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Roma – Brisbane Pipeline: NPV DORC key inputs

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1. INTRODUCTION

The ACCC Draft Decision on the Roma-Brisbane Pipeline (RBP) Access Arrangement states that the NPV DORC valuation method is incapable of being applied to arrive at a robust valuation for a natural gas transmission pipeline.[1] The Commission's evidence in support of this proposition is the divergence between its own NPV DORC result of $171.6m and APT's result of $342.6m.

In fact, though, this divergence is driven by three important differences in approach between the ACCC and APT, namely:

- Different timing on asset renewals is assumed in the two calculations;
- Adoption by the Commission of the so-called "Incumbent perspective" creates an additional tax expense for the existing pipeline that materially reduces the DORC value; and
- Different discount rates are used in the two calculations.

If these three differences were resolved, then the ACCC and APT calculations would converge to a single well-defined valuation.

An additional point of difference raised by the Commission, namely the use by APT of a pre-tax discount rate and pre-tax cashflows versus its own use of a post-tax framework, turns out to make only a very slight difference to the valuation in practice.

The purpose of this note is to present a conceptual framework for the application of DORC principles to the valuation of existing regulated gas pipelines which is intuitively obvious, and which permits the merits of the various approaches on Incumbent versus New Entrant perspectives, and on discount rates to be evaluated decisively.

The following sections present the conceptual framework, then discuss the Incumbent and other perspectives, then discount rates. Timing differences for asset renewals are the subject of separate submissions by APTPPL.

1 See Draft Decision, p. 32: "The extent of this variance leads the ACCC to conclude that it can have little confidence that the use of NPV DORC is likely to produce an ICB figure that is consistent with the principles in s.8.1 of the code."

2. CONCEPTUAL FRAMEWORK FOR DORC

The aim of price regulation is to establish prices for natural monopoly services that are comparable to those that would have prevailed had the services been provided in workably competitive markets. The emphasis on workable, rather than perfect competition reflects the fact that infrastructure services involve fixed costs that would not be recoverable under the strict marginal cost pricing that would prevail in perfectly competitive markets.

As the asset valuation is a key determinant of the regulated price, the natural question is "what valuation would prevail in a workably competitive market?" For a brand-new asset, the answer is straightforward: efficient actual cost, assuming that in a competitive market the asset would be built to its current specifications. The Optimised Replacement Cost (ORC) valuation method caters for that qualification.

The valuation becomes more difficult when the asset is not new. Intuitively it seems necessary to discount the ORC value to reflect the fact that the asset is partially depreciated: its remaining life is shorter than a new asset; it is likely to be more expensive to operate than a new asset; and the owner has presumably already recovered some of its initial capital investment. The depreciated ORC value (DORC) is, of course, the quantity of particular interest to regulators in price determination. To date, economics and regulatory practitioners have struggled to agree on a method of appropriately quantifying this discount.

Discussions in the regulatory literature and precedent material display a sense of confusion over the appropriate method of implementing the conceptual framework[2] for the DORC calculation. Before the discount can be quantified it is necessary to understand why exactly the discount is applied. A conceptual framework is proposed below that is intuitively obvious and which provides helpful guidance on the most contentious questions.

2.1. COMPETITIVE MARKET FOR PIPELINE SERVICES

It is well accepted that regulation attempts to replicate outcomes that would have prevailed in a workably competitive market. It is not impossible to imagine a competitive market for gas pipeline services. The prerequisites for a given pipeline in such a market are as follows:

- the pipeline's destination is served by many pipelines, possibly from different sources;

2 There is broad agreement that DORC should be based on present values of forward-looking quantities, and that the centrepiece of these calculations is a build vs. buy decision concerning the pipeline in question. The specifics of implementation remain controversial, and it is these specifics that can be illuminated by setting out the conceptual framework in more detail.

- the delivered price of gas at this destination is established by competition between gas suppliers using these pipelines, as well as competitive conditions on the demand side;
- the pipeline in question supplies such a small proportion of the overall gas delivered to the destination that it is not capable of influencing the gas price there by manipulating its own output;
- the pipeline's point of origin is served by many other pipelines, possibly going to different destinations; and
- the pipeline in question transports such a small proportion of the overall gas produced at the point of origin that it is not capable of influencing the well-head gas price by manipulating its own output.

These competitive market assumptions lead to several important observations. First, competition between pipelines will ensure that, over any pipeline's life cycle, its owners will earn zero economic profit. Second, the construction of a new pipeline in direct competition to the existing pipeline will have no effect on either the quantity of gas transported on the existing pipeline or the market price for gas transportation services—in other words, the arrival of a direct competitor will not lead an existing player to discount its price or reduce its output.

2.2. ALTERNATIVE THOUGHT EXPERIMENT

Another way of looking at the concepts underlying DORC is to posit a perfectly contestable market for the right to hold a pipeline franchise. In this section this alternative framework is developed in order to provide more clarity over the likely tax implications of contestability.

In order for a pipeline valuation to induce efficient investment, it must at least provide the owner with the minimum amount of compensation required to induce that owner to build the pipeline, subject to a schedule of payments that spreads the valuation amount over time.

The simplest mechanism that will yield this valuation is a competitive tender for the right to own and operate the existing pipeline, where the tender will be won by the bidder offering the lowest pipeline tariff. If one assumes a perfectly competitive field of bidders, as one would get in a Bertrand auction, the valuation question boils down to what would be the minimum (i.e., winning) bid?

In each year, the pipeline owner incurs costs, and for the first N years the owner also obtains a tax benefit through deductibility of depreciation. At the end of N years, the original owner can obtain further tax benefits by selling the pipeline to another owner. The further tax benefits will be reflected in that future sale price.

At the outset the first owner, in purchasing the pipeline, obtains two[3] sets of tax entitlements: one for years 1 … N, and one for years N+1 … 2N. The second set of entitlements can be realised by the first owner through a forward contract for sale of the pipeline at the end of year N. As the field of bidders for the initial pipeline franchise is assumed to be competitive, any successful bidder can be expected to propose initial ownership by itself (purchaser A) for the first N years, then ownership by a "stapled" purchaser B for the second N years. A successful bid would therefore reflect the expected cost profile and the present value of the stream of tax benefits over 2N years. If a bidder only took account of the first N years' tax benefit, it would be underbid by another offer that took account of the second N years' benefit.

The situation becomes even clearer if one thinks of the tax credit as an asset that is attached to the pipeline. The owner, selling the pipeline and tax credit asset at year 0 would sell it for a price that included 2N years' worth of tax benefits. If it sold for only N years' worth of benefits it would be handing the present value of the second N years' tax credits as a gift to the new owner.

Therefore, the payment that would make the owner indifferent between operating the pipeline itself and entering into a resale deal at the end of year N must include the present value of tax credits from years N+1 … 2N, as the opportunity cost to the owner of continuing to operate the pipeline itself is the amount that corresponds to the present value of those tax credits.

The upshot of these considerations is that it is incorrect to assume in the NPV DORC calculation that an incumbent owner does not obtain any tax depreciation benefits from the existing pipeline.

2.3. DECISIONS FACING VARIOUS PLAYERS

Given this characterisation of a competitive market for gas pipeline services, the question of interest is what valuation would be placed by various players on an existing pipeline?

A hypothetical new entrant (HNE) to this market faces a decision between constructing a new pipeline or purchasing the incumbent's existing pipeline at a mutually agreeable price. The highest price the HNE would pay for the existing pipeline is the price at which it would be indifferent, in a net present value sense, between building or buying second-hand. This "New Entrant Perspective" gives rise to the NPV DORC calculation that was proposed by APT and explained in detail in the earlier CRA Report of February 2006.

3 If the tax life of a pipeline, N, is 20 years, but its engineering life is 80, then up to 4N years' worth of tax credits may be attainable by reselling it three times. In order to simplify the discussion here, we only consider 2N years, but the concepts would apply equally for any number of resale events.

Of course, as the ACCC has noted, there are other players in this competitive market, namely the incumbent and the group of gas consumers at the destination, not to mention gas producers at the point of origin. It is important to consider the decisions these players face as well.

The incumbent faces two decisions, which will be analysed in more detail in the next section:

1. faced with an offer from a new entrant to buy the existing pipeline, whether to accept, and if so what reservation price[4] to put on the asset; and

2. in the absence of an offer to buy the existing pipeline, when should it be replaced with a new pipeline to continue the business.

The gas customers do not, strictly speaking, face any decisions regarding the construction of a new pipeline, as they do not control this outcome. Nevertheless it is instructive to consider what decision they would prefer, if they had a voice.

Similarly, barring vertical integration between gas production and pipeline ownership (which is absent in the case of the RBP), gas producers do not face any decision regarding the construction of a new pipeline. Still, it is instructive to consider what decision producers would prefer, if they had some control over the decision.

These questions are examined in the section below.

4 The seller's reservation price is the lowest price the seller would accept to part with the existing pipeline. The buyer's reservation price is the highest price the buyer would pay to acquire the existing pipeline.

3. INCUMBENT PERSPECTIVE

The Commission bases its own NPV DORC calculation on what it describes as the "Incumbent Perspective", by which it means that the option of operating the existing pipeline is made more costly by the absence of tax benefits that would accrue to a new entrant[5] but not an incumbent owner. NPV DORC is reduced when the existing pipeline becomes more costly to operate. This section evaluates the Commission's Incumbent Perspective approach in the light of the conceptual framework for pipeline competition outlined above.

3.1. DECISION TO SELL TO NEW ENTRANT

Any incumbent calculation must be made in the context of a specific decision that the incumbent might face. There are really only two decisions the incumbent could realistically take that would involve a valuation of the existing pipeline: first, what reservation price to apply in evaluating an offer to buy from a new entrant and second, assuming no change in ownership, when to replace the existing pipeline with a new one. The first question is considered here, and the second in the following subsection.

The incumbent would accept any offer to buy the existing pipeline at a price exceeding the expected net present value of continued ownership. That net present value represents the incumbent's reservation price. It depends on future revenues and expenditures. Future revenues depend on future haulage tariffs, as well as future gas volumes transported.

The incumbent's reservation price cannot be evaluated without knowing the future haulage tariffs. This fact makes it unsuitable as a reference point for a regulatory asset valuation. Using the minimum price the incumbent would accept to sell the existing pipeline as the regulatory valuation would create an irresolvable circularity: the regulated tariff depends on the regulatory valuation, which would depend on the incumbent reservation price, which depends on the regulated tariff. Therefore, the incumbent's reservation price, whatever it might be, sheds no useful light on the question of NPV DORC.[6]

5 A new entrant buying a second-hand pipeline is permitted to claim depreciation on the purchase price as a tax deduction. In contrast, an incumbent owner of a pipeline is likely to have used up its tax deductions in the past.

6 Note, however, that this circularity problem does not affect the NPV DORC calculation for the HNE reservation price. The HNE reservation price depends only on the comparison of present values of costs between the existing and new pipelines. Revenue only comes into the HNE NPV DORC calculation insofar as it must be sufficient to justify replacement of the pipeline when it is life expired.

3.2. DECISION TO REPLACE EXISTING PIPELINE

The incumbent would replace the existing pipeline when the net present value of future expenditures on the existing pipeline equals or exceeds the net present value of future expenditures on the new pipeline, including the capital cost of acquiring it. The comparison is able to be made on the basis of expenditures alone by our assumptions that the pipeline tariff is independent of which pipeline transports the gas, and that the new pipeline has the same capacity as the existing one. These assumptions imply that in each year the revenue earned by the new pipeline is the same as the revenue earned by the existing pipeline.

This comparison of net present values of expenditures is similar to the one that is performed in the NPV DORC calculation, but the decision context implies that replacement of the existing pipeline will only occur when NPV DORC is zero or negative. Recall that NPV DORC represents the capitalised savings a new entrant would achieve by using the existing pipeline instead of building a new one. When it is time to replace the existing pipeline, there are no savings.

Once again, the incumbent's decision to replace the existing pipeline sheds no useful light on the question of NPV DORC.

3.3. ACCC INCUMBENT DORC CALCULATION

The ACCC's own NPV DORC calculation does not correspond to any conceivable decision that an incumbent might make in the competitive pipeline market being discussed here. The Commission has calculated the difference between the NPV of future expenditures that a hypothetical new entrant would face if it elected to construct a new pipeline, and the NPV of future expenditures that the incumbent would face, taking account of the particular tax circumstances of the incumbent in the real world of today, rather than the hypothetical contestable market on which DORC is founded.

The problem with the comparison the ACCC has made is that it mixes evaluations made by different parties. On one hand, the new entrant's NPV of costs for the new pipeline, and on the other, the incumbent's NPV of costs for the existing pipeline.

This defect could possibly be overcome if the new pipeline part of the calculation was interpreted as the NPV of costs that the incumbent would face if it constructed a new pipeline, but this interpretation makes no sense. The incumbent would only construct a new pipeline and abandon its existing pipeline if continuing to operate it was uneconomic, in which case NPV DORC would be zero or negative.

In short, the ACCC's NPV DORC calculation has no bearing on any of the decisions that a new entrant or an incumbent could plausibly face, and therefore it has no relevance to the asset valuation that would arise in a competitive pipeline market.

3.4. TAXATION IN A COMPETITIVE PIPELINE MARKET

The claim might be put that basing NPV DORC on the HNE's perspective would attribute to the incumbent a tax benefit that it may not actually be able to obtain. This benefit arises from the fact that the HNE would be able to claim a tax deduction for the depreciation on its purchase price, DORC, over a period of 20 years. A pipeline that has been under the same ownership for more than 20 years would most likely not receive this tax deduction. Hence, the argument goes, an incumbent would not have access to tax deductions to minimise its costs of owning the existing pipeline, so the "Incumbent DORC" would be lower than the "HNE DORC".

This argument essentially invokes an ad-hoc adjustment to the NPV DORC valuation in order to prevent the incumbent obtaining a revenue benefit by virtue of its ability to sell the pipeline to a party that could obtain tax deductions for depreciation on the second-hand purchase price.

This ad-hoc adjustment is inconsistent with the behaviour that would be expected in a competitive pipeline market. Such a market, in equilibrium, would have a single gas transportation price, meaning that for two pipelines with identical capacity the ***pre-tax*** revenues would be equal. In such a market, if equal pre-tax revenues led to unequal post-tax revenues, then the firm with the disadvantageous tax position would modify its behaviour. In the particular case in point, the behaviour modification is that incumbent pipeline owners would sell their pipelines once the tax deductions for depreciation had been used up. In equilibrium in a competitive pipeline market, incumbents would never be in the disadvantageous tax position that the ACCC has assumed for its Incumbent DORC calculation.

Once that characteristic of competitive pipeline markets is taken into account, the properly construed Incumbent DORC coincides with the HNE DORC as calculated by APTPPL and CRA.

3.5. CONSUMER PERSPECTIVE

NERA's paper considers the NPV DORC calculation from three perspectives: the HNE and Incumbent perspectives already mentioned, and also the perspective of gas consumers.[7] Unlike the HNE and Incumbent, consumers do not have an explicit reason for valuing a gas pipeline, as they do not build, buy or sell pipelines. Further, it is not clear what influence, if any, consumers have over the ownership and construction decisions taken by others.

If, for the sake of argument, these practical issues are put to one side and it is supposed that the consumers' preference for an existing or newly constructed pipeline were in some way influential in the decision, then it is of some interest to consider what these preferences might be in the competitive pipeline market being considered here.

7 "Comparison of DORC Estimation Procedures," NERA, 25 July, 2006, pp. 13-14.

The fundamental question in this connection is whether consumers would be better off as a result of a decision to build a new pipeline, and to what extent that answer might be affected by the value of the existing pipeline.

The answer is that consumers would be indifferent, and that this indifference would not be affected by the valuation of the existing pipeline. The reason is that the competitive pipeline market establishes the haulage tariff through competition. This tariff applies to the existing pipeline and to any new pipeline that might be constructed. The delivered price of gas to these consumers is not affected by the decision to construct a new pipeline.

For this reason, the consumer perspective does not shed any useful light on the quantification of NPV DORC.

3.6. PRODUCER PERSPECTIVE

Although it has not so far been raised by the ACCC or any of its advisers, for completeness it is worth considering whether the gas producer's perspective would yield a usefully different value for NPV DORC.

We assume, in keeping with the facts of the RBP, that the incumbent has no interests in upstream production, and vice versa, and that the new entrant would not have any upstream interests either.[8]

In characterising the competitive pipeline market, it was assumed above that the existing pipeline carries such a small proportion of the gas produced at the point of origin that the wellhead gas price would not be affected by any manipulation of output by the pipeline owner. As the new pipeline would have the same capacity as the existing one, it would have the same inability to influence well-head price. Given those points, the gas producers, like the consumers, would be indifferent between the construction of a new entrant pipeline or not.

For this reason, the producer perspective does not shed any useful light on the quantification of NPV DORC.

8 This assumption is in keeping with current Australian pipeline law which prohibits pipeliners from owning gas. Even if this prohibition were not in effect, permitting the new entrant to have upstream interests would cloud the analysis of the pipeline valuation in an unhelpful way, as it would bring vertical leverage effects into the decision process.

3.7. CONCLUSION ON HNET PERSPECTIVE

In conclusion, the only perspective which sheds any useful light on the NPV DORC estimation is that of the hypothetical new entrant. Despite its superficial appeal, the calculation based on the so-called "Incumbent Perspective" only corresponds to an asset valuation that could conceivably arise in a competitive market for pipeline services, if it is recognised that incumbents in such a market would, in equilibrium, sell their pipelines once the tax deductions had been consumed. In that case, the Incumbent DORC is equal to the HNE DORC as calculated by APTPPL and CRA.

The alternative perspectives of consumers and producers do not shed any further light on the issue, as consumers and producers would each be indifferent between construction of a new pipeline or not, under the competitive market assumptions outlined here.

4. DISCOUNT RATE ISSUE

Because the NPV DORC method involves taking net present values of cash flows over time, the result is strongly influenced by the discount rate chosen. APT's application of the method has adopted the regulatory Weighted Average Cost of Capital (WACC) as the discount rate on the grounds that it best reflects the time value of money relevant to the valuation of a regulated pipeline.

The ACCC, supported by experts including Professor Bruce Grundy, has instead adopted the risk-free rate as the discount rate in its NPV DORC calculation on the grounds that the discount rate should reflect the systematic risk inherent in the cash flows being discounted and that future pipeline expenditures exhibit no systematic risk, according to the Commission.

This section provides a means of reconciling these different views and resolving the question by referring to the competitive market for pipeline services that has been discussed above.

4.1. AXIOMS EMPLOYED

Three assumptions are employed in the discussion below:

1. the NPV of economic profit to the existing pipeline must be zero;
2. the NPV of economic profit to a new pipeline must also be zero;
3. the revenue earned by the new pipeline is the same as that earned by the existing pipeline each year.

The first two assumptions reflect the aim of price regulation generally to eliminate economic profits.[9] Such a zero economic profit outcome would be expected in a competitive market for pipeline services, too. The third assumption would be expected to hold when the new and existing pipelines have the same capacity and face the same haulage tariffs. A single haulage tariff is characteristic of the competitive pipeline market.

4.2. MATHEMATICAL CONSEQUENCES OF AXIOMS

The first assumption implies that the present value of net cash flows to a new entrant purchasing the existing pipeline is zero:

9 That does not mean that regulated firms earn no profit. Rather, the accounting profits earned by regulated firms are intended to reflect their cost of capital. This cost of capital is an economic cost. Earning positive economic profits would be equivalent to earning monopoly rents.

$$PV\ of\ NCF_{buy} = -DORC + \sum_{i=1}^{n} \frac{R_i - E_i}{(1+W)^i} = 0 \qquad (1)$$

The second assumption implies that the present value of net cash flows to a new entrant building a new pipeline is also zero:

$$PV\ of\ NCF_{build} = -ORC + \sum_{i=1}^{n} \frac{R_i - C_i}{(1+W)^i} = 0 \qquad (2)$$

In these formulae, R_i is the revenue earned by a pipeline in year i, E_i is the sum of operating and capital expenditures incurred by the owner of the existing pipeline in year i, C_i is the sum of operating and capital expenditures incurred by the owner of the newly-built pipeline in year i, and W is the discount rate.

The third assumption implies that the terms R_i in the two equations are equal.

To simplify the notation, in what follows the summation ranges are not stated. It should be assumed that all sums are over the index "i" for values from 1 to n. Equating these present values, rearranging terms and cancelling out the revenue terms:

$$DORC = ORC - \sum(E_i - C_i)/(1+W)^i \qquad (3)$$

This formula is the NPV DORC formula applied by APT and CRA in their submissions to the ACCC. Note that it is derived mathematically from the three assumptions mentioned in the previous subsection. If these assumptions hold, then this formula must also.

Because the firm's WACC would normally be used to discount net cashflows in the first two equations, it strongly suggests that the discount rate, W, used in the formulae above should be the WACC in the third equation, too, implying that the discount rate for NPV DORC should also be the pipeline's WACC.

If any doubt remains over the appropriate discount rate, consider the following consequences of using the risk-free rate as the discount rate in the NPV DORC calculation.

First, note that the discount rate used in equation (3) must be the same discount rate that is used in equations (1) and (2) because equation (3) is derived directly from them. The consequence of adopting the risk-free rate as the discount rate in equation (3) is that the risk-free rate would have to be used as the discount rate in equation (2) as well.

Second, note that equation (2) can be rearranged to express the present value of revenues in terms of the present value of costs and ORC:

$$\sum R_i/(1+W)^i = ORC + \sum C_i/(1+W)^i \qquad (4)$$

If the discount rate, W, were set equal to the risk-free rate it would be tantamount to setting the regulated revenue at a level that would represent a return on assets equal to the risk-free rate. A simple example demonstrates this point. To simplify the algebra, assume for this example that the pipeline has an infinitely long life and that revenue and costs are each constant over time. Calling the revenue annuity R:

$$\sum R_i/(1+W)^i = \text{R} \sum 1/(1+W)^i = \text{R X/(1-X), where X} = 1/(1+\text{W})$$

$$= \text{R/W.}$$

Similarly, $\sum C_i/(1+W)^i = \text{C/W}$, where C is the cost annuity.

Substituting these values, equation (4) becomes:

R/W = ORC + C/W, which implies:

$$\text{R} = \text{W} * \text{ORC} + \text{C} \qquad (5)$$

Equation (5) is the familiar building block formula for establishing the regulatory revenue requirement with the depreciation term omitted, reflecting the assumed infinite life of the asset, and the asset value not depreciating as a result. The rate of return on assets that is embedded in the regulatory revenue is W. If W is set at the risk-free rate, as the Commission seeks to do in the NPV DORC calculation, then the asset owner is permitted to earn only the risk-free rate on its investment, not its cost of capital.

For this reason, the discount rate used in the NPV DORC calculation must be the regulatory WACC. Selecting the risk-free rate instead in the DORC calculation would necessarily result in the regulated firm earning below its risk-adjusted cost of capital on its investment. That outcome would be inconsistent with the broad principles for determining the Rate of Return in the preamble to section 8 of the gas code, which require "*a return which is commensurate with the prevailing conditions in the market for funds and the risks involved in delivering the Reference Service.*"

4.3. RELATIONSHIP TO CONCLUSIONS OF GRUNDY AND NERA

Given the reasonableness of the underlying assumptions and the mathematical proof flowing from them, it is important to consider how this conclusion could be so different from those reached by Professor Grundy and NERA. Professor Grundy asserts, as a general matter, that relatively certain expenditure streams should be discounted at a rate lower than the firm's weighted average cost of capital.[10] NERA's commentary on the subject largely follows Professor Grundy's.

Neither Professor Grundy nor NERA qualify these statements with reference to the purpose of the present value calculation, nor the type of firm which is considered. However, these qualifications turn out to be crucial to the question of interest here. The empirical work cited by Professor Grundy and NERA was reported in Brealy, Cooper, and Habib.[11] Unfortunately, that paper provided no detail concerning the sample of UK firms that formed part of that preliminary study. The study's context, being a contrast between behaviour of public sector organisations and private firms, does not suggest that the firms considered were subject to price regulation. Many of NERA's examples concern insurance companies, which are not constrained to earn zero economic profit.

As the foregoing algebraic analysis demonstrates, the fact of price regulation is fundamental to our conclusion, which depends on the three stated assumptions. If these assumptions are not met, as they appear not to be in the examples cited by Professor Grundy and NERA, then our conclusion does not follow.

Thus the positions of Professor Grundy and NERA can be reconciled with the conclusions reached here by observing that the ACCC experts were speaking about firms that are fundamentally different from a covered gas pipeline, which is constrained to earn zero economic profit.

Notwithstanding the general thrust of his comments, Professor Grundy states that the following CRA proposition is correct:[12] "*If it is true that MSP revenues and expenditures exhibit very similar systematic risk profiles, then the correct discount rate to use in the NPV DORC calculation is satisfactorily approximated by the pipeline's WACC.*" If revenues are constrained by regulation to approximate costs, then it is difficult to see how revenues and expenditures could fail to exhibit very similar systematic risk profiles.[13]

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10 Professor Grundy's paragraph 4, in Appendix A to NERA's 25 July 2006 report "Assessment of Elements of APT's DORC Calculations for RBP" says of the ACCC's approach of separately valuing revenue and expenditure streams,"Not only is there precedent for the ACCC's approach but there is no alternative if one wishes to value future expenditure (as one does in the current context)."

11 Brealey, R.A., I.A. Cooper and M.A. Habib, "Investment appraisal in the public sector," Oxford Review of Economic Policy, 13(4), 12-28.

12 The proposition referred to in the text is the third sentence of conclusion iii of the CRA report which Professor Grundy was critiquing. In paragraph 4 of his report, Professor Grundy states that this sentence is correct. See Grundy report, Appendix A to the NERA report "Assessment of Elements of APT's DORC Calculations for RBP", p. 24.

Therefore, the broader conclusions reached by Professor Grundy and NERA in support of the ACCC approach of discounting costs at the risk-free rate are not valid for, or indeed relevant to the specific case in point, namely the regulatory valuation for the RBP.

4.4. CONCLUSION ON APPROPRIATE DISCOUNT RATE FOR NPV DORC

In conclusion, the only discount rate for the NPV DORC calculation that would be consistent with the requirements of the gas code that the Rate of Return take account of the prevailing conditions in the market for funds and the risks involved in delivering the Reference Service is the regulatory WACC. The use of the risk-free rate in the NPV DORC calculation would be inconsistent with this requirement of the code.

13 Further, and more generally, it is important to note that even relatively fixed cost profiles may have positive betas due to covariance between the discount rate used to calculate present values and the market index. This effect is discussed in "Cost of Capital for Greenfields Investments in Gas Pipelines", Kevin Davis and John Handley, 30 April 2002, p.17.