Submission on

Draft Grid Investment Test

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October 29, 2004

Executive Summary

1. The choice of discount rate is likely to be material.
2. Real options analysis might fail to be a valid approach because of incomplete markets.
3. Synergies and options together make multistage stochastic programming a viable valuation tool.
4. Attempts at modeling the effects of bidding in this context should be carried out before they are dismissed as immaterial.
5. Risks in the NPV of market benefit of the project need to be accounted for in the analysis.
6. Sensitivity analysis is valuable but robustness to perturbation should not be applied as a strict criterion in the GIT.

Introduction

This submission made on behalf of the Electric Power Optimization Centre at the University of Auckland addresses several issues raised by the September 2004 Draft Consultation Paper. This is not intended to be a comprehensive submission but a raising if some issues that we believe require more careful consideration before adopting the draft GIT rules.

Discounting

In Q6 following paragraph 49 the question is asked: "Is the choice of discount rate likely to materially affect which projects are selected?" We imagine that some projects might involve different timing of benefits, especially if new generation will make use of some projects earlier or later than others, so the discount rate will be material in many instances.

Real Options Analysis

With regard to Q31, we believe that flexibility in investment should not be overlooked and so the optionality of investments should be accounted for. It is not clear to us that real options analysis is appropriate for grid investment. In particular the construction of a martingale measure for valuation (whether in a binomial lattice or continuous time) relies on the existence of complete markets in which the risks of the benefits can be perfectly hedged by tradeable instruments. We are concerned about the validity of the analysis in the absence of these conditions.

Synergies

One further drawback in real options analysis is that it is very difficult to apply for more than simple investment projects, especially if there are synergies between different options. One might imagine an optimal grid investment that involved staged increases in capacity in different parts of the network that collectively yielded a better NPV of benefits than any other staged plan. Furthermore the individual projects might not look attractive, but together their value is much greater than the sum of their contributions. Such synergies are particularly present in electricity transmission capacity expansion problems.

This sort of problem cannot be easily solved in a real-options framework, but is well served by multi-stage stochastic programming models (see e.g. www.stoprog.org and the paper by Singh *et al* on the EPOC web site.) Stochastic programming models can compute a policy maximizing expected NPV over many scenarios as proposed in paragraph 115. (A complicating issue is the choice of discount rate here since the optionality built in to the stochastic programming solution will decrease the risk that is represented in the NPV by the choice of discount rate. The discount rate should be at the risk-free rate for real-options analysis, so for stochastic programming it should be chosen to lie somewhere between the WACC and the risk-free rate.)

Bidding

In Q17 (following paragraph 70) the question is asked: "Is the choice between least-cost and bidding approaches likely to materially affect the choice of grid investment versus alternatives to transmission, and if so, why?" In a fully deregulated market, we believe that these effects need to be accounted for, at least in some circumstances. For example, a constrained line can incentivise gaming behaviour to exploit local market power. The benefits from increasing the capacity come not only from changes that would accrue from agents bidding at marginal cost. Of course we recognize that this poses very difficult modeling issues, but the Commission should be thinking of ways of attacking these. It is dangerous to dismiss them as immaterial when they might not be.

In paragraph 92 the Commission states that they intend to include competition benefits (presumably from changes in bidding behaviour amongst other things) in the analysis, to be presented separately from the market benefits. In paragraph 105 the Commission proposes a sensitivity analysis to investigate bidding behaviour in the presence of a new investment. It is not clear from these statements exactly what role an investigation of bidding behaviour will play in the grid investment test. We recognize that the modeling issues are difficult, but we believe that a clearer role for these effects should be laid out in this document.

Risk and Return

In paragraph 114 the Commission recommends expected net market benefit over a number of scenarios as an appropriate measure of value for comparisons between projects. It should be mentioned that this measure ignores the risks associated with the variation in outcomes between scenarios. For example, two projects with very similar expected NPV values might have very different variation in outcomes over different scenarios. One might produce a very low variation, and the other a high variation. We believe that some account should be taken of this variance. Otherwise there is some likelihood of a bad investment choice being driven by a high expected value but with huge risks.

Adopting a risk-neutral stance by maximizing expectation of market value is acceptable when decisions are made repeatedly and the long-run average value is sought. However for one-off investments that will be made at most once, some account of risk aversion must be taken. A number of risk measures are possible for doing this. A common approach is for the decision maker to adopt and optimize using a utility function. Alternatively the Commission might constrain the project's risk. For example the Commission could constrain the choice of investment to have a bound on its Value at Risk or Conditional Value at Risk.

Sensitivity Analysis

In paragraph 105, it is proposed to carry out sensitivity analysis to ensure the robustness of outcomes of proposed projects. This is desirable but if applied too rigorously this could lead to very few projects passing the GIT. It is possible that the order of projects according to expected NPV of market benefit is very sensitive to perturbation on the parameters and conditions (particularly relating to bidding behaviour). This might mean that no projects from a deserving list will pass the GIT of being better than the others over all model perturbations. This would make it unwise to make robustness from a comprehensive sensitivity analysis a necessary component to the GIT.