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22 April 2005

Ms Paula Rebstock
Chair
Commerce Commission
P O Box 2351
Wellington

Dear Ms Rebstock

Orion New Zealand response to questions – information disclosure review

Thank you for the opportunity to present our views to the Commission with respect to valuation choice and information disclosure.

This letter now addresses questions which were raised by the Commissioners during our presentation, and also includes some comments with respect to matters raised by other parties during the conference. Also attached is a separate paper from NERA which addresses indexation issues raised by the Commission.

PART ONE: Responses to questions raised by the Commission

Question 11 - *In light of the Electricity Networks Association's submission on the matter (see Day 1 Transcript, pp 163-164), please indicate whether Orion would have any concerns if the Commission were to allow Transpower to use a system fixed assets valuation methodology that was different from a valuation methodology mandated for distribution businesses, particularly in respect of assets at the margin. (Day 4 Transcript, pp 464-465).*

Orion would be comfortable if an historic cost valuation basis was used for Transpower and ODV applied to all distribution businesses. We concur with the view expressed in PricewaterhouseCooper's written submission (page 45, first paragraph).

We would regard any trading of assets between Transpower and a distributor as simply a commercial transaction. The regulatory value that either business places on the traded assets will be only one factor in settling on a price. Other strategic issues are likely to play a part.

However, we also consider that the ODV Handbook rules should have consistent unit replacement costs for assets used by both Transpower and electricity lines businesses (ELBs). The apparent anomaly identified by Marlborough Lines (Conference Transcript p 452) for 11kV overhead lines with Mink conductor has possibly arisen because of different assumptions in the costing. This is a problem with the current ODV Handbook where the assumptions behind the asset unit replacement costs are not given in sufficient detail.

In principle, we would share ENA's concern if two ELBs (Transpower and a distribution business) under the same regulatory regime were allowed to earn different returns on the same assets. However, only a few assets at our boundary interface are of common interest and their values are likely to be relatively immaterial compared with the total values of our networks.

Furthermore, we acknowledge that Transpower's business is quite different to ours and therefore different criteria (such as regulatory) can apply. Transpower need to be compared with other transmission companies in terms of risk, value, performance and returns.

Question 12 - Please provide views on the extent to which the Commission might seek further information under section 57U of the Commerce Act for the purpose of monitoring information disclosure requirements vis-à-vis the Commission's ability to place reliance on the auditing process. (Day 4 Transcript, pp 500-501).

We note Commissioner Rebstock's comments on page 501 of the transcript that "...the Commission has had some experience of finding the audited results not correct...". Whilst we do not know the specific circumstances to which the Commissioner refers, we recall the extensive review of ELB ODV's which the Commission undertook in 2001 and early 2002, following which all but two ELBs had their valuations confirmed. The then-Chair, John Belgrave, noted that "*the Commission's overall view was that the ODV Handbook has been generally applied well by electricity lines companies, although the audit prompted some improvement.*"¹

Following the review, the Commission's advisors, Parsons Brinckerhoff Associates, made a series of recommendations for inclusion in later versions of the ODV Handbook.

We believe that there are some areas where the information disclosure can be improved, and we have included some comments in our submission. This includes improved clarity about how the avoided cost allocation methodology (ACAM) should be applied, particularly with respect to the "boundaries" around the notional ELB created – that is, clearer definitions regarding which ELB activities are "in" or "out" for regulatory purposes.

We are of the view that if the Commission has concerns over the quality of audit work, then a review of any disclosures that appear to be incorrect is likely to further improve the consistency of information disclosed. However, the process may be iterative and ongoing.

The Commission has powers to monitor and verify information that is required to be disclosed to it under section 57T. These powers do not extend to include non-relevant information. Where, for example, the Commission requests information concerning the non-regulated aspect of an ELB, there will always be the risk that part or all of the information at issue may not be relevant to the Commission's monitoring role. Accordingly, there is the prospect in this situation that the Commission may act *ultra vires* in exercising its information gathering powers under 57U(1)(b).

While technically the Commission may (subject to relevancy) seek further information under section 57U(1)(b), in addition to audited disclosure statements, we remain of the view that this requirement for further information would be unnecessary where there is a requirement to provide audited disclosure statements, unless it is apparent that any such disclosures may be incorrect.

¹ Press release by the Commerce Commission, 4 April 2002

The scheme of the legislation clearly anticipates (under section 57U(3)) that the Commission may properly rely upon audited or certified disclosure statements in order to meet its obligations under section 57U. The duty of care owed by auditors to the ELBs can extend to the Commission. The following steps (outlined in *Caparo Industries plc v Dickman* [1990] 1 All ER 568) establish how this duty of care can extend to the Commission. It must be made known to the auditor that:

1. the purpose of the audit is to verify the ELB's information disclosure under section 57T;
2. his or her advice will be communicated to the Commission;
3. the Commission will use, and be likely to act upon, this advice for the monitoring and verification purposes under section 57U without independent inquiry; and
4. the advice may be acted upon to the Commission's detriment.

It is informative to note the reliance placed upon information auditing procedures in other regulatory settings. We set out below details of information auditing requirements which are in place for ELBs (distributors) in Victoria and water companies in England and Wales.

1. Essential Services Commission, Victoria

The Essential Services Commission of Victoria (ESC) has issued a guideline² that sets out, among other things, how auditors are to be appointed for the purpose of reviewing the performance of distributors against key licence obligations and the quality of regulatory data reported pursuant to their licence obligations.

The Guidelines specify that:

1. it is the distributor's responsibility to appoint an auditor, however the auditor must be approved by the ESC;
2. the ESC *may* specify the terms and conditions of appointment;
3. the auditor reports to the distributor, who is then required to submit that report to the ESC;
4. the auditor's primary duty of care is to the ESC. The auditor also has a duty to the distributor. The auditor's duty of care is formalised in a tripartite deed between the ESC, the distributor and the auditor; and
5. the distributor is responsible for the auditor's remuneration.³

² Essential Services Commission, *Electricity Guideline No.9: Regulatory Audits of Distribution and Retail Businesses*, March 2003

³ This is not explicitly specified in Guideline No.9, but is referred to in the ESC's *Electricity Industry Guideline No.3: Regulatory Information Requirements, Issue No.4*, January 2004, p.16

2. Office of Water Services, England and Wales

The England and Wales water regulator, Ofwat, differentiates between ‘reporters’, responsible for the non-financial reporting requirements of a water company, and ‘auditors’, responsible for reviewing the water company’s financial accounts.⁴

Reporters, usually consulting engineers, have two major roles:

- (1) to scrutinise the historical data presented in water companies’ annual returns; and
- (2) to review the forecast data presented in the five-yearly submissions for reviews of prices limits. Accountants audit the statutory and regulatory accounts of water companies.

Ofwat’s *Reporters to Ofwat: Reporters Protocol*⁵ specifies the role of the reporter and the relationship between the reporter and the auditor. The Protocol specifies that:

1. reporters are appointed by the water company, subject to Ofwat approval;
2. Ofwat must approve the contract between the company and the reporter;
3. the reporter sends the report to Ofwat on request, and a copy of the report to the company;
4. the reporter’s primary duty of care is to Ofwat, but also has a duty of care to the company; and
5. the company is responsible for the reporter’s remuneration.

In contrast, auditors are to be appointed by the water company under the general terms and conditions of the Companies Act 1985.

Reporters and auditors are required to work together to provide the necessary scrutiny of the submissions, particularly where there is overlap with regulatory accounts, and water companies are obliged to arrange for access between the two to make this possible. The reporter does not have to conduct a separate audit of company data or systems if this duplicates earlier scrutiny by the auditor.

In summary, if the Commission believes that auditors certify information that is incorrect, then

- improving clarity, but reducing detail in the requirements will assist
- a post-audit review of disclosures which appear to be incorrect will assist in understanding the extent of the problem – if any
- approving and training a number of auditors acceptable to the Commission could also assist, if the problem exists.

We believe that the auditor’s primary duty of care is to the ELB through confirming compliance with the requirements.

⁴ Ofwat, *Information Note 28: Reporters Auditors and Valuers*, April 1994, revised December 2004.

⁵ Ofwat, *Reporters to Ofwat: Reporters Protocol*, Issue 2 – March 2003

Question 13- Please provide any empirical evidence in relation to the 'smoothing' effect of adopting a real WACC plus CPI indexation compared to maintaining a nominal WACC and using capital cost indexation. (Day 4 Transcript, pp 505-508).

This is the subject of a separate paper prepared by NERA, which is attached as Appendix 1.

In summary, the paper demonstrates:

- there is a trade-off between ensuring a smooth ROI in the years between market-based adjustment to ODV unit costs and reducing the magnitude of the revaluation every fifth year;
- the CPI has shown greater stability over the past ten years than any other potential index published by Statistics New Zealand and tends to produce a smoother ROI profile under reasonable assumptions about actual unit cost changes; and
- the reported ROI is likely to be smoother under a real WACC framework.

Question 14 - Please provide views on the notion that efficiency benefits that are achieved through economies of scope as a result of synergies between a lines business and one or more other businesses (which may be regulated or unregulated) should be shared with the lines business consumers. (Day 4 Transcript, pp 508-509).

We do not believe that companies that operate either multi-utility businesses, or have considerable activities in non-regulated businesses, whether nationally or internationally, should be required to use the efficiencies of scope offered by their incremental activities to share benefits with the customers in their regulated businesses. This is consistent with our view that a more-efficient company should be permitted a return above WACC, and that this is best considered in terms of the level of RROI achieved by the ELB.

The issue as to whether or not economies of scope should be able to be retained by the business must relate to the yardstick against which the Commission assesses an ELB's performance. If the Commission focuses on the costs that would be incurred by an averagely efficient stand-alone ELB, then it is appropriate for ELBs to retain any benefits that may arise from engaging in separate activities.

It would be inappropriate for the Commission to apply a "best of the best of the best" new entrant test, assuming that the new entrant brings substantial economies of scale and scope when entering the market as this would dampen incentives for ELBs to invest. Proper application of ACAM is an appropriate cost allocation mechanism, as it provides a meaningful basis for comparison with a standalone, average-efficient new entrant ELB.

Further, the debate on ACAM and the sharing of economies of scope to date may have made too much of the potential short term benefits to consumers from moving away from ACAM. There is no strong evidence to suggest that significant economies of scope exist between gas pipeline businesses and ELBs. There is very limited opportunity for economies of scope in the area of system fixed assets, which makes up the bulk of the costs for these companies (depreciation, return on investment, maintenance etc). Operating costs in which there may be some opportunity for economies of scope make up a relatively small component of total costs.

A cursory examination of the operating costs Orion disclosed for the 2004 regulatory disclosures suggests that such synergies are likely to arise from less than 10% of operating costs, which are the ones that could potentially be "shared". Therefore, even if expanding business activities enabled (say) a 20% reduction in combined costs, this would result in only a 2% reduction in operating costs.

Operating costs (including transmission) accounted for around 60% of actual revenues (including transmission) under a building-blocks approach for Orion in 2004. Therefore, even taking an optimistic view that the firm could reduce shared costs by this extent, the implications to consumers would amount to around 1% of the cost of our delivery services (or less than half a percent of their retail electricity bill). The hypothesis, that only limited economies of scope exist between ELBs and gas pipeline businesses, is supported by the evidence that there are currently only a small number of companies that engage in both activities.

The perception that more substantial economies of scope exist between the businesses may have arisen from inappropriate applications of ACAM. It is important to distinguish between the principles underlying ACAM and the way in which the approach has been implemented in the sector. In the absence of a clear set of principles and guidelines, application of ACAM has no doubt varied between ELBs, and possibly over time. This may have resulted in cursory examinations by ELBs of the true level of avoidable costs that would be associated with exiting particular business activities.

For example, if a company had electricity lines and gas pipeline activities that were of roughly equal significance which shared common overhead (not total operating) costs of \$100, the exit from either of these activities could reasonably be expected to have a significant impact on "overhead" costs, such as corporate employee salaries and wages. However, it is unlikely that the common overhead costs would be reduced by half. It might be appropriate, therefore, to assign \$60 or \$70 to each activity in applying ACAM, but not appropriate to assign the \$100 to both activities. We suggest the development of well-founded guidelines on the application of ACAM is a high priority. The guidelines should be developed following further consultation, and we believe that workshops would be valuable in assisting implementation.

Our view that ELBs should be able to retain any benefits that may arise from engaging in other, unrelated, activities does not extend to the indefinite retention of economies of scale. Where an ELB owns a number of separate or non-contiguous electricity networks then that business should be treated as one network under the electricity disclosure requirements, thereby requiring the business to model only one electricity network in applying the avoided cost allocation methodology. Such treatment is consistent with the Commission's objective of assessing performance against that of a standalone efficient new entrant. Diverging from this treatment could result in the abuse of the ACAM methodology by ELBs artificially dividing a network into a number of smaller regions.

We believe it appropriate that following a merger, or due to inherent company efficiencies above the industry standards, that economies of scale should be kept by the ELB for a period of time before some of the benefits are shared with customers. This will encourage ELBs to innovate and invest.

These matters have been further discussed in our response to question 9 of our main submission.

Question 15 - Please provide views on the way and extent to which various types of information could practically and usefully be disaggregated for disclosure purposes. (Day 4 Transcript, pp 509-511).

In our key points, we highlighted our concern over the Commission's proposed revisions to seek separate information for non-contiguous networks (Orion submission, p4). This would be costly and could set an unhelpful precedent since customers within separate parts of contiguous networks could also seek separated information, and any such separation would have to be arbitrary.

We also expressed the view (Orion submission, p7) that disaggregation is not necessary and in some cases may be counterproductive, such as in relation to mergers and acquisitions where extensive analysis, post-merger, is no longer relevant.

Our presentation slide 39 summarised our view to recommend against any general disaggregation of information because:

- ELB will have common costs that would not be split in normal course of business
- the degree of disaggregation becomes arbitrary
- disaggregation could lead to conflicting views from various interested parties
- disaggregated splits would not be recognised within the operations of the ELB.

Our view remains the same. Pragmatically, there are many costs within our business that must be allocated on some basis to derive prices. Disaggregating general disclosure information would be artificial and could lead to unnecessary concerns by some stakeholders if they perceive a mismatch between costs and charges for a 'pocket' of a network, regardless of whether this was within a separate non-contiguous network or not.

In terms of reliability performance, we recognise the unavoidable inherent influence of consumer density. Our suggestion (Orion submission, pp 22 and 23 and presentation slide 31) is for ELBs to disclose their reliability performance for each GXP, along with the applicable consumer density (ICPs per km). This will enable more meaningful comparisons of reliability performance over bands of consumer density.

Note that an unwelcome side-effect could arise from this change. Generally, in lower consumer-density areas the reliability-performance is worse (eg in rural areas), but the prices are often the same. If the higher capital and maintenance costs per consumer in those lower density areas are not understood, then the expectations of consumers and stakeholders may not be reasonable. Our view is that the trade-off between price and quality is appropriate only in like situations, particularly with regard to consumer density.

Question 16 - Please comment on options for enhancing the disclosure of lines business forecast information. (Day 4 Transcript, pp 517-519).

During our presentation to the Commission we noted concerns over providing detailed forecast information. This was also addressed in our submission in our response to question 8.

We noted at the conference that we currently provide 10-year forecast information within our asset management plan, and our experience to date had been that even in the relatively short term we have seen some significant variations between expectation from one plan to the next.

We also noted that due to the existing cpi-x framework there was little opportunity for a ELB to markedly alter profitability in the short term, and that financial disclosures would likely be heavily caveated and unauditable.

At page 516 of the transcript, Greg Houston noted that the Australian regime's use of forecast information is with respect to price resets. We would accept also that company forecasts would be of particular importance in New Zealand in the event of an investigation following a breach of the existing price threshold regime.

We suggest that if the Commission requires additional information from the industry as a whole with respect to forecast capital expenditure etc that this disclosure be clarified as a requirement within the asset management plan contents. However, clearly the further forward the forecast information looks, the less reliable that forecast is.

We see little merit in providing other forecast information as part of an ongoing information disclosure regime. To do so may also lead to investigations as to the cause of any differences between forecast and actual data, the analysis of which would be highly time-consuming, but of little apparent value.

PART TWO: Additional comments and responses to other matters raised during the conference.

GAAP as the basis for financial disclosures

We advocate the disclosure of relevant financial measures which are generally GAAP-based. In our submission we supported some minor deviations from GAAP, such as the use of ODV depreciation as the basis for a notional tax calculation, and the elimination of deferred tax. However, such disclosures need not take the form of a full structured set of GAAP-compliant financial statements. Specifically, the statement of cashflows, the statement of movements in equity and many of the notes to the financial statements, while GAAP compliant, are totally irrelevant to the disclosure regime.

In relation to the concerns expressed in the Commission's discussion paper (para 213), information regarding actual capital expenditure, appropriately categorised, and information regarding capital contributions could more clearly be specified as specific disclosures.

Further, the statements of financial position and performance could be eliminated or simplified considerably to focus on the relevant aspects of these schedules.

We note that, to an extent, this opinion is supported in other submissions (Transpower⁶, PWC⁷). We acknowledge the support from other submitters of alignment with GAAP in preparing financial disclosures; however, we expect that in many cases this support may not conflict with our view, and that a more limited set of clearly defined GAAP-compliant disclosures would hold wide appeal.

Price disclosure and price averaging

Genesis⁸ commented on the difficulty in translating wholesale distribution pricing into meaningful and measurable retail pricing. Genesis also commented on the comparability of different pricing structures.

We understand that Genesis' main concern relates to demand based pricing, where the peak *rate* of consumption derived from more sophisticated metering at the GXP is used as a chargeable quantity. Genesis are concerned that the majority of retail metering (measuring only total consumption, without reference to the timing of consumption), does not allow them to accurately pass on this cost to the customers that contribute to the cost. Instead they must average the cost across all customers.

The peak use of distribution networks (ie congestion) is the key capital cost driver. In applying a demand-based charge, we pass this pricing information through to retailers. Retailers are the only party in a position to combine distribution cost drivers with other cost drivers in order to determine an appropriate retail pricing structure.

Another major input cost for retailers - generation, is also time-based - as evidenced by the wholesale energy market. Metering solutions that allow retailers to accurately assess individual customers' contributions to these input costs are available; and only the retailer can decide when it is commercially viable to utilise this technology.

If distributors were required to carry out price averaging (as suggested by Genesis) the

⁶ Transpower (transcript, page 15 & Disclosure submission para 32 & 33)

⁷ PWC (Submission, page 28)

⁸ Genesis (transcript page 89)

opportunity to innovate and develop efficient pricing structures would be diminished.

Retail prices to consumers in Orion's region contain significant price signals driven by wholesale line charges (e.g. Meridian's residential day rate is 21.30c/kWh and their night rate is 8.44c/kWh). This illustrates that retailers have no problem forming retail price structures which have price differentials greater than those in areas supplied by ELBs who use old-style tariffs. This example demonstrates that the 'averaging' can be less under our wholesale pricing, contradicting Genesis' assertion. The comments from Genesis appear to overlook that old-style line tariffs contain a far greater level of cost averaging than our cost-reflective prices.

We urge the Commission to continue to rely on pricing disclosures by distributors, and not to influence the operation of the competitive retail market by requiring distributors to disclose distribution prices in a retail format.

Lower price for rural customers

Genesis⁹ suggested that the different level of service received by different customer groups should be reflected in different pricing levels. As rural customers receive a lower service level (more frequent interruptions of longer duration), this might imply they should receive a lower price.

In our experience, the additional capital cost in supplying rural areas (with as few as 6 connections per kilometre of high voltage line) together with higher maintenance costs far exceeds the relatively small financial advantage in providing a lower level of service. We currently do not differentiate urban and rural prices (an approach now supported by Government Policy Statement 99). It would be incongruous to apply a lower price to a category of connections that already benefit from cross-subsidisation.

Reliability information by feeder

Refer also to Orion's answer to question 15. Genesis¹⁰ supported the Commission's suggestion¹¹ that reliability performance measures should be disclosed at the feeder level.

We again highlight the considerable problems with this proposal and suggest the costs associated with implementation of this will far outweigh any benefit in providing the additional disclosure. We believe that a reasonable level of comparability may be achieved by disclosing reliability information at the GXP level, together with parameters describing the area supplied by the GXP (eg consumer density expressed as consumers per kilometre of high voltage conductor), to facilitate comparison within the network and with areas in other networks with similar consumer densities.

The problems associated with feeder level disclosure include:

1. Volatility of results - reliability measures are dominated by infrequent and unrelated but significant events. At feeder level, a single event can influence the result to the extent that the feeder affected is considered one of the worst. However, this information may not be indicative of a problem and it would not be prudent to incur the cost of preventative action in response to individual volatile results. In relation to the suggestion to disclose feeder level reliability measures, responding to

⁹ Genesis (transcript page 91 (top), page 118 (bottom))

¹⁰ Genesis submission on information disclosure (dated 23 February 2005) paragraph 8 and Genesis transcript page 93.

¹¹ Commerce Commission Information Disclosure discussion paper dated 24 December 2004.

consumers that perceive a problem on their feeder represents an unnecessary cost. Our assessment of “worst feeders”, as disclosed in our Asset Management Plan, smoothes this volatility by considering a 5 year average.

2. Number of consumers affected - some of our feeders have as few as one consumer. Disclosing reliability averages at this level is not consistent with the objective of the information disclosure to access the ELB’s overall performance, not the exceptions.
3. Volume of information – we have approximately 600 11kV subtransmission feeders and 600 11kV distribution feeders. Publishing this volume of low value information would be counter-productive.
4. Configuration changes - we note Genesis’ assertion that “... every consumer ... is supplied by a single 11kV feeder and there’s virtually no exceptions ...”¹² This statement is false. Orion and many other distributors operate meshed high voltage networks where customers are supplied by multiple feeders, and by links between these feeders. Our network configuration is altered to accommodate different loading levels and load growth. This adds considerable complexity to Genesis’ suggestion that consumers might be able to ‘look up’ the reliability information in relation to their own feeder – we are not in a position to record or maintain a complete history of network configurations that would be required to support this type of disclosure.
5. Cost - issues of changing network configurations aside, capturing and disclosing feeder level information would require significant system enhancement and higher ongoing costs. The information would inevitably include irreconcilable deviations from the reliability actually experienced by consumers (as a result of complex configuration changes) and we would face the cost of reconciling resulting customer queries and complaints.

We acknowledge that consumers and other stakeholders may benefit from a more detailed level of reliability disclosure. This can be achieved with GXP level disclosures, where, with the benefit of other attributes of the GXP (eg consumer density), more meaningful comparisons can be drawn within the network and between different networks. In our opinion, the copious volume of costly feeder level information would provide little value to users of the information.

‘Excessive returns’ at the sub-network level

The Commission asks if ‘excessive returns’ at the sub-network level are an issue of proper concern for the Commission¹³. We believe that, cost allocation difficulties aside, different observed average rates of return between sub-networks and between consumer categories is inevitable in the provision of any network service and supported in many pricing methodologies.

Such differences arise not only because for costs that cannot be directly attributed to individual customers or classes of customers, there isn’t a single correct allocation of costs, but also for reasons of practicability, such as the administrative ease of offering tariffs that apply network wide. We see no intrinsic reason for the Commission to pay special attention to this issue, and suggest the best approach to addressing such issues on a case by case basis, as and when they arise.

¹² Genesis (transcript page 93)

¹³ Commission Chair (transcript page 60 (bottom), transcript page 206)

Conclusion

Thank you for the opportunity to provide further comments and clarification on our submission, and on other matters which arose during the conference.

We look forward to continuing to work with the Commission during the further development of the information disclosure regime.

A handwritten signature in black ink, appearing to read 'Roger Sutton', with a long horizontal flourish extending to the right.

Roger Sutton
Chief Executive Officer

APPENDIX 1

Review of the information disclosure regime/implementing valuation choice for system fixed assets - a paper by NERA.



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22 April 2005

**Ms Paula Rebstock
Chair
Commerce Commission
PO Box 2351
Wellington
NEW ZEALAND**

Dear Ms Rebstock

**Review of the Information Disclosure Regime/Implementing Valuation Choice for
System Fixed Assets**

During my 11 April presentation to the Commission on the choice of system fixed asset valuation for electricity lines businesses, I raised the possibility of indexing Optimised Deprival Value (ODV) asset values by the Consumer Price Index (CPI) and deriving a return on investment (ROI) measure specified in inflation adjusted (or 'real') terms. I suggested that this might provide smoother outcomes for the measured ROI than the alternative of indexing ODV values by a capital cost index and comparing the resulting ROI measure with an inflation inclusive (or 'nominal') weighted average cost of capital (WACC).

This letter responds to your request for empirical evidence on this issue.

Background

The Commission's draft decision and discussion paper on the implementation of valuation choice discussed a number of indexing options for both ODV and IHC asset values. In the case of ODV, the principal purpose of indexation would be to reduce the extent of the periodic revaluation needed when disclosure handbook unit costs are adjusted periodically to bring them into line with 'market prices' for system fixed assets' replacement costs. For businesses that chose to adopt an ODV-based asset value full revaluations would take place, say, every five years, with an annual indexing of the asset base in interim years. The choice of index will therefore be important for the stability of both reported ODV values and ROI, remembering that the latter is affected both by the level of ODV, which appears as its denominator, and through the incorporation of changes in ODV as revaluations in its numerator.

During the conference I discussed two principal options for inflating the asset base between revaluations:

1. retain the nominal ROI/WACC framework and apply *either* a capital cost index *or* CPI to inflate ODV values - in which case all asset revaluations must be treated as an income adjustment in deriving the corresponding ROI; or
2. move to a real ROI/WACC framework and index ODV values according to changes in the CPI - in which case only the periodic adjustment of ODV unit costs¹ would need to be treated as an income in deriving the corresponding ROI.

Both these methods would preserve the financial capital of a lines business (and so satisfy the NPV=0 principle), provided they are implemented correctly and consistently, and in that respect they are equivalent.² However, both the measured ROI and its volatility will differ under the two approaches.

The analysis below uses a simple example to demonstrate that:

- there is a trade-off between ensuring a smooth ROI in the years between market-based adjustment to ODV unit costs and reducing the magnitude of the revaluation every fifth year;
- the CPI has shown greater stability over the past ten years than any other potential index published by Statistics New Zealand and tends to produce a smoother ROI profile under reasonable assumptions about actual unit cost changes; and
- the reported ROI is likely to be smoother under a real WACC framework.

Importance of a Stable Index

The reported ROI has at least two principal roles, both of which are likely to benefit from a framework that gives rise greater stability over time. First, ROI is reported each year as part of the information disclosure regime. If the index used to inflate the asset value is relatively volatile, the reported ROI will tend to jump around and potentially mislead analysts about the underlying stability or financial performance of the business. Second, if an electricity lines business (ELB) breaches its price path under the threshold and control regime, one of the factors the Commission has proposed to examine is the reported ROI. Greater volatility

¹ This is because the annual CPI-linked indexation of asset values substitutes for the inflation component of the WACC, which nets out of the ROI measure. Note this analysis leaves aside the possibility of ODV valuations arising from optimisation of assets, which also need to be incorporated into the income adjustment step in deriving ROI. However, this does not affect the choice of indexation measure.

² See NERA, *Comment on the Commission's Valuation Choice Discussion Paper*, February 2005 for further discussion.

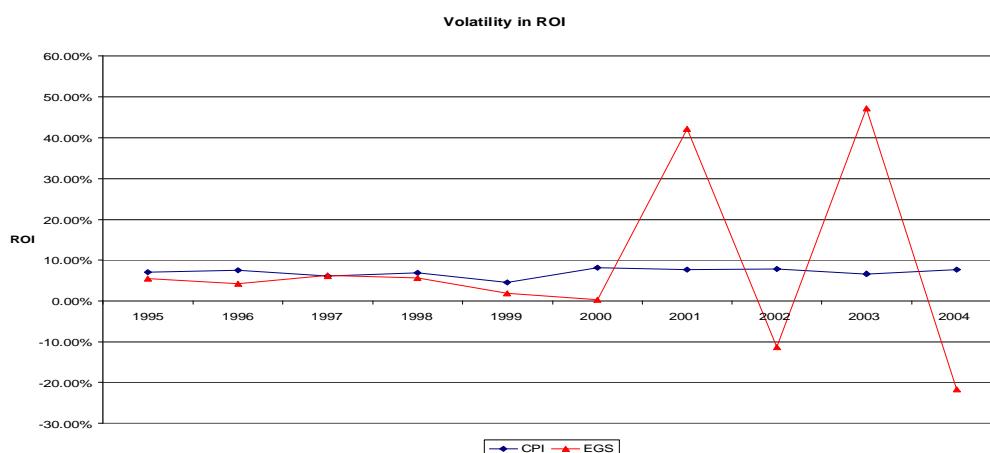
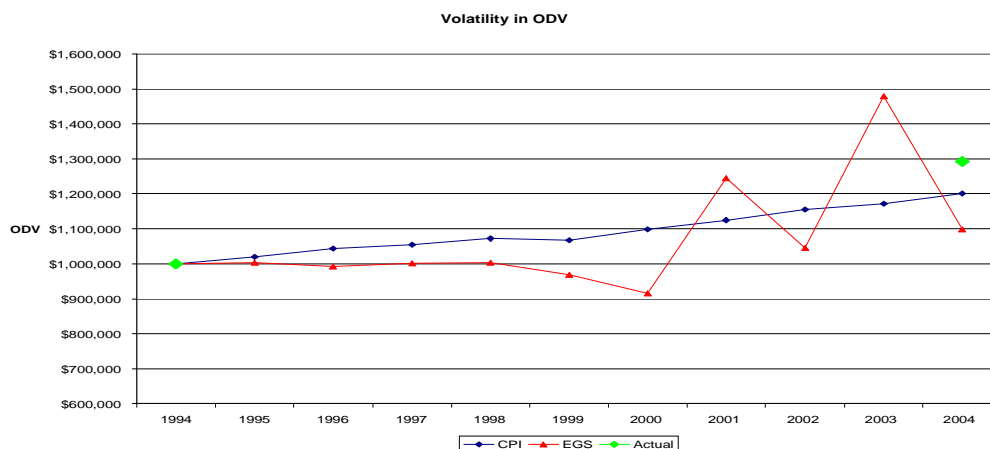
in that ROI would make the analysis of excess returns more difficult, with some peaks or troughs in reported ROI having the potential to be misleading.

There are two separate effects influencing the volatility of ROI over a given five-year period. In the interim years between revaluations, the most important feature of an index is its stability over the period. In the fifth year where unit costs and adjusted and so assets re-valued, the important determinant of stability in reported returns is the accuracy with which the index predicts the revised unit costs. These two considerations potentially involve a trade-off between the smoothness of the path in the interim years and the adjustment in the final year. For example, one index may provide a smoother path between years one and four, but require a large adjustment in year five. Alternatively, another index may exhibit more volatile characteristics, but over the five-year period will achieve an asset valuation closer to the actual ODV following revaluation, and thus require a comparatively smaller adjustment in year five.

It must be remembered, however, that although the *average growth rate* of an index may be closer to the actual average growth rate, if the index is volatile it may be a less accurate predictor of the actual revaluation in any given year than a second, smoother, index that has a significantly different average growth rate. The charts below show the ODV and ROI implied by two alternative indices: the CPI, with an average annual growth rate of 2.02% and variance of 0.13 over ten years; and a subset of the producer price index (PPI), electricity generation and supply (EGS), which has an average annual growth rate of 2.71% but a variance of 43.39 over the same period.

If *actual* unit costs were to grow at 2.6% over the same ten years, one might expect the EGS to offer a better prediction of the actual value of ODV in year ten since its average growth differs by only 0.11% compared to 0.58% for CPI. However, the significant volatility of that index actually causes the estimated ODV to differ significantly from actual ODV and so causes the reported ROI also to be more volatile. In fact, use of the CPI requires the least adjustment of ODV values in year ten.³

³ Note that throughout this paper we use a hypothetical example of an electricity lines business with a starting ODV asset value of \$1m and an initial net operating surplus (that is: revenue – operating costs – depreciation – tax) of \$50,000. The depreciation rate is assumed to be zero for simplification purposes, although this does not affect the comparisons between ROIs. Net operating surplus is the same under each scenario, and is assumed to increase by the change in the CPI each year, to allow us to isolate the effect on ROI of different indexation options. This set of assumptions is consistent with the Commission's CPI-linked price path threshold. Working capital and non-system fixed assets are assumed to be zero, and the denominator of ROI is the average asset value over the year, less half revaluations where appropriate.



This analysis shows that volatility appears to be a primary concern when choosing an index to inflate the asset base. Irrespective of how well an index reflects *actual average* annual growth over a period, if the index is volatile there is no reason to conclude that it will deliver a more stable measure of ROI.

Inherent to the following analysis is therefore the trade-off between achieving a smooth ROI in the years between revaluations, and minimising the required adjustment in the years in which revaluations occur.

Indexation Options

We have considered several indices available from Statistics New Zealand that may be appropriate for indexing ODVs between full revaluations. These are:

- Consumers Price Index (CPI);
- Producers Price Index (outputs) (PPI(out));

- Producers Price Index (inputs) (PPI(in)); and
- Capital Goods Price Index (CGPI).

PPI(out) is derived from combining PPI(in) and CGPI in addition to the labour cost index. There is currently no published subset of these indices that specifically reflects electricity distribution system fixed assets. There are subsets of the PPI for Electricity, Gas and Water and Electricity Generation and Supply; however these subsets tend to be significantly more volatile than the aggregated indices, as demonstrated above. Furthermore, both subsets reflect changes in costs that are not relevant to an electricity lines business, including the cost of gas, water, and electricity generation, and so there is no reason to believe these subsets would more accurately reflect changes in electricity distribution system fixed asset costs than CPI, PPI or CGPI.

The following table summarises the average, variance, maximum and minimum values for each of the indices identified over the period March 1994 to March 2004.⁴

Table 1

	CPI	PPI(out)	PPI(in)	CGPI
Average annual growth rate	2.04%	1.70%	1.64%	1.18%
Variance ⁵	0.12	0.37	0.85	0.22
Maximum	3.95%	5.90%	8.00%	4.04%
Minimum	-0.10%	-0.40%	-1.30%	-0.88%

We have also examined each of the five-year periods from March 1994 to March 2004 (ie, March 1994 to 1998, March 1995 to 1999, etc) and the CPI also has the lowest variance in both these two periods. This is consistent with the general expectation that a more comprehensive index will show greater stability over time.

Changes in Unit Costs Over Time

As noted above, there is a trade-off between stability over time and the magnitude of any necessary revaluations every fifth year. Consequently, the choice of index turns on assumptions or expectations about the actual growth in the unit cost of system fixed assets

⁴ These calculations were made using a point-to-point estimate, ie, the change in inflation between March and March each year.

⁵ Note that variances have been scaled up by 1000 for presentational purposes.

over the period. One difficulty with this analysis is the paucity of data on unit cost changes over time.

We have two potential sources of information:

1. the change in the total ODV of system fixed assets for all ELBs between 2003 and 2004, where the 2003 valuations reflect 1994 standard unit costs and the 2004 valuations reflect 2004 unit costs; and
2. an Orion-specific measure of the change in unit costs, constructed by comparing Orion's 2003 ODV, obtained using the 1994 standard unit costs, with its 2003 FRS-3 valuation, using updated costs.

Each of these potential measures of the change in unit costs over time has deficiencies. The change in ELB's total ODV between 2003 and 2004 was 28%.⁶ This figure reflects the impact of several components: changes in quantities between 2003 and 2004; changes in the valuation of non-standard assets between 2003 and 2004; and changes in costs between 1994 and 2004. It would be a time-consuming exercise to extract the cost change component from that 28%. However, we note that in past years, where no change in costs occurred, changes in ODV between years have ranged from -0.54% to 5.46%.⁷ Thus it seems reasonable to assume that much of the change between 2003 and 2004 was due to the reflection of updated unit costs. An increase of 28% over ten years represents an annual average compound growth rate of 2.50% per annum.

In 2003 NERA constructed an Orion-specific index for the purpose of estimating changes in unit costs over time.⁸ A comparison between ODV handbook standard unit costs and updated unit costs used in the FRS-3 valuation suggested unit costs have increased by 27% over 9 years, ie, a 2.44% compounded annual growth. This potential estimate of changes in actual costs is useful in that the ODV and FRS-3 valuations use consistent quantities. However, the index reflects increases in costs based on Orion's specific mix of assets. ELBs with different proportions of assets will see either greater or smaller changes in costs, reflecting their own mix of assets.

Both these estimates rely on just two point estimates spanning a nine- or ten-year period, and so give no indication of how costs are likely to change over a five-year period, or whether the magnitude of the cost change can be expected to be similar over time. To avoid the need to rely on a single actual growth rate based on either of the above methods, we

⁶ Vector's presentation during Day 2 of Review of the Information Disclosure Regime and implementing Valuation Choice for System Fixed Assets, 18 March 2005, p.251

⁷ Obtained from the Ministry of Economic Development's website

⁸ See NERA, *Estimating the Rate of Economic Profit for Electricity Lines Businesses*, November 2003 for more information

have analysed the stability of reported ROI using a range of what we believe to be reasonable average growth rates, guided by the growth rates identified above.

Analysis and Results

For each postulated actual growth rate in unit costs, or scenario, we have calculated the implied ROI under the following assumptions:

- the starting asset base is \$1m and is inflated by the appropriate index each year based on actual movement in indices over the last ten years;
- net operating surplus (ie, NOS, or revenue less operating costs less tax less depreciation, as consistent with the disclosure definition) is \$50,000 at the beginning of the first year and increases by CPI each year for each indexation method; and
- capital expenditure, working capital and non-system fixed assets are assumed to be zero.

ROI in year t is then: $(\text{NOS} + \text{revaluations}) / (\text{average asset base over the year} - \text{half the revaluations})$.

For each assumption about unit cost changes, the ten-year period from 1995 to 2004 has been examined in addition to each of the six five-year periods within that time frame. The index that produces the smoothest ROI in any given period, given our assumption about actual growth, is then identified. A sample output for one scenario, and the average and variance of each index under each scenario, is appended to this letter.

The results are set out in the table below. The first three rows identify the assumed actual average growth rate of unit costs over a ten-year period, a five-year period, and the implied compounded annual growth per annum under each scenario. The index that produces the smoothest ROI path in a given year is identified under each scenario.

The purpose of including the total growth over the ten and five-year periods is to emphasise that although the actual growth rate in any given year may vary outside the range we have examined, it is the total growth over the five or ten-year period that is important, since the revaluations do not occur every year. The compounded annual growth rate simply serves as an indication of the *average* growth in any given year.

Table 2
Comparison of Choice of Index under Various Cost Growth Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Actual total growth over 10 years	5.11%	10.46%	16.05%	21.90%	28.01%	34.39%
Actual total growth over 5 years	2.53%	5.10%	7.73%	10.41%	13.14%	15.93%
Actual average per annum growth	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
1995 - 2004	CGPI	CGPI	PPI(out)	CPI	CPI	CPI
1995 - 1999	PPI(in)	PPI(out)	PPI(out)	CPI	CPI	CPI
1996 - 2000	PPI(out)	PPI(out)	CPI	CPI	CPI	CPI
1997 - 2001	CGPI	CPI	CPI	CPI	PPI(out)	PPI(out)
1998 - 2002	CPI	CPI	CPI	CPI	PPI(out)	PPI(out)
1999 - 2003	CPI	CPI	CPI	CPI	CGPI	PPI(out)
2000 - 2004	CGPI	CGPI	CGPI	CPI	CPI	CPI

Several observations are worth noting from this table:

- for any given actual growth rate, the index that provides the most stable path for ROI over a particular 5-year period depends on how smooth that index is and how closely it predicts revaluations in the final year. The best index for any particular period therefore changes over time as growth rates and volatility change;
- for any given growth rate, CPI provides a less volatile ROI measure more often than any other index;
- CPI is the only index that provides the most stable path for ROI at least once for every actual growth rate;
- the available data on actual growth rates (approximately 2.4% per annum) strongly suggests CPI provides the more stable outcomes;
- under an assumption of relatively low growth in actual unit costs (0.5% to 1.0%), there is no clear choice of index in the years in which CPI is not the preferred option;
- PPI(out) tends to jump around, providing a more stable ROI path under an assumption of low actual growth in some years, but providing a more stable path under an assumption of high growth in other years, as does CGPI to some extent; and
- the index that provides the most stable path for ROI in any given five-year period depends crucially on an assumption about how unit costs can be expected to change over that period.

These results are based on the last ten years of movements in CPI, PPI(out), PPI(in) and CGPI and do not necessarily provide an indication of how these indices will behave in the future.

Given the apparent superiority of CPI over the last ten years for the purpose of deriving a stable reported ROI, we examined the conditions that would have to hold for CPI always to provide a smoother path with each period. These results are tabled below.

Table 3
Range of unit cost inflation rates over which CPI would result in the smoothest path

Period	Minimum required <i>average</i> change in costs per annum over 5 years	Maximum required <i>average</i> change in costs per annum over 5 years
1995 – 1999	1.65%	Upwards of 7%
1996 – 2000	1.05%	Upwards of 7%
1997 – 2001	1%	2%
1998 – 2002	Less than -2%	2.3%
1999 – 2003	Less than -2%	2.1%
2000 - 2004	1.89%	3.5%

Provided that the annual average change in unit costs was not less than 1.05% or more than 2.3%, CPI would have provided the smoothest ROI path in four out of the six periods examined.

Choice of WACC Framework

Under both a nominal and a real framework for reported ROI, and where ODV values are indexed each year by the CPI, the underlying revenues and asset values will be identical in every year. During the years between revaluations, a real framework will necessarily deliver a more stable reported ROI because it does not contain the volatile inflation component. This stems from the definition of nominal WACC, which is simply real WACC plus inflation.

During the year in which unit costs are adjusted so as to be in line with market values, and so ODV revaluations take place, the revaluation under a real WACC will comprise the change in asset value from the previous year less the inflation component. By contrast, under a nominal WACC framework, the revaluation component is simply the difference between the two years' successive ODV values, since inflation is already allowed for. This implies that the stability of the reported ROI in that final year is dependent on the level of both revaluations and inflation in the revaluation year.

Where inflation and revaluations move in opposite directions, ie, one is positive and the other negative, the reported ROI under a real WACC framework will be more volatile in the year of the revaluation, since the required revaluations will be greater. Where inflation and revaluations move in the same direction, the relative stability of a nominal versus a real WACC framework in the revaluation year is unclear and depends on the relative changes in inflation and revaluations.

The impact on relative volatility over the full five-year period between revaluations therefore depends on the extent of volatility in the final year. The relative stability of ROI in interim years under a real WACC serves to offset some of the variation in the revaluation year; however, where the difference between inflation and revaluations is extreme, the resulting extreme variation in the final year may result in the nominal WACC providing a smoother ROI path.

To ascertain the likelihood of a real WACC delivering a more stable ROI path on average than a nominal WACC, we have conducted a similar analysis to that for the comparison of indices, using a range of assumptions about changes in unit costs over time and analysing historical data from 1994 to 2004. Under both frameworks we assume ODV is indexed by CPI. The resulting average ROI and variance under each scenario are appended.

The results show that in approximately 83 per cent of the scenarios, the use of CPI indexation with a real WACC provided a more stable reported ROI than adoption of CPI and a nominal framework.

Conclusions

The two key criteria in choosing an index are volatility over time and accuracy in predicting changes in actual unit costs over time. A critical component of analysing potential indices is therefore knowledge of how actual unit costs *do* change over time. Unfortunately there is very limited evidence on cost changes for electricity distribution fixed assets.

Our analysis has therefore focussed on the choice of index under varying assumptions about actual growth. This analysis suggest that, for the most part, the CPI is likely to deliver a more stable measure of ROI over time than PPI(out), PPI(in) or CGPI. It must be remembered, however, that these results are derived from one set of index figures over a ten-year period, and so do not necessarily provide an accurate picture of expected movements in indices over the next ten years.

Furthermore, the volatile nature of indices suggests that over several five-year periods, the index that produces the smoothest ROI path will not necessarily be the same for each of those five-year periods. Based on the available evidence, however, CPI does appear to be the preferable index.

n/e/r/a

The relative volatility of reported ROI under a real WACC, as distinct from a nominal WACC, framework for reporting returns, where ODV is indexed by CPI, depends not only on the actual level of revaluations, but also the magnitude and direction of inflation in the revaluation year. Although it is difficult to predict with any accuracy how inflation will change in any given year, the available data suggests that on average the adoption of a real WACC framework would produce a smoother ROI over a given five-year period, and will certainly provide a smoother path over the years between revaluations. The underlying revenues and asset values, however, are the same under either option.

Should you wish to discuss any aspect of this letter, please do not hesitate to contact me.

Best regards

A handwritten signature in black ink that reads "Greg Houston". The signature is written in a cursive style with a large, stylized initial "G".

Greg Houston
Director

Appendix 1: Sample Spreadsheet for 1999 to 2003 under 2% Actual Annual Growth

Actual average growth assumption: 2.00% **Actual ODV in year 5:** \$1,104,081

CPI	Index	ODV	Net Surplus	Revaluations	Average ODV	ROI
31-Mar-98		\$1,000,000	\$50,000			
31-Mar-99	-0.10%	\$998,999	\$49,950	-\$1,001	\$999,499	4.89%
31-Mar-00	1.50%	\$1,014,014	\$50,701	\$15,015	\$1,006,507	6.58%
31-Mar-01	3.06%	\$1,045,045	\$52,252	\$31,031	\$1,029,530	8.21%
31-Mar-02	2.59%	\$1,072,072	\$53,604	\$27,027	\$1,058,559	7.72%
31-Mar-03	2.52%	\$1,104,081	\$54,955	\$4,982	\$1,088,076	8.11%

PPI (out)	Index	ODV	Net Surplus	Revaluations	Average ODV	ROI
31-Mar-98		\$1,000,000	\$50,000			
31-Mar-99	0.40%	\$1,004,000	\$49,950	\$4,000	\$1,002,000	5.39%
31-Mar-00	3.60%	\$1,040,144	\$50,701	\$36,144	\$1,022,072	8.65%
31-Mar-01	5.90%	\$1,101,512	\$52,252	\$61,368	\$1,070,828	10.92%
31-Mar-02	3.10%	\$1,135,659	\$53,604	\$34,147	\$1,118,586	7.97%
31-Mar-03	-0.40%	\$1,104,081	\$54,955	-\$31,579	\$1,119,870	2.06%

PPI(in)	Index	ODV	Net Surplus	Revaluations	Average ODV	ROI
31-Mar-98		\$1,000,000	\$50,000			
31-Mar-99	-0.20%	\$998,000	\$49,950	-\$2,000	\$999,000	4.79%
31-Mar-00	5.20%	\$1,049,896	\$50,701	\$51,896	\$1,023,948	10.28%
31-Mar-01	8.00%	\$1,133,888	\$52,252	\$83,992	\$1,091,892	12.98%
31-Mar-02	2.80%	\$1,165,637	\$53,604	\$31,749	\$1,149,762	7.53%
31-Mar-03	-1.30%	\$1,104,081	\$54,955	-\$61,556	\$1,134,859	-0.60%

	CGPI	ODV	Net Surplus	Revaluations	Average ODV	ROI
31-Mar-98		\$1,000,000	\$50,000			
31-Mar-99	0.09%	\$1,000,892	\$49,950	\$892	\$1,000,446	5.08%
31-Mar-00	1.85%	\$1,019,427	\$50,701	\$18,535	\$1,010,160	6.92%
31-Mar-01	4.04%	\$1,060,647	\$52,252	\$41,219	\$1,040,037	9.17%
31-Mar-02	1.61%	\$1,077,738	\$53,604	\$17,091	\$1,069,192	6.67%
31-Mar-03	0.37%	\$1,104,081	\$54,955	\$26,343	\$1,090,909	7.08%

Appendix 2: Comparing Indices: Average and variance of ROI under each scenario

1995 - 2004		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.71%	5.83%	5.86%	5.93%	2.3239	1.8322	2.4604	0.4502	
1.0%	6.16%	6.29%	6.31%	6.41%	1.2056	0.9389	1.5015	0.2122	
1.50%	6.62%	6.76%	6.79%	6.93%	0.4583	0.4509	0.9386	0.4732	
2.00%	7.11%	7.26%	7.28%	7.46%	0.1384	0.4282	0.8308	1.3032	
2.50%	7.61%	7.78%	7.80%	8.02%	0.3079	0.9369	1.2430	2.7791	
3.00%	8.14%	8.33%	8.34%	8.60%	1.0352	2.0498	2.2470	4.9858	

1995 - 1999		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.66%	5.76%	5.79%	5.80%	1.6701	0.0875	0.0186	0.1198	
1.0%	6.13%	6.26%	6.29%	6.31%	0.9499	0.0299	0.0884	0.3570	
1.50%	6.61%	6.77%	6.81%	6.83%	0.4431	0.2261	0.4197	0.8656	
2.00%	7.10%	7.28%	7.33%	7.36%	0.1633	0.6916	1.0282	1.6617	
2.50%	7.60%	7.81%	7.86%	7.90%	0.1245	1.4421	1.9302	2.7620	
3.00%	8.10%	8.35%	8.41%	8.45%	0.3413	2.4944	3.1427	4.1840	

1996 - 2000		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.58%	5.67%	5.69%	5.75%	0.3867	0.0025	0.0398	0.2374	
1.0%	6.07%	6.18%	6.20%	6.26%	0.1249	0.1113	0.2832	0.6951	
1.50%	6.57%	6.69%	6.72%	6.79%	0.1046	0.4839	0.7985	1.4374	
2.00%	7.08%	7.22%	7.25%	7.33%	0.3406	1.1361	1.6018	2.4808	
2.50%	7.60%	7.75%	7.79%	7.88%	0.8481	2.0843	2.7098	3.8429	
3.00%	8.13%	8.30%	8.34%	8.44%	1.6432	3.3457	4.1399	5.5415	

1997 - 2001		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.58%	5.64%	5.67%	5.74%	0.2313	0.4569	0.8708	0.1955	
1.0%	6.08%	6.13%	6.16%	6.25%	0.0620	0.2193	0.5753	0.5231	
1.50%	6.58%	6.63%	6.66%	6.77%	0.1395	0.2247	0.5196	1.1275	
2.00%	7.09%	7.14%	7.16%	7.30%	0.4787	0.4879	0.7181	2.0249	
2.50%	7.62%	7.66%	7.68%	7.85%	1.0954	1.0243	1.1863	3.2324	
3.00%	8.15%	8.19%	8.21%	8.40%	2.0057	1.8500	1.9401	4.7677	

1998 - 2002		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.61%	5.64%	5.70%	5.66%	0.5539	2.5547	4.8496	0.6951	
1.0%	6.09%	6.10%	6.15%	6.15%	0.2287	1.7290	3.7225	0.3967	
1.50%	6.59%	6.58%	6.61%	6.65%	0.1408	1.1105	2.7839	0.3375	
2.00%	7.09%	7.06%	7.08%	7.15%	0.3048	0.7121	2.0460	0.5322	
2.50%	7.61%	7.56%	7.56%	7.67%	0.7360	0.5478	1.5218	0.9961	
3.00%	8.14%	8.06%	8.05%	8.20%	1.4500	0.6317	1.2245	1.7450	

1999 - 2003		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.63%	5.61%	5.65%	5.61%	0.9048	3.8294	6.1959	1.1180	
1.0%	6.11%	6.06%	6.09%	6.09%	0.4348	2.7422	4.8594	0.5889	
1.50%	6.60%	6.53%	6.54%	6.58%	0.1933	1.8453	3.6975	0.2845	
2.00%	7.10%	7.00%	7.00%	7.08%	0.1944	1.1511	2.7218	0.2190	
2.50%	7.61%	7.48%	7.47%	7.58%	0.4530	0.6726	1.9445	0.4069	
3.00%	8.13%	7.97%	7.95%	8.10%	0.9842	0.4231	1.3783	0.8633	

2000 - 2004		Average ROI				Variance			
Actual change	CPI	PPI(out)	PPI(in)	CGPI	CPI	PPI(out)	PPI(in)	CGPI	
0.5%	5.27%	5.20%	5.20%	5.24%	2.608	4.505	6.852	1.850	
1.0%	6.15%	6.07%	6.04%	6.14%	0.997	2.451	4.389	0.612	
1.50%	6.63%	6.53%	6.50%	6.62%	0.448	1.648	3.351	0.277	
2.00%	7.12%	7.01%	6.96%	7.12%	0.124	1.054	2.506	0.180	
2.50%	7.61%	7.49%	7.43%	7.62%	0.038	0.680	1.867	0.334	
3.00%	8.12%	7.99%	7.92%	8.14%	0.205	0.542	1.447	0.754	

Appendix 3: Comparing WACCs: Average and variance of ROI under each scenario

1995 - 2004	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.71%	3.68%	2.091532	1.814293
1.0%	6.16%	4.13%	1.085022	0.862694
1.50%	6.62%	4.59%	0.412499	0.241768
2.00%	7.11%	5.07%	0.124595	0.001448
2.50%	7.61%	5.57%	0.277151	0.196794
3.00%	8.14%	6.10%	0.931666	0.888443

1995 - 1999	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.66%	3.83%	1.6701	0.8257
1.0%	6.13%	4.30%	0.9499	0.3318
1.50%	6.61%	4.78%	0.4431	0.0562
2.00%	7.10%	5.27%	0.1633	0.0123
2.50%	7.60%	5.77%	0.1245	0.2143
3.00%	8.10%	6.28%	0.3413	0.6769

1996 - 2000	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.58%	4.24%	0.3867	0.3382
1.0%	6.07%	4.73%	0.1249	0.0568
1.50%	6.57%	5.22%	0.1046	0.0128
2.00%	7.08%	5.73%	0.3406	0.2208
2.50%	7.60%	6.24%	0.8481	0.6958
3.00%	8.13%	6.77%	1.6432	1.4536

1997 - 2001	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.58%	4.08%	0.2313	0.4791
1.0%	6.08%	4.56%	0.0620	0.1218
1.50%	6.58%	5.06%	0.1395	0.0001
2.00%	7.09%	5.56%	0.4787	0.1285
2.50%	7.62%	6.08%	1.0954	0.5219
3.00%	8.15%	6.60%	2.0057	1.1962

1998 - 2002	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.61%	3.93%	0.5539	0.6483
1.0%	6.09%	4.41%	0.2287	0.2168
1.50%	6.59%	4.90%	0.1408	0.0144
2.00%	7.09%	5.40%	0.3048	0.0553
2.50%	7.61%	5.91%	0.7360	0.3541
3.00%	8.14%	6.43%	1.4500	0.9263

1999 - 2003	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.63%	3.72%	0.9048	0.9329
1.0%	6.11%	4.20%	0.4348	0.3974
1.50%	6.60%	4.68%	0.1933	0.0832
2.00%	7.10%	5.17%	0.1944	0.0041
2.50%	7.61%	5.68%	0.4530	0.1745
3.00%	8.13%	6.19%	0.9842	0.6092

2000 - 2004	Average		Variance	
	Nominal	Real	Nominal	Real
Actual change				
0.5%	5.27%	3.03%	2.607921	2.176046
1.0%	6.15%	3.91%	0.9966	0.733471
1.50%	6.63%	4.38%	0.448476	0.271779
2.00%	7.12%	4.87%	0.124421	0.03228
2.50%	7.61%	5.36%	0.038336	0.028685
3.00%	8.12%	5.86%	0.204678	0.275253