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Electricity Commission

Discount Rate for Application in Grid Investment Test

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Final Report

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1. EXECUTIVE SUMMARY

1.1 Scope of Paper

In its Consultation Paper on the Grid Investment Test (GIT) the Electricity Commission (the Commission) noted its intention to seek further external advice on the appropriate discount rate(s) to use. The Commission has asked Saha International Limited to prepare advice on the selection of the discount rate to be applied in the GIT which will be used by Transpower and the Commission, in accordance with rule 6.2 of section III of the Electricity Governance Rules 2003 (EGR), to evaluate transmission investments for regulatory approval. We note that the Commission has sought and obtained advice from market participants. The Commission has expressed a preference for a discount rate set equal to Transpower's regulated weighted average cost of capital (Transpower WACC). We further note that a Transpower WACC has in the past been produced by the Transpower Board and by the Commerce Commission – albeit with small variations in the choice of model formulation.

The advice in this paper is primarily intended to initiate and inform discussion within the Commission on the appropriateness of using the Transpower WACC or one or more private sector rates as the discount rate for the GIT. It also considers the appropriateness of using a "public" discount rate based on social time preferences, or perhaps some weighted average discount rate that recognises both social and private sector preferences.

This paper should be viewed as a support paper, assisting deliberations by the Commission in its final recommendation to the Minister on all aspects of the GIT. As such, the discussions in this paper are expected to contribute to a larger Commission paper that sets out its final conclusions on the GIT.

1.2 Objectives and Application of the GIT

The paper begins with an introduction and background to provide context for the discussion and describes how the GIT fits into the overall Part F framework. A summary of the Commission's tentative proposals with regard to setting the discount rate and the observed industry position to date is also included to assist the reader.

It is important to consider more than just the discount rate, and an overview of the grid investment process highlights that while the discount rate is important to the grid investment process, it is one of many parameters, and has a relatively small impact on project selection. This paper does not discuss these other parameters in detail or consider their relative importance. However, comment is made on the impact on the overall outcome of using a particular discount such as a discount rate set equal to Transpower WACC or set equal to a private sector rate. Also we note that the practical application of the Australian regulatory test has shown that other parameters are likely to be more important (see Section 5) in determining outcomes.

The GIT and the Part F Transport Rules may provide, at first, conflicting signals on the nature of the optimal discount rate. For example, including as a benefit the reduction in the cost of non-supply[1] under the GIT (assessed by taking a probabilistic estimate of the

[1] See the table 4-1 – the definition of Market Benefit – value of involuntary demand curtailment.

amount of un-served energy that the project will relieve and multiplying it by the value of lost load [VoLL[2]])—suggests that a social rate of time preference (defined in section 4.2) should be used in preference to a private sector discount rate. On the other hand, the Rules stipulate that the test is to evaluate net benefits accruing to "those persons who produce, distribute and consume electricity over a period of 20 years". On the surface at least, this would indicate the application of an industry rate (a private sector rate) may be appropriate. We propose that this duality may provide some support for a blended rate.

Our preliminary conclusion is that the Rules (as they are) provide limited guidance to the selection of the most appropriate discount rate. If anything, they possibly suggest a combination of rates to meet the many objectives of the GIT. In addition, the Commission's timetable (driven in a large part by some urgency in addressing some critical investment requirements) and the linkages between the grid investment processes (see figure 4-1) require a pragmatic approach to determining the discount rate. At least in the first stage of the new planning environment and the current timetable, the selection of a largely pre-determined single rate or an agreed method to calculate the rate, is preferred.

1.3 Summary of Discount Rate Theory and Practice

The next section presents a summary of current discount rate theory and practice, highlighting a number of issues in selecting a discount rate for use in the GIT. In the absence of the Rules providing definitive guidance on the appropriate discount rate, we have applied first principles. The key conclusions are:

- The GIT has similarities with national cost benefit analysis and hence discount rate discussions should refer to the social time preference rate and the social opportunity cost (where private sector involvement is a distinct possibility);

  In this regard we would stress that the GIT is a net benefits test primarily concerned with deferring investment - not assessing the revenue performance of a particular project.

- There are three generally accepted approaches[3] to determining discount rates in national cost benefit analysis. These are:

  - Social Opportunity Cost (SOC)-the rate that reduces the NPV of the best alternative private use of the funds to zero. It is the most relevant when the good or service could be provided by the private sector;

  - Social Rate of Time Preference (SRTP) – the rate that compares private consumption today with private consumption in the future. Depending on the timeframe of the project it can require judgements on inter-generational issues. It is most relevant when social preferences, not just financial sector considerations need to be accounted for and is generally lower than the SOC or private sector rates; and

[2] $20,000 MWh has been suggested (current value in the Australian National Electricity Market).
[3] Young, L. September 2002. Determining the Discount Rate for Government Projects – New Zealand Treasury Working Paper 02/21

  - A Weighted Average – the weighted average cost of the two approaches above to reflect foregone consumption and loss in private investment.

- We do not believe the use of an investor centric WACC (taking into account the riskiness of future income streams) is appropriate for the GIT;

- Calculation of an appropriate private sector WACC will be subject to a number of challenges if consultation on the "appropriate rate" is allowed; and

- Use of multiple rates may address some of the modelling uncertainties specific to particular projects/alternatives but in the context of the GIT may have negligible benefit for the effort required. As noted previously, such an approach may foster unproductive debate.

1.4 International Practice

In Section 6, we provide a brief review of international practice regarding the economic selection of transmission investments and alternatives and the use of discount rates in:

- Australia;
- US (California, New England, PJM);
- UK.

However, given that many jurisdictions have not yet formalised grid investment approval processes or whose electricity markets are sufficiently differentiated from New Zealand's to make the issue relevant, the experience is limited.

The most relevant market is Australia, which has implemented a regulatory test and applied it to the approval of connections between regions (interconnectors). The key conclusions of this brief review are:

- The Australian regulator has generally been concerned with encouraging unregulated transmission projects;

- The robust nature of the Australian energy market has arguably allowed the regulator some latitude in being able to judge regulated projects as if they were unregulated projects (to focus on the encouraging of new entrants rather than having to address serious supply problems). In New Zealand, the perceptions of risk are different;

- As New Zealand's regulatory GIT is a form of national cost benefit analysis it is not focussing on what is best for investors (a funding bias) but rather it concerned with the ranking of projects by the degree to which they deliver net benefits favoured by society;

  In many practical applications of the Australian regulatory test the impact on project rankings of the discount rate has been negligible. For instance, the ACCC has acknowledged in its evaluations of the Murraylink transmission submissions that the selection of discount rate has little impact on project rankings;

- There is a lack of specificity in the use of discount rates in the other jurisdictions examined.

1.5 Evaluation

In order to assess the appropriateness of different discount rates, a two step process was employed. The first step was to establish evaluation criteria. These were established by reference to the existing Rules (especially the objectives of the GIT) and some practical principles. This resulted in evaluation criteria being selected that ensured the following outcomes were attained:

- Maximise economic efficiency;
- Reflect end-users preferences regarding the trade-off between reliability and cost;
- Not discriminate against transmission alternatives;
- Balance reliability and costs of non-supply;
- Be transparent;
- Have no significant data acquisition issues;
- Be consistent with good international practice;
- Reflect industry views;
- Comply with the Government Policy Statement (GPS) and Legislation.

The second step was to evaluate the different discount rates against the different criteria. The following table shows the degree of fit between the basic three different discount rates and the evaluation criteria.

Evaluation Criteria	**Comment on the Appropriate Discount Rate**
Maximise economic efficiency	The rate that achieves this is unknown. Given that social outcomes are integral to the GIT some bias towards the social rate of time preference is likely to be appropriate
Reflect the interests of end-use customers in ensuring a reliable transmission system having regard to the cost to end use customers	Transmission investments tend to be more reliable. A lower discount rate would generally favour transmission investments. It has been observed that end-use customers put a high value on reliability. Such preferences are consistent with a lower discount rate such as that generally associated with social rate of time preference

Evaluation Criteria	Comment on the Appropriate Discount Rate
Take into account transmission alternatives	Transmission alternatives tend to have lower commissioning costs and more immediate access to benefits and hence tend to be favoured when a higher discount rate is applied. A discount rate based on the social opportunity cost and/or a private sector rate would be appropriate
Balance the cost of attaining different levels of reliability against the cost of non-supply	Refer to comments on reliability e.g. social rate of time preference. However for this criteria, other parameters are likely to be more influential (e.g. VoLL)
Transparency	Social Rate of Time Preference is not defined but is often expressed as within the range of 3 – 5 %. This rate is not particularly transparent. Similarly, it is difficult to assign the social opportunity cost without the reference to the private sector benchmark. Therefore the most transparent discount rates are those obtained in the competitive sector (private sector rate) or the regulated sector such as a Transpower WACC
Data Availability	Social rate of time preference is difficult to identify and normally assigned a range (3- 5 %). Similarly, it is difficult to assign the social opportunity cost without the reference to the private sector benchmark. Data is available from the competitive sector (private sector rate) and the regulated sector such as Transpower's regulated WACC. However, data availability going forward for Transpower's regulated WACC may be an issue (see section 8.3 below)
Consistency with International Practice	International experience apart from Australia is limited due to most jurisdictions not formalising grid investment approval processes. The experience shows a wide range of approaches to discount rates from adopting rates close to zero (New England) to a commercial rate as in the Australia regulatory test. As we note in section 6.1.5, there are some key difference in the GIT and Australia's regulatory test. These differences support the discount rate being closer to a social rate of time preference in New Zealand for the GIT
Industry Consensus	The current preference is for the rate applicable to Transpower being applied (see section 4.1.5)
Compliance with GPS and Electricity Amendment Act	The Commission has to balance the following requirements: ▪ Non-discrimination between transmission investments ▪ Ensuring reliability ▪ Possible future funding of transmission alternatives

Evaluation Criteria	Comment on the Appropriate Discount Rate
	▪ WACC of an investor in transmission alternatives (given the impact of some portion of their income will be regulated) Balancing of requirements would indicate a preference for a weighted average discount rate (see section 7.4)

The above evaluation tends to support the following conclusions:

- An evaluation of alternative discount rates using evaluation criteria consistent with the objectives of the GIT suggests social preferences and commercial preferences need to be taken into account;

- A weighted average discount rate – weighted for social and commercial preferences – is likely to be most appropriate;

- A weighted average discount rate is consistent with the GPS which on the one hand seeks to avoid discriminating against Transpower's investments through the use of high discount rates, whilst on the other hand seeks to avoid discriminating against private investment in transmission alternatives.

1.6 Formulation of a discount rate and conclusion

The use of the Transpower WACC to approximate a weighted average discount rate - weighted between public/social and private/commercial preferences – is considered in Section 8. This section provides a rationale for the serious consideration of weighted discount rate and why (supported by previous sections) a Transpower WACC may be a suitable proxy for this rate is provided. As noted below, this should be confirmed by further analysis.

In the body of the paper we describe the use of discount rates (generally), and conclude:

- Discount rates are used to reflect choices about consumption and risk;

- It is important that the discount rate should reflect the nature of the underlying cash flows;

- The purpose of the discount rate in the GIT is **not** to:

  - Assess risky income streams of underlying transmission investments or alternatives. Many respondents to the Commission consultation paper understood this to be the primary purpose of the discount rate and hence believed that the use of a Transpower WACC would introduce selection bias[4]; and

[4] Although the majority of respondents tended to support the use of the Transpower WACC.

  - Determine the regulated revenue requirements/funding of projects (a different rate could be applied)[5].

  Rather, it has a simple, twofold purpose:

  - Ranking of projects; and

  - Ensuring the net benefit of the selected project is positive.

- The GIT is a form of national cost benefit analysis. In this sense the GIT is primarily concerned with the deferral of investment. An investor-centric discount rate (e.g. a CAPM-based WACC – discounting risky project cash flows) is therefore not appropriate for the purposes of the GIT. Instead, in this paper we demonstrate that the appropriate discount rate for the GIT is a weighted average[6] of the:

  - Social Opportunity Cost; and

  - Social Rate of Time.

To the extent that Transpower continues to involve itself in addressing commercial and social objectives, the parameter values applying to Transpower means that the Transpower WACC provides an approximate proxy for the weighted average of the social rate of time preference and the private sector discount rate. Transpower's regulated revenue and its numerous roles in the electricity sector as set out in its Statement of Corporate Intent would also tend to imply the Transpower WACC is close to a weighted average discount rate.

We would suggest that further analysis is undertaken to confirm this approximation and the Commission sets out acceptable values for the relevant parameters in the calculation of a Transpower WACC or some other proxy for a weighted average discount rate.

It should be noted that regulatory protagonists will select and argue the interpretation that generally suits themselves best (from a pricing standpoint). For this reason it may be advisable for the Commission to obtain broad agreement that a weighted average rate is the most appropriate for the GIT and that the Transpower WACC is an appropriate proxy.

In light of this recommendation, our last section considers the appropriateness of the Commission proposal to use Transpower WACC. We would note that this rate is unlikely to be identical to a weighted average of the social opportunity cost and social rate of time preference. However, we would argue that as the Transpower WACC reflects a weighting of social and commercial objectives, it too can be seen as an average composite discount rate.

In applying this rate we are cognisant that:

[5] As noted by the ACCC, a different discount rate can be used for setting an allowable revenue for the asset after it has been built

[6] We have not sought to determine the relative weights.

- GIT rankings are not overly sensitive to discount rates;
- the use of Transpower WACC is consistent with the objectives of the GIT and GPS;
- the Transpower WACC is a good approximation of such a rate given Transpower's numerous roles in the electricity sector as set out in its Statement of Corporate Intent. We would also note it complies with the GPS by not discriminating against Transpower;
- its use would be consistent with a suitable level of funding if transmission alternatives were to receive regulated income; and
- its use is supported on the grounds of pragmatism given the imperatives of grid planning and investment.

In the last section, we discuss whether the Commission needs to estimate its own WACC for the GIT (based on Transpower WACC methodology). This is on the basis that the current regulatory regime does not require a "regulated Transpower WACC" to be produced. We, therefore, have concerns as to whether it will be produced in a timely and/or robust manner.

Therefore, it may be appropriate for the Commission to:

- Set out its own framework for determining the weighted average discount rate; and
- Undertake its own periodic calculation of the discount rate (e.g. Transpower WACC).

The Commission's consultation paper notes that the use of multiple rates may be more theoretically correct in some situations[7]. However, the derivation of these rates is likely to be problematic and controversial.

However, specifying multiple rates is not impossible and some participants believe that the cost and effort required in determining a discount rate appropriate for the nature of the investment (uncertainty of future cash flows) is less than the potential costs of a misallocation of resources.

We would note that the principal reason for multiple discount rates (to reflect the uncertainty that materialise in assessing the costs and benefits of a particular project) is pragmatically and practically addressed by robust information on particular projects being provided and sensitivity testing in undertaking the GIT. Selection bias will be addressed by sensitivity testing.

The implied assumption is that selection bias is undesirable. We would note that the optimal discount rate (to the extent it does not materially affect which projects are selected) should bias selection towards the most desirable project from a national cost benefit standpoint. The rate should be reflecting the mix of public and private consumption decisions hence our advocacy for a weighted average.

[7] Electricity Commission; "Consultation Paper – Draft Grid Investment Test"; September 2004; para 42

Sensitivity testing should alleviate some of the concerns regarding the use of a single weighted average discount rate such as the Transpower WACC. It is important to note the requirement to undertake sensitivity testing when applying the GIT in a discussion about the most appropriate discount rate. The reasons are that sensitivity testing should:

- Highlight any potential issues with regard to using the Transpower WACC;
- As with the National Cost Benefit analysis, the range may be sufficiently large to include the private sector rate; and
- Demonstrate the relative importance of the discount rate relative to other parameters (e.g. the value of VoLL) and ensure that values used in these parameters are scrutinised as well.

2. INTRODUCTION

The Electricity Commission (the Commission) has asked Saha International Limited to prepare advice on the selection of the discount rate to be applied in the Grid Investment Test (GIT) which will be used by Transpower and the Commission, in accordance with rule 6.2 of section III of the Electricity Governance Rules 2003 (EGR), to evaluate transmission investments for regulatory approval. The Commission has expressed a preference for a discount rate set equal to Transpower's regulated weighted average cost of capital (Transpower WACC).

The base assumption adopted in this paper is that the discount rate parameter in the GIT is used in ranking transmission investment projects and transmission alternatives under consideration and not for discounting project specific systematic risk.

The following figure provides an overview of the grid investment process and sets the context for discount rate discussions. While the discount rate is important to the grid investment process, it is one of many parameters, and has a relatively small impact on project selection. This has been borne out by practical experience in the application of the Australian Regulatory Test (see sections 6.2.4 and 6.2.5) where the sensitivity to the discount rate has been negligible (e.g. the ACCC acknowledged that in its evaluation of the Murraylink transmission investment the discount rate had minimal impact on project rankings).

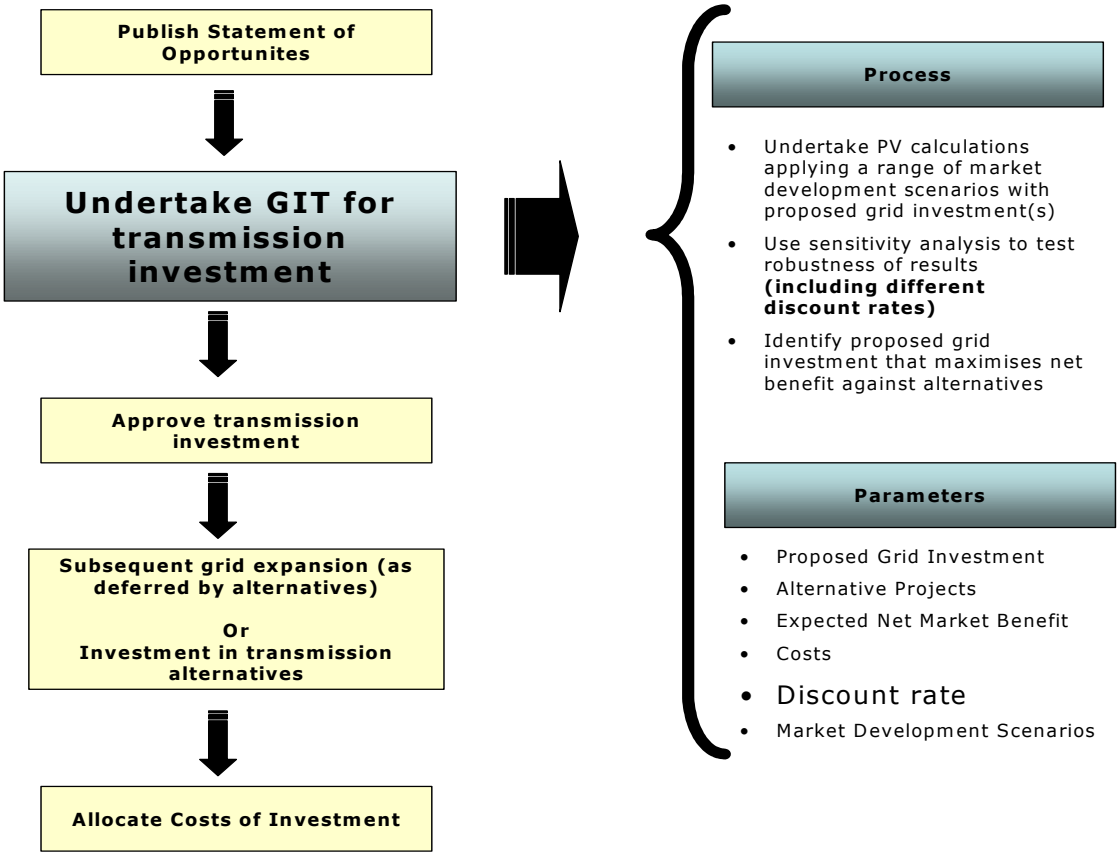

Figure 2-1 Grid investment process

This paper does not discuss these other parameters in detail or consider their relative importance. However, comment is made on the impact on the overall outcome of using a discount rate set equal to Transpower WACC and set equal to a private sector rate.

The Commission has expressed a preference that a single discount rate be used, and that this rate be equal to the Transpower WACC in the year that the test is applied. While the Commission acknowledges that the use of multiple rates may be more theoretically correct in some situations, specifying how these rates should be derived would be both problematic and controversial. A single unambiguous rate is considerably simpler to specify and implement. That said, as we note further in the document, the ongoing independent determination of the Transpower WACC may also raise some issues.

The GIT resembles the Australian regulatory test, which specifies the use of private sector discount rates. Furthermore, the Commission's advisors on the GIT (Frontier Economics) has advised the Commission that the Transpower WACC is not appropriate because it does not reflect the true cost of capital to private investors. Specifically, the advisors have stated that because of different risks faced by Transpower and its customers, it is appropriate that:

"…the discount rate would be the private discount rate applying to an investor in electricity transmission assets. This is likely to be higher than the regulatory weighted average cost of capital (WACC) applicable to Transpower, which may not reflect the risks of transmission investment to customers."

In turn, Commission staff have noted that the sensitivity analysis procedures in the GIT are intended to identify any actual situations where the value of an input parameter would have an impact on project selection.

The principal reasons for the Commission's expressed preference are interpreted and expanded in the following table:

Simplicity	The Commerce Commission would set the rate, and provide supporting analysis and periodic review The GIT analysis is used only to rank regulated transmission investments and confirm that they have a net benefit
To avoid unproductive debate	Project ranking is typically unaffected by the choice of discount rate (within reasonable bounds)
	Although there are strong arguments for and against each of the two approaches, there is no clear winner
	The sensitivity testing requirement of the GIT provides a safety net
	Deriving the Transpower WACC may be performed more transparently than deriving multiple rates
	Use of the Transpower WACC is consistent with capital funding procedures.

	Using the Transpower WACC allows the comparison of transmission alternatives to take into account the relatively low cost of Transpower funding
	Timetable limitations

Table 2-1 Potential reasons for setting the discount rate equal to the Transpower WACC

Most importantly, any reasonable discount rate – for example private rates of return on investment, or Transpower WACC – is unlikely to alter the rankings of different projects, and hence focus on the reasonableness of other parameters in the GIT may be more productive. However, the choice of the discount rate does present implications if the GIT analysis was to be used to calculate the funding/revenue requirement for the alternative projects.

In summary, the Commission has adopted a stance that the Transpower WACC is appropriate as a discount rate for the GIT. This paper discusses a range of options for setting the discount rate for the GIT, with the purpose of informing the Commission on the appropriateness of its own proposal.

3. SCOPE OF PAPER

In its Consultation Paper on the GIT the Commission signalled its intention to seek further external advice on the appropriate discount rate(s) to use. This paper forms part of that advice. We note that the Commission is also seeking advice from industry participants and has requested[8] responses to the following questions contained in the Consultation Paper:

Question 5	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 a Transpower WACC?
Question 6	Is the choice of discount rate likely to materially affect which projects are selected under the GIT?

The advice in this paper is primarily intended to initiate and inform discussion within the Commission on the appropriateness of using the Transpower WACC or one or more private sector rates as the discount rate for the GIT. It also considers the appropriateness of using a "public" discount rate based on social time preferences, or perhaps some weighted average discount rate that recognises both social and private sector preferences.

Finally, it explores the arguments for and against a simpler approach, as opposed to the more complex task of specifying or describing the process for deriving a single private sector rate or multiple discount rates that would reflect the risk of individual projects and risk to different proponents. As such, this paper serves as a support paper, assisting deliberations by the Commission on its final recommendation to the Minister on the GIT. The findings in this paper are expected to contribute to a larger Commission paper that sets out its final conclusions on the GIT.

The paper is structured as follows:

- Background information, including:
    - A context for the discussion and describes how the GIT fits into the overall Part F framework; and
    - A summary of the Commission's tentative proposals and the observed industry position.
- A summary of current discount rate theory and practice, including:
    - The purpose of discount rates (public and private sector);

[8] The Commission has received responses and this paper has addressed relevant issues raised in these responses.

  - National cost/benefit analysis; and
  - A review of the current WACC/CAPM framework.

- International Practice in Regulated Transmission Investment, including:
  - Existing processes for economic selection of transmission investments and alternatives and the use of discount rates in:
    - Australia;
    - US (California and New England);
    - UK.
- A proposed approach and summary of issues around the proposed approach, including a discussion of who the beneficiaries are and the relationship between the beneficiaries and the discount rate.
- Implications (advantages and disadvantages) of different options for setting the discount rate, including:
  - Evaluation criteria;
  - Evaluation of discount rate options;
  - Compliance with GPS and legislation.
- Formulation of the discount rate for the GIT:
  - Weighted average discount rate;
  - Process for arriving at the discount rate for the GIT;
  - Issues with the application of the Transpower WACC.

4. BACKGROUND INFORMATION

4.1 Introduction

This section is to provide sufficient background information for the reader to assist in assessing the degree to which the details of the GIT, its application and objectives provide an indication of the appropriate discount rate. Additionally, consideration should be given to the practicalities of specifying multiple rates given the current timetable and the benefits of exactness versus the costs of the investigation and potential delay to the grid investment processes (and our earlier comments about the practical experience of applying different discount rates on ranking outcomes in Australia).

4.2 Context

In some ways, the GIT and the Part F Transport Rules both can be seen to provide conflicting signals on the nature of the optimal discount rate. For example, including as a benefit the reduction in the cost of non-supply[9] under the GIT (assessed by taking a probabilistic estimate of the amount of un-served energy that the project will relieve and multiplying it by the value of lost load [VoLL[10]])—suggests that a social rate of time preference (defined in section 4.2) should be used in preference to a private sector discount rate. On the other hand, the Rules stipulate that the test is to evaluate net benefits accruing to "those persons who produce, distribute and consume electricity over a period of 20 years". On the surface at least, this would indicate the application of an industry rate (a private sector rate) may be more appropriate.

In order to assess the extent to which the current Part F Rules and the draft GIT provides guidance, a summary of the GIT Rules is set out below. Our preliminary conclusion is that the Rules (as they are) provide limited guidance to the selection of the most appropriate discount rate. If anything, they possibly suggest a combination of rates to meet the many objectives of the GIT. On the other hand, the Commission's timetable (driven in a large part by some urgency in addressing some critical investment requirements) and the linkages between the grid investment processes (see figure 4-1) require a pragmatic approach to determining the discount rate. At least in the first stage of the new planning environment and current timetable, the selection of a pre-determined single rate, is preferred.

4.2.1 Brief Description of the Grid Investment Test

Under Part F the Commission will approve and publish a draft GIT for the assessment of regulated investments. The Commission has completed the first stage of implementing a regulatory benefits test and the draft GIT is included in the Commission's consultation paper as Appendix 2. The GIT will, if approved by the Minister, become a schedule to Section III Part F of the Rules. The Rules set out a high level application and objectives of the GIT and provide some context for a discussion about the most appropriate discount rate. The main parts of the draft GIT define how the test should be administered. Again, the definition assists in discussion regarding the selection of the most appropriate rate. The most important components are set out in 4-1 below:

[9] See the table 4-1 – the definition of Market Benefit – value of involuntary demand curtailment.
[10] $20,000 MWh has been suggested (current value in the Australian National Electricity Market [NEM]).

GIT Component	Definition
Proposed Grid Investment satisfies the GIT	Maximises the Expected Net Market Benefit compared with a number of alternatives Expected Net Market Benefit must be greater than zero Sensitivity testing supports the above result
Proposed Grid Investment	Economic or reliability investments proposed by Transpower over $1M in CAPEX (less rigour required in application of GIT if CAPEX is less than $5M)
Expected Net Market Benefit	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 alternatives
Net Market Benefit	Market Benefit identified minus the cost of the Proposed Grid Investment or alternatives (present value of all the costs associated with the investment over 20 years).
Market Benefit	Present value of the benefits over 20 years where benefits include changes in: ▪ Fuel costs ▪ Value of involuntary demand curtailment ▪ Costs of demand-side management ▪ Costs resulting from the deferral of CAPEX on expected transmission and energy market investments (other than the Proposed Grid Investment) ▪ Operational and maintenance costs of market participants ▪ Transmission losses and ancillary services ▪ Competition benefits (if considered appropriate by the Commission and Transpower)
Market Development Scenarios	A number of reasonable electricity demand & supply scenarios, with and without the Proposed Grid Investment and alternatives

Table 4-1 Components of the GIT

Without trivialising the importance of the discount rate, the impact on project selection of the choice between (say) the Transpower WACC and a calculated private sector WACC may be considerably smaller than the impact of other parameter assumptions such as a variation in the cost of the proposed grid investment being 20 percent more expensive than first assumed or VoLL being $10,000 MWh as opposed to $20,000 MWh.

4.2.2 Application of the Grid Investment Test

Once the GIT has been approved by the Minister, it is to be applied by:

- The Commission:
    - in developing grid reliability standards;

- to review and approve reliability and economic investments; and
- to review transmission alternatives.

- Transpower, to determine which proposed investments are to be included in the grid upgrade plan.

Rule 6.2 of section III of part F, lists the intended users of the GIT. These intended uses are shown in Table 4-2 below.

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
6.2.4	The Commission, to review transmission alternatives

Table 4-2 The intended users of the GIT

The linkages between the GIT and the regulated grid investment processes are shown in Figure 4-1 below:

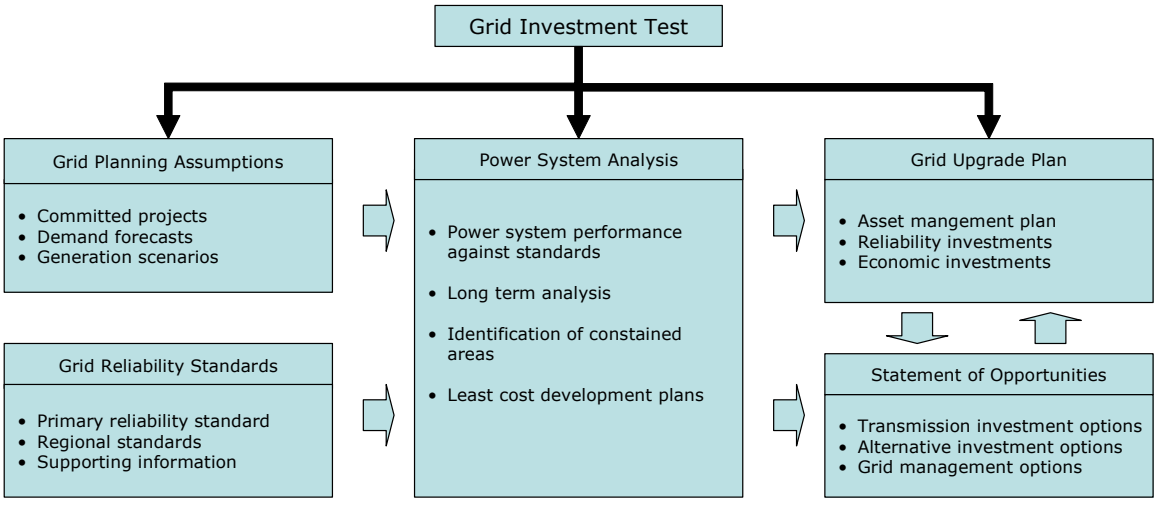

Figure 4-1 Linkages between the GIT and the regulated grid investment processes

At least on the surface, the application of the discount rate in the GIT indicates no strong preference for any single discount rate. Rules 6.2.1 and 6.2.2 may indicate a preference

for the use of public/social discount rate and rule 6.2.4 a preference for a private sector WACC.

4.2.3 Objectives of Grid Investment Test

The objectives of the test are set out in Section III of the Transport Rules.

Rules 6.3.1–6.3.6 list a number of objectives to the test. These are shown in Table 4- 3 below.

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

Table 4-3 Test objectives

The Commission's advisors have interpreted the Rules as follows:

- Promotion of economic efficiency (rule 6.3.1)— the grid test should seek to maximise the sum of consumer and producer surplus;
- Reflect the interests of end-use customers and enable the selection of transmission upgrade options that maximise the total net benefits to participants (Rules 6.3.1 and 6.3.4)—the grid test should focus on the electricity sector net benefits and not the impact on the wider economy and wealth transfers within the sector;
- Rule 6.3.4—the test should take into account transmission alternatives;
- Balance the cost of attaining different levels of reliability against the cost of non-supply (Rules 6 3.3, 6.3.5 and 6.3.6)—identify economic and reliability investments. Frontier Economics recommended that reliability investments (those investments required to

meet deterministic reliability standards e.g. n-1) be evaluated using a cost effectiveness test (the least cost option is chosen). The Commission rejected this, tentatively proposing that all projects be evaluated using the same GIT.

The Commission has also interpreted the above objectives. As the Commission interprets the Rules, the focus should be on maximising expected net market benefits to market participants, specifically:

- 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

- The market comprises generators, lines businesses, and electricity consumers—that is, the parties who produce, distribute, and consume electricity.

The Commission understands that the objectives imply a narrower focus for the GIT than reading of rule 6.3.1 would imply (i.e., the application of a broad social cost-benefit test). The inclusion of the other objectives is to ensure that the GIT focuses on net benefits to the electricity market.

The Commission has distilled the above and proposed two primary purposes of the GIT:

- Rank proposed grid investments according to those that provide the greatest expected (positive) net market benefit after taking into account alternatives to transmission investments; and

- Assist proponents of alternatives to transmission investments (generation, demand side management, distribution networks) and transmission investment contracts by providing information and efficient location signals.

4.2.4 Summary of Preliminary Positions

The primary rationale of Frontier Economics' recommendation for the Commission to adopt a private sector discount rate is that because grid investment approved under the GIT is most likely to displace private sector investment, the private sector discount rate best reflects the opportunity cost of such an investment.

The Transmission Advisory Group (TAG) supports the Commission to the extent of rejecting Frontier Economics' recommendations that a private sector rate should not be used but rather a public sector rate. A TAG issue paper states:

The group disagrees with Frontier's recommendation that the discount rate for assessing both transmission and transmission alternatives should equal the rate a private investor would use. The group believes a public sector rate should be adopted, for the following reason:

- *The group agrees with Frontier that transmission projects, if they are approved under the GIT, are most likely to displace private sector investment in generation and load (rather than alter household consumption profiles);*

- *However, transmission alternatives will be funded from regulated sources, and therefore private investors can be expected to evaluate those opportunities at lower rates than for projects earning only market revenue.*

Given the above it would be useful to invite comment on whether Transpower's pre-tax WACC is an appropriate discount rate.

In general the group does not have a view about a figure for the discount rate, and recommends the Commission set the figure based on research rather than public submissions"[11]

We would also note that the majority of submissions to the GIT consultation paper support the application of the Transpower WACC.

The recommendation that the rate be set by reference to research may create problems, given the need for the Commission to fairly urgently assess and approve transmission augmentations.

The Commission understands the appropriate framework is primarily one of investment decision-making in a regulated environment, and that the use of a Transpower WACC is more consistent with this. Although at this stage no formal decision has been made to fund alternatives to transmission, the Commission considers that alternatives should be assessed using the same discount rate as the grid investment.

4.2.5 Summary of Preliminary Commission View

The Commission's tentative main proposals in regard to the relevant discount rate are:

- The GIT is a net benefit test;

- A Transpower WACC is the appropriate and pragmatic discount rate to use. The Commission considers that it is impractical to use private sector rates given the current requirement to use the GIT to assess grid upgrade proposals *on the table* (there is not enough time available to analyse and identify private sector discount rates);

- The discount rate would be set at a:

    - nominal rate (real rate) if costs and benefits are expressed in nominal (real) terms; and

    - pre-tax (post-tax) rate if costs and benefits are expressed in pre-tax (post-tax) terms.

[11] Transmission Advisory Group Comments on Transmission Issues Papers 6 August 2004

5. A SUMMARY OF CURRENT DISCOUNT RATE THEORY AND PRACTICE

5.1 Introduction

An understanding of the purpose of discount rates and the WACC/CAPM methodology is important in identifying the most appropriate discount rate for the GIT. This section is intended to assist in this understanding.

The section begins with the basic purposes of discount rates and notes the dual purpose of discount rates (i.e. to reflect choices about consumption and risk), considers which purpose is more prominent with regard to the selection of discount rate, and then notes the key objectives of the GIT - which is to both rank projects and to identify which has a NPV greater than zero. We note that the GIT is a form of national cost benefit analysis and this has implications for the selection of the discount rate. The WACC/CAPM methodology is also briefly described as are some current issues with its application. The key conclusions of the section are:

- Due to the similarities of the GIT and national cost benefit analysis, a weighted average discount rate should be given serious consideration to reflect both the social time preference rate and social opportunity cost (where private sector involvement is a distinct possibility);

- An investor centric WACC (taking into account the riskiness of future income streams) is inappropriate for the GIT. For instance, it may lead to perverse outcomes where a relatively weak investor was rewarded with the highest WACC; and

- Use of multiple rates may address some of the project specific uncertainties in conducting the GIT, but in the context of the GIT may have negligible benefit for the effort required. As noted previously, such an approach may foster unproductive debate.

5.2 Purpose of discount rates

Discount rates reflect an opportunity cost in both the private and public sector context. This opportunity cost comprises two elements:

- Time preference (utility of current consumption versus future consumption); and

- Compensation for risk (uncertainty about the future requires greater expected return).

In a perfect market, a discount rate will reflect the clearing of investment and consumption. The discount rate is the point of indifference where individuals are prepared to defer consumption and invest in risk free or risky opportunities. Discount rates, inter alia, provide a means for assessing optimal outcomes due to individual/market/social preferences over time.

The discount rate should reflect the nature of the underlying cash flows, and as stated by Frontier, the discount rate under the GIT is used to convert future cash flows to present values. The choice of the discount rate may affect the GIT by:

- Determining whether the NPV of a project is positive or negative; and
- Potentially affecting the projects rankings (where the pattern of cash flows is sufficiently dissimilar across projects).

The GIT represents the application of a discount rate in a regulatory context by the Commission. This closely follows recent moves by the Commerce Commission to adopt discount rates for other purposes in the electricity and gas sectors. For instance, discount rates have been used by the Commerce Commission for the regulation of monopoly businesses for the following purposes:

- Analysis of excess profits (in the New Zealand context to see if the industry should be controlled); and
- Setting forward prices (the building blocks approach).

The purpose of the discount rate in the GIT is **not** to:

- Assess risky income streams of underlying transmission investments or alternatives. Many respondents to the Commissions consultation paper understood this to be the primary purpose of the discount rate and hence believed that the use of a Transpower WACC would introduce selection bias; and
- Determine the regulated revenue requirements/funding of projects (a different rate could be applied)[12].

Rather, it has a simple, twofold purpose:

- Ranking of projects; and
- Ensuring the net benefit of the selected project is positive.

This twofold purpose is identical to that of the economic test option of the Australian regulatory test.

5.3 National Cost Benefit Analysis

The GIT is a form of national cost/benefit analysis. As with national cost benefit analysis, one of the objectives of the GIT is to achieve outcomes that maximise the contributions to the economy as a whole. This occurs where consumer and producer surpluses are maximised as required under Objective 6.1 of the GIT.

[12] As noted by the ACCC, a different discount rate can be used for setting an allowable revenue for the asset after it has been built

A national cost benefit analysis is usually undertaken to support allocative efficiency (however the discount rate for achieving allocative efficiency is difficult to determine in practice).

There are three generally accepted approaches[13] to determining discount rates in national cost benefit analysis. These are:

- Social Opportunity Cost (SOC)-the rate that reduces the NPV of the best alternative private use of the funds to zero. It is the most relevant when the good or service could be provided by the private sector;

- Social Rate of Time Preference (SRTP) – the rate that compares private consumption today with private consumption in the future. Depending on the timeframe of the project it can require judgements on inter-generational issues. It is most relevant when social preferences, not just financial sector considerations need to be accounted for and is generally lower than the SOC or private sector rates; and

- A Weighted Average – the weighted average cost of the two approaches above to reflect foregone consumption and loss in private investment.

$$\textit{Weighted Average Rate} = \Phi SOC + (1-\Phi)SRTP$$

Where Φ is the proportion of resources or costs displacing private investment and $(1-\Phi)$ is resources or costs displacing current consumption.

The social opportunity cost may in certain circumstances reflect the discount rate prevailing in the private sector (or regulated sectors of the economy). Generally speaking such private sector rates are equal to a firm's WACC as determined using the CAPM. CAPM-based WACCs may differ between firms as some parameters used in their calculation will depend on the individual firm. For example, some firms are involved in relatively risky activities. Transpower's CAPM-based WACC may, for this reason, be different to the WACC of other New Zealand electricity companies.

Cost benefit analysis aims to identify the additional benefits of a project with respect to a pre-defined base case. The additional costs incurred in achieving these benefits are also taken into account. The resultant net benefit is the present worth of the incremental benefits less the incremental costs. The purpose of such analysis is to ensure resources are utilised in a way that maximises the utility of society as a whole (i.e. reflects the notion of allocative efficiency). This is closely associated with the concept of Pareto optimality where no resources are wasted and no individual can be better off without a corresponding reduction in someone else's welfare.

Three conditions support Pareto Optimality:

- Resources are used in a way that maximise their value to the economy;

[13] Young, L. September 2002. Determining the Discount Rate for Government Projects – New Zealand Treasury Working Paper 02/21

- Consumption is maximised through response to appropriate signals; and

- Marginal Social Cost and Marginal Social Benefit are equal in value to consumers and producers (where social costs and benefits include externalities).

In real life, these seldom are equal and policy makers accept outcomes from initiatives where the marginal social benefit attributable in one area of the economy is greater than the social costs realised by another group. This is similar to the net benefits test of the GIT - which is not concerned with wealth transfer effects provided there is overall demonstration of net benefit. This has relevance to the choice of discount rate, as in real world situations the social rate of time preference will not equal the social opportunity cost (which may represent a higher discount rate).

It is generally accepted that there is no right discount rate and accordingly most cost/benefit analysis is accompanied by sensitivity analysis using a range of discount rates. In the public sector it is common to use the social rate of time preference for the discount rate as this reflects society's indifference between consumption in one period and the next.

Bearing in mind that the GIT is a form of national cost benefit analysis, it is useful to review some recent application of national cost benefit analysis and the discount rate sensitivity range in New Zealand. Two such examples are:

1. Greenhouse Emissions Policy Timing Review[14]

The analysis of the costs and benefits of early policy action by New Zealand prior to the commencement in 2008 of the first commitment period under the Kyoto protocol, involved an assessment period of up to 25 years. The discount range chosen for the review was 5 - 10%. The review noted that the choice of discount rate is contentious. For example, using a high discount rate such as that applying to individuals is that it would tend to create "myopic behaviour" with the consequence that the future is discounted too heavily. As an aside, we note that similar sentiments were expressed by the ACCC in its discussion paper reviewing its regulatory test. In this case the ACCC referred to a submission by a distributor company forum that stated that a:

"*move towards a [high] cost of capital … would result in an inappropriately short-term focus for investments, resulting in a move to the minimum sized, least capital cost solution. It states that this would be accompanied by*

- *Much higher cost of losses;*
- *Risk of non-supply, where this is factored into account;*
- *Out of merit generation; and*
- *Operating expenditure (Opex).*"

[14] Geoff Bertram and Simon Terry Associates Ltd, "A Review of Reports by NZIER and the Centre for International Economics", November 2000.

2. National CBA to take Water From The Waitaki Catchment

The second study that is relevant is the cost benefit analysis of water allocations from the Waitaki catchment[15]. In this study a 30 year period was adopted together with residual values where appropriate. The long period of assessment for the study reflected the need to assess dynamic impacts on electricity supply side planning and the longevity of underlying electricity assets. The benefit and cost streams as determined against the relevant base case were modelled in real terms (as at July 2003) with the pre-tax real discount rate in a sensitivity range of 5 - 10%.

5.4 Overview of WACC/CAPM Methodology

This section provides an overview of the CAPM-based WACC, and discusses issues related to the use of WACC/CAPM methodology. In New Zealand, Transpower's regulated WACC and a private sector WACC are, in general, based on the comparable formulations of the WACC/CAPM methodology. This may be useful if private sector preferences need to be taken into account in assessing net benefits under the regulatory test. As this methodology is widely discussed in the academic literature, we do not intend to provide a full explanation but rather focus on those issues relevant to the purpose of the use of the WACC in the GIT.

According to Lally[16], the WACC applicable to New Zealand is calculated using the following formula:

$$WACC = k_e(1-L) + k_d(1-.33)L$$

where k_e is the cost of equity capital, k_d the current interest rate on debt capital, and L the leverage ratio. k_d was estimated to be the sum of the current risk free rate (R_f) and a premium *(p)* to reflect particular systematic risks. Systematic risk is defined as the risks that covary (are related to) general market risks.

$$k_d = R_f + p$$

The cost of equity, determined by the Capital Asset Pricing Model,

$$k_e = R_f(1-T_I) + \phi\beta_e$$

where T_I is the average (across equity investors) of their marginal tax rates on ordinary income, φ the market risk premium, and β_e the beta of equity capital.

From an investor perspective, fundamental issues have been raised with regard to the methodology. Supporters of the CAPM model argue that there is no need to amend the

[15] Sinclair Knight Merz, Draft National Cost Benefit Analysis of Proposals to take water from the Waitaki River, 3 May 2004
[16] The Weighted Average Cost of Capital for Gas Pipeline Businesses, 14 May 2004

basic premises of the model. For example there is no need to capture unsystematic risk as investors can diversify their investment portfolios. However, detractors[17] note that the methodology does not sufficiently capture all relevant risk imposts because diversification is not itself sufficient to account for the following:

- Foregone future investment options potentially expose the firm to constraints on its future investment activity, including:
    - a potential inability to access funds for new projects if current project fails to deliver expected returns; and
    - resource constraints (labour, management etc.,).
- The cost of capital is not independent of the firm that undertakes the investment as assumed by the CAPM;
- Information asymmetries;
- Stranding of assets;
- Regulatory risk; and
- Insurance.

Investors may argue for higher WACCs to reflect factors such as real options. In practice, empirical evidence of investor "hurdle" rates suggests that such premia may be expected, and may in fact exist from time to time in the competitive sector. However, most regulators, including (to date) the Commerce Commission, have shown no tendency to add premiums to the WACC. Instead regulators have adhered to tightly constraining parameter values to within the traditional formulation of the WACC/CAPM methodology.

Unfortunately, while there is heated debate about the usefulness of CAPM deriving the cost of equity, there is also widespread agreement that there is no practical alternative.

From a national cost benefit analysis perspective when the ranking of social outcomes is important (as opposed to investor risk return relationships) the issue of additional premia has largely been avoided. In fact there is widespread acceptance that a lower discount rate reflecting social preferences, (such as social rate time preference) may be more appropriate.

The fundamental principle, that a discount rate should reflect the nature of the underlying cash flows, when taken to its natural conclusion, means that a unique discount rate should be used to assess the net benefit of each transmission investment and alternative[18]. However, notwithstanding this, the small project-specific differences in discount rate would

[17] The WACC - A Sceptic's View Glenn Boyle ISCR 1 September 2004
[18] As the assessment of the costs and benefits associated with a particular transmission project/alternative is not without a degree of subjectivity

be unlikely to change any outcomes of the GIT, particularly once the results of the sensitivity testing have been taken into account.

5.5 Summary of Section 5

The section has highlighted a number of issues in selecting a discount rate for use in the GIT. The key points include:

- The GIT has similarities with the national cost benefit analysis and hence discount rate discussions are relevant, especially preference for a weighted average to reflect both the social time preference rate and social opportunity cost where private sector involvement is a distinct possibility;

  However we would stress that the GIT is a net benefits test primarily concerned with deferring investment not assessing the revenue performance of a particular project;

- We do not believe the use of an investor centric WACC (taking into account the riskiness of future income streams) is appropriate for the GIT. For instance, it may lead to perverse outcomes where a relatively weak investor was rewarded with the highest WACC;

- Calculation of an appropriate private sector WACC will be subject to a number of challenges if consultation on the "appropriate rate" is allowed; and

- Use of multiple rates may address some of the modelling uncertainties specific to particular projects/alternatives but in the context of the GIT may have negligible benefit for the effort required. As noted previously, such an approach may foster unproductive debate.

6. INTERNATIONAL PRACTICE

6.1 Introduction

This section gives a brief overview of the use or implied use of discount rates in grid investment planning. However, given that many jurisdictions have not yet formalised grid investment approval processes or whose electricity markets are sufficiently differentiated from New Zealand's to make the issue relevant, the experience is limited.

The most relevant market is Australia, which has implemented a regulatory test and applied it to the approval of connections between regions (interconnectors). The key conclusions of this brief review are:

- The Australian regulator has generally been concerned with encouraging unregulated transmission projects;
- The robust nature of the Australian energy market has arguably allowed the regulator some latitude in being able to judge regulated projects as if they were unregulated projects (to focus on the encouraging of new entrants rather than having to address serious supply problems). In New Zealand, the perceptions of risk are different;
- As New Zealand's regulatory GIT is a form of national cost benefit analysis it is not focussing on what is best for investors (a funding bias) but rather the ranking of projects by the degree to which they deliver net benefits favoured by society;
- In many practical applications of the Australian regulatory test the impact on project rankings of the discount rate has been negligible;
- There is a lack of specificity in the use of discount rates in other jurisdictions.

6.2 Australia

The economic benefit test being developed in New Zealand to evaluate new regulated transmission and transmission alternative projects is based on the measurement of the incremental market benefits of the project. The Australian Competition & Consumer Commission (ACCC) promulgated its market benefit test in December 1999[19]. This test was developed by the ACCC and Ernst & Young's Australasian energy consulting group. Until then the comparable benefit test in Australia had been based on a measure of consumer benefit.

The Australian regulatory test consists of two approaches to confirming the appropriateness of a project: an economic test (the market benefit test) and a cost minimisation test (the reliability test). In essence, proponents of intra-regional transmission projects can use either approach to obtain ACCC regulatory approval.

[19] Regulatory test for new interconnectors and network augmentations. ACCC, 15 December 1999.

Proponents of inter-regional projects, on the other hand, must use the market benefit approach.

6.2.1 December 1999 test

The following extracts from the December 1999 regulatory test set out the Rules relating to the choice and the use of the discount rate for the market benefit approach:

> *For the purposes of the test*
>
> *…*
>
> *(c) the net present value calculations should use a discount rate appropriate for the analysis of a private enterprise investment in the electricity sector;*
>
> *(d) the calculation of the market benefit or cost should encompass sensitivity analysis with respect to the key input variables, including capital and operating costs, the discount rate and the commissioning date, in order to demonstrate the robustness of the analysis;*
>
> *(e) a proposed augmentation maximises the market benefit if it achieves a greater market benefit in most (although not all) credible scenarios;…*

The main implications for the selection and use of the discount rate are that a single discount rate should be applied; that the discount rate be one used for a private enterprise investment analysis; and that sensitivity tests be undertaken around the discount rate to ensure a robust result.

In practice, most Australian intra-regional regulated transmission projects since 1991 have been evaluated with the transmission reliability test. Only the inter-regional regulated transmission projects (the reliability test cannot be used for these) and a single intra-regional project have been evaluated using the market benefit test.

6.2.2 June 2001 review

On 19 June 2001, the ACCC and the National Electricity Code Administrator (NECA) announced their commitment to review the essential investment framework. In a 2003 discussion paper on the review of the regulatory test,[20] the ACCC summarised and responded to the submissions from interested parties received on an earlier issues paper. One of the questions for submission was "Is the choice of discount rate, being the rate appropriate for the analysis of a private enterprise investment in the electricity sector, still appropriate?" The Commission summarised the respondents' submissions to this question as follows:

> *EME (Edison Mission Energy), SPI (SPI PowerNet), Origin (Origin Energy), SHT (Snowy Hydro Trading Propriety Limited), Loy Yang and NRG (NRG Flinders) believe that the use of a discount rate for regulated investments is appropriate, and should be consistent with the uniform treatment of regulated and unregulated projects. The RNPP (Tasmanian Reliability and Network Planning Panel) states that the discount rate should be commensurate with the rate applied by commercial*

[20] Review of the regulatory test, discussion paper, ACCC, 5 February 2003.

enterprises facing similar risks (low risk, but high impact) and the WACC used at the last regulatory revenue reset adjusted for changes in the environment.

ElectraNet SA, VENCorp and TransÉnergie submit that the regulatory test should have discount rates closely linked to the determination of a commercial WACC. TransÉnergie states that for instance, if a lower discount rate is used in the regulatory test, effectively signalling that there is less risk of the benefits being achieved, then the revenue cap determination should reflect a similarly lower WACC.

The NEDF (National Electricity Distributors Forum) considers that a discount rate appropriate for private investment will not provide the appropriate outcome for regulated network investments in all circumstances. It explains that the existing networks have been progressively developed, using a discount rate appropriate for relatively low risk investments. The networks are largely optimal and within regions, have relatively low costs of losses and generally small levels of out of merit generation, which continue to benefit customers.

NEDF submits that to move towards a cost of capital reflecting higher risk would result in an inappropriately short-term focus for investments, resulting in a move to the minimum sized, least capital cost solution.

NEDF also states that the pricing associated with regulated network investments reflects their economic life and would not be aligned with the investment process, and that this approach would be of particular concern if applied to regulated network investments designed to meet specified regulatory reliability standards.

The ACCC also commented in the discussion paper on the choice of discount rate. Quoting from the ACCC:

There have been questions raised as to what the appropriate discount rate to use should be. The results of the regulatory test will depend on the discount rate used in the NPV analysis. The regulatory test requires that sensitivity analysis be undertaken for the discount rate to assess the robustness of the NPV results.

In its review to the Commission, Ernst & Young noted that[21]

"for the purpose of calculating an NPV of anticipated benefits, a commercial discount rate should be used. This will remove a potential source of bias between generation and transmission options". The Commission has previously indicated that "electricity networks are commercial activities which transport electricity from generators to customers and facilitate competition between remote and local generation. Consequently, investment in electricity networks can crowd out investment in competitive activities. In order to ensure that regulated network investments are undertaken in a competitively neutral way in comparison to generation and non-regulated investments, the Commission has accepted the argument that a commercial discount rate should be used".

The Commission further noted that

[21] Review of the assessment criterion for new interconnectors and network augmentation, Final Report to the Australian Competition and Consumer Commission, Ernst & Young, March 1999.

"the net present value calculation should use a discount rate appropriate for the analysis of a private enterprise investment in the electricity sector"[22] *Submissions to the Issues Paper have indicated that a commercial discount rate is appropriate for calculating the NPV of the projects. It was noted that the use of a discount rate for regulated investments applicable to an equivalent private investment in the electricity sector is appropriate, consistent with the uniform treatment of regulated and unregulated projects.*

In essence, therefore, the ACCC has indicated its preference to retain the use of a private investment discount rate because it would contribute to a neutrality between generation and non-regulated investments.

6.2.3 August 2004 test

The new version of the regulatory test was published on 11 August 2004.[23] In its introductory paragraphs to the new test, the Commission states:

On the use of either a real, nominal, pre-tax or post-tax discount rate, the ACCC believes that, in line with VENCorp's suggestion, the guiding principle should be that the discount rate must be consistent with the cash flows being discounted. This is consistent with generally accepted finance principles.

and…

The ACCC disagrees with Transend that the discount rate used in the regulatory test should reflect the regulatory WACC for the respective TNSPs. The ACCC considers that the discount rate adopted for the purposes of a regulatory test evaluation should be a commercial discount rate in order to ensure network and non-network investments are compared on a competitively neutral basis. The discount rate used in an assessment should be consistent with the opportunity cost of capital of an investment in electricity infrastructure. The ACCC believes that the regulatory WACC might reasonably be considered the lower boundary of the discount rate but not the mean value around which sensitivity testing is conducted. The ACCC has amended the regulatory test to ensure that the regulatory WACC can only be considered a lower boundary in a regulatory test assessment.

With regard to the choice and the use of the discount rate, the market benefit test now states, as at 11 August 2004:

(1) An option satisfies the regulatory test if:

…

(b) in all other cases—the option maximises the expected net present value of the market benefit (or in other words the present value of the market benefit less the present value of costs) compared with a number of alternative options and timings, in a majority of reasonable scenarios.

and…

[22] Regulatory test for new interconnectors and network augmentations. ACCC, 15 December 1999, p21.

[23] Review of the Regulatory Test for Network Augmentations, ACCC, 11 August 2004

(10) The present value calculations must use a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector. The discount rate used should be consistent with the cash flows being discounted.

and…

(15) The calculation of the costs or market benefits must encompass sensitivity testing on key input variables. Sensitivity testing may be carried out on, but not limited to, the following, and should be appropriate to the size and type of project:

…

(c) Discount rate (the lower boundary should be the regulated cost of capital).

6.2.4 Sensitivity to the discount rate

VENCorp: Latrobe Valley–Melbourne augmentation

Table 3 and Table 4 (Appendix 1) show the results of VENCorp's February 2002 regulatory test submission for an intra-regional augmentation of the transmission system that supplies Melbourne from the generation stations in the Latrobe Valley.[24] [25] The values are in millions of dollars.

Four projects were evaluated: Termination upgrade; Rowville option; Cranbourne option; and a 5th 500 kV line. The Rowville transmission augmentation project was selected and implemented.

As can be seen from the tables 1 and 2 in Appendix 1, the top-ranked project was unchanged by the use of a 6% or an 8% real, pre-tax discount rate, except for one sensitivity scenario in which the net benefit of the Rowville option was matched at a 6% discount rate by the Cranbourne option.

With a 10% discount rate, the top-ranked project was very sensitive to the choice of scenario. If the analysis had been undertaken at only a 10% discount rate, no clearly preferred project would have emerged.

IRPC: SNOVIC and SNI evaluation

Tables 3- 5 show the results of the Inter Regional Planning Committee's 31 October 2001 regulatory test evaluation of the proposed Snowy–Victoria (SNOVIC) interconnector

[24] Optimising the Latrobe Valley to Melbourne electricity transmission capacity—Economic evaluation, VENCorp. February 2002.

[25] Optimising the Latrobe Valley to Melbourne electricity transmission capacity—Appendices of economic evaluation, VENCorp. February 2002.

proposal[26] and Transgrid's South Australia–New South Wales interconnector (SNI) proposal.[27]

As can be seen from the tables, in only one case was the top-ranked project (constructing both the SNOVIC interconnector and the SNI interconnector) changed by the use of a 9%, 11%, or a 13% real, pre-tax discount rate. With a base case scenario plus LRMC pricing, the construction of SNOVIC and a 500MW gas turbine generator showed a slightly greater net benefit than the construction of two interconnectors.

VENCorp: SNOVIC evaluation

Prior to the completion of the Inter Regional Planning Committee's SNOVIC study, the Victorian Government commissioned VENCorp to prepare a preliminary evaluation of the SNOVIC project that follows the ACCC test procedures. This report was completed in March 2001.[28] In the report, VENCorp evaluated six alternative projects: "Do nothing"; "Gas turbines only"; "Basslink"; "250 MW upgrade of interconnector, plus gas turbines"; "400 MW upgrade of the SNOVIC interconnector, plus gas turbines"; "800 MW upgrade of the SNOVIC interconnector, plus gas turbines"; and "Staged upgrade of the SNOVIC interconnector to 800 MW, plus gas turbines".

As can be seen from Table 8 option C2, a 400 MW upgrade of the SNOVIC interconnector, plus gas turbines is the preferred option for all three discount rates, 7%, 8%, and 9%.

Murraylink application for conversion to a prescribed service

This application of the regulatory test was prepared by Murraylink Transmission Company shortly after the commissioning of the Murraylink interconnector between Victoria and South Australia. In order to set a regulatory asset value for the Murraylink project, the company compared the net benefit of the project with the net benefit of six equivalent alternative projects.

In its preliminary view, the Commission stated that it was of the view that the absolute value of the discount rate in a regulatory test assessment is not relevant to the extent that the change in the commercial discount rate does not change the ranking of alternative projects. In its final decision, the ACCC confirmed that it considers that the changes in the discount rate do not affect the ranking of Murraylink and the alternative projects and therefore the outcome of the regulatory test assessment.[29]

6.2.5 Conclusions

Although the ACCC has explicitly considered changing the discount rate used in the market benefit test it has chosen not to do so, and has retained the use of a private investment

[26] SNOVIC Stage 2 report, Version 7, Inter-Regional Planning Committee SNOVIC Assessment Group, 31 October 2001.
[27] SNI Stage 2 report, Version 07, Inter-Regional Planning Committee SNI Assessment Group (Excluding TransGrid), 26 October 2001.
[28] Assessment of options for upgrading of the Snowy to Victoria transmission capacity— A report for Department of Natural Resources and Environment, VENCorp, 29 March 2001.
[29] Murraylink Transmission Company Application for Conversion and Maximum Allowed Revenue, ACCC Decision, 1 October 2003. Pages 80, 84.

rate. However, the ACCC is now more specific on selecting and applying the discount rate. Firstly, the discount rate should be consistent with the real, nominal, pre-tax or post-tax nature of the cash flows being discounted. Secondly, the sensitivity testing around the discount rate should use the regulatory WACC as the lower bound.[30] As before, the project achieving the greatest positive market benefit in the majority of scenarios is selected.

The ACCC chose a private investment rate for the discount rate as this was consistent with the uniform treatment of regulated and unregulated projects. However, despite the similarity of the tests between Australia and New Zealand, there are differences in the nature of the competing projects and the perceptions of risk. As a result, the basis for the Australian conclusion may not be fully comparable to the New Zealand situation.

One of the differences between the Australian and New Zealand markets is that, in Australia, a second alternative to regulated transmission is the option of unregulated transmission. In drafting the Australian electricity code, NECA has generally been concerned with removing any bias against unregulated transmission projects. This concern may be generally reflected in the regulatory test.

A second difference is that, despite occasional concerns about meeting peak load during temperature extremes, the Australian market has proved to be robust with regard to energy supply. This has arguably allowed the Australian regulator some latitude in being able to judge regulated projects as if they were unregulated projects. In New Zealand, the perceptions of risk are different.

A third difference is that the GIT is a form of national cost benefit analysis. It is not focussing on what is best for investors (a funding bias) but rather the ranking of projects by the degree to which they deliver the net benefits to society.

The ACCC has acknowledged in its evaluations of the Murraylink transmission submissions that the selection of discount rate has little impact on project rankings.

6.3 United States

On August 15, 2003, President George Bush and Prime Minister Jean Chrétien established a joint U.S.-Canada Power System Outage Task Force to investigate the causes of the previous day's electricity blackout and how to reduce the possibility of future outages.

In response to the task force's blackout report, the American Federal Energy Regulation Commission (FERC) stated in April[31] that it expects independent system operators (ISOs), regional transmission operators (RTOs), and public utilities to perform their functions consistent with, and to no less a standard than, North American Reliability Council (NERC) reliability standards and NERC audits. The Congress is currently considering energy legislation which would address the reliability of the nation's bulk power system based on mandatory industry compliance with such reliability standards. Accordingly, FERC has this year been urging the (industry-led) NERC to adopt tougher, clearer and enforceable new

[30] The introductory paragraphs to the 11 August 2004 Review equate the "regulated cost of capital" with the "regulatory WACC".

[31] Policy statement on matters related to bulk power system reliability, 107 FERC ¶ 61,052, April 19, 2004, pages 5, 10.

reliability standards to replace the current voluntary reliability guidelines, and is working with NERC in performing reliability audits.[32] The task force has recommended that the U.S. and Canadian regulatory authorities develop a regulator-approved mechanism for funding NERC and the regional reliability councils, to ensure their independence from, the parties they oversee.

Arguably, this strengthening of federal support to NERC and its regional Reliability Authorities will place pressure on state electricity regulatory authorities placing weight on the economic and reliability benefits put forward in utilities' siting applications for new transmission systems. At present, the state electricity regulatory authorities' requirements for evidence of economic and reliability benefits may have little or no resemblance to those calculated in the ISOs' and RTOs' planning procedures.

6.3.1 California

Depending on the environmental and economic attributes of a proposed transmission project and the project sponsor, a number of agencies can have planning, review, oversight and approval roles. These agencies range from the California System Operator (CAISO), the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) to the boards of municipal districts and utilities. In a number of previous cases, especially in determining project need, the same project has received multiple reviews by various agencies, each seeking to carry out their individual mandates.

6.3.2 California State Government Agencies

In California, regulators evaluate new projects from a number of perspectives. For example, the California Governor's office published a California Standard Practice Manual for the economic analysis of electricity demand-side programmes and projects.[33] This manual, for use by the California Public Utilities Commission and the California Energy Commission sets out five types of NPV cost-effectiveness tests, each of which captures the costs and benefits of a project from a different perspective. The five tests are the Participant Test, the Ratepayer Impact Measure (RIM), the Program Administrator Cost Test (PAC), the Total Resource Cost Test (TRC), and the Societal Test. In evaluating projects, programme administrators and state agencies are required to consider the tradeoffs between these tests.

The demand-side programmes and projects manual is silent on the discount rates to be used, stating only that an (unspecified) societal discount rate is to be used for the Societal test. The Societal test includes in its analysis the effects of externalities, such as environmental and national security impacts. According to a CPUC draft report, as at 8 January this year the nominal discount rate that is, in practice, applied for the Societal test is 8.15%.[34]

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[32] FERC use of the grid reliability appropriation for fiscal year 2004, Report to the United States Congress from the Federal Energy Regulatory Commission staff, 30 September 2004.

[33] California Standard Practice Manual: Economic Analysis Of Demand-Side Programs And Projects, California Governor's Office, October 2001.

[34] A forecast of cost effectiveness avoided costs and externality adders, prepared for California Public Utilities Commission Energy Division, Energy and Environmental Economics Inc, 8 January 2004.

6.3.3 California System Operator

The CAISO must evaluate all potential transmission upgrades that CAISO ratepayers would be asked to fund. As part of this responsibility, the CAISO has spent the last several years developing and refining a methodology to evaluate the economic viability of these proposed upgrades. This methodology is described and applied in the CAISO's evaluation of the proposed Path 26 upgrade study, submitted to the California Public Utilities Commission on 4 June 2004.[35] The project benefits have been modelled using the "PLEXOS for Power Systems" software developed by Drayton Analytics in Adelaide.

The methodology evaluates the upgrade from (1) a Societal Western Electricity Coordinating Council area perspective, (2) Modified Societal perspective, (3) a CAISO Ratepayer perspective, and (4) a CAISO Participant perspective. The report states: [36]

> *Each perspective provides the policy makers with some important information. If the benefit-cost ratio of an upgrade passes the CAISO participant test, but fails the WECC test of economic efficiency, then it may be an indicator that the expansion will cause a large transfer of benefits from one producer and consumer region to another. On the other hand, if the proposed project passes the societal test but fails the CAISO participant test, this may be an indication that other project beneficiaries should help fund the project rather than solely CAISO ratepayers. Policy makers should review these differing perspectives to gain useful information when making decisions. (page E5)*

and…

> *The NPV of a transmission upgrade (may) hinge on who will ultimately bear the cost of the project. Depending on who ultimately funds the transmission project the applied discount rate could be different. For instance, if the transmission project is funded by CAISO ratepayers then a social discount rate or a regulated discount rate should be applied. However, if an independent merchant entity funds the project, a private discount rate should be applied. Similarly what should be included in the benefit and cost calculation also depends on who ultimately funds the project and who benefits from the project. (Page 2-16)*

In practice, however, due to data limitations and time constraint, CAISO has only modelled two years: 2008 and 2013. No discount rate has been applied: the benefits in these two years have been compared with the levelised annual capital and O&M cost of the path 26 upgrade by assuming an annual carrying charge rate of 10%.

6.3.4 New England

For the past three years, ISO New England has conducted and directed the preparation of a New England regional transmission plan, RTEP. According to the Overview chapter of the November 2003 plan, RTEP03:[37]

> *The RTEP is a comprehensive electrical engineering assessment comprised of numerous studies and analyses of New England's bulk electric power system. The RTEP identifies power system*

[35] California Public Utilities Commission Investigation No. 00-11-001 (phase 5).
[36] Transmission Economic Assessment Methodology (TEAM), California Independent System Operator, June 2004.
[37] RTEP03 Executive Summary and Overview, ISO New England, 13 November 2003. Page 8.

problems or needs. These problems and needs in turn provide signals to the market of opportunities to address those needs, including investment in generation, merchant transmission facilities, and demand (or load) response programs which promote power system reliability and improve wholesale electricity market efficiency.

If the market does not respond with adequate solutions to defined system needs, the RTEP presents a coordinated transmission plan that identifies appropriate projects for ensuring both reliability and economic efficiency. This coordinated plan is updated as market responses to identified problems develop. Transmission projects are implemented only after market solutions have been given first consideration.

Thus, the RTEP is a planning process that integrates market response with needed reliability and economic transmission upgrades. The goal of the RTEP is to achieve a reliable system of generation, distributed resources, and transmission; this facilitates the development of a robust market with due consideration of environmental issues.

We have not yet obtained a full copy of the 2003 plan. However, perusal of the 2002 plan shows that the process involves a net benefit transmission augmentation analysis, evaluating the benefits of relieving constraints between system sub-areas. Net benefits of augmentation are evaluated for each of six consecutive years. Total benefits are reported as simple arithmetic sums, i.e. in effect, a zero discount rate is applied.[38]

6.4 United Kingdom

There appears to be no formal process for setting the discount rate as it relates to approval of National Grid transmission investment plans as part of rate setting in the UK. Some indication of the discount rate the UK Government believes is acceptable, is provided via its support of renewable generation. The UK Government has a target for renewable generation to provide ten per cent of UK electricity in 2010 with a further aspiration to double this share by 2020.

To review each investment proposal made by the transmission licensees for the reinforcement of transmission networks and to assist in developing initial proposals Ofgem engaged engineering consultants Sinclair Knight Merz (SKM). They have considered forecasts of renewable connections; the trade offs between investment and constraint costs; the risks of stranded transmission assets and the licensees' estimated costs. The results are reproduced in Ofgem's initial proposals for incentive arrangements to provide funding for transmission investment for renewable generation. [39]

Reference to SKM's draft report show that SKM has capitalised the energy cost savings of relieving the transmission constraints by assuming an interest rate of 6.25% and a 40 years depreciation life, consistent with the assumptions used in the last transmission price control.[40] The results are preliminary, and final Ofgem proposals are expected in November 2004.

[38] RTEP02, ISO New England, 7 November 2002. Pages 126 – 130; Appendix page 75.
[39] Transmission Investment for Renewable Generation—Initial Proposals, Ofgem, August 2004.
[40] Technical evaluation of transmission network reinforcement expenditure proposals by licensees in Great Britain—Draft report for public release, Sinclair Knight Merz, August 2004.

7. IMPLICATIONS (ADVANTAGES AND DISADVANTAGES OF DIFFERENT APPROACHES)

7.1 Introduction

We are inclined to agree with Frontier[41] that:

- identifying the precise discount rate to use in cost benefit analysis is controversial;
- the choice of discount rate will typically not change project rankings; and accordingly;
- a pragmatic approach is preferable.

From our earlier discussion of discount rate theory and practice, together with the discount rate recommendations of Frontier and the Commission, it is clear that several potential discount rate options exist for the GIT. These options are:

- Social rate of time preference;
- Social opportunity cost;
- Transpower WACC;
- The rate of return on private investment;
- Weighted average rate.

In the following subsections we have identified specific criteria with which to evaluate these options, and we conduct an evaluation to determine which discount rate should be used by the Commission.

7.2 Evaluation Criteria

Ideally our evaluation criteria should include the key objectives of the GIT but include other criteria covering practical implementation issues (including the practical cost of attempting a sophisticated estimation of the discount rate), a requirement for compliance with Government policy, Transpower and industry concerns, for example:

- Maximise economic efficiency (i.e. the sum of consumer and producer surplus);
- Reflect the interests of end-use customers in ensuring a reliable transmission system;
- Take into account transmission alternatives;

[41] Frontier Economics; "Draft Grid Investment Test – Final Draft Discussion Paper"; June 2004; pp 27-28

- Balance the cost of attaining different levels of reliability against the cost of non-supply;
- Enhance future reliability;
- Transparency;
- Data Availability;
- Consistency with International Practice;
- Industry Consensus (facilitating outcomes acceptable to Transpower and designated transmission customers);
- Compliance with GPS and legislation.

7.3 Evaluation of Discount Rate Options

In the table below we have evaluated the potential discount rate options using the evaluation criteria set out in section 7.2.

Evaluation Criteria	Comment on the Appropriate Discount Rate
Maximise economic efficiency	The rate that achieves this is unknown. Given that social outcomes are integral to the GIT some bias towards the social rate of time preference is likely to be appropriate
Reflect the interests of end-use customers in ensuring a reliable transmission system having regard to the cost to end use customers	Transmission investments tend to be more reliable. A lower discount rate would generally favour transmission investments. It has been observed that end-use customers put a high value on reliability. Such preferences are consistent with a lower discount rate such as that generally associated with social rate of time preference
Take into account transmission alternatives	Transmission alternatives tend to have lower commissioning costs and more immediate access to benefits and hence tend to be favoured when a higher discount rate is applied. A discount rate based on the social opportunity cost and/or a private sector rate would be appropriate
Balance the cost of attaining different levels of reliability against the cost of non-supply	Refer to comments on reliability e.g. social rate of time preference. However for this criteria, other parameters are likely to be more influential (e.g. VoLL)

Evaluation Criteria	Comment on the Appropriate Discount Rate
Transparency	Social Rate of Time Preference is not defined but is often expressed as within the range of 3 – 5 %. This rate is not particularly transparent. Similarly, it is difficult to assign the social opportunity cost without the reference to the private sector benchmark. Therefore the most transparent discount rates are those obtained in the competitive sector (private sector rate) or the regulated sector such as a Transpower WACC
Data Availability	Social rate of time preference is difficult to identify and normally assigned a range (3- 5 %). Similarly, it is difficult to assign the social opportunity cost without the reference to the private sector benchmark. Data is available from the competitive sector (private sector rate) and the regulated sector such as Transpower's regulated WACC. However, data availability going forward for Transpower's regulated WACC may be an issue (see section 8.3 below)
Consistency with International Practice	International experience apart from Australia is limited due to most jurisdictions not formalising grid investment approval processes. The experience shows a wide range of approaches to discount rates from adopting rates close to zero (New England) to a commercial rate as in the Australia regulatory test. As we note in section 6.1.5, there are some key difference in the GIT and Australia's regulatory test. These differences support the discount rate being closer to a social rate of time preference in New Zealand for the GIT
Industry Consensus	Assuming the TAG view is representative of industry, the current preference is for the rate applicable to Transpower being applied (see section 4.1.5)
Compliance with GPS and Electricity Amendment Act	The Commission has to balance the following requirements: ▪ Non-discrimination between transmission investments ▪ Ensuring reliability ▪ Possible future funding of transmission alternatives ▪ WACC of an investor in transmission alternatives (given the impact of some portion of their income will be regulated) Balancing of requirements would indicate a preference for a weighted average discount rate (see section 7.4)

Table 7-1 Evaluation of Discount Rate Options

While Frontier did not adopt an evaluation method to select an appropriate discount rate, it implicitly adopted an "investment" perspective (as per Australian regulatory test), where compensation for risk is important, rather than a "consumptive" perspective that is more reflective of underlying social time preferences. Frontier justified their choice of private rate of return on the basis that a regulated transmission project would likely displace private electricity investment. However, the basis for the choice of discount rate displacing "higher value" private sector projects under the proposed GIT is unclear.

In assessing the evaluation, the Commission has a number of objectives that while not mutually exclusive do suggest competing discount rate approaches (e.g. promotion of alternatives would lead to a more commercial rate versus reliability objective which would tend to support the call for a lower discount rate). Hence, the above evaluation of discount rate options demonstrates that some of the Commission's objectives are achieved through taking account of social preferences whilst other objectives are achieved through commercial preferences. It reinforces the view that a weighted average may be the best way to achieve this balance between meeting the requirements of investors, consumers and Transpower without discriminating unfairly against any of the parties.

7.4 Consistency with Government Policy Statement and Electricity Amendment Act 2004

The Government has recently updated and republished a policy statement for the electricity sector (GPS)[42] and amended the Electricity Act to clarify the role and responsibilities of the Commission. The GPS and the Act requires the Commission to achieve, inter alia, the following specific outcome:

"d 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"

This objective is subject to a number of interpretations with regard to the most appropriate discount rate to be applied in the GIT. It potentially provides mixed signals with regard to discount rate setting. Clearly, discrimination exists already in that the Commission allows Transpower to be the monopoly provider of transmission services. Investors will have different cost structures which mean some will need less incentive/support than other proponents. The requirement is not transparent enough to ascertain how far the Commission must go in creating neutral incentives or positive discrimination.

Hence the immediate question is what level of discrimination is allowed. Is it discriminatory to use Transpower's regulated WACC in the GIT? Probably not, as the GIT is primarily a device for ranking different transmission investments. Would the use of Transpower's regulated WACC preclude other investors from providing alternatives if it was also to calculate the funding for the alternative? Regulated funding for transmission alternatives has not been instituted but it is the intention of the Government to have this explored.

[42] Government Policy Statement On Electricity Governance 13 October 2004

The GPS when discussing transmission alternatives expects the Commission to consider devising a mechanism that funds transmission alternatives based on the avoided cost of competing transmission investment. This implies the use of discount rate close to a Transpower WACC:

"90 As part of its consideration of transmission pricing, the Commission should consider whether there would be net benefits in providing for a mechanism whereby investments in transmission alternatives receive payments reflecting some or all of the value of avoided transmission investment. This is a complex subject, and the Commission will need to take into account, among other things, practicalities, effects on incentives to invest in alternatives, and the extent of assurance that grid reliability standards will be met."

It may be reasonable to assume that if the alternative was to receive regulatory funding, the investors may require a lower discount rate than otherwise as the risk premium on both debt and equity would be lower.

The GPS also implies that it would be equally unfair if Transpower's transmission investments were discriminated against because of the choice of a relatively high discount rate. A high discount rate would impact negatively on transmission investment given the high capital cost and long life of transmission assets.

7.5 Possible Alternative

The Commission acknowledges that the use of multiple rates may be more theoretically correct in some situations but has noted that the derivation of these rates would be both:

- Problematic;
- Controversial; and
- Selection bias will be addressed by sensitivity testing.

However, specifying multiple rates is not impossible and some participants believe that the cost and effort required in determining a discount rate appropriate for the nature of the investment (uncertainty of future cash flows) is less than the potential costs of a misallocation of resources.

We would note that the principal reason for multiple discount rates (to reflect the uncertainty that the costs and benefits of particular project materialise) is pragmatically and practically addressed by robust information on particular projects being provided and sensitivity testing in undertaking the GIT.

The implied assumption is that selection bias is undesirable. We would note that the optimal discount rate (to the extent it does not materially affect which projects are selected) should bias selection towards the most desirable project from a national cost benefit standpoint. The rate should be reflecting the mix of public and private consumption decisions hence our advocacy for a weighted average.

Sensitivity testing should alleviate some of the concerns regarding the use of a single weight average discount rate such as the Transpower WACC. It is important to note the requirement to undertake sensitivity testing when applying the GIT in a discussion about the most appropriate discount rate. The reasons are that sensitivity testing should:

- Highlight any potential issues with regard to using the Transpower WACC;
- As with the National Cost Benefit analysis, the range may be sufficiently large to include the private sector rate; and
- Demonstrate the relative importance of the discount rate relative to other parameters (e.g. the value of VoLL) and ensure that values used in these parameters are scrutinised as well.

7.6 Summary of Section 7

This section has evaluated several alternative discount rates that could be used in the GIT. The key points include:

- An evaluation of alternative discount rates using evaluation criteria consistent with the objectives of the GIT suggests social preferences and commercial preferences need to be taken into account;
- A weighted average discount rate – weighted for social and commercial preferences – is likely to be most appropriate;
- A weighted average discount rate is consistent with the GPS which on the one hand seeks to avoid discriminating against Transpower's investments through the use of high discount rates, whilst on the other hand seeks to avoid discriminating against private investment in transmission alternatives.

We suggest that the Commission derive a weighted average discount rate (some weighting of the social rate of time preference rate and social opportunity cost). Further study is required but it is reasonable to adopt the position that the Transpower WACC is a good approximation of such a rate given Transpower's numerous roles in the electricity sector as set out in its Statement of Corporate Intent. We would also note it complies with the GPS in not discriminating against Transpower. In addition, it provides a suitable level of funding if transmission alternatives were to receive regulated income.

The use of the Transpower WACC to approximate a weighted average discount rate - weighted between public/social and private/commercial preferences – is considered further in Section 8.

8. FORMULATION OF DISCOUNT RATE FOR THE GIT

8.1 Introduction

In this section the rationale for serious consideration of a weighted average discount rate and why (supported by previous sections) a Transpower WACC may be a suitable proxy for this rate is provided. We conclude that it may appropriate for the Commission to:

- Set out its own framework for determining the weighted average discount rate; and
- Undertake its own periodic calculation of the discount rate (e.g. Transpower WACC).

8.2 Weighted Average Discount Rate

It is our view that a rate approximating the weighted average of the Social Opportunity Cost and the Social Rate of Time Preference be adopted. It is not inconceivable that a Transpower WACC would provide a close approximation of this weighted average discount rate. This should be confirmed by further analysis (e.g. comparing Transpower WACC as calculated by Lally and/or Transpower with this estimated weighted average discount rate).

In this regard, Transpower's post-tax nominal WACC has recently been estimated as follows:

- Commerce Commission (August 2003) 6.8%[43]
- Transpower Board (2002/03 SCI) 7.4%[44]

We also note that Transpower has recently estimated its pre-tax real cost of capital to be 7%[45]. After adjusting for tax and inflation differences, Transpower's recent estimate of its pre-tax real cost of capital is broadly consistent with earlier post tax nominal estimates[46]. It would appear that Transpower's WACC, as a proxy for the weighted average discount rate, is approximately 7% at this point in time. This estimate will necessarily change as the underlying WACC/CAPM parameters change from time to time.

8.3 Process for Deriving a Discount Rate for the GIT

As we have noted the formulation of a widely accepted discount rate is complex and controversial. A social opportunity cost is likely to be based on a private sector discount rate as determined by the WACC/CAPM methodology. Each parameter in the calculation of the WACC is subject to debate. A thorough discussion of the various issues, together with arguments for and against the adoption of particular parameter values, is provided in a

[43] Plus a margin estimated to be 0.15% for asymmetric risks in using an ODV valuation methodology.
[44] Also estimated to be 7.2% for 2003/04, and 7.1% for 2004/05.
[45] Transpower; "Submission to the Electricity Commission on the draft Grid Investment Test"; October 2004; paras 65 & 83.
[46] That the pre-tax real estimate and the post-tax nominal estimates should both be approximately 7% is coincidental.

recent paper by Dr Martin Lally.[47.] The table below provides a summary of the different issues and notes the range of possibilities available in quantifying the parameter.

To the extent that Transpower continues to involve itself in addressing commercial and social objectives, the parameter values applying to Transpower provides an approximate proxy for the weighted average of the social rate of time preference and the private sector discount rate. We would suggest that the further analysis referred to above is undertaken and the Commission sets out acceptable values for the parameters in the table below.

It should be noted that regulatory protagonists will select and argue the interpretation that generally suits themselves best (from a pricing standpoint). The degree in differentiation that can be achieved via this approach can be illustrated by noting the difference in market risk premiums observed by IPART in various studies in the Australian market. The value that could be attributed to the Market Risk Premium ranged from 3.4% (Ibbotson Associates – averaging of historical premiums over the period 1970 -1998) to 7.6% (Dimson, Marsh and Staunton – geometric averaging of historical premiums over the period 1900 – 2000). For this reason it may be advisable for the Commission to obtain broad agreement that a weighted average rate is the most appropriate for the GIT and that the Transpower WACC is an appropriate proxy.

Parameter	**Issue**
Choice of Model	▪ Officer versus Brennan-Lally
Market Risk Premium	▪ Forward looking estimates, historical premiums, constant reward to risk methodology, surveys of investors and finance professionals ▪ Length of period for averaging ▪ Choice of markets for comparison (e.g. local or international) ▪ Average taxation rates versus marginal rates ▪ Selection of underlying risk free rate
The Risk Free Rate	▪ Period of averaging ▪ Matching the regulatory price review period (e.g. 5 year regulatory rate reset should use 5 year bond rate) or a rate based on the duration of the firm's assets or the underlying rate used in calculating the market risk premium
Tax	▪ Statutory versus effective tax rates
Asset Betas	▪ Type of industry (e.g. necessities versus luxury goods) ▪ Customer type (e.g. public versus private) ▪ Pricing structure (e.g. predominance of spot versus contract sales) ▪ Regulated/non regulated source of income ▪ Market characteristics (e.g. level of competition)

[47] Lally, M. May 14 2004 , The Weighted Average Cost of Capital For Gas Pipeline Businesses

Parameter	Issue
Leverage	▪ Actual versus optimal debt/equity ratios
Debt Premium	▪ Different cost of borrowing for different entities depending on their credit rating ▪ Applicability of allowing for additional refinancing costs due to entities inability to borrow for lengthy periods (in excess of 7 years)
Form of Ownership	▪ Tradability of underlying securities of firm ▪ Personal taxation and impact of imputation ▪ Imposition of corporate tax on public enterprises
Real Versus Nominal WACC	▪ Impact of revaluations if using nominal rates
Value of dividend imputation credits	▪ Access and utilisation factors – the proportion of imputation credits a company distributes and the amount of imputation tax credits that can be used by investors in offsetting their own tax liabilities
Margin over WACC	▪ Asymmetric risks (e.g. stranding) ▪ Costs of financial distress ▪ Timing of investments

8.4 Issues with the Application of Transpower's Regulated WACC

The application of Transpower's regulated WACC is not as simple as it first appears. There is no regulated Transpower WACC at this point in time. However, Transpower's Board did, prior to the introduction of the threshold's scheme, explicitly publish a WACC and used it to determine its charges to transmission customers. A Transpower WACC was derived by the Commerce Commission, but it has not used this WACC in the regulatory regime. However, the Commerce Commission has recognised that there are inherent pricing issues between the current threshold's scheme and any transmission pricing methodology and control imposed on Transpower by the Commission that need to be resolved.

Hence, a brief discussion on the historical derivation of WACC by Transpower and the new approach to setting Transpower's rate of return will assist in highlighting some of the issues relevant to the Commission's preliminary proposal to apply the Transpower WACC.

8.4.1 Historical Determination of Transpower WACC

Prior to the introduction of the price and quality threshold scheme, Transpower determined its own WACC as part of determining its revenue requirements for non-contestable services. The revenue requirement was determined by having regard to

- Budgeted costs of operations and maintenance out 3 years;
- Receiving a return equal to the full economic cost in the medium term;

- Receiving a commercial return and the requirement to maintain key financial ratios
- Price stability and predictability for grid users.

In the previous self-regulatory environment, Transpower's Board set its WACC parameters based on its assessment and/or independent analysis (e.g. risk free rate, cost of equity etc.). In determining its WACC, it used a standard CAPM adjusted for taxation and imputation to calculate its cost of equity (R_e).

$$R_e = R_f (1 - T_I) + B_e \times PT_{MRP} + D_{IA}$$

Where:

- *R_e is the economic rate of return on equity.*
- *$R_f (1 - T_I)$ is the Post Tax Risk-Free Return.*
- *T_I is the Tax Parameter relating to interest.*
- *B_e is the Equity Beta.*
- *PT_{MRP} is the Post Tax Market Risk Premium.*
- *D_{IA} is the Dividend Imputation Adjustment.*

The most recent modelling by Transpower resulted in a WACC of 7.4% to 7.1% covering the period 2002 – 2005. The cost of equity was calculated to be 9.8% to 9.4% for the same period.

Transpower also operated an accumulated economic gain (loss) memorandum account. This accounted for excess or under returns achieved by Transpower on the basis of setting Economic Value (EV) added to zero (i.e. it would make price rebates to the customers if it achieved a return higher than its WACC). This EV framework ensured that economic gains and losses were passed on to the customers over time to ensure fairness (to both shareholders and customers), price stability and predictability. The Commerce Commission has ignored the balance in the EV account in setting Transpower's price path but has noted it may consider it in the case of a threshold breach or in setting new price thresholds.

This analysis to back calculate or independently calculate the Transpower WACC could be undertaken by the Commerce Commission specifically for application in the GIT. This may require rule and legislative changes.

8.4.2 Derivation of the Transpower WACC Going Forward

Transpower is entering a new regulatory regime where the WACC is not a factor in resetting prices. Instead an index method is used to determine the value of X in the CPI-X price path regime. The index method chosen was Meyrick's total factor productivity analysis (TFP). Very simply, the method analysed Transpower's disclosed input and output data for the period 1999 -2003 to assess whether Transpower had been efficient in its resource allocation, efficiency being measured by the changes in prices, inputs (operating expenses, line and transformer capacity) and outputs (throughput, capacity and connections). The TFP analysis does not reference a rate of return. This is unlike, a

building blocks approach, which would as the name implies, build up a price based on reasonable assessments of operating and maintenance costs, depreciation, asset value (historic cost or ODV) and the cost of capital based on WACC. The TFP analysis instead does not explicitly reference a rate of return.

In addition to the Commerce Commission price thresholds, the Electricity Commission will be required to endorse Transpower's pricing methodology and may make changes accordingly.

In its most recent decision the Commerce Commission has set a price path threshold for Transpower only up until the year ending June 2005. The Commission has set the X factor at 1 (equivalent to Transpower's prices being capped at CPI -1). The X factor applying to that year was set based only on a B factor[48]. The reason for a one year period rather than a five year reset period for the lines companies is due to the need to harmonise roles and responsibilities of the Electricity Commission and Commerce Commission.

Transpower has noted the importance of harmonisation of the requirements imposed by the threshold regime and the Commission requirements regarding transmission pricing. Transpower has proposed a full building blocks approach that would among other things explicitly calculate a WACC.

"In its submission on the Discussion Paper, Transpower proposed that the Commission adopt a full building blocks approach to resetting its price path threshold. This would explicitly take into account future capital and operating expenditure to derive a revenue requirement over the five-year period, and could possibly provide Transpower with greater certainty given the respective roles of the Electricity and Commerce Commissions. A price path could then be derived from this revenue requirement.

A full building blocks approach would require the Commission to model Transpower's regulatory asset base over the entire regulatory period, requiring a forecast of capital expenditure, depreciation, disposals and acquisitions of assets, operating and maintenance expenditure, tax payable, as well as factors such as CPI, demand growth and WACC."[49]

The Commission understood that such an approach was inconsistent with the regulatory intent of the threshold regime. However, over the next year, "the Commission would consider the appropriate implementation of the targeted control regime for Transpower, in light of the emerging roles and responsibilities of the Electricity Commission, and in consultation with interested parties".

Hence, some of the problems that were apparent with using private sector rates may arise with the use of a yet to be determined Transpower Discount Rate:

- Continuation of the input/output analysis to set the threshold's scheme does not require the explicit setting of a discount rate (in contrast to a "building blocks"

[48] A B factor represents the expected industry-wide improvements in efficiency and is determined through TFP analysis

[49] Commerce Commission Regulation of Electricity Lines Businesses Final Threshold Decision 23 December 2003

approach), and therefore, requires back calculation from the capped price which may negate somewhat the "simplicity" and "unproductive" debate arguments;

- The rate may be less scrutinised than if it was an integral part of the regulation of Transpower's prices;

- The rate may be set infrequently (five yearly price review period) and may not be appropriate for evaluating investments if there have been material changes in the underlying data (e.g. interest rates).

8.4.3 Practical Solution to the setting of a Transpower WACC

If the Commission adopts formally its preferred option – that is to apply the Transpower WACC as the discount rate for the GIT – the Commission will need to identify the formulation that defines the Transpower WACC.

In this paper we have identified two variations of the Transpower WACC:

- the Commerce Commission derivation of the WACC (as per the Electricity Line Business Inquiry); and

- the Transpower Board derivation of the WACC (which we have set out in Section 8.4.1).

Although other derivations of the Transpower WACC are possible (e.g. other variations of the CAPM), for practical reasons and in terms of relevance to New Zealand, we would see no need for the Commission to consider other such alternatives.

Having defined the choice of derivation for the Transpower WACC, in either case, it may be necessary for the Commission to periodically determine its own "Transpower WACC" on the basis that either:

- the Commerce Commission does not publish at reasonable intervals a Transpower WACC or an appropriate alternative to the weighted average being suggested); or

- independence from the Transpower Board is desirable.

If the Commission was to adopt the Transpower Board methodology we would make the following initial observations:

- The Transpower WACC may not be sufficiently forward looking (for instance the derivation of the risk free rate is based on prior year 10 year Government Bond rates). Consideration could be given to derive a longer risk free rate to align with the period of assessing the net benefits. However, this may be spuriously accurate (similar to deriving multiple rates for different projects).

- An independent view of Transpower's optimal debt/equity mix and equity beta may be required.

- Transpower calculated a post Tax nominal WACC and an adjustment would have to made to ensure that the WACC was set at a rate that reflected how the underlying costs and benefits of a particular project are expressed (i.e. real or nominal, pre-tax or post-tax as required).

As it is contemplated that the Commission will assume the regulatory responsibilities of the Commerce Commission, it may be more pragmatic for the Commission to develop a discount rate as currently formulated by the Commerce Commission. This derivation would ensure consistency across the existing regulatory regime.

APPENDIX 1

Australian regulatory test results, showing sensitivity to discount rate assumptions

Market scenario 6% D.R.	**Base case growth**			**Basslink**	**SNOVIC 800**	**NO SNOVIC**	**Retire LV 500 MW**	**LRMC**	**DM in Victoria**
Load growth	Medium	Low	High	Medium	Medium	Medium	Medium	Medium	Medium
Termination upgrade	5.5	4.2	8.8	5.1	5.4	8.2	1.4	2.6	5
Rowville option	11.5	8.1	21.9	10.8	11.5	14.5	6.3	19.6	11
Cranbourne option	6.2	5.7	18.3	7.1	7.8	10.9	2.7	16	7.4
5th 500 kV line	-13.2	-20.5	-6	-18	-17	-14	-22.4	-8.3	-17.5

Market scenario 8% D.R.	**Base case growth**			**Basslink**	**SNOVIC 800**	**NO SNOVIC**	**Retire LV 500 MW**	**LRMC**	**DM in Victoria**
Load growth	Medium	Low	High	Medium	Medium	Medium	Medium	Medium	Medium
Termination upgrade	4.6	3.5	7.4	4.2	4.5	7	0.9	1.9	4.2
Rowville option	7.5	4.6	16.5	6.9	7.5	10.2	2.9	14.7	7.1
Cranbourne option	2.9	1	11.8	2.2	2.8	5.5	-1.8	10	2.5
5th 500 kV line	-20.1	-26	-13.4	-22.9	-22.9	-20.3	-27.7	-15.3	-23.3

Market scenario 10% D.R	**Base case growth**			**Basslink**	**SNOVIC 800**	**NO SNOVIC**	**Retire LV 500 MW**	**LRMC**	**DM in Victoria**
Load growth	Medium	Low	High	Medium	Medium	Medium	Medium	Medium	Medium
Termination upgrade	3.8	2.9	6.2	3.4	3.8	5.9	0.5	1.4	3.4
Rowville option	4.1	1.5	11.8	3.5	4.1	6.4	-0.05	10.5	3.7
Cranbourne option	1.1	-3	6.2	-2.1	-1.5	0.8	-5.6	4.9	-1.8
5th 500 kV line	-26.1	-30.7	-19.9	-28.9	-28	-25.7	-32.4	-21.3	-28.4

Table 3 Results of VENCorp Latrobe Valley to Melbourne augmentation study, by

market development scenario, at 6%, 8%, and 10% discount rates

Scenario 6% D.R.	**VOLL change to $20k**	**Project cost increase by 12.5%**	**Project cost reduce by 12.5%**	**Double FOR**	**Carbon tax**	**ROTS increase by 12.5% and CBTS reduce by 12.5%**
Load growth	Medium	Medium	Medium	Medium	Medium	Medium
Termination upgrade	8	5.3	5.7	12.4	5.5	5.5
Rowville option	15.1	10.1	13	18.8	16.5	10.1
Cranbourne option	16.7	8.1	10.1	17.5	12.9	10.1
5th 500 kV line	-8.7	-17.6	-8.8	-6	-7.3	-13.2

Scenario 8% D.R.	**VOLL change to $20k**	**Project cost increase by 12.5%**	**Project cost reduce by 12.5%**	**Double FOR**	**Carbon tax**	**ROTS increase by 12.5% and CBTS reduce by 12.5%**
Load growth	Medium	Medium	Medium	Medium	Medium	Medium
Termination upgrade	6.8	4.4	4.8	10.7	4.6	4.6
Rowville option	11.1	5.9	9.1	13.9	12	5.9
Cranbourne option	12.1	3.1	5.3	11.9	7.3	5.3
5th 500 kV line	-16.3	-25	-15.3	-13.7	-14.8	-20.1

Scenario 10% D.R.	**VOLL change to $20k**	**Project cost increase by 12.5%**	**Project cost reduce by 12.5%**	**Double FOR**	**Carbon tax**	**ROTS increase by 12.5% and CBTS reduce by 12.5%**
Load growth	Medium	Medium	Medium	Medium	Medium	Medium
Termination upgrade	5.8	3.6	4	9.3	3.8	3.8
Rowville option	7.7	2.3	5.8	9.7	8.1	2.3
Cranbourne option	8.2	-1.3	1.1	7	2.6	1.1
5th 500 kV line	-23.2	-31.3	-20.9	-20.5	-21.3	-26.1

Table 4 Results of VENCorp Latrobe Valley to Melbourne augmentation study, by sensitivity scenario, at 6%, 8%, and 10% discount rates

11% D.R.	Growth			Basslink	Heywood	No Murraylink	550MW GT	Coal Plant	Least cost planning
	Medium	High	Low	Medium	Medium	Medium	Medium	Medium	Medium
SNI	74.2	76.7	52.0	78.9	73.9	106.7	57.6	72.2	65.1
SNOVIC	213.6	205.1	187.4	204.3	213.7	213.1	184.3	209.6	213.5
SNI + SNOVIC	248.0	254.8	203.8	243.5	247.8	272.0	206.7	249.5	244.5

13% D.R.	Growth			Basslink	Heywood	No Murraylink	550MW GT	Coal Plant	Least cost planning
	Medium	High	Low	Medium	Medium	Medium	Medium	Medium	Medium
SNI	62.20	64.60	42.50	65.60	61.90	88.00	44.20	60.60	55.20
SNOVIC	201.20	192.40	172.70	191.60	201.20	200.70	168.70	195.60	201.30
SNI + SNOVIC	226.30	232.70	179.70	220.10	226.10	246.10	180.30	224.50	223.60

7% D.R.	Growth			Basslink	Heywood	No Murraylink	550MW GT	Coal Plant	Least cost planning
	Medium	High	Low	Medium	Medium	Medium	Medium	Medium	Medium
SNI	92.70	95.10	66.10	99.20	92.20	134.90	77.10	89.90	80.10
SNOVIC	233.20	225.10	209.70	224.40	233.30	232.70	207.00	231.60	232.50
SNI + SNOVIC	281.00	288.70	239.20	279.20	280.80	310.80	244.40	287.80	276.00

Table 4 Results of IRPC SNI ands SNOVIC interconnector study, by LRMC bidding market development scenario, at 11%, 13%, and 7% discount rates

11% D.R.	Growth			Basslink	Heywood	No Murraylink	550MW GT	Coal Plant
	Medium	High	Low	Medium	Medium	Medium	Medium	Medium
SNI	58.8	52.8	44.6	60	58	80.4	43.7	62.9
SNOVIC	207	205.2	189	206.8	207.1	207.5	176	201.8
SNI + SNOVIC	234.5	237.5	197.9	236.4	233.9	252.3	185.7	222.4

13% D.R.	Growth			Basslink	Heywood	No Murraylink	550MW GT	Coal Plant
	Medium	High	Low	Medium	Medium	Medium	Medium	Medium
SNI	50.4	43.9	36.4	51.3	49.7	67.7	33.6	53.3
SNOVIC	193.8	191.8	173.8	193.5	193.9	194.2	159.9	188.6
SNI + SNOVIC	213.1	216	174.4	214.3	212.6	227.8	159.8	199.1

7% D.R.	Growth			Basslink	Heywood	No Murraylink	550MW GT	Coal Plant
	Medium	High	Low	Medium	Medium	Medium	Medium	Medium
SNI	71.8	66.2	56.7	73.4	70.7	99.6	58.2	77.4
SNOVIC	227.7	226	211.9	227.8	227.9	228.4	199.7	222.6
SNI + SNOVIC	267.1	270.5	232.3	270.2	266.3	289.4	222.9	257.5

Table 5 Results of IRPC SNI ands SNOVIC interconnector study, by SRMC bidding market development scenario, at 11%, 13%, and 7% discount rates

11% D.R.								**Optimised Commissioning Date**			
	Double FOR	20% lower GT Capital Cost	Carbon tax	Price elast-icity	SA gas 3.0/GJ	20% lower NSW coal price	Playford refir-bished	SNI Delay	SNOVIC Delay	Both Delay	Minor re-visions
SNI	73.60	43.00	64.80	N/A	73.00	74.00	76.70	71.40	74.20	71.40	73.00
SNOVIC	219.10	161.20	211.50	N/A	216.50	213.50	208.10	213.60	194.30	194.30	209.60
SNI + SNOVIC	259.00	172.70	237.20	N/A	253.60	249.60	242.20	257.10	240.80	237.90	242.70

11% D.R.								**Optimised Commissioning Date**			
	Double FOR	20% lower GT Capital Cost	Carbon tax	Price elast-icity	SA gas 3.0/GJ	20% lower NSW coal price	Playford refir-bished	SNI Delay	SNOVIC Delay	Both Delay	Minor re-visions
SNI	62.2	32.4	54.7	N/A	61.6	62.1	63.9	59.4	62.2	59.4	61.1
SNOVIC	206.5	151.4	198.9	N/A	203.5	201.1	195.3	201.2	180	180	197.8
SNI + SNOVIC	235.9	154.9	217	N/A	231	227.7	220.1	236.7	218.4	215.6	221.9

11% D.R.								**Optimised Commissioning Date**			
	Double FOR	20% lower GT Capital Cost	Carbon tax	Price elast-icity	SA gas 3.0/GJ	20% lower NSW coal price	Playford refir-bished	SNI Delay	SNOVIC Delay	Both Delay	Minor re-visions
SNI	90.9	59	80.4	N/A	90.4	92.1	96.2	89.6	92.7	89.6	91.3
SNOVIC	239.1	176.9	231.2	N/A	236.7	233	228.3	233.2	215.7	215.7	228.2
SNI + SNOVIC	294	199.6	267.7	N/A	287.7	282.7	275.6	288.7	274.3	271.2	274.4

Table 6 Results of IRPC SNI ands SNOVIC interconnector study, by sensitivity scenario, at 11%, 13%, and 7% discount rates

Scenario	Additional cost of this scenario relative to first ranked scenario ($M)		
	7%	**8%**	**9%**
C2: 400 MW upgrade of interconnector, plus gas turbines	0	0	0
C1: 250 MW upgrade of interconnector, plus gas turbines	10.4	11.4	12.3
C4: Staged upgrade of interconnector to 800 MW, plus gas turbines	35.5	30.5	25.9
A: Gas turbines only	32.5	35.7	38.7
C3: 800 MW upgrade of interconnector, plus gas turbines	43.8	41	38.3
B: Basslink	99	111	121.6
"Do nothing"	200.7	153.9	111.8

Table 8 Results of VENCorp SNOVIC study, by market development scenario, at 7%, 8%, and 9% discount rates. Costs are expressed relative to costs of the top ranking (i.e. C2) proposal.