



# **ELECTRICITY COMMISSION**

## **Consultation Paper**

### **Draft Grid Investment Test**

**September 2004**

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## 1. Introduction

### a) The purpose and scope of this paper

#### Rule requirements

1. Part F of the Electricity Governance Rules (“the rules”) requires the Commission to determine the most appropriate grid investment test (“the GIT”) for assessing proposals for grid upgrades, for reviewing alternatives to transmission, and for developing grid reliability standards.
2. The Commission is required to publish a draft of the GIT, consider submissions, and recommend an appropriate GIT to the Minister of Energy within 20 business days of the expiry date for submissions.<sup>1</sup>
3. The GIT needs to be in place by February 2005 to allow time for Transpower to use it to formulate its grid upgrade plan, and time for the Commission to review Transpower’s proposals and alternatives to transmission, to approve a grid upgrade plan by September 2005 (target in draft GPS).

#### The process followed by the Commission

4. The Commission engaged Frontier Economics to prepare a draft GIT, which was published on the Commission’s website in August 2004.<sup>2</sup> The Commission also received reports from the Transmission Advisory Group (TAG)<sup>3</sup> and the Transmission Pricing Advisory Group (TPAG),<sup>4</sup> and has revised components of the GIT provided by Frontier Economics.

#### The purpose of this paper

5. The purpose of this paper is to provide an opportunity for market participants to comment on the draft GIT, as presented in appendix 2 of this paper. The Commission agrees with Frontier’s recommendations in regard to most aspects of the GIT, and refers readers to Frontier’s report for a discussion of key issues considered by the Commission.

### b) Submission requirements

6. The Commission would like to invite submissions to the Commission on the proposal and in answer to the specific questions by **5pm on 29 October 2004**. Please note that because of the statutory timing obligations of the Commission, submissions received after this date may not be able to be considered.
7. The Commission’s preference is to receive submissions in electronic form (Microsoft Word format and pdf) and to receive one hard copy of the electronic version.

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<sup>1</sup> Rules 6.4, 6.5, and 6.6 of section III of part F.

<sup>2</sup> “Draft Grid Investment GIT,” Frontier Economics, Final Draft Discussion Paper, June 2004.

<sup>3</sup> “Comments on Transmission Issues Papers,” TAG, 6 August 2004. See [www.electricitycommission.government.nz/advisory/transmission/draft-reports.html](http://www.electricitycommission.government.nz/advisory/transmission/draft-reports.html).

<sup>4</sup> “Transmission Pricing Methodology Issues – Comments,” TPAG, 6 August 2004.

8. The electronic version should be emailed with the phrase "Submission on draft grid investment test" in the subject header to [info@electricitycommission.govt.nz](mailto:info@electricitycommission.govt.nz), and one hard copy of the submission should be posted to the address below.

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9. The Commission will acknowledge receipt of all submissions electronically. Please contact Jenny Walton if you do not receive electronic acknowledgement of your submission within 2 business days.
10. *Submissions should be provided in the format shown in appendix 3.* Your submission is likely to be made publicly available on the Commission's website. Submitters should indicate any documents attached in support of the submission in a covering letter, and indicate clearly confidential information provided to the Commission.
11. All information provided to the Commission is subject to the Official Information Act 1982.

**c) Commonly used acronyms**

ACCC	Australian Competition and Consumer Commission
GIP	Grid Injection Point
GIT	Grid Investment Test
GPS	Government Policy Statement
GUP	Grid Upgrade Plan
GXP	Grid Exit Point
MWh	Mega-Watt hour
SOO	Statement of Opportunities
TAG	Transmission Advisory Group
TPAG	Transmission Pricing Advisory Group
VOLL	Value of Lost Load
WACC	Weighted-Average Cost of Capital

## 2. Executive Summary

### **The purpose of this paper**

12. The purpose of this paper is to provide an opportunity for market participants to comment on the draft GIT, as presented in appendix 2 of this paper.

### **Objective of the GIT**

13. The objective of the GIT is to approve grid investment proposals when doing so maximises expected net market benefits to parties who produce, distribute, and consume electricity. These benefits comprise not just economic benefits (e.g. lower dispatch costs and competition benefits), but also reliability benefits and the benefits of certainty and acceptability.
14. The rest of this section briefly outlines key issues for consultation.

### **Reliability investments**

15. The Commission proposes to apply a cost-benefit test to all reliability investment proposals, rather than adopt a cost-effectiveness test for some reliability investments and a cost-benefit test for other reliability investments as proposed by Frontier. The Commission's approach means that reliability and economic investments will be subject to the same grid investment test.

### **Discount rate**

16. The Commission proposes to use Transpower's weighted-average cost of capital as the discount rate for the GIT, rather than adopt a private sector rate as proposed by Frontier.

### **Materiality thresholds**

17. The Commission proposes that the GIT be applied to individual grid investments with capital costs above \$1 million. The Commission also proposes that the GIT be applied with less rigour and comprehensiveness for grid investments with capital costs between \$1 million and \$5 million than for grid investments costing more than \$5 million.

### **Least-cost expansion**

18. The Commission proposes future market development scenarios be based on the assumption that new sources of generation capacity will enter the market in accordance with a least-cost expansion plan for a specific market development fuel scenario, and that load is always served from least cost sources of supply.
19. The alternative approach is to assume new generation capacity is added in a more 'realistic' manner, which takes into account the fact that the electricity market is not perfectly competitive. The Commission proposes that the 'realistic' bidding approach be considered in sensitivity analysis.

### **Eligible projects**

20. The Commission proposes that the GIT consider alternatives to transmission that do not have a specific proponent. This is similar to the Australian regulatory test which specifically allows for non-proponent alternatives.

#### **Competition benefits from a project**

21. The Commission proposes that competition benefits be included in the market benefit of a project, on an optional basis. Competition benefits are to be calculated and presented separately from other market benefits.

#### **Government policies**

22. The Commission proposes that Government policies that reflect externalities and that are explicitly priced in electricity goods and services should be included in the GIT, e.g. the proposed carbon charge.

#### **Base case scenarios**

23. The Commission proposes to require that grid investment and alternatives to transmission be assessed against scenarios for future market development published in the SOO. At this stage the Commission is expecting to publish five base case scenarios in the initial SOO.
24. There may be situations where a proposed grid investment, or group of proposed grid investments, is already in a base case scenario. The Commission proposes to deal with this by removing those investments from the base case scenario and introducing alternative arrangements consistent with that scenario to allow comparative evaluation of the merits of the investment.

#### **Real options analysis**

25. The Commission proposes to use 'real options analysis' where it is practicable to do so.

#### **Selecting the highest-value project**

26. The Commission proposes to adopt the decision rule that a proposed grid investment satisfies the GIT if:
  - a. The proposed grid investment maximises the expected net market benefit compared with a number of alternative projects;
  - b. The expected net market benefit of the proposed grid investment is greater than zero; and
  - c. If sensitivity analysis is conducted, a conclusion that a proposed grid investment satisfies sub-paragraphs (a) and (b) above is sufficiently robust having regard to the results of that sensitivity analysis.

27. *Expected net market benefit* is defined as the probability-weighted average of the results of the market development scenarios.

### 3. Objectives and Scope

#### a) Objectives of the GIT

##### Uses of the GIT

28. The various uses of the GIT are specified in rule 6.2 of section III of part F, which states the GIT be applied by:

6.2.1 The Commission in developing grid reliability standards;

6.2.2 Transpower, to determine proposed economic investments for inclusion in the proposed grid upgrade plan;

6.2.3 The Commission, to review and approve reliability and economic investments; and

6.2.4 The Commission, to review transmission alternatives.

##### Part F objectives for developing the GIT

29. Similarly, the objectives of the GIT are specified in rule 6.3 of section III of Part F. This states that the Commission must have regard to the following objectives in developing the GIT:

6.3.1 Promoting economic efficiency (including energy efficiency) in transmission and the wholesale market;

6.3.2 As far as practicable reflecting the interests of end use customers in ensuring a reliable transmission system having regard to the cost to end use customers;

6.3.3 Reflect a reasonable economic assessment of the balance between different levels of reliability and the expected value of energy at risk;

6.3.4 Enabling selection of transmission upgrade options that maximise the total net benefits to those who produce, distribute and consume electricity after taking into account transmission alternatives;

6.3.5 Promoting certainty for investment in transmission, generation and transmission alternatives and investment contracts;

6.3.6 Facilitating outcomes acceptable to Transpower and designated transmission customers.

##### Interpretation of Part F objectives

30. In undertaking quantitative analysis it is essential to have a well-specified objective function. The Commission interprets the above objectives as requiring it to focus the GIT on *maximising expected net market benefits*, where:

a. *Expected net market benefit* means the probability-weighted average of the net market benefit of the market development scenarios developed for the future with the proposed project;

b. Net market benefit means the market benefit of a project less the cost of the project;

- c. *Market benefit* means the present value of benefits to persons who produce, distribute and consume electricity. Market benefits comprise not just economic benefits (e.g. lower dispatch costs and competition benefits), but also reliability benefits (6.3.2. and 6.3.3) and the benefits of certainty and acceptability (6.3.5. and 6.3.6); and
  - d. *The market* comprises generators, lines businesses, and electricity consumers – that is, the parties who produce, distribute, and consume electricity.
31. On its own, rule 6.3.1 would imply a broad social cost-benefit test, but the presence of rule 6.3.4 narrows the GIT to focusing on net benefits to the electricity market. This means, for example, costs and benefits falling on other sectors of the economy, such as the gas industry, are not to be taken into account in the GIT.

Q1: Do you agree with the Commission's interpretation of the objectives of the GIT, and if not, why not?

## **b) The purpose of the GIT**

32. Taking into account the above objectives, the principal purposes of the GIT are to:
- a. Establish that proposed grid investments provide the greatest expected net market benefit after taking into account alternatives to transmission; and
  - b. Provide information, including efficient location signals, to proponents of investment in generation, demand-side management, distribution networks and transmission investment contracts.

Q2: Do you agree with the Commission's specification of the principal purpose of the GIT, and if not, why not?

## **c) Reliability investments**

### **The proposal**

33. The Commission proposes to apply a cost-benefit test to all reliability investment proposals as all projects provide both economic and reliability benefits. This means all reliability and economic investments will be subject to the same grid investment test.

### **Frontier's recommendation**

34. The Frontier Economics report recommended a dual approach to assessing reliability investments:<sup>5</sup>
- a. A cost-effectiveness test for reliability investments expected to deliver mostly reliability benefits. It is convenient to refer to these as *pure reliability investments*; and

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<sup>5</sup> The dual approach is illustrated in Figure 4 on page 25 of the Frontier report.

- b. A cost-benefit test for reliability investments when alternative proposals are expected to deliver significantly different and material economic benefits (*"hybrid reliability investments"*).
35. The Frontier report proposed a \$10 million cap on the cost of projects eligible for assessment under the cost-effectiveness test.<sup>6</sup> All other projects would be assessed under the cost-benefit test.
36. The Frontier report states the cost-benefit test for hybrid reliability investments would be conducted by assessing reliability in probabilistic terms and using estimates of the cost of unserved energy to put a monetary value on supply interruptions.<sup>7</sup>

### Discussion

37. In proposing a dual approach, Frontier were mindful of the requirement to develop a GIT capable of assessing reliability investments regardless of whether deterministic or probabilistic grid reliability standards are chosen.<sup>8</sup> Frontier argued cost-benefit analysis was suitable if a probabilistic standard is adopted, but not if a deterministic standard is adopted, because the benefits of maintaining a deterministic standard are not explicitly valued.<sup>9</sup>
38. The Commission received detailed comments from TAG on this issue, and agrees with TAG that the dual approach is unnecessary regardless of which standard is adopted.<sup>10</sup> Although a deterministic standard may be set without explicitly valuing unserved energy, projects satisfying a deterministic standard can be assessed using probabilistic planning analysis, and an explicit value for unserved energy can be used in that assessment.
39. Frontier also suggested the cost-effectiveness test greatly simplifies the application of the GIT to reliability investments.<sup>11</sup> The Commission agrees with TAG that in practice the dual approach is likely to complicate the overall GIT process, as it will require the Commission or Transpower to distinguish between pure and hybrid reliability investments. This could distract the Commission and industry into arguments and legal disputes about the definition of an investment proposal.
40. On a more practical level, Transpower and the Commission will be conducting probabilistic analysis for hybrid reliability investments anyway, and so applying the same tools to pure reliability investments will not require new skills or analytical tools. Also, the dual approach is problematic if alternative pure reliability investment proposals yield similar reliability outcomes but over different time periods. The cost-effectiveness test does not provide a basis to compare the benefits of longevity against the costs of longevity.
41. The Commission acknowledges there are likely to be cases where the size of an investment proposal is too small to justify the costs of conducting a full cost-benefit test. It agrees with TAG that these should be dealt with by adopting less rigorous processes for the cost-benefit test rather than ignoring reliability benefits altogether, as would be the case under a cost-effectiveness test.

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<sup>6</sup> Page 26, section 5.2.1 of the Frontier report.

<sup>7</sup> Page 26, section 5.2.2 of the Frontier report. Readers should note that Frontier defined hybrid reliability investments as economic investments.

<sup>8</sup> Page 24, section 5.1.3, of the Frontier report.

<sup>9</sup> Page 24, section 5.2, of the Frontier report.

<sup>10</sup> Pages 26 and 27 of the TAG report.

<sup>11</sup> Page 25, section 5.2.1, of the Frontier report

Q3: Do you agree that cost-benefit test (incorporating probabilistic planning analysis) can be used even if a deterministic grid reliability standard is adopted, and if not, why not?

Q4: Do you agree with the Commission's proposal to apply a cost-benefit test to all reliability investment proposals, and if not, why not?

## 4. Model Parameters

### a) Discount rate

#### The proposal

42. The Commission is tentatively proposing to set the discount rate for the GIT equal to the regulated Transpower weighted-average cost of capital (WACC), but is intending to seek further advice on the appropriate discount rate(s) to use, and would particularly welcome consultation input on this issue. While using multiple rates may be theoretically correct, the use of a single unambiguous rate is considerably simpler to specify and implement and the impact can be checked through sensitivity analysis.
43. The discount rate would be set at a nominal rate (real rate) if costs and benefits are expressed in nominal (real) terms. Likewise, the discount rate would be set at a pre-tax (post-tax) rate if costs and benefits are expressed in pre-tax (post-tax) terms.

#### Discussion

44. Frontier Economics recommended the Commission adopt a discount rate that would be applied by a private investor in the electricity sector, on the basis that if grid investment is approved under the GIT then it is most likely to displace private sector investment in generation and load.
45. TAG suggested the Commission should adopt Transpower's WACC, on the presumption that alternatives to transmission could be funded from regulated sources, which private investors would evaluate at lower rates than for projects earning only market revenue. TAG also recommended that if a private sector rate is adopted, then the figure for the discount rate should be determined by research rather than simply public submissions.
46. The Commission believes the appropriate framework is primarily one of investment decision-making in a regulated environment, and using Transpower's WACC is more consistent with this. Although at this stage no decision has been made to fund alternatives to transmission, the Commission believes alternatives should be assessed at the same discount rate as grid investment.
47. The Commission notes that there is limited time available to research private sector discount rates and consult on them before the GIT needs to be available to assess grid upgrade proposals. In contrast, Transpower's WACC is readily available, and unambiguously defined.
48. The Commission is not expecting the choice of discount rate to materially affect the choice of project under the GIT, but in any case is intending to conduct sensitivity analysis to identify when outcomes are affected.
49. In view of the above, the Commission believes the most practicable approach at this stage is to adopt Transpower's WACC.

Q5: Do you agree that the time available to research and select a private sector rate is too short, and therefore the most practicable approach is to adopt Transpower's WACC?

Q6: Is the choice of discount rate likely to materially affect which projects are selected under the GIT?

**b) Timeframe**

50. The Commission proposes a 20-year timeframe for assessing net market benefits, with a terminal value added if substantial net benefits are expected beyond this timeframe. This is the approach recommended by Frontier Economics, and is consistent with commercial practice for the analysis of investments with long implementation timeframes.

Q7: Do you agree that a 20-year timeframe be adopted for the GIT, and if not, why not?

Q8: Should terminal values be added if substantial net benefits are expected beyond the 20-year timeframe? In what circumstances should terminal values be used?

**c) Cost of unserved energy**

**The proposal**

51. The Commission proposes that an initial central value of unserved energy of \$20,000/MWh be applied, with sensitivities of \$10,000/MWh and \$30,000/MWh be used where the size and cost magnitude of the project warrant the additional analysis. The Commission has, however, engaged further advice on this parameter and will take this into account when reviewing submissions.

**Discussion**

52. This is the approach recommended by Frontier Economics, and is based on an assessment of New Zealand and overseas research. The Commission agrees with Frontier's assessment that further empirical research is required to form robust values for the cost of unserved energy for New Zealand.
53. Accordingly, the Commission believes Frontier's recommendation is the most practicable approach to adopt at this stage.

Q9: Does an *initial* central value for unserved energy of \$20,000/MWh reflect a balanced assessment of current New Zealand and international evidence? If not, how would you assess that evidence?

Q10: Referring to the discussion in section 6.3 of the Frontier report, are there other empirical studies that should be reviewed to form an *initial value* for unserved energy?

Q11: Should a central value for unserved energy be adopted, or should separate values be assigned for different categories of consumer? If separate values should be assigned, what categories would you adopt and what values would you assign? Would consumers expect to pay different transmission charges if the transmission services they received reflected consideration of different unserved energy values?

Q12: Do you agree that sensitivities of \$10,000/MWh and \$30,000/MWh be used where the size and cost magnitude of the project warrant the additional analysis, and if not, why not?

**d) Application thresholds**

**The proposal**

54. The Commission proposes that the GIT be applied to individual grid investments with capital costs above \$1 million. The Commission also proposes that the GIT be applied with less rigour and comprehensiveness for grid investments with

capital costs between \$1 million and \$5 million than for grid investments costing more than \$5 million.

**Discussion**

55. Frontier Economics proposed a materiality threshold of \$5 million for grid investments, based on an assessment of the cost of transformers and line realignments.
56. The Commission proposes the \$1 million threshold to provide more visibility for the development and selection of alternatives to transmission. This is necessary because alternatives to transmission are often low cost, and may be beneficial to adopt at even low levels of grid expenditure. The \$1 million threshold provides the Commission with greater oversight of grid expenditure decisions at the level relevant for alternatives to transmission.
57. Moreover, there is also uncertainty regarding the ongoing regulatory and contractual framework applying to Transpower. Expenditures of \$1 million on connection or deep connection assets could substantially affect transmission costs for some transmission customers, and it would be in their interest for regulatory oversight to be exercised before such costs are incurred.
58. The Commission is mindful of the potential for the \$1 million threshold to impose high burdens on Transpower, and therefore is proposing that the GIT be applied with less rigour and comprehensiveness for grid investments with capital costs between \$1 million and \$5 million than for investments costing more than \$5 million. This is consistent with the principle for grid planning assumptions where the process for developing the assumptions is to be commensurate with the economic significance of the decision being made.<sup>12</sup>

Q13: Do you agree the materiality threshold should be set at \$1 million, and if not, why not?

Q14: Should the GIT be applied with less rigour and comprehensiveness for grid investments with capital costs between \$1 million and \$5 million than for investments costing more than \$5 million? If yes, is it necessary to specify what must be included in such analyses?

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<sup>12</sup> Rule 10.2.4 of section III of part F

## 5. The Content of the Base Case

### a) The purpose of the base case

59. The base case describes the current status of the electricity industry, and how it is expected to develop if the project being evaluated does not occur.
60. The specification of the base case is critical to estimating the benefits of a project, because the benefits of a project are determined by how it alters future market developments – that is, how it may defer or avoid investments that would occur without the project.
61. The Commission is aware there is considerable uncertainty about how the industry may develop in the future, and intends to prepare a number of base case scenarios, which it will publish in the SOO and invite comment during that process. This section focuses on the variables to be included in the base case, and section 7(a) discusses how the Commission intends to evaluate projects against multiple base case scenarios.

### b) The current status of the electricity industry

#### The proposal

62. The Commission proposes the following variables be used to specify the current status of the electricity industry:
  - a. The size and location of customer load;
  - b. The value of unserved energy (initially, \$20,000/MWh but to be replaced by a value or values published by the Commission);
  - c. The operating and maintenance costs of efficiently supplying demand from existing projects;
  - d. Transfer capacities and capabilities of key transmission lines; and
  - e. The cost of providing sufficient ancillary services costs and the cost of transmission losses involved in efficiently supplying demand.

#### Discussion

63. The above proposal is the same as that proposed by Frontier Economics. The main issue for discussion is paragraph (c), which assumes load is served from least cost sources of supply. The Commission appreciates that significant judgement is often required to determine 'least cost,' as the opportunity cost of hydro sources of energy depend on assumptions about the probability of running out of water, and operating restrictions affect the opportunity cost of thermal plant.

Q15: Are there other variables the Commission should include in its description of the current status of the electricity industry, and if so, what are those variables?

**c) Future market development**

**The proposal**

64. The Commission proposes the following variables be used to specify reasonably expected future development of the electricity industry:
- a. The size, timing and location of load growth;
  - b. The value of unserved energy (initially, \$20,000/MWh but to be replaced by a value or values published by the Commission);
  - c. The size, location, and timing of committed and modelled projects;
  - d. The operating and maintenance costs of efficiently supplying demand from existing projects, committed projects, and modelled projects;
  - e. The capital costs of efficiently supplying demand from modelled projects;
  - f. Transfer capacities and capabilities of key transmission lines; and
  - g. The cost of providing sufficient ancillary services and the cost of transmission losses involved in efficiently supplying demand.

**Discussion**

65. The key issue here is the implicit assumption in paragraph (c) that new sources of generation capacity will enter the market in accordance with a least-cost expansion plan (and that load is always served from least cost sources of supply). The alternative approach is to assume new generation capacity is added in a more 'realistic' manner, which takes into account the fact that the electricity market is not perfectly competitive.
66. Section 4.1.2 of the Frontier report provides a very good discussion of the issues with each option, and recommends the least-cost approach be adopted, with a 'realistic' bidding approach considered for sensitivity analysis.
67. The Commission acknowledges the least-cost approach is likely to wrongly predict the volume, timing, and location of new generation capacity in future years, as it cannot reflect key real world commercial drivers for generation investment discussed above. On the other hand, the 'realistic' bidding approach is a far more subjective and complex exercise, and it is not clear that it would achieve more accurate predictions. It would also reduce the transparency of the GIT process, as it would be more difficult for third parties to replicate the analysis.
68. The primary concern with wrongly predicting the volume, timing, and location of new generation capacity is that projects would be approved when none were needed, and vice versa. The Commission intends preparing five scenarios for future market developments to address these uncertainties (see section 7(a) below).
69. The choice between least-cost and realistic bidding approaches may not greatly affect comparisons of grid investment and alternatives to transmission. The reason is that the benefits of both types of projects arise from deferment of new generation capacity assumed to occur in their absence. Accurately modelling the time period of deferment is probably far more important than getting the base case exactly right.

70. On balance the Commission believes the most practicable approach is to adopt the least cost approach, and conduct the 'realistic' bidding approach as part of the sensitivity analyses (discussed in section 7(b)).

Q16: Do you agree that the primary issue with wrongly predicting new generation capacity is that projects would be approved when none were needed, and vice versa?

Q17: Is the choice between least-cost and bidding approaches likely to materially affect the choice of grid investment versus alternatives to transmission, and if so, why?

Q18: Do you agree that the least cost approach, supplemented with sensitivity analysis of 'realistic bidding' approaches, is the most practicable approach for New Zealand?

#### **d) Committed and modelled projects**

##### **The proposal**

71. The Commission proposes that committed projects be defined to be projects that are reasonably likely to proceed in a similar timeframe regardless of whether or not the proposed grid investment or any alternative project proceeds. Committed projects must satisfy all of the following criteria:
- a. The proponent has obtained all required planning consents, construction approvals and licences, including completion and acceptance of any necessary environmental impact statement;
  - b. Construction of the project has commenced or a firm commencement date has been set;
  - c. The proponent has purchased, settled, acquired land (or commenced legal proceedings to acquire land) for the purposes of construction;
  - d. Contracts for supply and construction of the major components of the plant and equipment (including any generators, turbines, boilers, transmission towers, conductors, terminal station equipment) have been finalised and executed, including any provisions for cancellation payments; and
  - e. The financing arrangements for the project, including any debt plans, have been conducted and completed.
72. In the case of transmission augmentation projects, the Commission has unconditionally approved the project following application of this grid investment test.
73. Modelled projects comprise transmission augmentation projects and non-transmission projects, other than the proposed grid investment and alternative projects, which are:
- a. Identified in the statement of opportunities as likely to occur in a market development scenario;
  - b. Reasonably expected to occur in that market development scenario within the time horizon for assessment of the market benefits and costs of the proposed grid investment and alternative projects; and
  - c. The likelihood, nature and timing of which will be affected by whether the proposed grid investment or any alternative project proceeds.

### Discussion

74. The Frontier report made a distinction between modelled projects and anticipated projects. The latter were projects that satisfy all but one of the criteria for committed projects. The Commission also did not believe it was necessary to distinguish between anticipated and modelled projects as modelled projects are required to be based on those in the most recent statement of opportunities.

Q19: Do you agree with the above criteria for committed projects? Should criteria be added or deleted, and if so, which ones?

Q20: Is there value in distinguishing between anticipated and modelled projects?

Q21: Is the description of modelled projects clear and unambiguous?

### e) Existing and decommissioned projects

#### The proposal

75. The Commission proposes to define existing projects as projects that have been commissioned prior to, and are in operation at the time of, the application of this grid investment test.
76. Decommissioned projects means the decommissioning, removal or de-rating of existing projects which are reasonably likely to occur in a similar timeframe regardless of whether or not the proposed grid investment or alternative project proceeds and in relation to which either:
- a. Both of the following are satisfied:
    - i. A final decision to decommission, remove or de-rate the existing project after a specified date has been made and has been publicly announced; and
    - ii. Contracts to directly or indirectly facilitate the decommissioning, removal or de-rating of the existing project have been finalised and executed; or
  - b. Consents or contracts for the operation and maintenance of the existing project have been terminated or have expired with no reasonable prospect of renewal, or in relation to which agreements for early termination have been finalised and executed.

Q22: Is the description of existing and decommissioned projects clear and unambiguous?

## 6. Project Requirements

### a) Alternative projects

#### The proposal

77. The Commission proposes the following criteria be used for selecting alternative projects for comparison with Transpower's grid upgrade proposals. Alternative projects must be:
- a. Technically feasible;
  - b. Reasonably likely to proceed if the proposed grid investment does not proceed and unlikely to proceed if the proposed grid investment does proceed;
  - c. Reasonably expected to provide similar benefits in type, but not necessarily in magnitude, to relevant nodes, as the proposed grid investment;
  - d. Appropriate in number and technology given the cost magnitude of the proposed grid investment, the complexity of the required modelling, and the urgency of the proposed grid investment; and
  - e. Reasonably expected to enable the deferment of the type contemplated by the proposed grid investment for a period of 1 year or more.
78. Note that alternative projects include any variant of the proposed grid investment involving a non-negligible change in the timing of the grid investment.
79. The Commission also proposes that the GIT consider alternatives to transmission that do not have a specific proponent.
80. The Commission notes that alternatives selected must include transmission projects where appropriate.

#### Discussion

81. Eligibility criteria are required because conducting the GIT will be a time-consuming and complicated task, making it impracticable to subject all proposals to full GIT assessment. The criteria need to reflect views about the cost of assessing an additional proposal under the GIT versus the probability and cost of not identifying a more efficient outcome.
82. Criteria (a), (c), and (e) are intended to screen out alternative projects that are not workable, fail to provide benefits to relevant nodes, and fail to significantly defer grid investment. Projects with any of these characteristics are very unlikely to provide a more efficient outcome than a grid investment proposed by Transpower.
83. Criterion (d) provides discretion for the Commission to limit the number of alternatives where necessary to expedite the GIT process or where a larger number or range of projects is not justified by the cost of the proposed grid investment.

84. The above criteria are similar to those proposed by Frontier Economics, with consequential changes made for the Commission's decision to subject reliability investments to the same cost-benefit analysis as economic investments.<sup>13</sup>
85. Frontier had included commercial feasibility as a criterion, which would appear to exclude consideration of alternatives requiring regulated funding. As the Commission has not decided whether to propose regulated funding for alternatives to transmission, excluding such projects is premature at this stage.
86. On a related matter, the Commission also notes the Australian Competition and Consumer Commission (ACCC) has recently ruled that alternatives to transmission need not have a proponent if they are economic investments, but must have a proponent if they are reliability investments.<sup>14</sup> The Electricity Commission does not propose to adopt this approach, but will wish to satisfy itself that a transmission alternative will be implemented if investment is required and Transpower's grid investment is rejected.
87. Frontier also suggested that criterion (c) require alternatives to provide benefits in a similar timeframe and to the same nodes as would be provided by Transpower's grid investment proposal. The Commission agrees with TAG that requiring a similar timeframe is unnecessarily restrictive, as most alternatives to grid investment will not require the same timing – that is, they could be implemented earlier or with shorter lead times. Alternatives may also be relevant to only one or a few nodes, but may nevertheless address grid capacity issues effectively.
88. The Commission has added criterion (e), which is that alternatives defer proposed grid investments by a minimum of 1 year. This imposes a relatively minimal materiality threshold to eliminate low value projects.

Q23: Which criteria do you disagree with, and why? What other criteria should be considered? Are the above criteria clear and understandable?

## **b) Benefits from a project**

### **The proposal**

89. The Commission defines the *market benefit* of a project as the present value of benefits to those who produce, distribute and consume electricity in New Zealand. This includes competition benefits discussed in section 6(c) below.
90. The Commission proposes to calculate the non-competition benefits of a project by estimating the present value of:
  - a. Changes in fuel costs of existing, committed, and modelled projects;
  - b. Changes in the value of involuntary demand curtailment;
  - c. Changes in the costs of demand-side management;
  - d. Changes in costs resulting from the deferral of capital expenditure on modelled projects;

<sup>13</sup> The Commission's decision to subject reliability investments to the same cost-benefit analysis as economic investments is discussed in section 4(d) of this paper. The criteria recommended by Frontier Economics is provided in annex 1 of the Frontier report.

<sup>14</sup> "Review of the Regulatory Test for Network Augmentations," ACCC, 11 August 2004.

- e. Changes in costs resulting from differences in the size of capital expenditure on modelled projects;
- f. Changes in costs resulting from differences in operations and maintenance expenditure on existing, committed, and modelled projects;
- g. Changes in costs for ancillary services;
- h. Changes in transmission losses
- i. Subsidies or other benefits provided under or arising pursuant to all applicable laws, regulations and administrative determinations; and
- j. If considered appropriate by Transpower or the Board and separately identified and calculated, competition benefits.

#### **Discussion**

91. The above variables are essentially the same as those proposed by Frontier Economics, and are standard to cost-benefit analysis of grid investments.<sup>15</sup> The main difference is the omission of the capital costs of committed projects, as committed projects are projects that will proceed regardless of whether the proposed grid investment or proposed alternative occurs or not. Hence, proposed grid investments or proposed alternatives should not alter the level of capital expenditure on committed projects.

Q24: Are there other variables that should be included in the definition of market benefits, and if so, what are those variables? Are the variables defined clearly and unambiguously?

### **c) Competition benefits from a project**

#### **The proposal**

92. The Commission proposes that competition benefits be included in the market benefit of a project on an optional basis. Competition benefits are to be calculated and presented separately from other market benefits.
93. The Commission proposes to define competition benefits as the effects of greater competition between generators resulting from a proposed grid investment or alternative project on:
- a. The cost of dispatch;
  - b. Forecast demand growth; and
  - c. The timing of modelled projects.
94. Where material benefits and costs of a grid investment cannot be quantified, the direction of the effect and likely magnitude should be identified.

#### **Discussion**

95. The Commission agrees with Frontier that it is difficult to model competition benefits, and is not sure they can be estimated with sufficient accuracy to justify

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<sup>15</sup> Page 47, annex 1, of the Frontier report, and also figure 3, page 21, section 4.3 of the Frontier report.

inclusion in market benefits. On the other hand, projects that enhance competition may bring large economic benefits over the long term, and significantly influence the future direction of key aspects of the electricity industry.

96. Frontier suggested that the best approach might be to allow investment proponents to include competition benefits if they are considered material. TAG suggested competition benefits be omitted from initial applications of the grid investment test, but that consideration be given to including competition benefits once more important issues have been addressed.
97. On balance, the Commission has decided to retain competition benefits in the definition of market benefits, and consult on these issues.

Q25: Should competition benefits be included in the GIT, and if so, how should they be measured?

#### **d) The costs of a project**

##### **The proposal**

98. The Commission proposes that the cost of a project be calculated as the present value of:
- a. Capital costs incurred prior to the commissioning of the project;
  - b. Operating, maintenance and dismantling costs over the operating life of the project;
  - c. Costs to participants associated with project testing;
  - d. Any additional amount, approved by the Commission, that could reasonably be considered to be a cost related to the commissioning of a project; and
  - e. Costs of complying with or arising pursuant to all applicable existing and anticipated laws, regulations and administrative determinations.

##### **Discussion**

99. The above variables are the same as those proposed by Frontier Economics.<sup>16</sup> The Commission agrees with Frontier that Government policies that reflect externalities and that are explicitly priced in electricity goods and services should be included in the GIT.<sup>17</sup> Ignoring these policies would reduce the accuracy of the GIT, and would require additional computations.
100. The Commission also agrees with Frontier that policy impacts should not be included in the GIT where they do not reflect externalities or where they are not explicitly priced into electricity market goods and services.

Q26: Are there other variables that should be included in the definition of project cost? Are the variables defined clearly and unambiguously?

Q27: Should Government policies that reflect externalities and that explicitly impose costs or benefits on electricity market parties be included in the GIT?

<sup>16</sup> Page 48, annex 1, of the Frontier report.

<sup>17</sup> Page 22, section 4.3 of the Frontier report

## 7. Project Evaluation

### a) Base case scenarios

#### The proposal

101. The Commission proposes to assess grid investment and alternatives to transmission against scenarios for future market development published in the SOO. At this stage the Commission is expecting to publish five base case scenarios in the SOO.
102. There may be situations where a proposed grid investment, or group of proposed grid investments, is already in a base case scenario. The Commission proposes to deal with this by removing those investments from the base case scenario and introducing alternative arrangements consistent with that scenario to allow comparative evaluation of the merits of the investment.

#### Discussion

103. The Commission faces considerable uncertainty regarding future generation location, arising from uncertainty about the cost and availability of fuel sources, and uncertainty about consenting outcomes. It does not seem wise in this situation to assess investment proposals against only one or two scenarios, as they are not representative of future outcomes that could quite likely occur. The Commission therefore intends to prepare several base case scenarios to represent the wide range of likely future market developments.
104. It is important projects being evaluated under the GIT are not also included in the base case. It is also important that all project proposals are assessed against the same scenarios, otherwise project comparisons will be incorrect. Assessing a wide range of future market developments is likely to necessitate adjustments to scenarios once project proposals are received by the Commission.

Q28: Should the Commission assess projects against several base case scenarios? If not, how should the Commission deal with uncertainty regarding future generation location?

Q29: Do you agree with the Commission's approach of replacing proposed grid investments with alternative arrangements if they are already in a base case scenario? If no, what other approach should be adopted?

### b) General sensitivity analysis

#### The proposal

105. The Commission proposes to require that sensitivity analysis is conducted for each of the market development scenarios using reasonable variations in the following:
  - a. Forecast demand;
  - b. The size, timing, location, operating and maintenance costs of:
    - i. The proposed grid investment or alternative projects; and
    - ii. Committed and modelled projects;

- c. The capital cost of:
    - i. The proposed grid investment and the alternative projects; and
    - ii. Modelled projects;
  - d. The timing of decommissioned projects;
  - e. The value of unserved energy – (\$10,000/MWh and \$30,000/MWh if the Commission does not publish other values);
  - f. The discount rate used in present value calculations;
  - g. A range of consistent hydrological inflow sequences, as defined in the statement of opportunities and centralised data set;
  - h. Generator and demand-side bidding strategies; and
  - i. Key input variables in the calculation of competition benefits.
106. The Commission proposes to require sensitivity analysis on the above variables unless it can be demonstrated that doing so is either:
- a. Not reasonably practicable; or
  - b. Not reasonably necessary.

**Discussion**

107. The purpose of the sensitivity analysis is to test the robustness of model results to variations in key parameters. The more variables included in the sensitivity analysis the greater the complexity of the analysis, and the greater the reporting burden.
108. The above list of key variables is quite large. Once Transpower and the Commission gain experience with the GIT, it should be possible to identify key variables with more confidence, and reduce the above list.

Q30: Do you agree sensitivity analysis should be conducted on the parameters listed above? What other variables should be considered for sensitivity analysis, and why?

**c) Real options analysis**

**The proposal**

109. The Commission intends to require use of standard net present value (NPV) analysis to calculate expected net market benefits for the scenarios published in the SOO, and for the sensitivity analysis discussed above. The Commission proposes to also allow 'real options analysis' where it is practicable to do so.

**Discussion**

110. The Frontier report presents real options analysis as an alternative approach to dealing with uncertainty, and recommends the Commission not adopt it because it would be difficult (if not impossible) to accurately value the most important real

options. They also argued that real options analysis would add considerable complexity to the GIT for little additional benefit.<sup>18</sup>

111. The Commission received detailed comments from TAG on this issue, and agrees with TAG that the Frontier report closed-off discussion of real options analysis too quickly, and didn't spell out the significance of these issues for choosing between large 'one-off' transmission solutions and alternatives to transmission, which tend to be smaller.
112. The advantage of real options analysis is that it can be used to estimate a value for flexibility for projects that expand capacity incrementally rather than in large chunks. Incremental expansion of capacity is valuable because it avoids the risk that large-scale expansion results in substantial spare capacity due to load growth turning out substantially different than predicted, or due to the location pattern of load turning out substantially different than predicted (perhaps due to new sources of generation).
113. The Commission agrees with TAG that scenario analysis doesn't calculate an explicit value for flexibility, and may therefore bias GIT outcomes against alternatives to transmission.

Q31: Should the Commission use real options analysis where it is practicable to do so? How important do you think it is to value flexibility in regard to decisions to be made under the GIT, and in what circumstances is it most important to value flexibility?

Q32: If it is complicated to apply real options analysis, should the Commission initially focus on the scenario analysis approach and develop real options analysis at a later stage?

#### **d) Selecting the highest-value project**

##### **The proposal**

114. The Commission proposes to adopt the decision rule that a proposed grid investment satisfies the GIT if:
  - a. The proposed grid investment maximises the expected net market benefit compared with a number of alternative projects;
  - b. The expected net market benefit of the proposed grid investment is greater than zero; and
  - c. If sensitivity analysis is conducted, a conclusion that a proposed grid investment satisfies sub-paragraphs (a) and (b) above is sufficiently robust having regard to the results of that sensitivity analysis.
115. As discussed in section 3(a), the term *expected net market benefit* is defined as the probability-weighted average of the net market benefit of the market development scenarios developed for the future with the proposed project. The market benefit of a project may be calculated with either standard NPV analysis or with real options analysis, provided the same approach is used for all projects being compared.

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<sup>18</sup> Page 35, section 6.4.2 of the Frontier report.

**Discussion**

- 116. The proposed decision rule differs from that suggested by Frontier Economics. Frontier suggested that a proposed grid investment satisfies the GIT if it maximises net market benefits in the greatest proportion of reasonable scenarios.<sup>19</sup>In contrast, the proposed decision rule is based on the probability-weighted average of the results of the market development scenarios.
- 117. The probability-weighted average rule would be the most accurate method of measuring expected net market benefits, but it is more complicated than the other two rules. Further there is no clear basis for establishing probabilities, potentially leaving the Commission with making arbitrary probability assignments.<sup>21</sup>
- 118. At this stage the Commission intends to specifically select scenarios on the basis that they have approximately equal probability of occurrence. At least for the first GIT process, the Commission intends to assign equal probabilities to the scenarios, which means it is calculating a *simple average*.
- 119. The Frontier proposal is the simplest rule, but it takes no account of the relative magnitudes of net market benefits associated with each scenario or their probability of occurrence. For example, consider the situation illustrated in Table 1 below, where three projects are assumed to be evaluated by the GIT under five scenarios. The highest net market benefits under each scenario are identified in bold type.
- 120. Table 1 illustrates the case where Project A achieves the highest net market benefit in two scenarios, and Project B achieves the highest net market benefit in three scenarios. Project C is inferior for all scenarios, but is the superior project in probability-weighted terms. The Frontier decision rule would select Project B, because it achieves the highest net market benefits in three of the five scenarios. Project A would be chosen under a simple average decision rule.

**Table 1: Alternative Decision Rules for the GIT**

Scenario	Probability	Net Market Benefits of Three Hypothetical Projects		
		Project A (\$m)	Project B (\$m)	Project C (\$m)
1	15%	<b>12</b>	2	9
2	15%	20	<b>22</b>	21
3	40%	36	<b>41</b>	40
4	15%	20	<b>22</b>	21
5	15%	<b>12</b>	2	9
Total	100%	100	89	100
Simple average		20	17.8	20
Probability-weighted average		24	23.6	25

- 121. At a broader level, the Commission appreciates it is proposing two methods for making decisions under uncertainty: standard NPV analysis and real option analysis. The Commission has not yet decided whether it will use real options

<sup>19</sup> Page 35, section 6.4 of the Frontier report. Note that Frontier use the terms “scenario analysis” and “sensitivity analysis” interchangeably, whereas in this document they mean different things.

<sup>21</sup> Of course in this case the Commission could just assign equal probabilities, which is the simple average rule.

analysis, but if it did, then it may need to adopt a decision rule to choose between the two approaches if they produce conflicting results.

122. At this stage the Commission is not sure of the accuracy and robustness of NPV analysis relative to real options analysis. In view of this, the best approach may be to leave the choice of method to the Commission's discretion, at least until some experience has been gained with both approaches.

Q33: In regard to the NPV analysis, which decision rule should be adopted, and why? Is the probability-weighted approach likely to be too complicated, and achieve spurious accuracy?

Q34: Is a decision rule required now to choose between the NPV result and the real options result if they conflict?

## e) Regulated funding of alternatives to transmission

### Part F and GPS requirements

123. The current rules do not provide for regulated funding of alternatives to transmission. Rule 2.2 of section III of part F specifically states that a purpose of section III is to *assist participants* to identify and evaluate investment in alternatives to transmission. No mention is made of regulated funding for alternatives to transmission, and rule 6.2.4 simply requires the Commission to use the GIT to review alternatives to transmission.<sup>22</sup>
124. Nevertheless, the draft Government Policy Statement (GPS) issued in September 2004 requires the Commission consider whether there would be net benefits in providing for a mechanism whereby investments in transmission alternatives receive payments.

### Implications for GIT decisions

125. The clear implication of the current rules is that the Commission can approve or reject Transpower's proposed grid investments, but not transmission alternatives. In broad terms, though, approving or rejecting Transpower's grid investment proposals amounts to rejecting or approving transmission alternatives that compete with that grid investment, because transmission alternatives are only likely to be commercially viable if grid investment does not proceed.
126. Nevertheless, it is possible the Commission rejects a Transpower grid investment because an alternative is more beneficial, only to find that a less favourable alternative pre-empts the highest value alternative. Under the current rules, these kinds of outcomes are the product of decentralised decision-making in market environments, and are no concern of the Commission once it has made its decision on Transpower's proposal (provided it appropriately incorporated the probability of implementation).

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<sup>22</sup> Part F refers to transmission alternatives in the following rules in section III: 2.2, 6.2, 9.1.2, 11.2, 13.3.3.4, and 14.3.2.2.

<sup>24</sup> Decisions regarding the transmission pricing methodology are likely to carry more significant implications for fairness.

## 8. Overall Assessment Against the Commission's Objectives

### a) Legislative requirements

127. Section 172E and s 172F of the Electricity and Gas Industries Bill ("Bill"), which amends the Electricity Act 1992 ("Act"), specify the requirements on the Commission regarding consultation and assessment of a rule before recommending a rule be made to the Minister of Energy.
128. The draft terms sheet presented in section 8 of this paper will be incorporated as a schedule to section III of part F. Although the Bill is not yet enacted, the Commission wishes to proceed on the basis that it will be enacted shortly, and has therefore prepared this assessment of the proposed GIT to acknowledge the intentions of the new Bill.
129. Under s 172E, the Commission is required to apply s 172X of the Act. The amended s 172X under the Bill requires the Commission to give effect to its principal objectives and specific outcomes, and its GPS objectives and outcomes.
130. A further requirement under the Bill is that the Commission must carry out an assessment under s 172F. The Commission must:
  - a. Seek to identify all reasonably practicable options for achieving the objective of the proposed rule;
  - b. Assess those options by considering the benefits and costs of each option, the extent to which the objective would be promoted or achieved by each option, and any other matters the Commission considers relevant;
  - c. Ensure that the objective of the proposed rule is unlikely to be satisfactorily achieved by any reasonably practicable means other than the making of the rule (for example, by education, information, or voluntary compliance); and
  - d. Prepare a statement of the proposal for the purpose of consultation under s 172F(2)(b)(ii). Under s 172E(2)(b)(ii) the Commission must consult with persons that the Commission thinks are representative of the interests of persons likely to be substantially affected by the proposed rule.
131. The statement of proposal must contain:
  - a. A detailed statement of the proposal;
  - b. A statement of the reasons for the proposal;
  - c. An assessment of the reasonably practicable options including the proposal; and
  - d. Any other information that the Commission considers relevant.

### b) Assessment against objectives and outcomes

132. Table 2 below assesses the proposed GIT against the principal objectives of the Commission, objectives specified in rule 6.3 of section III of part F for developing the GIT, and against the outcomes specified in the GPS.

Q35: Do you agree with the assessment in Table 2? If not, what assessments do you think should be changed and why?

### c) Statement of proposal

#### The proposal

133. The statement of the proposal is contained in this paper. In particular, the proposed rule (the draft GIT) is provided in appendix 2.
134. The reasons for the proposed rule are provided in section 1 of this paper and in sections 3 – 7 of this paper (which sets out the relevant rules in relation to the GIT).

#### Reasonably practical options

135. s 172F of the Bill requires the Commission to identify all reasonably practicable options for achieving the objective of the rule (including the proposed rule). The Commission is required under the rules to determine the most appropriate GIT and to recommend it to the Minister for inclusion in a schedule to section III of part F.
136. The objective of the rule is to determine the most appropriate GIT that meets the requirements of part F of the rules. This information is provided in sections 3 – 7 of this paper, and in reports from Frontier Economics and TAG.
137. In the Commission's view there are no other reasonably practicable options for achieving the objective of the proposed rule.

#### Cost-benefit assessment

138. s 172F of the Bill requires the Commission to assess the costs and benefit of all reasonably practicable options including the proposed rule. In qualitative terms, the Commission believes the proposed GIT is more likely to achieve the objectives of the rule than any alternative, for the reasons provided in sections 3 – 7 of this paper.

#### Assessment of non-rule options

139. The Commission is required to ensure that the objective of the proposed rule is unlikely to be satisfactorily achieved by any reasonable practicable means other than by making the rule (e.g. by education, information, or voluntary compliance). As discussed in sections 1 and 3 of this paper, the Commission is required to determine the most appropriate GIT and to recommend it to the Minister. Accordingly, the Commission considers that the objective of the rule is unlikely to be satisfactorily achieved by any other reasonably practicable means.

#### Submissions

140. The Commission also welcomes submissions on the proposed rule change. Submissions must be received by 5pm on **29 October 2004**. The requirements for submissions are set out in section 1(b) of this paper.

**Table 2: Assessment against Commission objectives and GPS outcomes**

Objectives	Response
<b>Act Objectives:</b> Under s172N, the principal objectives of the Commission are:	
<ul style="list-style-type: none"> <li>To ensure that electricity is produced and delivered to all classes of consumers in an efficient, fair, reliable, and environmentally sustainable manner; and</li> <li>To promote and facilitate the efficient use of electricity.</li> </ul>	<p>The proposed GIT contributes to efficiency by addressing free rider problems with current arrangements, so that grid investments are undertaken when net market benefits are positive and greater than the net market benefits of alternatives to transmission. Addressing the free rider problem also contributes to fairness, because all beneficiaries of an investment have to contribute to funding the investment.<sup>24</sup> The proposed GIT contributes to reliability and environmental sustainability, because net market benefits are defined to include reliability benefits, and environmental taxes and subsidies are taken into account in the definition of project costs and benefits. The proposed GIT promotes and facilitates the efficient use of electricity by ensuring local generation is made available to consumers only where that is a more efficient option than remote generation and transmission.</p>
<b>Part F objectives for developing the GIT (rule 6.3 of section III)</b>	
<ul style="list-style-type: none"> <li>6.3.1: Promoting economic efficiency (including energy efficiency) in transmission and the wholesale market</li> </ul>	<p>The proposed GIT promotes economic efficiency in transmission and the wholesale market by ensuring investment in local generation occurs only where that is a more efficient option than investment in remote generation and transmission.</p>
<ul style="list-style-type: none"> <li>6.3.2: As far as practicable reflecting the interests of end use customers in ensuring a reliable transmission system having regard to the cost to end use customers</li> </ul>	<p>The proposed GIT includes the value of unserved energy in its calculations of net market benefits, and so explicitly takes into account the cost of reliability to end use customers.</p>
<ul style="list-style-type: none"> <li>6.3.3: Reflect a reasonable economic assessment of the balance between different levels of reliability and the expected value of energy at risk</li> </ul>	<p>The proposed GIT includes assesses reliability investment proposals taking into account project costs and the value of unserved energy.</p>
<ul style="list-style-type: none"> <li>6.3.4: Enabling selection of transmission upgrade options that maximise the total net benefits to those who produce, distribute and consume electricity after taking into account alternatives to transmission</li> </ul>	<p>The proposed GIT focuses entirely on net benefits to electricity market participants.</p>
<ul style="list-style-type: none"> <li>6.3.5: Promoting certainty for investment in transmission, generation and transmission alternatives and investment contracts</li> </ul>	<p>The proposed GIT promotes certainty for investment in transmission and alternatives to transmission (which includes generation) by adopting robust and practicable rules for assessing the net market benefits of proposals for grid investment and alternatives to transmission</p>
<ul style="list-style-type: none"> <li>6.3.6: Facilitating outcomes acceptable to</li> </ul>	<p>The proposed GIT should facilitate outcomes acceptable to Transpower and designated</p>

Objectives	Response
Transpower and designated transmission customers	transmission customers by providing a transparent and robust methodology for resolving different views about key parameters.
<b>Assessment against GPS objectives and outcomes</b>	
<ul style="list-style-type: none"> <li>Energy and other resources are used efficiently</li> </ul>	The proposed GIT promotes efficient use of energy and transmission resources by ensuring local generation is made available to consumers only where that is a more efficient option than remote generation and transmission.
<ul style="list-style-type: none"> <li>Risks (including price risks) relating to security of supply are properly and efficiently managed</li> </ul>	The proposed GIT includes the value of unserved energy in its calculations of net market benefits, which should ensure transmission is available for generation to meet load.
<ul style="list-style-type: none"> <li>Barriers to competition in electricity are minimised for the long-term benefit of end-users</li> </ul>	The proposed GIT includes competition benefits in its calculations of net market benefits.
<ul style="list-style-type: none"> <li>Incentives for investment in generation, transmission, lines, energy efficiency, and demand-side management are maintained or enhanced and do not discriminate between public and private investment</li> </ul>	The proposed GIT enhances incentives for investment in generation, transmission, energy efficiency, and demand-side management by providing a transparent, credible, and robust method of deciding when grid investments should be undertaken. The proposed GIT does not discriminate between public and private investment.
<ul style="list-style-type: none"> <li>The full costs of producing and transporting each additional unit of electricity are signalled</li> </ul>	N/A
<ul style="list-style-type: none"> <li>Delivered electricity costs and prices are subject to sustained downward pressure;</li> </ul>	The proposed GIT includes competition benefits in its calculations of net market benefits, and so should facilitate competition where appropriate.
<ul style="list-style-type: none"> <li>The electricity sector contributes to achieving the Government's climate change objectives by minimising unnecessary hydro spill, efficiently managing transmission and distribution losses and constraints, promoting demand-side management and energy efficiency, and removing barriers to investment in new generation technologies, renewables and distributed generation.</li> </ul>	The proposed GIT contributes to the Government's climate change objectives by considering feasible alternatives to transmission, such as local/distributed generation and demand side initiatives.

## Appendix 1: Economic Framework for the GIT

### Monopoly regulation

141. A key feature of transmission is that grid investment is characterised by substantial economies of scale, as discussed in the paper prepared by Frontier Economics on the transmission pricing methodology.<sup>25</sup> Grid providers become natural monopolies, and like any monopoly, would face strong commercial incentives to restrict output to raise prices. In this case, they have incentives to restrict grid capacity to produce excessive loss and constraint rentals. Avoiding these problems requires price regulation or the removal of the profit incentive (i.e., trust or state ownership), or both.

### Strategic interdependence

142. The presence of large economies of scale for grid investment means that only large capacity expansions are economic. But large capacity expansions sharply reduce nodal price separation, which affect the pay-offs generators and load expected to receive from making location decisions in response to nodal price signals.
143. This creates a strategic interdependence problem, where the location decisions of grid users depend on Transpower's plans, and Transpower's plans depend on the investment and location decisions of generators and load. The SOO and GIT are intended to address this problem.

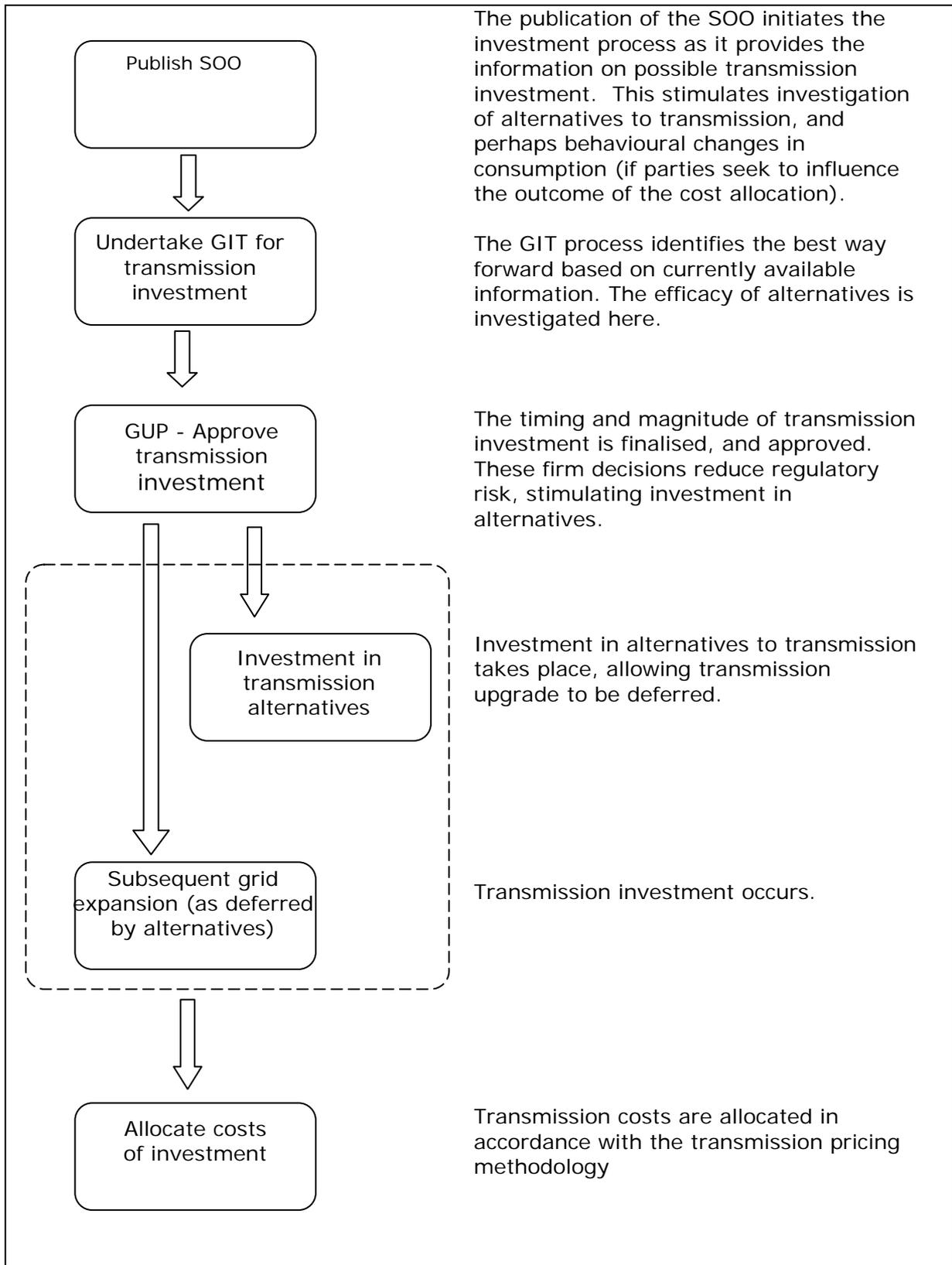
### Investment signals for alternatives to transmission

144. Figure 2 (next page) outlines the key role of the SOO in providing information about potential investments that may occur. Figure 2 also highlights that the grid investment process provides greater regulatory certainty to investors, as alternatives to transmission will not be committed by investors until the grid upgrade plan confirms the magnitude and timing of grid investments.
145. The SOO makes clear to market participants the Commission's views about future nodal price separation in the absence of certain grid investments or alternatives to transmission. Consistent application of the grid investment test, by Transpower and the Commission, will provide market participants with confidence to predict future grid investment decisions, and therefore predict future nodal price separation.

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<sup>25</sup> "Transmission pricing methodology – options and guidelines," Final draft issues paper, Frontier Economics, 28 June 2004.

**Figure 2 – Overview of the grid investment process**



### **Difficulties defining physical capacity rights**

146. Like other transport services, transmission conveys energy from locations where it can be produced relatively cheaply to locations where it is valued highly by consumers. But 'loop flow' effects on the core grid make it fundamentally different from many other transport services. In effect, the core grid is a shared asset because it is too difficult to define (and sell) physical capacity rights to circuits on the grid.
147. With 'loop flow' effects it is not possible to identify particular generators supplying particular offtakes – in physical terms, generators supply electricity to a pool and offtake parties withdraw electricity from that pool. This makes it impossible to attribute transport costs to consumers or generators on the basis of bilateral contracts agreed between them.

### **Free rider effects**

148. Likewise, it is not possible to quarantine to individual customers the expansion in *grid services* that arises from grid expansion. All customers downstream of a grid expansion receive the expanded service, in the form of reduced losses, reduced frequency and duration of binding constraints, and reduced probability of supply interruption. Moreover, the extent of the additional service varies by node, making it difficult to define and sell physical capacity rights for the grid.
149. In the absence of economies of scale, grid providers could finance their investments by buying power from generators at grid injection points (GIPs) and selling power to consumers at grid exit points (GXPs). Differences in nodal prices would be sufficient to fully fund grid capacity. The presence of economies of scale, and efficient nodal pricing, produces *revenue inadequacy*, and so transmission fees are required to make up the shortfall.
150. Under an open access regime, with no physical capacity rights, grid providers have no method of charging for grid capacity on a voluntary basis.<sup>26</sup> This allows consumers to free ride on grid expansion.

### **Implications for the GIT**

151. The economic rationale for the GIT is that it addresses economies of scale and free rider problems inherent with transmission. Applying the GIT forces designated transmission customers to pay for grid investment if the test shows that grid investment achieves the highest present value of net market benefits. Conversely, the GIT protects customers from paying for grid investments when it yields benefits less than costs, or when other alternatives produce higher net market benefits.

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<sup>26</sup> Financial transmission rights (FTRs) are not sufficient to overcome these problems arising from the lack of physical capacity rights, although they do assist with other aspects of the issue.

## Appendix 2: Draft Grid Investment Test

*This document is the Electricity Commission's Draft Grid Investment Test.*

### Making of Electricity Governance Rule

1. In accordance with rule 6.6, Section III of Part F (**Transport Rules**) of the Electricity Governance Rules and the provisions of the **Act**, the **Minister**, on the recommendation of the **Board**, on *[insert date here]*, makes this **grid investment test** a schedule to Section III, Part F of the **rules**.

### Preamble

2. Rule 6.1 in Section III, Part F of the **rules** requires the Electricity Commission, formally constituted as the **Board**, to determine the most appropriate **grid investment test** and in so doing must have regard to the objectives in rule 6.3, as required by rules 6.1 and 6.3.
3. Pursuant to rule 6.2, the **grid investment test** is to be applied:
  - (a) by the **Board**, in developing **grid reliability standards**, to review and approve **reliability investments** and **economic investments** and to review **transmission alternatives**, and
  - (b) by **Transpower**, to determine proposed **economic investments** for inclusion in the proposed **grid upgrade plan**.

### The grid investment test

4. A **proposed grid investment** satisfies the **grid investment test** if:
  - (a) the **proposed grid investment** maximises the **expected net market benefit** compared with a number of **alternative projects**;
  - (b) the **expected net market benefit** of the **proposed grid investment** is greater than zero; and
  - (c) if sensitivity analysis is conducted, a conclusion that a **proposed grid investment** satisfies sub-paragraphs (a) and (b) above is sufficiently robust having regard to the results of that sensitivity analysis.

### For the purposes of this grid investment test:

5. "**Proposed grid investment**" means an **economic investment** or **reliability investment** in the **grid** proposed by **Transpower** that requires estimated capital expenditure prior to commissioning of \$1 million or more.
6. The application of the **grid investment test** may involve less rigorous and comprehensive analysis than would otherwise be required, where the **proposed**

**grid investment** requires estimated capital expenditure prior to commissioning of less than \$5 million.

7. **"Alternative projects"** means any alternative transmission augmentation projects and **transmission alternatives** to the **proposed grid investment** that are:
  - (a) technically feasible;
  - (b) reasonably likely to proceed if the **proposed grid investment** does not proceed and unlikely to proceed if the **proposed grid investment** does proceed;
  - (c) reasonably expected to provide similar benefits, in type but not necessarily in magnitude, to relevant nodes, as the **proposed grid investment**;
  - (d) appropriate in number and technology given the cost magnitude of the **proposed grid investment**, the complexity of the required modelling and the urgency of the **proposed grid investment**; and
  - (e) reasonably expected to enable the deferment of investment of the type contemplated by the **proposed grid investment** for a period of 1 year or more.
8. **"Alternative projects"** include any variant of the **proposed grid investment** involving a non-negligible change in the timing of that **proposed grid investment**.
9. **"Expected net market benefit"** means the probability-weighted average of the **net market benefit** for each of the **market development scenarios** developed for the future with the **proposed grid investment** or **alternative project**.
10. **"Net market benefit"** means, for a **market development scenario** developed for the future with that **proposed grid investment** or **alternative project**, the **market benefit** of a **proposed grid investment** or **alternative project** in that **market development scenario** less the **cost** of that **proposed grid investment** or **alternative project** in that **market development scenario**.
11. **"Market benefit"** means the present value of the benefits to those persons who produce, distribute and consume electricity from a **proposed grid investment** or **alternative project** over a period of 20 years from the commissioning date (unless significant **market benefits** or **costs** are expected to arise from the **proposed grid investment** or **alternative project** after that time, in which case the then-present value of any future benefits may also be included in the **market benefit** of the **proposed grid investment** or **alternative project**) and includes:
  - (a) changes in fuel costs of **existing projects, committed projects** and **modelled projects**;
  - (b) changes in the value of involuntary **demand** curtailment;
  - (c) changes in the costs of demand-side management;
  - (d) changes in costs resulting from the deferral of capital expenditure on **modelled projects**;

- (e) changes in costs resulting from differences in the size of capital expenditure on **modelled projects**;
  - (f) changes in costs resulting from differences in operations and maintenance expenditure on **existing projects, committed projects and modelled projects**;
  - (g) changes in costs for **ancillary services**;
  - (h) changes in transmission **losses**;
  - (i) subsidies or other benefits provided under or arising pursuant to all applicable laws, regulations and administrative determinations; and
  - (j) if considered appropriate by **Transpower** or the **Board** and separately identified and calculated, **competition benefits**.
12. **"Competition benefits"** means the effects of greater competition between **generators** resulting from a **proposed grid investment** or **alternative project** on:
- (a) the cost of **dispatch**;
  - (b) forecast **demand** growth; and
  - (c) the timing of **modelled projects**.
13. **"Cost"** means the present value of the costs of a **proposed grid investment** or **alternative project** to those persons who produce, distribute and consume electricity over a period of 20 years from the commissioning date (unless significant **market benefits** or **costs** are expected to arise from the **proposed grid investment** or **alternative project** after that time, in which case the then-present value of any future costs may also be included in the **cost** of the **proposed grid investment** or **alternative project**) and includes:
- (a) capital costs incurred prior to the commissioning of the **proposed grid investment** or **alternative project** (as the case may be);
  - (b) operating, maintenance and dismantling costs over the operating life of the **proposed grid investment** or **alternative project** (as the case may be);
  - (c) costs to **participants** associated with testing of the **proposed grid investment** or **alternative project** (as the case may be);
  - (d) any additional amount, approved by the **Board**, that could reasonably be considered to be a cost related to the commissioning of a **proposed grid investment** or **alternative project** (as the case may be); and
  - (e) costs of complying with or arising pursuant to all applicable existing and anticipated laws, regulations and administrative determinations.
14. The **market benefits** and **costs** of a **proposed grid investment** or **alternative project** are determined for each of the **market development scenarios** for the future with that **proposed grid investment** or **alternative project** by

comparing that **market development scenario** with the corresponding **market development scenario** developed for the **base case**.

15. **"Market development scenarios"** means the number of reasonable future states of the electricity industry, developed for use in determining the **market benefits** and **costs** of a **proposed grid investment** and **alternative projects**, for each of:
  - (a) the future with a **proposed grid investment**;
  - (b) the future with each **alternative project**; and
  - (c) the future without the **proposed grid investment** or any **alternative project**.
  
16. Except where the development of an alternate future scenario to those outlined in the **statement of opportunities** is reasonably justified, the **market development scenarios** must be the possible future scenarios outlined in the **statement of opportunities** and the probability of occurrence of a **market development scenario** will be as set out in the **statement of opportunities** in respect of the relevant possible future scenario.
  
17. The supply-side of any **market development scenario** must include:
  - (a) **committed projects**;
  - (b) **decommissioned projects**; and
  - (c) **modelled projects**.
  
18. **"Committed projects"** means transmission augmentation projects and **non-transmission projects**, other than the **proposed grid investment** and **alternative projects**, which are reasonably likely to proceed in a similar timeframe regardless of whether or not the **proposed grid investment** or any **alternative project** proceeds and in relation to which either:
  - (a) all of the following are satisfied:
    - (i) the proponent has obtained all required planning consents, construction approvals and licences, including completion and acceptance of any necessary environmental impact statement;
    - (ii) construction has commenced or a firm commencement date has been set;
    - (iii) the proponent has purchased, settled or acquired land (or commenced legal proceedings to acquire land) for the purposes of construction;
    - (iv) contracts for supply and construction of the major components of the plant and equipment (including any generators, turbines, boilers, transmission towers, conductors, terminal station equipment) have been finalised and executed, including any provisions for cancellation payments; and

- (v) the financing arrangements, including any debt plans, have been conducted and completed; or
  - (b) in the case of transmission augmentation projects, the **Board** has unconditionally approved the project following application of this **grid investment test**.
19. **"Decommissioned projects"** means the decommissioning, removal or de-rating of **existing projects** which are reasonably likely to occur in a similar timeframe regardless of whether or not the **proposed grid investment** or **alternative project** proceeds and in relation to which either:
- (a) both of the following are satisfied:
    - (i) a final decision to decommission, remove or de-rate the **existing project** after a specified date has been made and has been publicly announced; and
    - (ii) contracts to directly or indirectly facilitate the decommissioning, removal or de-rating of the **existing project** have been finalised and executed; or
  - (b) consents or contracts for the operation and maintenance of the **existing project** have been terminated or have expired with no reasonable prospect of renewal, or in relation to which agreements for early termination have been finalised and executed.
20. **"Existing projects"** means transmission augmentation projects and **non-transmission projects** that have been commissioned prior to, and are in operation at the time of, the application of this **grid investment test**.
21. **"Non-transmission projects"** includes investments in local generation, energy efficiency, demand-side management and distribution network augmentation.
22. **"Modelled projects"** means transmission augmentation projects and **non-transmission projects**, other than the **proposed grid investment** and **alternative projects**, which are:
- (a) identified in the **statement of opportunities** as likely to occur in a **market development scenario**;
  - (b) reasonably expected to occur in that **market development scenario** within the time horizon for assessment of the **market benefits** and **costs** of the **proposed grid investment** and **alternative projects**; and
  - (c) the likelihood, nature and timing of which will be affected by whether the **proposed grid investment** or any **alternative project** proceeds.
23. **"Base case"** means the number of **market development scenarios** developed for the reasonable future state of the electricity industry without the **proposed grid investment** or any **alternative project**.
24. The **base case** must be reasonable having regard to:
- (a) the **grid reliability standards**;

- (b) any possible future scenarios outlined in the **statement of opportunities**;
  - (c) the current state of the electricity industry, including the following elements of the current state of the electricity industry:
    - (i) the size and location of **demand**;
    - (ii) the value(s) of unserved energy (which value(s) will be the value or values published by the **Board** for this purpose from time to time or, if no such value or values is published by the **Board**, \$20,000/MWh);
    - (iii) the operating and maintenance costs of efficiently supplying **demand** from **existing projects**;
    - (iv) transfer capacities and capabilities of key transmission lines; and
    - (iv) the cost of providing sufficient **ancillary services** and the cost of transmission **losses** involved in efficiently supplying **demand**; and
  - (d) reasonably expected future market development, including:
    - (i) the size, timing and location of **demand** growth;
    - (ii) the value of unserved energy (which value(s) will be the value or values published by the **Board** for this purpose from time to time or, if no such value or values is published by the **Board**, \$20,000/MWh);
    - (iii) the size, location and timing of **committed projects** and **modelled projects**;
    - (iv) the operating and maintenance costs of efficiently supplying demand by means of **existing projects, committed projects** and **modelled projects**;
    - (v) the capital costs of efficiently supplying **demand** by means of **modelled projects**;
    - (vi) the timing of **decommissioned projects**;
    - (vii) transfer capacities and capabilities of key transmission lines; and
    - (viii) the cost of providing sufficient **ancillary services** and the cost of transmission **losses** involved in efficiently supplying **demand**.
25. Where a material **market benefit** or **cost** cannot be quantified, the direction of the **market benefit** or **cost** and likely magnitude of the **market benefit** or **cost** must be identified.
26. All present value calculations must use a discount rate equal to the regulated **Transpower** weighted-average cost of capital applicable at the time this **grid investment test** is applied.

27. Either standard net present value analysis or real options analysis must be applied in assessing the **expected net market benefit** of a **proposed grid investment** or **alternative project**, depending on which type of analysis is more appropriate having regard to the likelihood of occurrence of any real options during the economic life of the **proposed grid investment** or **alternative project**.
28. If real options analysis is used, all material real options must be taken into account in determining the **market benefits** and **costs** of a **proposed grid investment** or **alternative project**.
29. Sensitivity analysis must be applied in assessing the **expected net market benefit** of a **proposed grid investment** or **alternative project**, unless it can be demonstrated that applying sensitivity analysis is either:
  - (a) not reasonably practicable; or
  - (b) not reasonably necessary.
30. In applying sensitivity analysis, a number of alternative reasonable scenarios should be developed for each of the **market development scenarios** using reasonable variations in the following:
  - (a) forecast **demand**;
  - (b) the size, timing, location, and operating and maintenance costs of:
    - (i) the **proposed grid investment** or **alternative project**; and
    - (ii) **committed projects** and **modelled projects**;
  - (c) the capital cost of:
    - (i) the **proposed grid investment** and the **alternative projects**; and
    - (ii) **modelled projects**;
  - (d) the timing of **decommissioned projects**;
  - (e) the value(s) of unserved energy (which varied value or values will be the value or values published by the **Board** for this purpose from time to time or, if no such value or values is published by the **Board**, \$10,000/MWh and \$30,000/MWh);
  - (f) the discount rate used in the present value calculations;
  - (g) a range of consistent hydrological inflow sequences, as defined in the **statement of opportunities** and **centralised data set**;
  - (h) **generator** and demand-side bidding strategies; and
  - (i) key input variables in the calculation of **competition benefits**.
31. Unless the context calls for another interpretation:

- (a) terms defined in Part A of the **rules** take that defined meaning;
- (b) a reference:
  - (i) to the singular includes the plural and conversely;
  - (ii) to a person includes an individual, company, other body corporate, association, partnership, firm, joint venture, trust, or Government Agency;
- (c) the word including or includes means including, but not limited to, or includes, without limitation;
- (d) where a word or phrase is defined, its other grammatical forms have a corresponding meaning.

**Appendix 3: Format for Submissions**

**Submission Summary Table – TITLE of PAPER**

<b>Paragraph</b>	<b>Comment</b>	<b>Proposed amendment</b>
<i>Para 12</i>	<i>Paragraph 4 does not....</i>	<i>We think that instead you should take the following approach</i>