Transpower undertook further and more detailed analysis of 9 options (including new transmission lines, augmenting existing assets and using HVDC technology) that were technically feasible to meet the identified need.

Amended Proposal options

102. **WHILE** the Electricity Commission had accepted in principle that a new line was the preferred approach to ensuring reliable supply of electricity to the upper North Island region, there were various permutations of what that line

might constitute depending on the capacity of the line, its location, and the staging of investments.

103. **THE** development of possible transmission line projects that would meet the demand is challenging because of the number of potential options that exist using various permutations and combinations of technologies, routes and forecasts. Selecting the preferred option in order to achieve Electricity Commission approval for the investment involves consideration of a wide range of factors but ultimately comes down to the economic test of the GIT.
104. **THE** preference for a high 400kV capable line option was not however pre-determined by Transpower. Indeed, in terms of the analysis of the 220kV and 400kV options for the GIT, it was apparent that the options (in terms of cost) were sufficiently close that Transpower did not know in advance which option would come out on top.
105. **THE** choice of technology is important because, over the period of the analysis, it is possible that some new or refined technologies will emerge. The choice for this investment will have implications for subsequent investments and, therefore, the overall costs and benefits of an option.
106. **IN** addition, the long life of the assets involved, and the staging of developments associated with those assets, means that there will be a number of decision points through the period under consideration.
107. **WHILE** there may be a high level of confidence that the first investment is a sound decision, technological and other changes introduce a degree of uncertainty for future decision points.
108. **THE** approach taken by Transpower for the Upgrade Project was to select project options that would meet the economic test of the GIT and be based on a known technology providing for future stages and development to be consistent with this technology. Some decisions at one time may allow for future options, while another decision at that time may not. For example, building a 400 kV capable line preserves the option for operating the line at 400 kV at a later time. Building a 220 kV line limits its capacity and precludes operation at a higher voltage.

109. **FOR** example, choosing a 220 kV line of certain design characteristics could be followed by a similar development or a duplicate new line when required. As noted in Mr Boyle's evidence, it was concluded that the 220kV alternatives assessed against the Amended Proposal would be likely to result in this situation.
110. **CHANGING** technology at a decision point was avoided by Transpower on the assumption that relative rankings of technologies will not change over time. For example, if 220 kV technology is less costly than HVDC for a comparative capacity, it was assumed that this will remain true over the study period unless there is a compelling reason to believe otherwise. In this case, there were no compelling reasons to believe otherwise
111. **THE** adoption of project staging delivers future opportunities to optimise investments to take account of actual outcomes and any future technological change. Building a 400 kV capable line costs more initially but provides upgrade options for future years. For a known initial cost, future capacity and loss benefits can be obtained.
112. **THE** development of transmission augmentation projects, therefore, focused on providing:
- (a) technology consistency through the study period; and
 - (b) staging, where practicable, to provide flexibility if forecasts turned out higher or lower than expected, to cap downside risks, and to provide opportunities to optimise future technology changes.
113. **THIS** approach in defining possible project options was based on using the best available information at the time of decision making and delivering an outcome that maximised future option values.
114. **AS** a result of the analysis and review of all the alternatives identified, the following short list of options was adopted by Transpower for more detailed assessment in the 2006 Amended Application for Approval:
- (a) Option 1 - 220 kV line into Pakuranga and Otahuhu;

- (b) Option 2 - 400 kV line into the South Auckland urban boundary, 220 kV into Pakuranga and Otahuhu (220/400 kV overhead staged line);
- (c) Option 3 - Duplexing of OTA-WHA A&B (an augmentation of the existing 220 kV assets);
- (d) Option 4 - Augmentation of the existing 220 kV assets using high temperature conductor;
- (e) Option 5 - 400 kV line into Otahuhu;
- (f) Option 6 - 220 kV line into Otahuhu;
- (g) Option 7 - 400 kV line into Pakuranga and Otahuhu;
- (h) Option 8 - 400 kV line into the vicinity of the South Auckland urban boundary, 220 kV line into Pakuranga and Otahuhu – early conversion to 400 kV; and
- (i) Option 9 – an HVDC line and converter stations at Whakamaru and Pakuranga or Otahuhu.

115. **TRANSPower** assessed the 9 options against the definition of “*alternative projects*” for the Upgrade Project using the following assessment criteria:

- (a) the estimated capital and operating costs of the relevant option (as an indication of whether the option would be likely to proceed as required by the definition of “*alternative projects*” at clause 19.3 of Schedule F4 of the Rules; and
- (b) the diversity benefits provided by the relevant option – the benefit of reducing reliance on a single transmission line, corridor or substation (as an indication of whether the option was reasonably expected to provide similar benefits as the proposal as required by the definition of “*alternative projects*” at clause 19.4 of Schedule F4.

116. **AS** as a result of that screening process, Transpower identified 3 short list options which it considered met the definition of “*alternative projects*” under the Rules, namely the 220 kV overhead line, the 220/400 kV overhead staged line and duplexing of OTA-WHA A&B (Options 1, 2 and 3 respectively). Those 3 short

list options were used in the grid investment test to select Transpower's preferred solution (i.e. the 220/400 kV overhead staged line) that formed the basis of the Amended Proposal.

117. **AN** assessment of the short list of options was carried out in order to limit the number of projects against which the grid investment test would be applied, in accordance with clause 11 of schedule F4 of the Rules.
118. **AS** I will outline later in my evidence, these options were peer reviewed by a range of independent organisations to confirm the cost estimates. Accordingly, I am satisfied that this process, as well as the public submission process run by the Electricity Commission, ensured that there was transparency and a high level of scrutiny of the various options and their merits.
119. **TRANSPOWER** included in its 2006 Amended Application for Approval analysis of both the high temperature conductor (i.e. Option 4) and the HVDC option (i.e. Option 9) and the reasons why both were rejected. This analysis was included as there had been a keen interest in those options from interested parties in submissions.
120. **THE** results of Transpower's application of the grid investment test indicated that Option 2, i.e., the 220/400kV overhead stage line, satisfied that test by having the lowest expected net market cost of the three options by approximately \$11.9 million in a total estimated NPV of \$824 million. The option that ranked next in the GIT results was the 220 kV overhead line option.

Electricity Commission consideration of the Amended Proposal

121. **THE** Electricity Commission consulted widely on the Amended Proposal. The Electricity Commission received 341 submissions on the Amended Proposal, from industry participants, city councils, businesses, industry and business associations, landowners and the public.
122. **THE** Electricity Commission also requested further information from Transpower on the Amended Proposal, which resulted in various meetings, briefings, letters, and further reports being sought and produced. My understanding is that the purpose of the information requests was to clarify

aspects of the Amended Proposal and to check and confirm the validity of Transpower's inputs and analysis. For example, there was discussion on how the cable installation from the south Auckland substations to Pakuranga and Otahuhu could be optimised. In addition, the Electricity Commission made formal requests for information under Rule 13.3.3, section III of Part F and those requests and Transpower's responses are set out below:

- (a) the Electricity Commission's request for information dated 17 November 2006, which sought information regarding the scenarios in the Electricity Commission's Statement of Opportunities, the length of the analysis period used, assessment of option values, comprehensiveness of demand and supply assumptions, line and substation design issues and options, the date when the project would be needed, HVDC options, connections to generation at Huntly, system protection and failure rates, and costs of duplexing options;
- (b) Transpower's response dated 29 November 2006 to the Electricity Commission's request for information dated 17 November 2006;
- (c) the Electricity Commission's request for information dated 8 December 2006 which sought information regarding a range of costing issues, project lead times, cooling of underground cables, extended generation scenarios, the project need date and contingencies, protection systems, staging of investment, and possible de-commissioning of existing assets;
- (d) Transpower's response dated 15 December 2006 to the Electricity Commission's request for information dated 8 December;
- (e) the Electricity Commission's request for information dated 20 December 2006 which sought information on modelling of strategic benefits, assessing costs and benefits without new generation, cable costs, and failure rates;
- (f) the Electricity Commission's request for information dated 21 December 2006 which was essentially relating to the same subject matter of the information sought on 20 December 2006; and

(g) Transpower's response dated 17 January 2007 to the Electricity Commission's requests for information dated 20 and 21 December 2006.

123. **THE** formal requests for information and Transpower's responses were all published by the Electricity Commission and are available on the Electricity Commission's website (www.electricitycommission.govt.nz).

Summary of Electricity Commission decision on Amended Proposal

124. **THE** majority view of the Electricity Commission was that the Amended Proposal reflected good electricity industry practice in meeting the grid reliability standards (particularly as it provides improved diversity of supply), complied with the Rules and minimised the expected net market cost compared with a 220kV alternative and therefore passed the grid investment test. It considered that the Amended Proposal was substantially better than the Original Proposal in terms of providing reliable and cost-effective transmission to the Upper North Island.

125. **COMMISSIONER** Pinnell disagreed with the assumptions and inputs adopted by the majority of the Commissioners, particularly regarding where new electricity generation sources for Auckland would be located and the level of electricity demand growth, and because of this he found that the Amended Proposal did not pass the grid investment test. Commissioner Pinnell relied on high level cost estimates focusing mainly on the option to re-conductor the existing 220kV circuits. Those cost estimates were not supported by Transpower's analysis. The majority adopted a more conservative view than Commissioner Pinnell on demand uncertainties in reaching their decision, and were satisfied that they had adopted reasonable assumptions which led to their conclusion, that the Amended Proposal minimises expected net market cost. The majority considered that this conclusion was robust having regard to the sensitivity analysis carried out.

Summary of process for the Upgrade Project

126. **THE** Electricity Commission consideration and approval process for the Upgrade Project (i.e. both the Original Proposal and the Amended Proposal) ran for 22 months. The analysis and review of the Upgrade Project by

Transpower and the Electricity Commission included identification of over 60 technically feasible options, ranging from augmenting the existing 220 kV line assets, use of HVDC technology, energy efficiency measures, energy substitution programs, peaking generation plant, wind generation, tidal generation, and coal or gas generation.

127. **THE** process involved, in addition to the Electricity Commission's comprehensive internal review of the Upgrade Project, separate independent reviews by expert consultants, of:
- (a) the Amended Proposal separately by Connell Wagner Limited and Parsons Brinckerhoff Associates;
 - (b) the technical components of the Amended Proposal by System Studies Group NZ Ltd;
 - (c) the power system analysis by System Studies Group NZ Ltd;
 - (d) the effects of constrained-on generation on the 2013 need date by System Studies Group NZ Ltd;
 - (e) the calculation of ultimate thermal capacity by System Studies Group NZ Ltd;
 - (f) transmission augmentations in the calculations of losses by System Studies Group NZ Ltd;
 - (g) the anticipated unserved energy in relation to transmission augmentations into Auckland by Parsons Brinckerhoff Associates;
 - (h) the electro-magnetic field profile for 400 kV structures by Parsons Brinckerhoff Associates;
 - (i) Transpower's capital cost estimates by Parsons Brinckerhoff Associates;
 - (j) the costing of power electronic equipment for alternative transmission augmentation into Auckland by Andersen Power Electronic Solutions Limited;

- (k) wholesale price separation: Whakamaru to Otahuhu by M-co New Zealand Limited;
- (l) the OTA-WKM A&B cables and C105 towers by Parsons Brinckerhoff Associates;
- (m) confidence issues related to timing of transmission investments by Professor Tim Hazledine, Department of Economics, University of Auckland;
- (n) a review of Castalia's independent review concerning discount rate for the grid investment test by Professor Graeme Guthrie, Department of Economics, University of Victoria;
- (o) a review of Castalia's independent review concerning foreign direct investment effects of the Upgrade Project by Professor Tim Hazledine, Department of Economics, University of Auckland;
- (p) the scope for alternatives to transmission reinforcement to supply the Auckland's growing electricity demand by Sinclair Knight Merz;
- (q) new and renewable technologies as transmission upgrade alternatives by TNEI Services Limited;
- (r) the uptake and cost of alternative generation in the Auckland region by Dr David Hume (an independent consultant);
- (s) demand-side alternatives by M-co New Zealand Limited;
- (t) a review of the Electricity Commission's power systems analysis by the General Electric Company's transmission studies team (a team with a wide range of international experience over a number of years);
- (u) an economic and regulatory review of the Electricity Commission's consideration of the Proposal in accordance with the grid investment test by Allen Consulting Group;
- (v) a review of the Electricity Commission's analysis of Transpower's Proposal and the ability to operate the system with the Proposal and Alternative Projects by Karri and Maharaj (independent consultants)

with extensive system operation experience obtained in New Zealand and Australia); and

(w) a review of the earlier work of The Property Group (which forms part of the review of Transpower's capital cost estimate by Parsons Brinckerhoff Associates) to consider property related concerns raised in submissions by Graeme Horsley Limited (a specialist property valuer).

128. **EACH** of the reports produced were made available on the Electricity Commission's website.
129. **FOR** both the Original and Amended Proposals, the Electricity Commission received a total of 462 submissions from industry participants, city councils, businesses, industry and business associations, landowners and the public.
130. I believe that the process followed and the analysis undertaken by Transpower, the Electricity Commission and industry as a whole was robust and complete and provided interested parties with the opportunity to provide feedback and comment throughout the process.
131. **IN** addition, I believe the Upgrade Project is still an appropriate solution to meet the growing demand for electricity in the upper North Island region and is consistent with industry trends to cater for increasing load growth by migrating to fewer lines of higher voltage and higher capacity.

ISSUES RAISED IN SUBMISSIONS

132. **RATHER** than respond to individual submissions, it is probably more useful to provide a brief response in respect of themes arising from submissions. In my view, the substance of many of these themes has been addressed in my evidence and the evidence of others. Nevertheless, I will summarise below responses to some of these themes.

Consideration of alternatives

133. **MY** evidence indicates that numerous alternatives to both the Original and Amended Proposal were identified, analysed, and considered. Many of the alternatives were peer reviewed by independent organisations, and the

Electricity Commission's public process ensured that competing views and interests were able to be put forward and considered. I consider that the analysis and the process underlying the consideration of alternatives was robust and thorough, given that information was subject to public scrutiny. In the circumstances, I consider that the consideration of alternatives (in terms of the Electricity Commission process) could be described as exhaustive.

134. **IN** terms of timing for the Upgrade Proposal, I consider that to achieve security of supply in the upper North Island, the Upgrade Proposal needs to be completed by 2013. I do not believe that it is appropriate or consistent with good electricity industry practice to utilise 100% of the available transmission capacity when dealing with a load of such significance at Auckland. Such a "just in time" approach places the reliability of supplies at risk from any contingency on the main power system or from the delivery risk of implementing a major project such as a new line.
135. **THE** use of undergrounding is typically restricted to urban areas where the cost of easements is very high. There are other justifications for cable usage but these must recognise the very high cost to customers paying for the investment. Cables are typically ten times more expensive on average than an equivalent overhead line in open country.

Sensitivity of analysis

136. **WHILE** the substance of this is more properly a matter that is covered by Mr Boyle, it is my view that the various scenarios and sensitivities that were considered and the thorough nature of the process that was undertaken, has ensured that the analysis of alternatives is robust. Furthermore, as noted earlier in my evidence, the approval of the Electricity Commission will be required some time in the future when the transition of the line from 220 to 400kV operation becomes necessary.

Independent/transparent process

137. **SOME** submitters have suggested that the Electricity Commission process was not transparent and that there was a lack of independent analysis. I consider that I have adequately responded to this issue elsewhere in my evidence.

Future scenarios

138. **SOME** submitters assert that a range of future events may defer or remove the need for this project or impact on the choice of a 400kV capable line. While I acknowledge that this is a possibility, I consider that appropriate sensitivity analysis was carried out and I also note that the project has been proposed on a staged basis (as outlined in Mr Coad's evidence) to allow some flexibility to respond to demand for electricity that is higher or lower than predicted. In my view, such an approach is prudent and consistent with good electricity industry practice.
139. **FURTHER**, I consider that recent events, such as the adoption of the New Zealand Energy Strategy with its focus on renewable generation, and the introduction of the Climate Change (Emissions Trading and Renewable Preference) Bill in December 2007 with its proposed moratorium on new baseload thermal generation, support the need for a new 400kV capable line between Whakamaru and South Auckland. Mr Boyle's evidence addresses these matters in further detail.

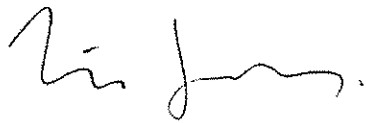
Scope of costs and matters considered under GIT

140. **SUBMITTERS** have suggested that the decision to proceed with the Amended Proposal is flawed because environmental and other costs have not been considered.
141. **THE** GIT is an economic test designed to select the investment option that provides the greatest expected net market benefit when compared to a number of alternatives. The robustness of the economic analysis is assessed by considering a range of sensitivities to key inputs to the analysis. The GIT is not a national benefit assessment, but rather assesses the costs and benefits that accrue to market participants. Environmental, cultural and other social impacts can be taken into account to the extent that they are, or are forecast to become, costs to the industry. The effect of the GIT is to ensure that only investments that can be economically rationalised are approved.
142. **IT** is worth reiterating that the GIT is primarily an economic test and, under the Rules, Transpower is obliged to follow that test if it seeks to have an

investment approved. Transpower has followed and applied the GIT and other applicable aspects of the Rules in seeking approval for the investment. The Amended Proposal was thoroughly reviewed and numerous questions and further information requests were made by the Electricity Commission to ensure that the data, assumptions and methods used in the GIT analysis were appropriate.

CONCLUSIONS

143. **MY** evidence demonstrates that the Amended Proposal which is now before the Board has been through a rigorous process. It also demonstrates that the process is transparent and has both enabled and resulted in an exhaustive consideration of the merits of various alternative options.
144. **GIVEN** the process to date, I consider that the appropriate focus should now be on whether the Upgrade Project before the Board is consistent with the relevant tests under the Resource Management Act, rather than using this process to re-litigate the merits of the Electricity Commission's decision to approve the Amended Proposal.



Timothy Andrew George

29 January 2008