Reform of Part XIC: Regulatory Certainty

Increasing regulatory certainty for telecommunications assets in Australia

A report for Optus

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Table of Contents

Table of Figures

Table of Tables

1. Introduction

1. Optus has asked the Competition Economists Group (CEG) to provide a report recommending options for reform of the telecommunications access regime in Australia which would increase regulatory certainty and, where related, address perceived failings in the current access regime.

1.1. Background

2. In April 2009 the Minister for Broadband, Communications, and the Digital Economy released a discussion paper titled *National Broadband Network: Regulatory Reform for 21st Century Broadband: Discussion Paper, April 2009*[1] *(discussion paper)*. The discussion paper indicated that the Government was considering options for reforming the existing telecommunications access regime by allowing the Australian Competition and Consumer Commission (ACCC) to "set up-front access terms for companies wanting access to Telstra and other networks".

3. The discussion paper identified a range of concerns or perceived deficiencies in relation to the operation of the existing telecommunications access regime (which is set out under Part XIC of the Trade Practices Act and commonly described as a 'negotiate-arbitrate model'). The main areas of concern were summarised in the discussion paper as follows:

> *"... the negotiate-arbitrate model is very slow, cumbersome and open to gaming (obstruction), and that Part XIC does not provide sufficient regulatory certainty for investment."*

4. The discussion paper does not apparently call for a fundamental reassessment of the economic principles underlying the access regime. A large focus of the discussion paper is based on process issues and possible reform options to speed up or reduce the cost of the price setting process. However, the discussion paper does, appropriately in our view, recognise that the current regime does not provide adequate regulatory certainty to make investments in long-lived regulated infrastructure (and long-lived infrastructure that is only useful when used in conjunction with access to regulated infrastructure).

5. The discussion paper proposes two options for reform. The first involves a number of procedural refinements to the existing regime to limit appeal rights, limit potential for delay (by allowing the ACCC to request a party to amend an access undertaking previously considered), and to allow:

[1] Minister for Broadband, Communications, and the Digital Economy, *National Broadband Network: Regulatory Reform for 21st Century Broadband: Discussion Paper*, April 2009, page 13.

"... the ACCC to specify pricing methodologies for declared services which would be used to determine prices over successive regulatory proceedings or successive undertakings in order to create greater regulatory certainty."

6. The second option proposed would allow the ACCC to set regulated prices up-front and specify the term of its access pricing decisions. Under this option the ACCC would also be required to start proceedings to put new prices in place before past pricing decisions expired. To the extent this allows for continuity across pricing setting periods it could allow the ACCC to increase certainty for investors regarding future regulatory decisions.

7. The discussion paper seeks comments from interested parties on improvements to the existing regime, specific comment on the options proposed, and asks parties to propose alternatives that they might favour.

1.2. Key conclusions

8. The key conclusions of this report are as follows:

   i. Regulatory certainty means more than simply knowing prices earlier or having a 'streamlined' process for setting prices. Regulatory certainty requires that parties, both monopolist and access seeker, can predict what prices will be next year and how they are likely to evolve in the long term. This requires knowledge of both: (a) how regulated assets will be valued in the near term; and (b) how the level of compensation over the asset's life will reflect that valuation.

   ii. The existing approach under Part XIC re-values existing assets annually (or every few years) using a highly ambiguous methodology for estimating the cost of replacing those assets today. The regime creates significant regulatory uncertainty for access provider and access seekers to the ultimate harm of end-users because it provides very little certainty on either (a) or (b) above. The value placed on the existing assets can change dramatically from one period to another despite the costs actually incurred in building those assets being unchanged. This causes large fluctuations in prices from one period to the next, which are associated with windfall gains and losses to the relevant parties (eg, windfall gains to access providers when prices rise unexpectedly and *vice versa*). This source of uncertainty over the regulatory price is unnecessary and also counter-productive to any objective of encouraging efficient investment in infrastructure.

   iii. Part XIC would benefit from greater prescription on the approach to determining regulated asset values and an explicit principle of compensation based on the NPV=0 rule. In the context of a regulatory framework, the NPV=0 rule requires that the owners of regulated assets can expect to receive a future revenue stream sufficient to cover their future expenditures plus a normal return on the value that has been placed on their regulated assets. This is sometimes termed expected 'financial capital maintenance'.

iv. Adherence to the NPV=0 rule is consistent with the promotion of efficient investment incentives for both monopolist and access seekers. The duplication of natural monopoly infrastructure is socially wasteful and should, in general, be discouraged.

v. The depreciated optimised replacement cost (DORC) method for the initial valuation of assets involves calculating the cost of replacing the existing network with one that is optimally configured at current day prices less an assessment of depreciation. The level of depreciation depends on the remaining life of existing assets and differences in service quality. DORC has strong economic foundations and regulatory precedent as a basis for determining the value of regulatory assets and is consistent with the economic principles which underpin Part XIC.

vi. The NPV=0 rule could be achieved by locking-in an initial DORC valuation of existing monopoly assets and predictably rolling-forward that value for net capital expenditure. This would significantly increase regulatory certainty for both the access provider and access seekers in contrast to the current regulatory regime.

vii. This would also remove the volatility inherent in the current approach, reduce incentives for gaming, and lessen unnecessary windfall gains and losses that are pervasive in the current regime.

viii. It would also bring telecommunications regulation more in line with other infrastructure regulations in Australia and would streamline regulatory processes.

1.3. Structure of this report

9. This remainder of this report has the following structure:

- Section 2 discusses the economic principles for regulating long-lived assets.
- Section 3 analyses how telecommunications regulation has evolved under Part XIC. We consider in some detail the key economic aspects of the regime and their impact on regulatory certainty.
- Section 4 discusses alternative models of regulation that provide greater regulatory certainty.
- Section 5 proposes an alternative model which addresses the key concerns identified in the previous sections but which remains consistent with the economic principles which underpin Part XIC.

2. Regulating long-lived assets

10. It is useful to begin this report by setting out some basic principles for regulating long-lived assets. We begin with a discussion of the rationale for regulating these assets. This has important implications for 'how' these assets should be regulated.

2.1. Why regulate access at all?

11. Regulation is motivated by a presumption that there are strong economies of scale in the production of some telecommunication services, meaning that the average cost of production is falling with total output. Where these economies are so large (relative to the size of the market) it is efficient to have only one firm provide the service, that service is considered a 'natural monopoly'.

12. An obvious concern about monopolies is that they may charge above cost for their services. However, this concern could be addressed without access regulation simply by regulating the final prices charged by the monopolist to its end-users. The rationale for access regulation is the desire to extend the arena of competition as far as possible into the telecommunications sector (the same is true for the energy and rail sectors). This is achieved by ensuring that competitors are able to get 'access' to the natural monopoly services by themselves and, in doing so, are not forced to also buy downstream services that have the potential to be competitively supplied.

13. The purpose for this form of 'deep' access regulation is to unleash competitive market forces into downstream areas of the economy previously considered monopolies. Regulating access to the core natural monopoly assets and services is considered 'essential' to promote competition (although vertically separating a firm's activities and prohibiting or limiting cross-ownership is an alternative policy solution). The idea being that competition in the previously monopolised downstream markets will yield efficiency gains to the benefit of society beyond what could have been achieved by simply regulating the downstream activity of the monopoly supplier.[2]

14. Entry into these new downstream markets generally requires access seekers to incur substantial costs in relation to assets that are specific and complementary to the monopoly access provider's service/network ('complementary assets'). For example, the use of the unbundled local loop requires access seekers to install equipment at exchanges, run fibre optic cable to those exchanges, and, of course, incur costs in acquiring customers. In economic terms much of these costs are 'sunk' and 'relationship specific'. That is, they are costs that cannot be reversed or salvaged

[2] A similar motivation is the existence of network externalities. Requiring networks to interconnect will result in benefits to society that cannot be captured by the networks themselves (otherwise they would have the incentive to agree interconnection) or prevent one network becoming dominant resulting in monopoly when more than one network is economic.

(labour used in installation can't be reversed, fibre cannot be costlessly rerouted, and marketing cannot be taken back) and they are reliant on continued access to the access providers network (there is no other local loop network to plug into).

15. In order to be enticed to make these investments, potential access seekers need a level of comfort that:

- They have access to the monopoly assets on reasonable price and non-price terms and conditions; and
- That this will continue to be the case over the life of their own sunk investments in complementary assets.

16. In order to be effective, access regulation needs to provide this level of comfort. Absent access regulation the potential access seeker would be fearful that once their investment in sunk complementary assets is made the monopoly access provider will have an incentive to raise prices and expropriate the value of those investments. This is known in the economic literature as the 'hold up' problem – with potential investors in complementary assets unwilling to make investments due to the expectations of 'hold up' by the other party following that investment being made. The opposite may also be true. A monopolist who was not vertically integrated, and therefore had to rely on one or more access seekers to make their investment valuable, would be fearful of making a sunk investment only to have the access seeker(s) demand a low price post investment on the basis that the monopolist had no alternative but to sell through them.

17. In this context, access regulation can be seen as a means to facilitate vertical contracting that would be of benefit to each party (and society) but is prevented because of difficulties in contracting when significant sunk costs must be invested by both parties. As CEG has previously observed:[3]

> *"Even if [the access provider] were willing to provide access ..., without regulated access, access seekers and [the access provider] may be prevented from negotiating access that will allow an efficient level of access and investment because of the potential for hold up in the future ...*
>
> *In our opinion there are circumstances where commercially negotiated prices for access ... may lead to opportunistic behaviour by negotiating parties that hinders negotiations and consequentially deters efficient investment. These circumstances would include:*

[3] Competition Economists Group (2007), *Economic analysis of sub-loop access*, Report for G9 Consortium, 5 September 2007, page 7.

- *Where contracts between the access seeker and the access provider cannot be made complete. For example they are not be able to fully anticipate the changing circumstances that may give rise to opportunistic behaviour; and*

- *The access seeker is required to make a sunk investment in assets that are specific to the network it is seeking access from (or that there is a material cost in adapting or transforming the assets for a competing network); or*

- *The access provider is locked in to the access seeker's investment."*

18. It might be thought that a commercially negotiated long-term contract between the access provider and the access seeker could provide the parties with sufficient certainty to make sunk investments. However, contracts can never completely envisage the future in a manner which addresses the possibilities for future expropriation. Indeed, in the Fisher Body – General Motors case, hold up arose because the contract designed to prevent hold up did not account for a substantial increase in demand for the particular car bodies subject to the contract, in effect *creating* an opportunity to exploit the other party.[4]

2.2. How should access prices be set?

19. Access regulation might best be thought of as a mechanism or tool to facilitate entry into downstream markets (in order to achieve the objective of promoting competition in those markets) by giving certainty to parties that their sunk investments will not be expropriated by the behaviour of other parties. However, it will only be successful in doing so if:

- Potential access seekers have confidence that future access price and non-price terms and conditions will allow them to recover their sunk investment in complementary assets; and
- The access provider has confidence that future access price and non-price terms and conditions will allow them to recover their sunk investment in extensions to and maintenance of the monopoly assets.

20. In order to promote competition access regulation must, in effect, 'replace' the long-term contract that parties would want to negotiate to their mutual benefit, but which is also of benefit to society because of the otherwise unrealisable benefits from competition in the downstream market (eg, technical efficiency in production and product differentiation that are not captured by the parties).[5] In this sense, the decision

[4] See Klein (1988), "Vertical integration as organisational ownership: The Fisher Body-General Motors Relationship Revisited" *Journal of Law Economics and Organisation*, Volume 4, Number 1.

[5] The 'negotiate-arbitrate model' can be partially explained in this context. In some cases it may be possible for an access provider and access seekers to reach agreement on access terms and establish a long-term contract (ie, when the

to regulate fundamentally and inextricably ties the purpose of access prices regulations to the need to provide certainty to parties that they will not have their sunk costs expropriated.

21. As the balance of power in commercial negotiations would generally be in favour of the access provider (because the access seeker has fewer or no 'outside options' so has to buy from the access provider who owns the natural monopoly) the focus of regulation would typically be on ensuring the access seeker's sunk costs are not expropriated by the access provider setting prices which are 'above cost'. That said, if regulation is to fulfil the role of a long-term contract then if it is to achieve the objective of promoting competition in the long term then it must not expropriate the sunk costs of the access provider by setting prices 'below cost'.

22. This means that the owner of the monopoly asset must expect that any future prudently incurred expenditure will be able to be recovered in higher access prices. That is, the regulatory regime needs to have a mechanism that ensures that the monopolist has an incentive to continue to efficiently maintain and, where required, extend the monopoly assets. However, because the access providers' network has largely already been built over a long period of time (mostly prior to the advent of regulation) there must be some compensation for the value of those historic costs already incurred. This requires that a value be placed on assets that the monopolist is, in effect, bringing to the regulatory framework.

23. This requires that, at any given time, the regulatory regime must:

    - Place a value on the pre-existing assets; and
    - Allow the access seeker to have an expectation that they will be able to recover through time both:
        - This value; plus
        - Any prudently incurred future expenditure.

24. The second dot point is simply a statement of what is known as the NPV=0 rule (sometimes termed financial capital maintenance (FCM)). If the second dot point does not hold then the 'value' determined in the first dot point is meaningless. That is, it is meaningless to place a value on existing assets if the expectation under the regulatory regime is that less/more than this value will be recovered in future revenues.

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circumstances identified above are not overwhelming), and hence to the extent that there is uncertainty over whether agreeable terms can be reach it may be appropriate (lower cost) to allow parties to reach agreement rather than to simply impose regulation.

25. The NPV=0 rule is implicit in almost all monopoly regulation and is commonly prescribed in Australian monopoly regulations the form of an 'NPV=0 rule' or in a statement of FCM, with the important exception of Part XIC.

26. The current regulatory regime makes achievement of the NPV=0 rule very difficult because it introduces a great deal of uncertainty around future changes in the valuation of existing assets. Rather than simply setting the value of existing assets next year equal to the value of existing assets today plus prudent net capital expenditure (as is done in other regulatory regimes), the current telecommunications regulatory regime re-values existing assets every few years based on the highly ambiguous and hazy concepts of what it would cost to replace those assets today but with somewhat arbitrary restrictions on the nature of this replacement ('scorched node' optimisation).

27. The effect of this is that the value placed on the existing assets can change dramatically from one period to another despite the nature of those assets being unchanged and the costs actually incurred in building those assets being unchanged (ie, a trench housing copper cable remains the same trench from year to year but its regulatory value can be very different if the assumed cost of copper or labour etc in 'replacing'[6] that trench has changed). This means that future changes in asset valuations can cause large fluctuations in prices from one period to the next - with these are associated large windfall gains/losses to the relevant parties (windfall gains/losses to access providers/seekers when prices rise unexpectedly and *vice versa*).

28. The key conclusion of this report is that this source of uncertainty over the regulatory price is unnecessary and counter-productive to promoting efficient investment in both the monopoly asset and complementary assets used by access seekers. We recommend an alternative approach that:

    - Undertakes a 'one off' value on the pre-existing monopoly assets;
    - Commits to allow a normal rate of return on that asset value; and
    - To only amend that value to reflect prudently incurred capital expenditure less depreciation underlying the calculation of access prices (ie, return of capital in access prices).

29. We now turn to the first of the above steps.

[6] Notwithstanding that the trench will never be 'replaced'. That is, the trench will never be filled in and re-dug.

2.3. Putting a value on past investments

30. Prior to addressing how to establish the time path of revenues needed to compensate the owner of long-lived assets (over the life of those assets) consistent with the NPV=0 rule, regulation must first address what value is to be placed on the existing assets.[7] The question must be asked "what is the fair and/or efficient value that should be placed on these assets (note this question must be asked in the current regulatory regime also)?".

31. In answering this question it is useful to imagine a world in which the (long-lived) monopoly network is yet to be constructed and a contract must be agreed in order for the (newly minted) access provider to build and operate the network using the most efficient technology at the time. In this hypothetical world the access seekers and monopolist have a more equal bargaining position as neither has yet sunk any investments.

32. In such a negotiation, the access provider would demand that access seekers agree to pay prices which provide the access provider with revenues which are expected to at least recover the upfront investment and on-going expenditures required to build the network and provide services (and a risk adjusted return on those expenditures consistent with the level of residual risk contained in regulated revenues). Access seekers would demand that those costs be prudently incurred and demand some over-sight to that effect.

33. In this example, the value of the assets is readily identified in the actual costs incurred by the access provider in building the network (and the access seekers may gain comfort as to the efficiency of those costs through tendering arrangements or other incentive mechanisms).[8] However, it is more often the case that long-lived assets already in existence only subsequently come under some form of regulation as a result of a change in ownership (where they were previously a government owned monopoly now corporatised or privatised) or as a result of a policy change to introduce competition into a newly defined downstream market.

34. In such cases, the historic costs incurred in building the asset are unlikely to be readily identifiable and a thought experiment may be needed to try to identify an asset value 'as if' the access provider and access seekers were freely entering into commercial negotiations to identify a current market value for the asset. The thought experiment would need to ask:

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7 We discuss whether they should be re-valued over time at the end of this section.

8 The recent competitive tender for a new National Broadband Network could be seen as an attempt to identify the efficient costs of building a monopoly network.

If the supply of the monopoly network could now be put to a competitive tender, what is the maximum amount access seekers would need to pay the access provider to compensate it for the use of its existing network (noting in the hypothetical tender they had the alternative of another access provider providing an optimally configured replacement asset)?

35. The answer to this thought experiment is the depreciated optimised replacement cost (DORC) method of asset valuation which the ACCC has constructed (for electricity access regulation) as:[9]

"... the price that a firm with a certain service requirement would pay for existing assets in preference to replicating those assets"

36. DORC represent a hypothetical valuation in which there is competition 'for the market'. Of course, it is clear that such competition is hypothetical. In reality, there are significant sunk costs which mean that there can be no such market (and in fact if this were not the case then there would be no reason to regulate). In this regard it is important to note that DORC is not an attempt to set prices that create incentives for efficient entry or bypass by a new entrant. In addition, a DORC valuation does not reflect the opportunity cost of using the assets. DORC is simply an economic thought experiment to put a fair or market value on the asset, by constructing a hypothetical in which that asset was tradeable in a open market (which, by definition, it is not). We discuss the range in which asset values can be set without distorting efficient entry and bypass decisions in section 3.2 - we note that DORC would fall within this range.

37. DORC is the asset valuation that is widely used for valuing regulated monopoly networks and is, for example, prescribed in the Gas Code[10] as an important reference point for determining the Initial Capital Base of a gas pipeline when it is first subject to regulation. It has been used to establish the initial value of most monopoly assets in Australia (including gas and electricity distribution and transmission assets and rail networks).

38. The DORC method asks what access seekers (if they could commercially negotiate to enter into a long-term contract) would be willing to pay *for the existing asset* if they had the alternative of another access provider providing an optimally configured replacement asset.

39. As such, the differences between the existing asset and the optimally configured replacement asset become critical to the correct definition of DORC. In particular, the

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9 ACCC (1999) Draft Statement of Principles for the Regulation of Transmission Revenues, page 39.

10 See the *National Third Party Access Code for Natural Gas Pipeline Systems.*

willingness of access seekers to pay for the existing network if they have the option of a replacement network would depend on differences in the:

- Future cost of operating the existing asset relative to the future costs of operating the replacement network. For example, an important cost saving associated with the existing asset is that it avoids the need to incur the upfront expenditures of building a new asset today. Offsetting this somewhat may be that the operating costs of a new asset could be lower than the operating costs of the existing asset; and
- The service quality offered by the replacement network in advance of (or in deficit to) the existing network. For example, a new network may be more reliable or have some other attributes that are valuable and which the existing network does not have.

40. DORC is calculated as the cost of replacing the existing network with one that is optimally configured at current day prices less an assessment of depreciation. The level of depreciation depends on the remaining life of existing assets and differences in service quality. Ignoring service quality differences for the moment, if the assets in the existing network have all just recently been replaced then there will be no (or very little) depreciation and DORC=ORC. Conversely, if assets need to be replaced in the very short term the assets will be largely depreciated and DORC will equal zero. Intuitively this is right, you would not be willing to pay much for a second hand network today if it needs replacing tomorrow. That is, the main value in buying a second hand network is that it allows you to delay/avoid expenditure on building a new asset. This value will be close to zero if the entirety of the existing asset needs replacement almost immediately after it is purchased.

41. In analytical terms, the DORC of a telecommunications network would be calculated as follows:

    i. Estimate the present value of all future costs of building and operating a telecommunications network – configured optimally on what a hypothetical new entrant would build if they were replacing the network (the optimised replacement cost (ORC));

    ii. Deduct from this the present value of all future expenditure on operating the existing telecommunications network (including the cost of replacing the assets as needed in the future) as currently configured; and

    iii. Deduct from this (or add to this) the present value of any higher (or lower) quality of service offered by the optimally configure replacement network.

42. Necessarily, the DORC valuation would need to consider all possible replacement networks that might be considered by a new entrant (with the lowest calculated value according to i., ii., and iii. representing the DORC asset value). For example, in

valuing the existing copper local loop telecommunications network a new entrant might consider another copper local loop, a fibre local loop, or a wireless local loop in order to provide access seekers with the ability to provide their end-users with calling and broadband services.

43. If the optimally configured new network was considered to be a copper based local loop then the value of the existing asset would simply reflect the expenditure savings associated with being able to use the existing assets (because service potential will be identical). These expenditure savings will be highest:

- The greater is the remaining life of existing assets (which increases the present value of delaying expenditure on a new asset by virtue of using the existing asset); and
- If the existing asset does not have significantly higher operating costs relative to a new network.

44. In contrast, if the optimally configured new network involved an alternative technology then differences in the value of services provided by the alternative technology relative to that provided by the copper network would need to be factored into the valuation of the existing network. Consideration of service potential might result in a lower valuation of the existing asset if the alternative technology provided higher quality services (eg, a fibre local loop network would provide faster broadband and so would have a higher service potential making the existing copper network less valuable in the eyes of access seekers). Alternatively, a wireless local loop network, which may involve lower expenditure to build (tending to reduce the DORC value of the existing assets) but may provide a lower download speed and therefore perhaps a lower quality of service (tending to increase the DORC value of existing assets).

45. In the telecommunications context, the service quality depreciation component of DORC is likely to be significant. For example, valuations of increased broadband speeds of a fibre local loop network over a copper local loop network are reportedly large.[11] This contrasts with DORC valuations in electricity, gas, and rail networks where the service quality differential has generally been considered not significant enough to warrant detailed investigation, though adjustments for service quality have been made.[12]

[11] Access Economics (2009) *Impacts of a national high-speed broadband network*, March 2009, Report by Access Economics Pty Limited for Telstra Corporation Limited.

[12] Booze, Allen and Hamilton (2007) *ARTC Standard Gauge Rail Network DORC*, Final Report, Australian Rail Track Corporation Ltd, January 2007.

2.4. Future regulatory resets

46. Where regulatory periods are defined as some period less than the life of the asset the regulation must specify a mechanism to 'roll-forward' the previous asset value to the start of the next period, so that prices for the next period can be based on that new asset value.

47. As a matter of economics, the cost of using an asset (known commonly as depreciation) during any regulatory period is equal to the change in the value of the asset from the start of that period to the start of the next. Quite simply, if we begin with an asset that is valued at $100 and we know that its value will fall by half in one year's time (for whatever reason), then by definition, the cost of using that asset for the year is $50. As such, the level of depreciation allowed in a regulatory determination defines the regulator's expectation of the change in the value of the regulated asset. A regulator cannot have inconsistent positions in relation to these two points. That is, it cannot define depreciation in the above example at something more or less than $50, if it believes that the asset will be worth $50 in one year's time.

48. The change in the value of regulated assets between regulatory periods would also increase with the capital expenditure by the monopoly in extending, replacing, or enhancing the network.

49. Regulatory certainty for the access provider can be fully achieved if the regulator allows the asset base to be rolled forward by actual capital expenditures less allowed depreciation. Amending the above example slightly, if the initial asset value is $100 and forecast depreciation is $50 and the access provider expects to spend (and actually spends) $25 on capital items then the regulation can ensure financial capital maintenance if the 'rolled forward' asset base is equal to $75 (assuming a zero discount rate).[13]

50. As discussed further below, the regime adopted under Part XIC does not have a clear nexus between the allowed depreciation in one period and the change in the value the asset base from one period to the next. As discussed, the allowed depreciation is based on the current asset value (determined by an optimised replacement cost mechanism) and assumed asset lives, asset price trends, and technology choices. The asset value in the subsequent period is based on a new optimised replacement

[13] Incentives for efficient capital expenditure can be created in the roll forward process if the asset base is increased by forecast capital expenditure and/or forecast depreciation. For example, if forecast (rather than actual) capital expenditure is allowed to be rolled in the asset base the firm will have the incentive to underspend its forecast. Similar incentive mechanisms are a common feature of most monopoly regulations in Australia.

cost estimate which reflects the actual change in asset prices (which will be certainly different from forecast) and might embody different technologies.[14]

51. No record is kept of whether the allowed depreciation in past periods has more than recovered the original asset base or whether a large deficit remains. Whether actual financial capital maintenance has been achieved or overachieved is, quite frankly, a mystery. Under a 'roll forward' approach there would be no such mystery as the regulatory regime keeps track of the allowed recovery of the asset (depreciation) and the balance of the asset in financial capital terms. Therefore, unlike the revaluation approach (which requires an estimate of depreciation based on some assumed asset lives) the total depreciation under the roll forward approach is not sensitive to the assumed life of an asset. This point is illustrated in section 3.4.

52. Another advantage of rolling forward the asset base (rather than continually revaluing the asset base based on an optimised replacement cost basis) is that it allows flexibility as to the time profile for the recovery of the asset base. The level of depreciation is not driven by some theoretical estimate of the change in the replacement cost of the asset (according to a hypothetical market standard) but can be adjusted to accommodate other objectives including an efficient allocation of capital costs over time which would increase the likelihood of recovering the asset (further increasing regulatory certainty).[15]

[14] Historically, the replacement cost estimates have come from entirely different models with fundamentally different assumptions regarding network design, asset lives, and annuities (flat and tilted).

[15] Baumol, W. (1971) "'Optimal Depreciation Policy: Pricing the Products of Durable Assets" *The Bell Journal Economics and Management Science*, Volume 2.

3. Telecommunications access regulation in Australia

3.1. Part XIC access pricing principles

53. Under Part XIC of the Trade Practices Act the ACCC is required to set, or only accept, prices which are reasonable as defined in section 152AH of the Act, which states:

> *"(1) For the purposes of this Part, in determining whether particular terms and conditions are reasonable, regard must be had to the following matters:*
>
> *(a) whether the terms and conditions promote the long-term interests of end-users of carriage services or of services supplied by means of carriage services;*
>
> *(b) the legitimate business interests of the carrier or carriage service provider concerned, and the carrier's or provider's investment in facilities used to supply the declared service concerned;*
>
> *(c) the interests of persons who have rights to use the declared service concerned;*
>
> *(d) the direct costs of providing access to the declared service concerned;*
>
> *(e) the operational and technical requirements necessary for the safe and reliable operation of a carriage service, a telecommunications network or a facility;*
>
> *(f) the economically efficient operation of a carriage service, a telecommunications network or a facility.*
>
> *(2) Subsection (1) does not, by implication, limit the matters to which regard may be had."*

where the following objectives must be had regard to in determining what is in the '*long-term interests of end-users'* (section 152AB):

> *"(c) the objective of promoting competition in markets for listed services;*
>
> *(d) the objective of achieving any-to-any connectivity in relation to carriage services that involve communication between end-users;*

(e) the objective of encouraging the economically efficient use of, and the economically efficient investment in:

(i) the infrastructure by which listed services are supplied; and

(ii) any other infrastructure by which listed services are, or are likely to become, capable of being supplied"

54. These matters have been translated by Australian telecommunications regulatory authorities (the ACCC and the Australian Competition Tribunal) into a regime which has the basic characteristics of other monopoly regulations. As noted above, these include a method for setting an asset value and a mechanism by which that asset value is recovered over its life. However, as implemented, the matters translate into a regulatory model with high levels of regulatory uncertainty, which is likely to be harmful to competition and investment.

55. As we discuss below, the method for setting asset values according to the principles set out in Part XIC has been motivated by inappropriate analysis of the promotion of facilities based competition. This analysis is largely responsible for an incorrect belief that annually re-valuing assets is required in order to keep sending the 'right' signal for potential access seekers to 'build or buy' access. While not achieving this goal, the effect of this annual revaluation has been to materially increase the amount of uncertainty in the regulatory regime for both access seekers and access providers.

56. In addition, the annual revaluation of assets has made the task of setting an appropriate annual recovery of assets (depreciation) extremely difficult. The regulation has relied heavily on mathematical formulae to set depreciation which require forecasts of asset lives and forecasts of asset price changes (both of which are highly uncertain). If these forecasts by the regulator turn out to be wrong, as they inevitably do, then windfall losses/gains accrue to the interested parties (access seekers and access provider).

57. As a direct consequence, access seekers and access providers expend a great deal of regulatory effort on influencing the regulator to use favourable cost models (to revalue the asset base) and choose favourable assumptions for asset price trends and asset lives to set depreciation. The result is further uncertainty for all parties and a model which in theory might achieve positive investment incentives (ie, NPV=0) but is more likely to result in substantial windfall gains and losses and higher uncertainty to all parties. That uncertainty comes at a cost to society because it raises the uncertainty and idiosyncratic risks of investments made by both access provider and access seeker alike.

58. We conclude in this section that even if the ACCC wanted to provide more regulatory certainty, it would be constrained by the lack of prescription in Part XIC.

3.2. Asset valuation under Part XIC

59. In determining the value of regulated telecommunications assets which are consistent with Part XIC the ACCC has historically given primacy to considerations of efficiency. In particular, the ACCC has promoted the concept of 'forward-looking efficient cost' as being important to promoting productive efficiency (encouraging efficient build versus buy decisions)[16] and dynamic efficiency (encouraging the least cost means of production are adopted over time)[17].

60. Recently, the ACCC stated its view that under Part XIC:[18]

> *"... the ACCC has indicated that 'optimised replacement cost' is its generally preferred method of cost valuation. Under this approach, each time an access price is determined, the existing sunk investment (in this case, the CAN) is revalued on the basis of a hypothetical situation where a brand new network is instantaneously constructed, and replicates the existing network's service potential, but uses best-in-use technology based on forecast demand. The 'cost' of building this hypothetical replacement network is therefore the 'asset base' from which access prices are determined.*
>
> *The application of an optimised replacement cost approach was premised on the fact that the cost that the access price is based on would send appropriate efficient build/buy signals. These signals were considered necessary because, when the telecommunications access regime commenced, it was believed that rapid technological change (where the least-cost technology continually changes), would lead to a declining unit cost of service provision, increasing the likelihood that access seekers would build their own competing infrastructure to provide end-user services. In particular, with falling replacement costs, valuing the network at replacement cost would mean that the asset base would be revalued downwards over time as costs fell, resulting in falling access prices, and thus discouraging access seekers from inefficiently building their own competing infrastructure."*

61. It is correct that efficient build versus buy signals are sent to access seekers if access prices reflect the 'cost' of them using the existing network. However, the problem with the logic set out above is that the 'cost' of access seekers using the existing network

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[16] That is, sending a signal to access seekers that if they can build new infrastructure more cheaply than they can buy access to existing infrastructure then they should do so.

[17] This is generally considered to be served if incentives for continual innovation exist for firms in the industry.

[18] ACCC (2009) Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking, Final Decision, Public Version, April 2009, page 54.

cannot be presumed to be, and in general will not be, equal to the forward looking cost of replacing the existing assets. [19]

62. As a matter of economics, it is only efficient for an access seeker to bypass the access provider's network when the cost of the services provided by the new network is less than the cost that would have been incurred in providing those services over the existing network (ignoring any additional benefits from providing services on the new network). Critically, the access price which encourages efficient bypass is one that is therefore no greater than the avoidable costs of providing those services on the existing network[20] (that is, the cost of operating and maintaining the existing network[21]) – a cost which is likely to be far less than the 'forward looking efficient cost' of building an optimised replacement network.

63. This economic reality simply reflects the fact that duplication of natural monopolies is socially wasteful and should, in general, be discouraged. This point has been recently recognised by the Australian Competition Tribunal which stated:[22]

> *"As Optus submitted, even if in the future with the exemption Optus were to expand the reach of its HFC network and offer services via that network to end-users who it currently services through a Relevant Service, this might not represent socially efficient investment if alternative measures of provision were available at a cheaper cost.*
>
> *...*
>
> *There is no suggestion in Telstra's submissions ... that Telstra's CAN or its HFC network lack capacity. The infill investment Telstra submits would flow from the exemption would, in effect, be but a duplication of Telstra's CAN and its HFC network. Such duplication of this 'last half-mile' infrastructure, if it were to occur, would, on the face of it, be a socially wasteful investment"*

64. In the context of the local loop, quite simply, the local loop assets comprise primarily of the value ascribed to copper cable and the ditches that the copper cable sits within. There would be little value to society (consumers) from someone else coming along and digging a new set of ditches connecting the same houses with copper. Moreover, because this would be very costly to do it would be socially wasteful (large costs

[19] Even setting aside the practical issues of estimating forward-looking efficient costs which mean that when implemented they are generally not forward-looking estimates, being typically based on constrained optimisations.

[20] The costs avoided as a result of not providing those services on the existing network.

[21] Including the cost of new of equipment, as required, and reflecting the scrap value of the asset (see below in paragraph 66).

[22] Application by Telstra Corporation Limited [2009] ACompT 1 (22 May 2009).

incurred for small or no benefit). Setting local loop prices based on the cost of digging ditches sends precisely the wrong build versus buy signal to access seekers. The signal it sends is "if you can dig a ditch for a lower cost than we estimate then you should go out and do it" when the efficient economic signal should be "don't dig a ditch laying new copper to existing households unless you can do so at a lower cost than simply maintaining the existing ditches and replacing the copper as it wears out".

65. Of course, no access seeker has actually gone and built new ditches bypassing existing ditches. The primary reason for this is that, given the economies of scale involved, even if they could build those ditches at half the cost estimated by the ACCC this would still only be profitable if they could win at least 50% of the wholesale market from the incumbent and if the incumbent didn't lower prices to defend its wholesale market share. Neither of these assumptions are economically sensible which further highlights the irrationality of purporting to need to set local loop prices based on the cost of digging ditches today in order to send 'efficient' build/buy signals to access seekers.

66. In our view there are two 'efficiency' considerations in valuing telecommunications assets, neither of which are likely to be determinative in setting asset values. We note that:

    i. Encouraging the efficient use of an asset (such as a telecommunications network with very large sunk costs) only requires that the asset is valued above its scrap value (and that prices recover this plus expenditure required to continue operating and maintaining the asset – including replacement of equipment as required). By definition, the fact that the costs of the network are sunk means that it cannot be relocated - therefore the cost of its use by access seekers is very low. (Of course, the long-term effect of choosing to value regulated assets at their scrap value after they are sunk is likely to be deleterious to efficient investment in the future.[23]); and

    ii. Discouraging inefficient bypass requires that access prices be set below the level at which access seekers would build a new asset despite it being more efficient to use excess capacity on the existing asset. This could be a risk under the ACCC's approach if it was targeting a value which put the access seeker on the cusp of build versus buy, but say, as a result of regulatory error, established a value which encouraged build.

67. Therefore within the range of scrap value and a value which encourages inefficient bypass, direct efficiency considerations offer little guidance as to the appropriate asset value. Where in this range one might fall can be informed by consideration of the

[23] If investors believe that there is a material risk of their prudent investments being valued at scrap value (effectively expropriated) then they are less likely to invest. This is a reason for not pursuing this policy. However, it is important to be clear this reason has nothing to do with sending efficient build/buy decisions.

concept of fair negotiation (between access provider and access seeker) that we discussed in section 2.2.

68. There is also, in our view, a common misunderstanding that 'forward-looking efficient costs' are somehow meant to mimic the outcome of a competitive market and that this is the purpose of Part XIC. For example, the ACCC has stated that:[24]

> *"In principle, the application of forward-looking costs would value all existing assets at the cost of a Modern Equivalent Asset (MEA). A MEA is the lowest cost asset built with the latest available, proven technology which can provide the equivalent service potential as the service which is being costed. In general, the forward-looking approach is more compatible with the competitive standard of efficiency, since in a competitive market, prices are set on the basis of the prevailing technology. In a competitive environment, operators would compete on the basis of costs likely to be incurred and are not compensated for costs incurred through inefficiency. In this regard, the estimation of efficient and forward-looking costs using a TSLRIC+ framework may indicate that a price term of an undertaking based on TSLRIC+ satisfies the legislative criteria that the ACCC must consider in determining whether to accept or reject an undertaking."*

69. In practice, trying to replicate the outcome of competitive market in a market that is not competitive is a highly questionable goal. Competition is a highly desirable way of organising economic activity because it reveals efficient costs and results in marginal prices that reflect the marginal avoidable costs of supply while also allowing firms to recover their total costs (including fixed costs). However, competition is only possible where the nature of the cost conditions in the market allow multiple players (actual or potential). Regulation of natural monopolies exists precisely in situations where this is not possible and where prices cannot simultaneously perform the dual role of promoting efficient levels of consumption (pricing equal to marginal avoidable cost) and allowing recovery of total costs (pricing at average total cost for a new entrant). In this context it is simply not meaningful to talk of regulation 'replicating' the results of a competitive market when the cost conditions in a regulated market mean that this is not possible.

70. Moreover, the idea that a hypothetically competitive market price can be estimated based on 'long-run estimates of average cost' (no matter how far into the future the 'long-run' is conceived) is incorrect. For example, Mandy (2002) has noted that:[25]

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[24] ACCC (2009) Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking, Final Decision, Public Version, April 2009, page 52.

[25] Mandy, D. (2002) "Pricing network elements when costs are changing" Telecommunications Policy, Volume 26, Issues 1-2, February-March 2002, page 59.

"... when the cost of capital inputs is changing over time, market prices must change as well in order to maintain the condition that an investment at each point in time is a breakeven proposition. In this inherently dynamic environment it is erroneous to think of a competitive equilibrium price as the minimum of some long-run average cost curve, because the cost curve will shift before the capital costs are fully recovered. In such a dynamic environment, the concept of competitive equilibrium prices must be modified to the notion of a dynamic price sequence with the property that a price-taking firm exactly recovers its costs over the life of the asset"

3.3. Theoretical problems with periodic re-revaluing asset under Part XIC

71. As noted above, under Part XIC asset valuation is not a once-off exercise. The assets are re-valued periodically, and in fact, under the 'standard' approach, as described by the Australian Competition Tribunal, re-valued annually. The Tribunal state that:[26]

"Under standard forward-looking cost models, this is performed by estimating what would be the efficient cost of providing the service if the network over which it is provided were to be built in the period(s) to which the undertakings relate. A standard forward-looking cost model would seek to consider how the network over which the ULLS was provided (the CAN) would be dimensioned if it was built anew in each of the three periods covered by the undertakings (1 January 2006 – 30 June 2006, 2006/2007 and 2007/2008). To avoid confusion, it should be noted that this does not mean that the capital costs associated with the construction of a hypothetical new network in each period covered by the undertakings would be modelled to be recovered, in full, in each of the periods in which the hypothetical new networks were modelled to be constructed. Rather, the capital costs would be annualised over the lifetime of the assets involved in constructing the network using a tilted annuity formula. Only those capital costs allocated to the first period using tilted annuity formula would be recovered in the first period in which the hypothetical new network was constructed."

72. The perceived benefit of periodically revaluing assets is that it adjusts asset values so they reflect the most efficient forward-looking technologies. We say 'perceived' benefit for two reasons. Firstly, in a practical sense the forward-looking costs models examined by the ACCC under Part XIC to set asset values are not particularly forward-looking. They are typically based on a 'scorched-node' modelling approach which accepts both the technology and architecture of the monopoly network and do not reflect forward-looking technologies which might be considered if the incumbent was not constrained by past decision (the so-called new entrant paradigm).

[26] Re Telstra Corporation Ltd (No 3) [2007] ACompT 3 (17 May 2007), paragraph 340.

73. Secondly, applied correctly, periodic revaluations of the asset (which are based on new lower cost technologies) would not result in necessarily lower charges. This is because an expected reduction in an asset value (whether because of new technologies or lower future prices for assets) would need to be reflected in higher depreciation charges for that existing asset.[27,28] This is implicitly recognised by the Tribunal in the above quote when it refers to the use of a 'tilted annuity'. Under a tilted annuity the level of depreciation reflects the expected change in the value of assets due to falling price trends and the adoption of new technologies. If asset prices are expected to fall or new technologies are expected to become efficient to adopt, a greater 'upward tilt' in the depreciation schedule is required, effectively front-loading the recovery of the existing asset.

74. If correctly implemented, it is only when there is an 'unexpected' change in technologies or asset prices that the revaluation would result in a change in asset value which is not reflected in the depreciation charge. However, unexpected changes are going to be the norm – because forecasts of technological change and future asset prices are inherently unreliable. Thus, far from creating regulatory certainty the periodic revaluation of assets creates volatility in charges (which as we note reduces regulatory certainty for both the access provider and the access seeker).

75. A concrete example illustrates this point. A significant proportion of the value of the telecommunications local loop is in copper cabling. As such, in determining the optimised replacement cost of the network the ACCC would, in a simplified sense, value that portion of the network equal to the optimal amount of copper in the network multiplied by the current price of copper. It would then set future depreciation of that copper (in the tilted annuity) based on the forecast change in copper prices expected over the regulatory period (which has historically been 12 months).

76. If the price of copper was expected to fall, there would be a higher depreciation allowance under the tilted annuity reflecting an expected large change in the optimised replacement cost of the copper portion of the network when it is re-valued next year. However, if there is forecasting error (which there inevitably will be) then the actual change in copper prices will differ from the forecast. When it comes to the following year and the copper portion of the network is re-valued, if the price of copper did not fall by as much as previously forecast the ORC of that portion of the network will be higher than forecast and the access provider will have received a windfall gain (because they will have received the depreciation allowance associated with a forecast fall in the price of copper that never happened).

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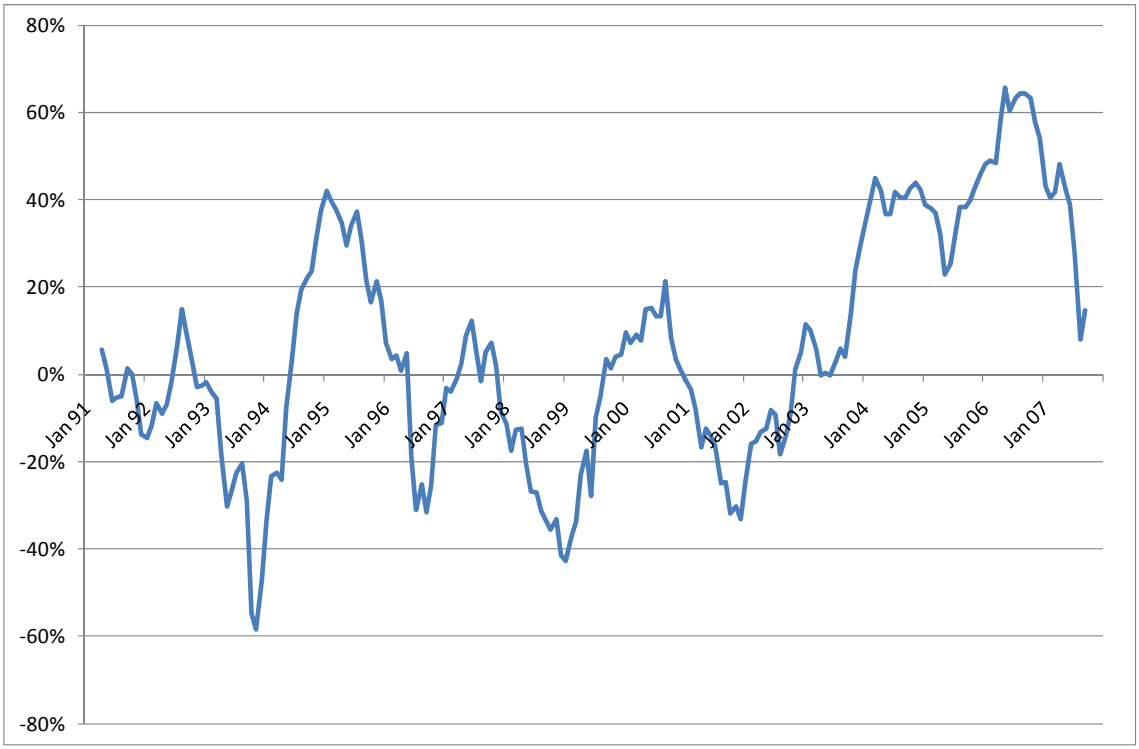
[27] As a matter of economics, the "cost" of using an asset in one period depends on the fall in the value of the asset over that period (depreciation of the asset). More precisely, in order to determine the cost of using an asset in period "t" you must determine the change in the value of the asset from period "t" to period "t+1". Therefore, if you expect to reduce the asset value in t+1 by say half (because of an expected asset value saving) the cost of that asset in period t (levied in the form of a depreciation charge) is equal that value reduction.

[28] Appendix A demonstrates this point algebraically.

77. Figure 1 below graphically illustrates the potential for forecasting errors in copper prices (and hence windfall gains and losses). It shows the percentage error in 15 month forecasts of copper prices (embodied in 15 month copper future prices) as reported by the London Metals Exchange (LME).

Figure 1: Accuracy of 15 month futures prices for copper



Source: London Metals Exchange

78. If the ACCC were as good at forecasting the change in copper prices as the copper futures market is, then the ACCC could expect an annual error of around 20%. This potential for windfall gains and losses and the reduction on regulatory certainty (and its cost in the form of regulatory risk) as a result of periodically revaluing assets has been recognised by the ACCC (itself) in the context of electricity regulation when it stated that:[29]

> *"Given changes in replacement costs over time, it makes it very difficult to forecast the end of period asset base which in turn makes it difficult to set the required level of depreciation. Inevitably there could be a deviation between the*

[29] ACCC (2004) Draft Decision, *Statement of Principles for the Regulation of Electricity Transmission Revenues – Background Paper*, 18 August 2004, page 67.

forecast end of period asset base and the actual asset base. This difference could be a source of risk for a regulated firm"

79. In this context the ACCC determined that there were no benefits from this continual revaluation that would justify the increased uncertainty and determined to 'lock in' the value of the regulatory asset base. However, in recognising the desirability of 'locking in' the asset value, the ACCC also recognised that in order to provide adequate regulatory certainty (and remove the source of risk) it must be backed by a clear commitment in the regulations (requiring a removal of discretion from the regulator to 'change its mind' in the future). The ACCC noted that in contrast to the Code regulating gas transmission assets the rules governing electricity transmission did not allow it to provide regulatory certainty and that it would be desirable for the rules to be changed:[30]

"The ACCC's approach to asset valuation will be to lock-in the [regulatory asset base], consistent with the reasoning outlined in this chapter. Noting that the code provides the discretion to revalue assets in service before (existing assets) and after (new assets) 1 July 1999, the ACCC considers that it would be highly desirable to amend the code to formalize the lock-in approach to asset valuation. This would provide greater certainty for investment..."

80. The ACCC has expressed a similar concern in relation to its powers under Part XIC. In considering a special access undertaking (SAU) offered by FANOC, the ACCC recognised limits to its powers to review and implement key inputs in a methodology which locked in an asset base and rolled forward that asset base over an extended period. The ACCC stated that:[31]

"... any methodology for setting access prices would require effective regulatory audit or review of key inputs and parameters in the methodology (such as demand forecasts and forecast or actual capital and operating expenditure) at appropriate intervals if the undertaking period is very long. This would be necessary for the ACCC to be confident that the access provider will exercise its discretion in applying the pricing methodology in an efficient manner. The ACCC notes that currently under Part XIC of the TPA it cannot carry out any power or functions under an SAU that would be necessary to allow for such an audit or review function while the SAU is on foot."

[30] ACCC (2004) Draft Decision, *Statement of Principles for the Regulation of Electricity Transmission Revenues – Background Paper*, 18 August 2004, page 67.

[31] ACCC, (2007) *Assessment of FANOC's Special Access Undertaking in relation to the Broadband Access Service*, Draft Decision, December 2007, page 99.

3.4. Practical concerns created by periodic asset revaluation

81. Apart from the uncertainty created by the revaluation of assets periodically, the continual estimation of an optimised replacement network injects into the regulatory regime a great deal of complexity and creates significant opportunities for regulatory opportunism and regulatory error.

3.4.1. Complexity in asset valuation

82. Valuing regulatory assets on the basis of (depreciated) optimised replacement cost requires a significant amount of information. Estimating the optimal replacement network alone requires information on all probable technologies and one must determine the optimal (least cost) configuration of each to serve the required demands on the network. Historically, in telecommunications, this has been the forum for the development of engineering-economic cost models.

83. In Australia, as elsewhere, the development of these models has been detailed and controversial. Each of the ACCC, Telstra, Optus, Foxtel, and Vodafone have developed models to value the optimised replacement cost of telecommunications networks, no doubt at considerable administrative cost.

84. Disputes have arisen on almost every aspect of the models. Most controversial, and complex, has been the determination of the optimal design of the telecommunications network that would replace the existing network. For example, the ACCC developed a mobile network cost model to assist it in setting access prices for mobile interconnection. The model (developed by consultants wik-Consult) was a 'scorched-earth' model which designed the architecture of the radio layer of the mobile network (the location of base stations) according to a various mathematical algorithms having no regard to topology of existing mobile networks.[32] Mathematical algorithms are common place in the design of replacement networks and are subject to on-going refinements, including contributions by CEG.[33]

85. Significant, but unresolved, complexity in optimised replacement cost estimates arise also in the estimation and forecasting of future costs. An accurate calculation of current optimal replacement costs requires the regulator to estimate the present value of all future expenditures for the construction and maintenance of the network over the life of the assets and the replacement of those assets until those costs have no present value. Typically, in regulatory models used in telecommunications regulation

[32] wik-Consult (2007) *Mobile Termination Cost Model for Australia*, Report for the ACCC, report the use of a variant of the Okamura-Hata radio propagation model.

[33] Competition Economists Group (2009) *Steiner improvements to the Analysys Fixed Network Cost Model*, A report for the Competitive Carriers Coalition.

in Australia the time profile of expenses is embodied in the current cost of each asset and a price trend for that asset over time.

86. Additional complexities arise in network element choices (governed by engineering rules and parameters), demand forecasting, estimates of spare capacity requirements, and cost allocations between services, to name a few.

87. These complexities can pose interesting and often esoteric questions for those involved in cost modelling. For example, there has been much debate, including by CEG, on the question of 'whether the costs of replacing existing telecommunications ditches should include the costs of digging up concrete driveways that were not there when the original ditch was dug?' Whilst intellectually stimulating in the most narrow of senses, they are often questions that have little, if any, relevance to achieving either efficient or fair access prices.

3.4.2. 'Tilted annuity' does not deal adequately with real world complexity

88. The complexities identified in the previous section create significant risk of regulatory error in revaluing assets, such that even if the intention is to provide an expectation that prices will be set to recover the cost of the asset over its life this may not be achieved.

89. A concrete illustration of this regulatory risk (and its impact on regulatory certainty or financial capital maintenance) is in relation to the choice of asset life and the choice of asset price trend that are currently used by the ACCC in calculating depreciation under Part XIC. Because assets are re-valued annually the ACCC must each year calculate its allowed depreciation based on the expected change in the cost of a new asset (the asset price trend) and an assumed asset life. It does this by using a 'tilted annuity' formula. The formula for the ACCC's tilted annuity is provided below:

$$Payment\ in\ year\ t = V * (1+\alpha)^{t-1} \frac{r-\alpha}{1-\left(\frac{1+\alpha}{1+r}\right)^{N}}$$

where:

V = the initial value of the asset set equal to the cost of replacing the asset in 'year 1';

α = the percentage change in the payment each year (the 'tilt');

r = the rate of interest ("time value of money" or "cost of capital")

N = the number of payments (life of the asset)

t = the year of the annuity, which under the Part XIC approach is always set equal to '1' because the asset is assumed to be replaced each year and the tilted annuity is set to calculated the allowed depreciation in 'year 1'

90. This is a formula for a series of annual payments over "N" years that have a present value of $V and where each year's payment is α higher than the previous year. In other words, this formula simply describes a stream of annual payments that are rising or falling at a given rate (the 'tilt') such that those payments have a present value (based on a particular discount rate) equal to the amount of the initial investment. The simplest tilted annuity is one where the tilt is set equal to zero. An example of a front-loaded (negative tilt) is a tilted annuity where the payment in each year is 5% lower than the payment in the last year. Similarly, a back-loaded tilted annuity (positive tilt) might have payments rising at 5% each year.

91. It is important to note that each of these tilted annuities conform, by construction, to the NPV=0 principle if, and only if, in future years the asset is re-valued equal to V in the last year plus α percent and if the assumed life of the asset (N) remains unchanged. Now α and N are nothing more than the model builder's (eg, the ACCC's) *forecast* of future asset price movements and the asset lives. If *actual* falls in asset prices are faster than assumed in α or assets are shorter lived than assumed in N then windfall losses will accrue to the access provider (and *vice versa*).

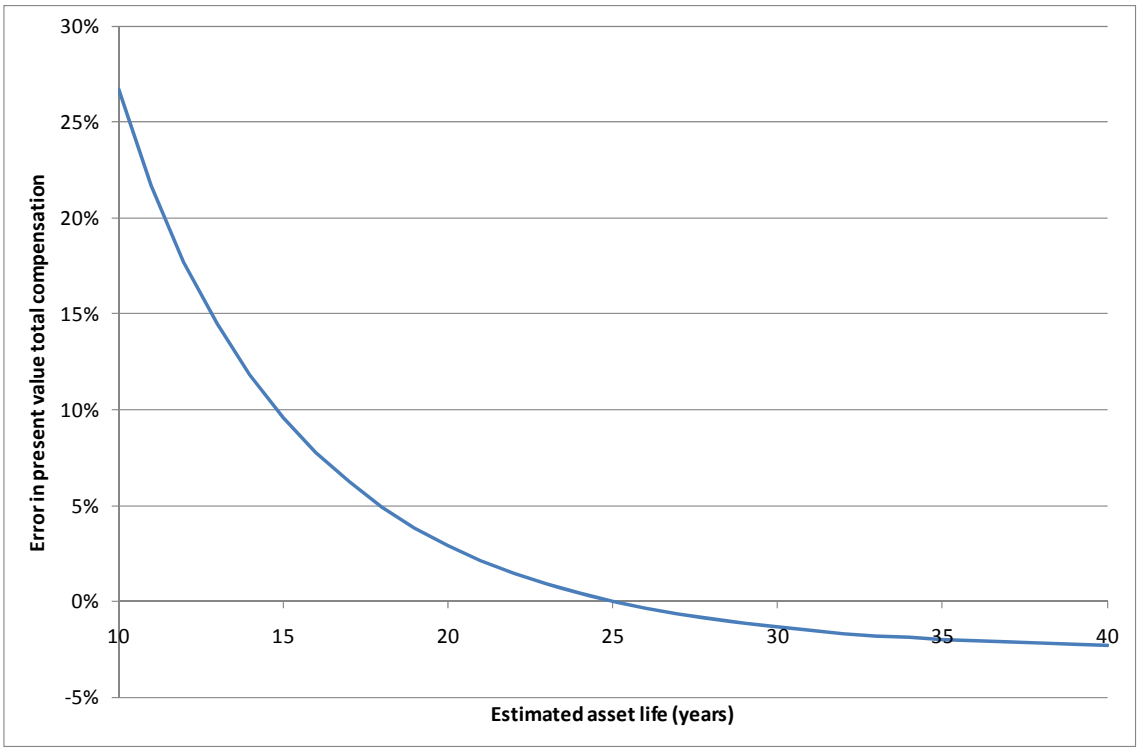
92. As already discussed, it is impossible for the ACCC (or anyone else) to accurately forecast asset price movements or even asset lives from year to year. We have seen this with the price of copper but it is equally true with predicting the rate of technological change that drives asset prices and asset lives. Moreover, with new models built that use different engineering assumptions then these, by definition, can't have been anticipated in past tilted annuity calculations.

93. The accrual of substantial windfall gains and losses, and the ensuing uncertainty this injects into regulatory preceding, might be justified if there were some benefit to the continual revaluation of assets and revisiting of past costing assumptions. However, in our view any such claimed benefits are dubious and, consistent with the ACCC's own thinking in the case of electricity regulation not sufficient to outweigh the costs of the associated uncertainty.

94. Figure 2 below illustrates the effect of an error in the estimated asset life graphically. It shows that for an asset that truly has a life of 25 years and future price trend of -5%. As can be seen, line crosses the horizontal axis at 25 years – showing that if the estimated asset life is equal to the actual asset life then there is zero under/over compensation. We understand that debate around copper lives used in the titled annuity formula for local loop services have ranged between estimates of 10 to 30

years.[34] If the estimated life was set at 10 years instead of 25 years then the present value of compensation provided would be around 27% higher than the actual estimated cost of the copper cable. This is very significant when one is considering a multibillion dollar regulatory asset – and is certainly worth parties to proceedings spending large amounts of resources on debates such as these. This demonstrates the massive sensitivity to assumptions, and potential for windfall gains and losses, when regulated prices are based on continual re-optimisation of asset values (rather than based on actual costs incurred when assets are replaced as is the case in the energy sector). Regulatory decision making could have a substantial, up to 15% impact on the present value of compensation, which for a multi-billion dollar regulatory asset is significant.

Figure 2: Difference in recovered cost from an error in the estimated asset life



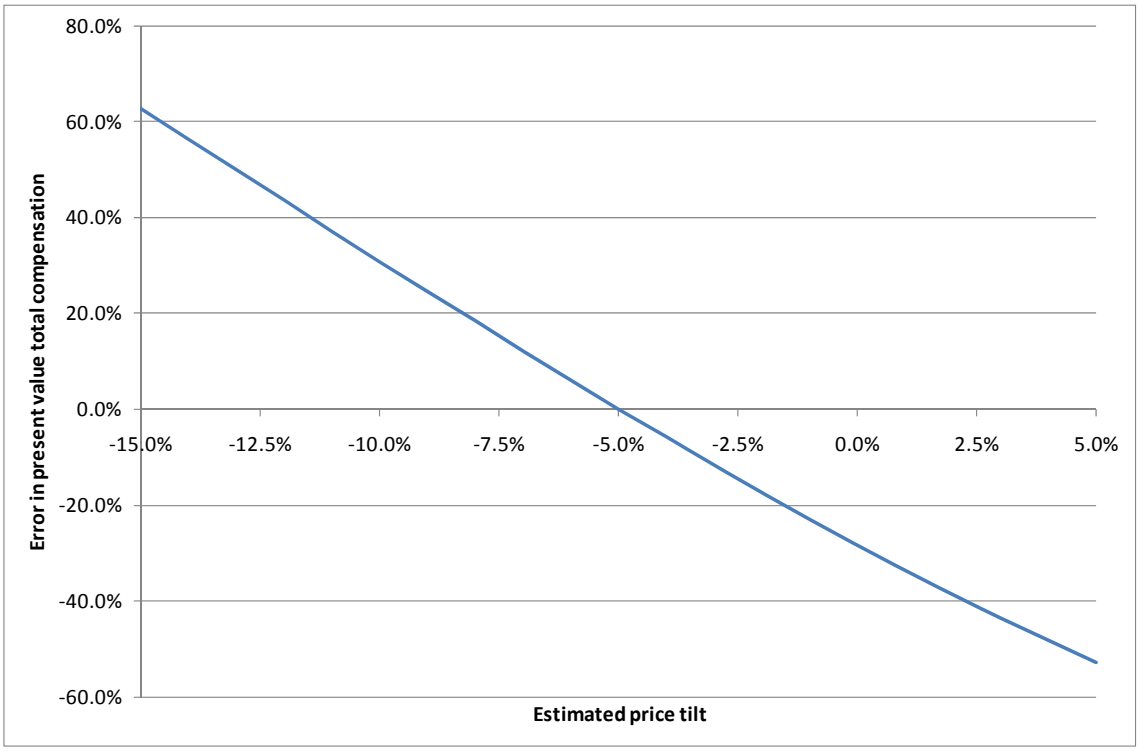
Source: CEG analysis

95. Figure 3 below demonstrates the significance of regulatory error in forecasting asset price trends. It shows that for an asset that truly has a life of 25 years and future price

[34] ACCC (2009) Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking, Final Decision, Public Version, April 2009, page 273.

trend of -5% the effect of an error in the asset price trend used in the tilted annuity formula over time can be significant.[35]

Figure 3: Difference in recovered cost from an error in the forecast price trend



Source: CEG analysis

3.4.3. Rent seeking

96. In the case of fixed line telecommunications assets, at least five different models have been subject to regulatory debate including the NERA model, the PIE model, the PIE II model, the TEA model, and the Analysys model. Each model has taken a different approach to the conception of an optimised replacement cost network and a different approach to determining depreciation (through different annuity assumptions). Each model provides the user with enormous discretion as to the cost estimate. As an indication Table 1 below show the differences between the access provider's (Telstra) price and the regulator's (ACCC) price for local loop services over time.

[35] The section should not be construed as a rejection of the concept of a 'tilted' annuity in the context of a regime which re-values the ORC periodically, nor does it support a 'flat' annuity over a 'tilted' annuity per se. It does say that under such a regime the 'best chance' of getting FCM is through setting a tilt which reflects best forecasts of price trends, but this will not resolved the uncertainty identified in this section and throughout this report.

97. It also shows that potential for variability in cost estimates made over time, in part driven by the assumptions used in the model.

Table 1: Local loop prices per month

	Telstra proposed price	ACCC proposed price	Difference %
2001	$63	$35	-44%
2002	$63	$35	-44%
2003	$22	$22	0%
2004	$22	$22	0%
2005	$30	$12.30	-59%
2006	$30	$13.70	-54%
2007	$30	$14.30	-52%
2008	$30	$16	-47%

Source: ACCC

98. Naturally the complexity in the models and the sensitivity of the asset values to assumptions increase the regulatory effort. The cost of this effort is a waste to society. In addition, when this regulatory effort goes beyond the basic requirement to abide with the regime and seeks to influence the outcome in the party's favour, the effort is described by economists as 'rent seeking'. The incentive to engage in rent seeking activity is a function of the size of regulatory discretion and the potential impact of that discretion.

99. In a once-off asset valuation the degree of regulatory discretion during that valuation exercise is significant (and hence the rent seeking effort would be expected to be large). However, if the asset base is not re-valued periodically, but is 'rolled forward', the degree level of rent seeking effort would be expected to be reduced (particularly if the method of rolling forward the asset base was prescriptive). In all real world arrangements to roll forward assets bases some discretion will remain with the regulator. For example, the assessment of prudent capital expenditure to 'roll into' the asset base will be subject to some regulatory discretion. However, the degree of discretion and its impact on overall cost recovery is significantly less than under the current (Part XIC) model.

100. When assets are re-valued periodically the gains from influencing the regulator are significant. This is not only because of the discretion involved in valuing the asset over and over again, but also in the discretion in setting the allowed depreciation under the tilted annuity – forecasting the future prices trends of assets and asset lives. The potential for large windfall gains and losses inevitably 'requires' access seekers acting rationally to match each other's efforts in tipping regulatory decision in their favour at great social cost.

4. Regulatory regimes providing greater certainty

101. As has been discussed extensively in the previous section, we consider that the existing telecommunications regulatory model (under Part XIC) creates significant regulatory uncertainty for access providers and access seekers alike, to the ultimate harm of end-users. The core of the uncertainty has two aspects:

- Inadequate instruction in the regulation on how to set the initial asset value for the purpose of regulating telecommunications assets; and
- Inadequate prescription on how that asset base should be recovered over time.

102. Part XIC sets broad principles for regulation which allow the ACCC considerable discretion in determining both the value of assets and the time path for the recovery of those assets. In addition, the principles give the ACCC discretion (some would say requires them) to re-value the assets periodically. This process and discretion creates uncertainty and risk.

103. In our view, Part XIC would benefit from greater prescription as to the approach to determining regulated asset values. We consider that regulatory certainty would be greater if the regime specified an expectation of compensation for future expenditures (based on an initial asset valuation at DORC and 'roll-forward' of that value with the objective of achieving NPV=0). This would bring telecommunications regulation more in line with other infrastructure regulations in Australia and would streamline regulatory processes.

104. We begin this section with a discussion of alternative regulatory models that embody a high level of regulatory certainty. We note that in the context of all possible regulatory models, the models that we discuss might be considered in the category of 'incentive regulation'. These models go beyond what might be described as 'light-handed' forms regulations such as information disclosure and negotiate-arbitrate (though how arbitration works ultimately would determine whether such models are light-handed), but are less 'heavy-handed' then rate of return regulation (which has strict financial capital maintenance). The models we discuss and the one that we propose create a high level of expectation of financial capital maintenance (much beyond that which currently applies under Part XIC) but include incentives for cost efficiency and prudency of investment that do not exist in rate of return regulation.

105. In particular, we discuss the laws and rules governing the regulation of gas transmission assets (pipelines) and the laws and rules regulating electricity distribution and transmission networks. We also discuss the regulatory model proposed by FANOC in a special access undertaking (SAU) which was an attempt under Part XIC to propose a more certain regulatory model.

4.1. Gas Law and Rules for regulating natural gas pipelines

106. The regulation of gas transmission assets in Australia is prescribed under the National Gas Law (Gas Law) and National Gas Rules (Gas Rules). In this section we also make references to the *National Third Party Access Code for Natural Gas Pipeline Systems* (the Gas Code). Even though the Gas Code was repealed in 2008 and has been replaced by the Gas Law and Rules, on some key matters the new rules refers back to the Gas Code. For example, in establishing the initial capital base for existing gas pipelines section 77(1)(a) of the National Gas Rules refers back to the provisions of the Gas Code. In addition, in some areas the original Gas Code provides a more straight-forward statement of the economic principles which we believe should be applied in reforming Part XIC.

107. The Gas Law and Rules (previously the Gas Code) provide a detailed set of principles for the regulation of gas transmission networks. The principles extend beyond broad objectives, such as the promotion of competition and efficient investment, to provide detailed guiding principles for the valuation of assets and the principles on which prices would be set by the regulator.

108. The Gas Law and Rules are not prescriptive to the point where no discretion is provided to the regulators, but that discretion is more limited than under alternative regulatory models (such as Part XIC). The Gas Law and Rules are also not inconsistent with the notion that access providers and access seekers may be able to negotiate commercially on access terms for services other than those that are meant to be significant. The Gas Codes stated aim was however is to reduce the number of arbitrations the regulator was called to make. This was achieved by some detailed prescription as to the approach of the regulator if it is called to arbitrate.

4.1.1. Clearly stated objectives of regulation

109. The Gas Law includes a set of objectives that guide what regulatory discretion that remains in the regime. These objectives are almost identical to those under Part XIC. The objectives of the Gas Law is stated as (section 23):

> *"The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas."*

4.1.2. Defined process for setting access terms

110. The Gas Law and Rules have an access provider submitting a proposal for access terms. It gives the power to the regulator to accept or reject a proposal and to specify

amendments to the proposal. It also gives the regulatory the ability to set its own access terms.

111. The was most clearly stated in the Introduction to the Gas Code:

> *"... the owner or operator of a Pipeline that is Covered under the Code is required to lodge an Access Arrangement with the Relevant Regulator. The Access arrangement is similar in many respects to an undertaking under Part IIIA of the Trade Practices Act and is designed to allow the owner or operator of the Covered Pipeline to develop its own Tariffs and other terms and conditions under which access will be made available, subject to the requirements of the Code. The Relevant Regulator will seek comments on the Access Arrangement and then may either accept it or reject it and specify amendments it requires to be made to the Access Arrangement. If rejected, the Access Arrangement must be modified and resubmitted. Under certain circumstances, the Relevant Regulator may draft and approve its own Access Arrangement. The legislation which implements the Code provides for administrative review of certain regulatory decisions made under the Code."*

112. Importantly, the access pricing proposal (or Access Arrangement under the Gas Code) must include pricing terms for all services that are "likely to sought by a significant part of the market" and any service the regulator considers should be included (see section 3.3 of the Gas Code). In addition the Code specifies:

- The content of the access pricing proposal, including how the prices comply with the pricing principle set out in the Gas Code (see section 3 and section 8 of the Gas Code, similar provisions are in Part 9 of the Gas Rules); and
- The process under which the access pricing proposal will be assessed, including the requirements for submission of the proposal, the procedures for public consultation and acceptance of the proposal, the scope of opportunities for review of the decision of the regulator, and the process for amending the proposal (see section 2 of the Gas Code).

4.1.3. Methods of valuing the initial asset base

113. Section 8.10 of the Gas Code (to which the Gas Rules refer) describes a number of asset valuation methods for setting the initial asset value. Under the Gas Code that initial asset valuation is never revisited, though as discussed below, additional capital expenditure can be added to the asset base.

114. The approaches to asset value described in the Gas Code include:

- Depreciate actual cost of building the network, calculated as the historic capital costs of building the network (if these are known) less accumulated depreciation;

- The depreciated optimised replacement cost (DORC) method which is the cost of replacing the existing network with an optimally configure network less an assessment of depreciation;
- A value based on past pricing practices allowing for economic depreciation of the asset and historic returns; and
- The price paid for the asset if it has been recently purchased (depending on the circumstance of the purchase).

115. DORC valuations have been a central point of reference in the valuation of numerous gas pipeline assets.

4.1.4. Statements of the NPV=0 principle

116. The Gas Code allows a number of approaches to the establishing allowable revenue for the period of an access proposal all of which are equivalent and consistent with the NPV=0 principle, as stated:

> *"NPV: The Total Revenue will provide a forecast Net Present Value (NPV) for the Covered Pipeline equal to zero. The NPV should be calculated on the basis of a forecast of all costs to be incurred in providing such Services (including capital costs) during the Access Arrangement Period, and using a discount rate that would provide the Service Provider with a return consistent with the principles in sections 8.30 and 8.31."*

117. The same principle is now embodied in Part 9 of the Gas Rules.

118. The principles to calculate the discount rate (or the weighted average cost of capital (WACC) allowed in the NPV calculation are provided within the Gas Code (at sections 8.30 and 8.31 of the Gas Code, now Part 9 Division 5 of the Rules) and the link between the allowed depreciation and the residual value of the asset value is also established (at section 8.34 of the Gas Code, similar in Part 9 Division 6 of the Rules).

119. In addition, the Gas Code clearly provides a principle of no intended under or over recovery of costs incurred (section 8.45 of the Gas Code, similar in section 89(1)(d) of the Gas Rules):

> *"The Depreciation Schedule should be designed so that an asset is depreciated only once (that is, so that the sum of the Depreciation that is attributable to any asset or group of assets over the life of those assets is equivalent to the value of that asset or group of assets at the time at which the value of that asset or group of assets was first included in the Capital Base, subject to such adjustment for inflation (if any)"*

120. Such a principle, if exported to telecommunications regulation, may likely resolve many of the ('above cost' vs 'below cost') complaints from both access seekers and access providers under Part XIC.

4.1.5. Incentive mechanisms

121. The Gas Code provides strong expectations of financial capital maintenance (though unlike rate of return regulation, cost recovery is not guaranteed). This is because incentive measures have been placed in the Gas Code (see Gas Rules at Part 9, Division 9) to encourage efficient utilisation of existing assets, cost efficiency, and efficient price structures.

122. The measures work so that the monopoly asset owner can exceed cost recovery if they spend less than forecasts of efficient future expenditures and earn more than expected revenues (based on demand forecasts and price structures) by respectively, operating more efficiently (spending less) and utilising the asset more effectively (selling more).

123. Unlike the variations from financial capital maintenance in Part XIC these are variations which are designed to promote competition and encourage efficient use of assets by virtue of rewarding the asset owner for superior performance on matters over which they have control – such as spending on the existing asset. This can be contrasted with the source of variation from financial capital maintenance under Part XIC which results from the regulator mis-forecasting price trends for replacement cost of existing assets.

4.2. The National Electricity Law and Rules (NEL and NER)

124. The NEL and NER are, for the purposes of this report, very similar to the Gas Code. They prescribe the overarching goal of financial capital maintenance of asset values for each electricity network that were initially established based on DORC valuations and are now rolled forward based on actual expenditure (plus or minus an efficiency dividend). This is the regime that was established following the ACCC's own call for the governing legislation to remove its discretion to periodically revalue assets (as discussed above).

4.3. FANOC special access undertaking

125. The FANOC special access undertaking (SAU) was submitted under Part XIC of the Trade Practices Act. The ACCC considered the SAU and made a draft decision to reject the undertaking based on it not satisfying the principles set out under Part XIC.[36]

126. FANOC proposed the construction of a fibre to the node access network which would overlay parts of the existing copper local loop with fibre optic cable. The fibre assets were expected to be long-lived (up to at least 15 years). As FANOC was also seeking access to all of the existing copper loops it would effectively replace the monopoly aspects of the existing copper network.

127. The SAU effectively proposed a 15 year regulatory contract with access seekers (via the ACCC) to give it an expectation of cost recovery (NPV=0 or financial capital maintenance). The model proposed by FANOC would allow the:[37]

> *"... costs of network construction [to] be recovered over the long run. The pricing model ensures this occurs by keeping track of the value of unrecovered expenditure, adjusted for the time value of money, during each Period. The gives rise to the concept of the Capital Asset Value (CAV) which is calculated at the beginning of each Period and is equal to the value of past expenditure less past revenue."*

128. The SAU explicitly drew on the key principles in the Gas Code to provide FANOC with regulatory certainty. In particular:

- The initial asset value was based on observed actual costs (as the asset was not already in existence an alternative asset valuation, such as DORC, was not needed);
- A strong expectation of financial capital maintenance was built into the model with the asset base (termed the Capital Asset Value) being rolled forward into future periods with a mechanism to track and deduct depreciation;
- Incentive measures were provided in the model to encourage efficient capital expenditure in future regulatory periods, increased sales of services, and more efficient pricing structures.

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[36] ACCC, (2007) *Assessment of FANOC's Special Access Undertaking in relation to the Broadband Access Service*, Draft Decision, December 2007.

[37] Hird, T. (2007) Economic Properties of the FANOC SAU, NERA report for FANOC, May 2007, page 8.

129. In its draft decision to reject the SAU the ACCC recognised the importance of regulatory certainty but found that demand uncertainty prevented it from committing to a pricing model beyond three years. The ACCC stated as follows:[38]

> *"The ACCC considers the combination of specific initial prices for the first three years and a pricing methodology to determine subsequent prices is an appropriate means to provide regulatory certainty to both the access provider as well as access seekers regarding pricing issues over the lengthy period covered by the SAU. Regulatory certainty will generally be in the interests of the access provider as well as access seekers and is also likely to support conditions that promote competition. In this regard, the ACCC notes it is very unlikely it could be satisfied that setting specific access prices for much longer than three years would promote competition, due to significant difficulties in identifying appropriate access prices in the future, particularly given the degree of uncertainty as to long-term future demand in communications markets."*

130. This position is difficult to reconcile, as the FANOC undertaking was not proposing 'specific access prices' but a pricing model which provided it with a high probability of cost recovery in the face of uncertain future demand and gave the ACCC an oversight role (similar to that provided regulators of gas pipelines under the Gas Code). In that regard the ACCC noted:[39]

> *"... any methodology for setting access prices would require effective regulatory audit or review of key inputs and parameters in the methodology (such as demand forecasts and forecast or actual capital and operating expenditure) at appropriate intervals if the undertaking period is very long. This would be necessary for the ACCC to be confident that the access provider will exercise its discretion in applying the pricing methodology in an efficient manner. The ACCC notes that currently under Part XIC of the TPA it cannot carry out any power or functions under an SAU that would be necessary to allow for such an audit or review function while the SAU is on foot."*

131. This conclusion may have unfortunate consequences for other attempts by access providers and access seekers to seek regulatory certainty under Part XIC. And suggests a need to expand prescription and direct ACCC powers to accept or set pricing proposals which provide greater regulatory certainty over the long-life of most telecommunications assets. We discussed, briefly, the elements of such prescription in the next section.

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[38] ACCC, (2007) *Assessment of FANOC's Special Access Undertaking in relation to the Broadband Access Service*, Draft Decision, December 2007, page 138.

[39] ACCC, (2007) *Assessment of FANOC's Special Access Undertaking in relation to the Broadband Access Service*, Draft Decision, December 2007, page 99.

5. A Telecommunications Access Code

132. The key conclusion of this report is that the level of uncertainty in the current access regime (under Part XIC) is largely unnecessary and counter-productive to promoting efficient investment in monopoly telecommunications assets and complementary assets used by access seekers. We consider that reform of the regime to provide greater regulatory certainty on key aspects of the regime would be of benefit to all parties.

133. We do not propose in this report to write a new Telecommunications Access Code like the Gas Code or the National Electricity Laws and Rules. We simply wish to set out the basic elements of an alternative regulatory regime which preserves the core economic principles underlying Part XIC but increases regulatory certainty and addresses some of the other failings identified in the regime.

134. In this report we have suggested an alternative regime that:

    i. Sets an initial asset value for existing monopoly assets by undertaking a 'one off' valuation based on the depreciated optimised replacement costs (DORC) of those assets;

    ii. Commits to allow a normal rate of return on that asset value and future unrecovered expenditures; and

    iii. Only amends the asset value to reflect prudently incurred capital expenditure less depreciation underlying the calculation of access prices (ie, return of capital in access prices).

135. Each of these elements is discussed further below.

136. We consider that this approach would be consistent with the economic principles underlying Part XIC - being the promotion of competition, the promotion of economic efficiency, and recognising the commercial interests of both access providers and access seekers, but would necessitate adding substantial prescription to the regime.

5.1. A 'one of' valuation based on the DORC of the asset to set the initial asset value

137. For assets that are not yet 'in existence' the actual costs of building them is a logical point of reference to set the initial asset value. As discussed, it would reflect a fair *ex ante* contract that would be preferred by both access provider and access seekers. However, in most cases the assets will be already 'in existence' and an economic value must be attached to the existing physical asset. The depreciated optimised replacement cost (DORC) of the asset is the result of an economic thought experiment that attempts to put a fair value on the existing asset. It does this by constructing a thought experiment to say what would be the maximum price that the owner could sell

the asset for in a contestable market, that is, the price they could get for the asset if they were not a monopoly and faced competition from other access providers. As we have noted it is clear that such a market is hypothetical.

138. Nevertheless, we consider that a DORC valuation of existing assets is consistent with the economic principles underlying Part XIC. By putting a 'fair' value on the asset given its remaining life and service potential relative to a replacement network it serves to protect the legitimate business interests of the monopoly (by getting a market value that does not account for its monopoly position) and protects the interest of access seekers (in not overpaying for an old asset). The ACCC has described the DORC of an asset in terms of the 'upper limit' fair value of an asset:[40]

> *"Another justification for DORC setting the upper limit to valuations comes from what a DORC valuation actually is attempting to measure. This is the maximum price that a firm would be prepared to pay for 'second hand' assets with their remaining service potential, higher operating costs, and (old) technology given the alternative of installing new assets which embody the latest technology, generally have lower operating costs, and which will have a greater remaining service potential."*

139. A DORC valuation is also consistent with promoting economic efficiency. As discussed in section 3.2, within the range of scrap value and a value which encourages inefficient bypass, direct efficiency considerations offer little guidance as to the appropriate asset value. A DORC estimate will fall within this range being above scrap value but below the full replacement cost (assuming assets have some remaining life). A DORC initial asset valuation and a regulatory commitment to roll that value forward adding prudent future expenditures will promote efficient investment, sending a signal to investors that they should expect a normal return. It will also promote entry by access seekers (reducing the risk of sunk cost expropriation) thereby promoting competition.

5.2. A normal rate of return

140. Many regulatory regimes prescribe significant detail as to the parameters used in the calculation of the cost of capital, whilst other set out the principles that should be applied. The telecommunications access regime under Part XIC is silent on the cost of capital which is to be allowed. This point has been controversial.

141. In order to promote efficient new investment the regulatory regime must at least prescribe a principle that the regulated asset owner be allowed a normal rate of return on the value of its existing assets and future unrecovered expenditures. The allowed return should provide the monopoly asset owner with a risk adjusted return on that

[40] ACCC (1998) *Final Decision Access Arrangement by Transmission Pipelines Australia Pty Ltd and Transmission Pipelines Australia (Assets) Pty Ltd for the Principal Transmission System (and related pipelines)*, 6 October 1998.

value and future expenditures which is consistent with the level of residual risk contained in regulated revenues.

142. We note that the regulatory design can have a significant effect on the residual risk in revenues and hence the cost of capital an access provider (and an access seeker investing in related infrastructure) should be allowed to earn.[41]

5.3. 'Rolling forward' the asset base with a clear link between depreciation and changes in asset values

143. The mechanism to roll forward the asset base consistent with the depreciation which has been allowed in past asset prices is at the core of regulatory certainty. The basic requirement in a regulatory regime is to establish a link between the asset base at the beginning of one regulatory period and the asset base at the beginning of the next regulatory period. This can be achieved by:

- Clearly defining the opening capital base for the regulatory period;
- Adding capital expenditure which will be spent during the regulatory period (forecast prudent capital expenditure may be allowed to create incentives for cost minimisation);
- Subtracting forecast depreciation for the regulatory period;[42]
- Subtracting the value of asset disposals; to arrive at,
- The opening capital base for the next regulatory period.

144. This could be supported by definitions of each of these elements to hold the intent of NPV=0. For example, depreciation could be defined in a manner to prevent over or under recovery. Guidelines for setting depreciation might also be included in the regime to facilitate the achievement of other Part XIC objectives, such as setting the timing of asset recovery to maximise efficiency (eg, time efficient Ramsey prices), or smooth asset recovery to minimise price shocks and hence encourage investment certainty.

5.3.1. Incentive mechanisms

145. Like the Gas Law and the FANOC undertaking, incentive arrangements could be introduced into the regulatory regime to provide incentives to increase utilisation of the network and to minimise future expenditures. These incentives can be structure in a

[41] Competition Economists Group (2008) *The Cost Of Capital for the National Broadband Network*, A report for Optus, 25 June 2008.

[42] Or actual depreciation could instead be subtracted to moderate the incentive to minimise costs (like in the FANOC undertaking for excluded capital expenditure).

way which creates very strong or 'high powered' incentives or in a way which creates moderate to weak or 'low powered' incentives. Introducing incentive measures can create a trade off between efficiency and regulatory certainty, because whilst the incentives increase efficiency they mean that financial capital maintenance will no longer be assured and can be under or over achieved (depending on outturn investment and outturn sales for the typical incentives mechanisms).

146. The cost (in terms of some reduced certainty, additional regulatory oversight, and the cost of creating rent seeking opportunities) of introducing moderate but targeted incentives into the regime described in this section is likely to be less than the economic benefits (increase efficiency). Ultimately, the question of cost versus benefit should be the test for diverging away from financial capital maintenance and deciding on the benefits of adding incentives (and the power of those incentives).

147. To be clear, we restate that unlike the variations from financial capital maintenance in Part XIC the variations discussed here are designed to promote competition and encourage efficient use of assets by virtue of rewarding the asset owner for superior performance on matters over which they have control – such as spending on the existing asset. This can be contrasted with the regulatory uncertainty created under Part XIC (by continually revaluing the asset base) which has very little real economic benefit (simply reflecting the forecasting error in regulatory decision) but has enormous costs in terms of administration, complexity, and rent seeking.

Appendix A. ORC and a 'year 1' tilted annuity

148. Given an initial optimised replacement cost (ORC) for an asset at time t=0, which can be expressed as V(0), and an expected rate of change in the cost of the asset, α, then the path of allowed revenues can be calculated using the tilted annuity formula:

$$\boldsymbol{R(t) = V(0)\frac{(1+\alpha)^{t-1}(r-\alpha)}{1-\left(\frac{1+\alpha}{1+r}\right)^{N}} = V(0)A(t)} \quad (1)$$

where: R(t) is the allowed revenue at time t;

r is the rate of return, assumed to remain constant over time;

N is the life of the asset; and

. A(t) is an annuity factor at time t that describes the relationship between revenue at time t and the initial ORC.

149. However, we observe that, by construction the ORC changes at the rate of α, so that:

$$\boldsymbol{V(t) = V(0)(1+\alpha)^{t}} \quad (2)$$

150. Substituting (2) into the tilted annuity formula at (1), we get:

$$\boldsymbol{R(t) = V(t)\frac{(1+\alpha)^{-1}(r-\alpha)}{1-\left(\frac{1+\alpha}{1+r}\right)^{N}} = V(t)A(0)} \quad (3)$$

151. That is, the revenue calculated at time t can be calculated the tilted annuity formula at (1) and an ORC at time t=0, but this is exactly equivalent to using an ORC at time t and using an annuity factor that assumes that we are at time t=0.

152. We show this equivalence in an example, assuming V(0) = $100, r = 10%, α = -5% and N = 15 years. Table 2 below shows the revenues calculated over 15 years using both approaches.

Table 2: Example of equivalence of revenue calculation

Time, t	V(0)	A(t)	V(0)A(t)	V(t)	A(0)	V(t)A(0)
1	100.00	0.1687	16.87	95.00	0.1776	16.87
2	100.00	0.1603	16.03	90.25	0.1776	16.03
3	100.00	0.1523	15.23	85.74	0.1776	15.23
4	100.00	0.1446	14.46	81.45	0.1776	14.46
5	100.00	0.1374	13.74	77.38	0.1776	13.74
6	100.00	0.1305	13.05	73.51	0.1776	13.05
7	100.00	0.1240	12.40	69.83	0.1776	12.40
8	100.00	0.1178	11.78	66.34	0.1776	11.78
9	100.00	0.1119	11.19	63.02	0.1776	11.19
10	100.00	0.1063	10.63	59.87	0.1776	10.63
11	100.00	0.1010	10.10	56.88	0.1776	10.10
12	100.00	0.0960	9.60	54.04	0.1776	9.60
13	100.00	0.0912	9.12	51.33	0.1776	9.12
14	100.00	0.0866	8.66	48.77	0.1776	8.66
15	100.00	0.0823	8.23	46.33	0.1776	8.23