"An Assessment of Telstra's
TEA Cost Model for Use in the Costing and Pricing
of Unconditioned Local Loop Services (ULLS)"

submitted to the
Australian Competition & Consumer Commission
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by

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1 INTRODUCTION & BACKGROUND

1.1 Scope of assignment

1.1.1 Counsel to Telstra retained us to provide analysis and advice about the appropriateness of the Telstra Efficient Access ("TEA") Cost Model, including whether the model accords with: (1) total service long-run incremental cost ("TSLRIC") principles; and (2) the criteria specified in Section 152AH(1) of the *Trade Practices Act 1974 (Cth)* ("TPA") for the pricing of Unconditioned Local Loop Services ("ULLS").[1]

1.1.2 We have made all the inquiries that we believe are desirable and appropriate and no matters of significance that we regard as relevant have, to our knowledge, been withheld from the ACCC in relation to this report. We have reviewed relevant sections of the TPA and relevant submissions to and reports, determinations, and declarations by the Australian Competition and Consumer Commission ("ACCC").[2] Based upon a review of these documents and our experience, including over a decade of analyzing long-run incremental cost models in telecommunications, we have undertaken an analysis of the TEA model, its economic assumptions, data sources, methods of calculation, parameters, key user input variables, and user interface. We have reviewed and followed the guidelines for expert witnesses in federal proceedings in Australia. Our resumes are attached to this report, and our qualifications are described below.[3]

1.1.3 Counsel to Telstra also retained us to prepare "an expert report expressing [our] opinions as to the following questions:

(a) does the model accord with TSLRIC principles; and

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[1] Letter from Mallesons Stephen Jaques to Robert G. Harris, 5 November 2007.

[2] See Appendix 2.

[3] Mr. Eric Schiff provided assistance in the form of auditing our sensitivity analysis. Mr. Schiff has a Masters of Science in Demography and a Bachelor of Science in Economics, both from the University of California in Berkeley, and he worked with Drs. Harris and Fitzsimmons for five years at LECG.

(b) is the model consistent with the criteria set out in Section 152H of the TPA?"[4]

Counsel also requested that our assessment consider the provisions of Section 152AB of the TPA and their implications for the use of the TEA model in the pricing of ULLS.

1.1.4 Counsel provided the following characterization of ULLS, upon which we have relied in our assessment of the Telstra cost model:

> ULLS is a service declared by the ACCC pursuant to Part XIC of the TPA. The ULLS service is described in the service declaration dated 4 August 1999 and the service redeclaration, made on 28 July 2006, both of which are attached for your information.
>
> Essentially ULLS provides the access seekers with the use of the copper based wire between the network boundary point at the end user's premises and a point of interconnection located at or associated with a customer access module (which can be located at Telstra's exchange building or somewhere between the exchange building and the end user customer). Currently, however, ULLS services are acquired by access seekers from the exchange building.[5]

1.1.5 In order to reduce duplication, our report will not describe or discuss the details of the TEA model. Rather, we refer the reader of this report to the TEA Model Overview for a description of the model. From our hands-on analyses and detailed conversations with the architects and builders of the TEA model, it is our conclusion that this document is an accurate characterization of the TEA model, the data bases on which it is grounded, its economic and network design assumptions, methods of "constructing" a forward-looking customer access network ("CAN") model, methods of calculation of physical units of capital investment, methods of calculation of the cost of those investments, the conversion of total capital costs into annual capital costs, the methods for incorporating maintenance, operating and other TSLRIC-relevant overhead costs, the means of

[4] Letter from Mallesons Stephen Jaques to Robert G. Harris, 15 November 2007.

[5] Letter from Mallesons Stephen Jaques to Robert G. Harris, 15 November 2007.

selecting user-defined input values (and other user variables such as the use of fibre optic cables), and the user interface to the model.

1.1.6 It is critical to note, at the outset, that unlike many other TSLRIC+ models, the TEA model is designed to estimate the cost of the CAN and only the cost of the CAN. The ULLS version of the TEA model is tightly focused on simulating a network designed to estimate the TSLRIC+ of unconditioned copper loops from customers to exchange buildings. As discussed below, this singular purpose and the use of detailed data (actual locations of customers, structure points, and cable routes) makes the TEA model uniquely positioned to model a realistic TSLRIC network focused on the most efficient manner of providing CAN services.

1.2 Qualifications of Dr. Robert G. Harris[6]

1.2.1 Dr. Harris is a Professor Emeritus in the Haas School of Business, University of California, Berkeley. He earned a Bachelor of Arts and Master of Arts degrees in Social Science from Michigan State University and a Master of Arts and Doctor of Philosophy degrees in Economics from the University of California, Berkeley. At Berkeley, he served as Chair of the Business and Public Policy Group, as Founding Director of the National Transportation Policy Research Center, and as Co-Director of the Consortium for Research in Telecommunications Policy, a collaborative program of the University of California at Berkeley, the University of Chicago, the University of Michigan and Northwestern University.

1.2.2 At Berkeley, Dr. Harris taught courses at the undergraduate, MBA and Ph.D. levels, including Microeconomics (emphasizing cost and pricing principles); Business & Public Policy; Industry Analysis and Competitive Strategy; and Telecommunications

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[6] Professional qualifications for Dr. Harris and Dr. Fitzsimmons are detailed in their curriculum vitae, attached as Appendix 1.

Economics (emphasizing costing and pricing principles). For several years, he organized and taught a course on telecommunications economics for the staff of the California Public Utilities Commission, and a one-week course on telecommunications economics, policies and strategies for company managers and policy-makers from the United States and abroad. He also taught telecommunications pricing principles and public policy at the Center for Telecommunications Management, University of Southern California. His academic research developed cost models, analyzed the effects of economic regulation and antitrust policy on industry performance, and addressed the implications of changing economics and technology for public policies and competitive strategies in transportation and telecommunications industries.

1.2.3 While on leave from the University in 1980-81, Dr. Harris served as a Deputy Director at the Interstate Commerce Commission, responsible for cost, economic and financial analysis. In that capacity, he was centrally involved in several major rule makings implementing the motor carrier and railroad regulatory reform acts of 1980 and directed the development of the Uniform Rail Costing System. He has also served as a consultant to the U.S. Department of Transportation, the U. S. General Accounting Office, the U. S. Office of Technology Assessment, the U. S. Department of Justice, the California Attorney General, the California Department of Consumer Affairs, the Minister of Planning of Japan and the Government of Mexico. He has testified on costing methods, competition policy and standards of maximum rate reasonableness, on behalf of several major shippers before the Interstate Commerce Commission.

1.2.4 Dr. Harris has been involved in the construction, review, testing and application of TSLRIC+ and TELRIC+ cost models since 1995.[7] He has testified on telephone rate

[7] TELRIC is the acronym for total element long-run incremental cost methodology designed by the FCC for implementing the Telecom Act of 1996 in the United States. In effect, it is the same as the TSLRIC+ methodology discussed in this report. The FCC was differentiating between the total long- run

design, costing methods, costing and pricing principles, competition policy and alternative regulation before the Federal Communications Commission ("FCC") and 25 state regulatory commissions in the United States. He has testified before telecommunications regulatory authorities in Canada and Mexico and before the United States Senate, the United States House of Representatives and the Joint Economic Committee of Congress on transportation, antitrust and telecommunications policy issues.

1.3 Qualifications of Dr. William Fitzsimmons

1.3.1 Dr. William Fitzsimmons holds a Ph.D. in Resource Economics from the University of Massachusetts, Amherst and has over twenty years experience in the economic analysis of issues related to the emergence of telecommunications competition. His industry experience includes two years of modeling demand for private line services for AT&T in New Jersey, six years as a financial modeler for BellSouth in Atlanta, and fourteen years as an industry expert working for LECG, LLC, an economic consulting firm. Throughout his career, Dr. Fitzsimmons has focused on the quantitative analysis of economic issues, and he has extensive experience with building and analyzing cost models that are used for setting cost-based prices for unbundled network elements and basic local telecommunication services. Dr. Fitzsimmons is currently an independent economic consultant.

1.3.2 At AT&T, Dr. Fitzsimmons constructed econometric models of the demand for private line (and special access) services, and he analyzed the business implications of the accelerating demand for higher capacity services, which continues today. At BellSouth, Dr. Fitzsimmons constructed financial models for the analyses of a wide range of

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incremental costs of a complete *service*, such as basic local service, and an unbundled network *element*, such as a loop.

investment and regulatory decisions. These included company-wide models for assessing the impacts of such issues as installing fibre deeper into the landline network, changing from rate of return regulation to price caps, and adopting usage sensitive pricing for basic local service. Dr. Fitzsimmons also constructed financial models for the analyses of domestic and international acquisitions, price restructuring for yellow pages advertising, and a number of state and federal regulatory initiatives.

1.3.3 At LECG, in the years leading up to and immediately following the passage of the Telecommunications Act of 1996 ("Telecom Act") in the United States, Dr. Fitzsimmons worked with Dr. Harris advising firms and regulatory commissions about the construction of cost models that are consistent with the proper economic interpretation of total long-run incremental cost ("TLRIC"). Since that time, his involvement has spanned a wide range of cost modeling issues and included in-depth analyses of models presented in regulatory proceedings by entrants, incumbents, and regulatory commissions. He has explained his analyses in reports and presentations to state and federal regulatory commissions; he has worked with modelers to resolve differences over cost modeling issues; and he has appeared in dozens of regulatory and litigation proceedings as an economic expert on the proper construction, population, and use of cost models.

1.3.4 Dr. Fitzsimmons' experience with the unbundling of network elements includes presentations of financial simulations to the FCC related to the potential impacts of unbundling on incumbent local exchange carriers and the business opportunities facing competitive local exchange carriers without the use of unbundled switching and transport. He has testified numerous times on the proper economic interpretation of TELRIC as it relates to a variety of network elements, including, most recently, an appearance before the Minnesota Public Utilities Commission in April 2008.

1.3.5 Dr. Fitzsimmons' analysis of cost models for basic landline telecommunications services takes place in the context of over twenty years of experience with the quantitative analysis of a wide range of telecommunications issues. In addition to his eight years working on firm-specific analyses with AT&T and BellSouth, his experience includes: (1) simulating the financial impacts on groups of entrants and incumbents from changes to regulatory policies and practices; (2) estimating the costs of providing wireless services; (3) assessing measures of the emergence of competition; (4) determining the appropriate use of cost models for setting cost-based prices for the high-frequency portion of the local loop; (5) analyzing potential damages related to inter-firm disputes; and (6) analyzing costs related to the use of public rights-of-way for placing telecommunications facilities.

2 TSLRIC & FORWARD-LOOKING NETWORK DESIGN

2.1 Economic rationale for using TSLRIC in pricing network elements or services such as ULLS

2.1.1 A fundamental economic concept underlying the transformation to competitive telecommunications markets is that competition provides the proper incentives for more efficient investment and innovation. To achieve this transformation, the ACCC mandates that Telstra make CAN assets available to competitors at TSLRIC-based prices. Its 2007 statement on ULLS pricing principles notes that:

> The ACCC has historically been of the view that a TSLRIC+ approach is consistent with the price that would prevail if an access provider faced effective competition, and that it usually best promotes the long-term interests of end-users.
>
> Further, the ACCC has historically been of the view that a TSLRIC+ pricing approach is consistent with the legislative matters discussed above at 2.2 [relevant sections of the TPA].

> The Australian Competition Tribunal has also expressed its general agreement with the TSLRIC+ pricing methodology...[8]

In its Final Report on the Pricing of unconditioned local loop services in 2002, the ACCC also observed that:

> Declaration of the ULLS enables service providers to connect their own networks to existing infrastructure to deliver new and innovative services to end-users more efficiently. This reduces the need for full duplication of communications networks, while encouraging service providers to establish their own infrastructure where this is efficient.[9]

Cost-based prices derived from a properly constructed and populated TSLRIC model will provide the proper signals for the development of efficient and beneficial facilities-based competition.

2.2 *Accurate, objective, and consistent implementation of TSLRIC+*

2.2.1 Before proceeding to the discussion of the appropriate approach to constructing and populating a TSLRIC+ model, it is important to begin with a clear view of two aspects of the TSLRIC+ methodology that are too often ignored. First, though the TSLRIC+ methodology is meant to simulate that which would prevail in a real-world competitive market, TSLRIC+ does not estimate costs that any real-world firm would or could incur. Second, due to underlying assumptions in the methodology and, at times, the efforts of regulators to stimulate even inefficient entry with below-cost prices, estimates of TSLRIC+ are prone to understating costs that any real-world firm could achieve and, therefore, understating prices that would prevail in a competitive market.

2.2.2 TSLRIC+ is an estimate of what it would cost a hypothetical firm to replace Telstra's current network in today's conditions in a very short period of time using a single

[8] "Unconditioned Local Loop Service (ULLS): Final Pricing Principles," Australian Competition and Consumer Commission, November 2007, pp. 9-10.

[9] "Pricing of unconditioned local loop services, Final Report," Australian Competition and Consumer Commission, March 2002, p. 7.

vintage of the best technology currently in use. This is consistent with the ACCC's conclusion that:

> replacement cost is the cost methodology most consistent with an efficient forward-looking network...In a practical sense, this means building a network that reflects best-in-use or best commercially available technology.[10]

This is the accepted TSLRIC network assumption even though it is well understood that no firm could ever build a network comprised of the best technology currently in use, and no firm could, therefore, experience the costs estimated by the TSLRIC+ methodology. As observed by the FCC when it was reconsidering the TELRIC methodology in 2003:

> One of the central internal tensions in the application of the TELRIC methodology is that it purports to replicate the conditions of a competitive market by assuming that the latest technology is deployed throughout the hypothetical network, while at the same time assuming that this hypothetical network benefits from the economies of scale associated with serving all of the lines in a study area. In the real world, however, even in extremely competitive markets, firms do not instantaneously replace all of their facilities with every improvement in technology. Thus, even the most efficient carrier's network will reflect a mix of new and older technology at any given time.[11]

Although the internal tension identified by the FCC between a TSLRIC+ network and a real-world network indicates that the TSLRIC+ methodology has an inherent downward bias, it does not invalidate the methodology. The validity of the TSLRIC+ approach rests on its ability to estimate costs that are reasonable proxies for the costs that an efficient firm could actually achieve. The key word is "reasonable". Prices based upon cost estimates that are reasonable approximations of what a real-world firm could

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[10] Telstra's Access Undertaking for the Unconditional Local Loop Service, Discussion Paper, Australian Competition & Consumer Commission, June 2008, Section 5.2.6, p. 29.

[11] *In the Matter of Review of the Commission's Rules Regarding the Pricing of Unbundled Network Elements and the Resale of Service by Incumbent Local Exchange Carriers*, WC Docket No. 03-173, FCC 03-224, released September 15, 2003 ("*TELRIC NPRM*"), ¶50.

achieve will drive efficient and beneficial investment decisions for incumbents and entrants alike. Even with an inherent downward bias, the TSLRIC+ methodology can produce reasonable cost estimates when care is taken to design a network structure that is as reasonable as possible and select values for key inputs that are consistent with the TSLRIC+ standard, internally consistent with each other, and consistent with the best available information. The second key word is, thus, "consistent". Given the inherent downward bias in the TSLRIC+ methodology, attempts to further depress costs with unreasonable and inconsistent assumptions in order to stimulate entry are misguided and will prove harmful to the development of an efficient industry.

2.2.3 Additional factors that contribute to the understatement of cost estimates are discussed below. A number of these are linked to the hypothetical nature of this cost estimation methodology. As observed by the noted regulatory economist, Professor Alfred Kahn,

> [P]olicymakers...ignore the *actual* incremental costs of the incumbent suppliers and instead adopt as the basis for policy the costs of a *hypothetical*, most efficient new entrant, constructing an entire set of facilities as though writing on a blank slate...[12]
>
> TELRIC-BS [Blank Slate] calculations...will tend systematically to understate actual incremental costs.[13]

Although we do not assume that the experience in the U.S. is universally applicable or predictive of what will occur in Australia or elsewhere, the following assessment by the ex-Chairman of the FCC of the implementation of the TSLRIC methodology is noteworthy with regard to this point. In 2001, after five years of overseeing the implementation of the U.S. Telecom Act, Chairman Powell concluded that:

> [G]overnment policy was a little too generous in incenting quick [business] models...I think we probably bent a little more in the direction of resale

[12] Alfred E. Kahn, "Whom the Gods Would Destroy or How Not to Regulate," AEI-Brookings Joint Center for Regulatory Studies, Washington, D.C., 2001, p. 4 (emphasis in the original).

[13] *Id.*

> than facilities because everybody was really anxious to get competition...we have to do the hard medicine stuff now...[to] make sure that whatever competition does come is real and lasting.[14]

In the U.S. context, facilities-based competition includes combining leased loops (i.e., the CAN) with self-supplied facilities, such as switching and transport, while resale refers to reselling the incumbent's finished services. The FCC reinforced Chairman Powell's concern in 2003 when it observed as follows:

> To the extent that the application of our TELRIC pricing rules distorts our intended pricing signals by understating forward-looking costs, it can thwart one of the central purposes of the [Telecom] Act: the promotion of facilities-based competition. While our UNE pricing rules must produce rates that are just, reasonable and nondiscriminatory, consistent with the Act's goal of promoting sustainable competition, they should not create incentives for carriers to avoid investment in facilities.[15]

This goes to the fundamental goal of TSLRIC+ pricing, which is to provide the proper signals for efficient investment decisions by incumbents and entrants. To accomplish this, TSLRIC+ must provide estimates that are reasonable approximations of the costs that an efficient firm could actually hope to achieve.

2.2.4 In the final analysis, the hypothetical nature of the TSLRIC+ methodology does not preclude the use of this methodology for setting cost-based prices that promote efficient and beneficial facilities-based competition. When estimated accurately, objectively, and consistently, TSLRIC+ can provide reasonable cost estimates and provide a useful basis for setting prices for this proceeding. Even estimates that are made without a bias toward understating costs and with assumptions and information that are consistent with the TSLRIC framework and internally consistent with each other may understate costs that a real-world firm could achieve. These estimates are, however, unencumbered with

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[14] "Powell Blames CLEC Money Woes on Lenders, Bad Business Plans," Part 2 of Powell's Interview Transcript, Edie Herman, Mary Greczyn, Communications Daily, May 23, 2001.

[15] TELRIC NPRM, ¶3.

past regulatory and business decisions, and difficult to improve upon as a basis for simulating prices that would prevail in a competitive environment. Accurate, objective, and consistent estimates of TSLRIC+ have known strengths and shortcomings that on balance make this methodology reasonable and acceptable. Inaccurate, biased, and inconsistent estimates, however, are neither reasonable nor acceptable as a basis for setting cost-based prices of the CAN.

2.2.5 It follows that, estimates of TSLRIC+ are only as good as the model and methods used to estimate them. Accurately and objectively estimating TSLRIC+ is a critical step toward simulating prices that will lead to efficient investment decisions by all competitors. If sound TSLRIC+ principles are adopted, cost-based prices will provide: (1) proper signals for build-versus-lease decisions for all competitors and potential competitors; and (2) fair and reasonable compensation for Telstra. If, however, TSLRIC+ is estimated with a downward bias, as has often happened in the U.S., TSLRIC-based pricing will preclude the very facilities-based competition it is meant to foster. Rather than promote efficient and beneficial facilities-based competition, such prices will depress the investment incentives facing wireline competitors (including the incumbent) and firms using alternative technologies, such as firms using cable and wireless networks.

2.3 TSLRIC+ and the TEA Model

2.3.1 In the case at hand, Telstra is putting forth a model designed to apply the TSLRIC+ methodology to estimate the long-run, forward-looking, efficient costs of building and operating a local network capable of providing unconditioned copper loops. This model estimates the direct cost of building and operating the CAN to provide unconditioned copper loops, as specified by the ACCC, at the level of output provided over Telstra's current network using current build-out conditions (such as existing terrain, buildings, and other obstacles) and the best technology, practices, and procedures currently in use.

In short, it estimates the costs that a reasonably efficient firm would incur to build and operate a new CAN to reach all customer premises reached by Telstra's current network, and it includes a reasonable allocation of joint and common costs.

2.3.2 Given its intended use in pricing ULLS, it is necessary to ask what it would cost a firm to build, operate, and maintain a new CAN when working through the theoretical TSLRIC+ construct. This firm would have to build its network in the environment as it exists today, with buildings, highways, streets, yards, rivers, mountains, and other man-made and natural obstacles in place. The firm would have to use the construction techniques or placement methods needed to build around or under these obstacles and would not have the luxury of installing its network in unobstructed "green field conditions." In addition, if the firm were building a loop network today, designed to serve all of the existing premises (an assumption that is consistent with TSLRIC+), it would operate in a world with rights-of-way in their current positions and face limited opportunities to share the costs of placing facilities with other network service providers. Assuming a network serves all customers captures significant economies of scale in TSLRIC+. It precludes, however, the existence of competitors for the purpose of sharing the cost of placing facilities.

2.3.3 Telstra provides statements by CIC [redacted] and CIC [redacted] that lay out the practical and technical reasons why there are few opportunities to share the cost of placing facilities with other entities. These statements are consistent with our experience with working through these issues in numerous cost modeling dockets in the United States.

2.3.4 A good TSLRIC cost estimation model "simulates" actual construction costs using "real-world" assumptions regarding the methods, technologies, and equipment a firm would use to build, operate, and maintain a new network in a competitive environment.

Although TSLRIC is a theoretical construct, it can provide meaningful information for setting cost-based prices if – and only if – TSLRIC+ cost estimates are based on:

- Actual and realistic, not hypothetical or idealistic, assumptions related to building and operating a reliable network;
- Forward-looking, best available technology and practices consistent with a real-world network architecture and actual conditions;
- Input values that are consistent with the rules and purpose of the modeling exercise and with each other; [16]
- The inclusion of all costs that are incremental to providing copper CAN services (including ULLS) to as many customers as are capable of being supplied with these services; and
- The addition of reasonable allocations of joint and common costs.

As described below, the TEA model structure is based upon these criteria.

2.4 *Assumptions have the overall effect of reducing TSLRIC estimates*

2.4.1 TSLRIC models rely on a number of assumptions that are best described as necessary fictions. For example, TSLRIC models assume that the new CAN is built with:

- A single vintage of technology (with no time component);
- Precisely the correct dimension (with no reinforcements or stranded plant); and
- The best technology (with no technological "mistakes").

These assumptions are described below.

2.4.2 As discussed above, TSLRIC models (including the TEA model) assume that the hypothetical firm uses only the latest technology, which is tantamount to assuming that the replacement network is built in a very short period of time or instantaneously. This assumption is intended to ensure that any and all economies of scale and scope and the efficiency of today's best technology are incorporated in the model and its estimated costs. As pointed out by the FCC, however, in the real world even the most efficient

[16] The purpose of the exercise at hand is to model the incremental, forward-looking, efficient costs of building and operating a reliable network that reaches all customer premises reached by Telstra's current network to provide ULLS as defined above.

carrier's network will reflect a mix of newer and older technologies, because real-world networks are built over time. Entrants and existing firms expand and replace facilities at the margin while continuing to use facilities that are less efficient, yet economically viable. It is neither financially nor physically feasible to engage in wide-scale retirement and replacement of facilities whenever newer, more efficient, facilities are introduced.

2.4.3 TSLRIC models (including the TEA model) assume that the hypothetical firm builds the right amount of capacity to meet the current demand where it is currently located (with provisions for spare capacity for future growth in demand). But in competitive markets seldom, if ever, do competitors have exactly the right amount of capacity to meet demand during any given period, so they experience periods of excess or insufficient capacity, which raise costs above the ideal level as facilities in the first instance are underused and facilities in the second are reinforced. The costs of these "mistakes" are normal costs of doing business in a competitive industry, but TSLRIC does not incorporate these costs.

2.4.4 TSLRIC models (including the TEA model) assume that 100 percent of installed capacity is comprised of the best available technology, with no technological "mistakes" and no mixing of different vintages. In competitive markets, even the most efficient firms use a mix of technologies, only some of which (typically the newest plants, planes, or other facilities) are of the best, lowest-cost technology. Moreover, it is quite common for firms to make mistakes, choosing technologies that do not work out as hoped, or are quickly displaced by new, better technologies, and these mistakes raise costs above the ideal level. Higher costs due to these "mistakes" are also normal costs of doing business in a competitive industry, but TSLRIC does not incorporate these costs.

2.4.5 Thus, TSLRIC models, including the TEA model, are based upon a highly stylized view of competition – the kind one typically finds in economics textbooks, but <u>not</u> the real world. Costs estimated by such models are typically lower than the costs an efficient entrant would probably incur if it were to build, operate, and maintain a network in competition with the incumbent. That, of course, is the basic intent of TSLRIC: to remove the advantages of the incumbent, yet to provide incentives for entrants to invest in network facilities where it makes economic sense to do so.[17]

2.4.6 Although there are a number of fictional assumptions related to the TSLRIC network, it is, nonetheless, crucial that the remaining network design assumptions of the model and the inputs to the model be consistent with these assumptions and with the best available information. Otherwise, one is likely to set prices based on cost estimates that are unreasonably low, which would create a strong disincentive for competitors to invest in their own facilities – because it is much cheaper to lease facilities from the incumbent at these artificially low prices.

2.4.7 Yet, in fact, there are numerous instances in which TSLRIC models have been populated with inconsistent and unreasonable network design and economic input assumptions. Consider the low unbundled loop price set by a number of state regulators in the U.S. immediately following the FCC's decision to set prices based upon TELRIC, which is essentially the same as the TSLRIC methodology. (In the state of Iowa, for example, where we were involved in an extensive analysis of cost models and the values of key inputs, the initial unbundled loop price set in 1996 was considerably less than the price that was later established by the regulatory commission after a more

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[17] Relative to the costs that Telstra incurred to build the existing CAN, the TSLRIC assumption that the new CAN is built in today's conditions is one factor that may partially offset the understatement of TSLRIC costs described in this section. It is typically more costly to place facilities after roads, sidewalks, and landscaping are in place. Yet this is the environment in which most of a forward-looking network would be built.

accurate application of the TSLRIC methodology.) The resulting cost estimates do not – cannot – meet the requirement intrinsic to the use of TSLRIC in the first place, namely, that one is attempting to emulate a competitive marketplace. Rather than promote efficient competition, prices based on unrealistic inputs and assumptions will distort marketplace decisions by competitors and customers. If these prices are biased downward they will undermine incentives for infrastructure investment and innovation by Telstra and its competitors.

2.5 Public policy rationale for using logically consistent, realistic network assumptions and reasonable economic inputs in a TSLRIC+ model

2.5.1 The ACCC has declared that it will rely on TSLRIC in making pricing decisions, and Telstra has, therefore, developed a model for estimating TSLRIC. Because the root assumptions that underlie the use of TSLRIC as a basis of pricing models already incorporate competitive ideals, though, it is critically important, in evaluating the model and in considering what are reasonable inputs to the model, to use realistic and consistent assumptions. Pretending, for example, that an entrant could build a network using a minimum spanning tree as its network design, without incorporating actual topography, highways, roads, buildings and the like, means that the resulting cost estimates would have nothing to do with economic reality. In the real world, an entrant would have to build a network designed and placed in a manner that deals with existing structures and features.

2.5.2 A model that fails to incorporate these real-world costs will reduce cost estimates and lead to artificially low prices of ULLS. This will, in turn, thwart the statutory goal of promoting economically efficient investment. The statute requires that access prices meet the following objectives:

> *(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.*[18]

In terms of accomplishing objectives 'c' and 'e' there is an important distinction between adopting cost-based prices that will promote efficient and lasting competition and adopting below-cost prices in an effort to promote entry by even inefficient competitors.[19] The objectives required by the statute are furthered by prices that reflect the underlying cost of building and operating facilities. Prices that are below the cost of building and operating facilities will discourage investment by existing companies and entrants and, thereby, undermine the development of competition that is "real and lasting."

2.5.3 One significant advantage of the TEA model is that it allows users to choose the values of important economic inputs into the model. However, that capability also means that a user can, if so inclined, run the model with an unreasonable set of inputs that do not reflect economic reality in competitive markets, thereby reducing estimated costs below what an actual entrant would incur. The TEA model, therefore, is only as good as the inputs used in running the model. In other words, "GIGO" applies: "garbage in, garbage out." In somewhat less colloquial terms, "unreasonable input assumptions in, unreasonable cost estimates out."

2.5.4 It is especially important that users choose input values that are logically consistent with the proper interpretation of TSLRIC+, with each other, and with the best available information consistent with the TSLRIC+ construct. All inputs need to work together to simulate the same world, i.e., reflect the same assumptions. If TSLRIC is estimated

[18] Trade Practices Act of 1974, Subsection 12AB(2).

[19] It is our understanding that, from a technical perspective, the network design in the TEA model is consistent with the objective of any-to-any connectivity.

using logically inconsistent or unreasonable input assumptions, it will reduce technical, allocative, and dynamic efficiency.

2.5.5 **Technical economic efficiency** refers to making the best use of inputs in the production of outputs. The objective of technical efficiency is the production of any given level of output with the minimal use of inputs, in order to preserve scarce resources. Technical efficiency is maximized when companies and their employees minimize costs while maintaining or improving quality. When prices are based on economic cost and reflect market demand, consumers will turn to the seller with the lowest price – hence the producer with the lowest cost.[20] Policies that induce uneconomic entry into local exchange services reduce technical efficiency because services are not then provided by the most efficient supplier. Competition greatly exacerbates the potential harms from reducing technical efficiency due to uneconomic pricing. If, for example, Telstra is required to price ULLS below a competitive level, a customer may choose to purchase from Telstra rather than self-supply, even though its costs are lower than Telstra's costs. Such pricing policies generate technical inefficiencies, because the service is then not being provided by the least-cost producer.

2.5.6 **Allocative economic efficiency** refers to the best use of outputs. Prices play a critical role in achieving allocative efficiency because they are the signals of the cost and value of goods and services. Allocative efficiency means that outputs are sold at prices that reflect the true economic costs of producing the output, including a share of the common costs of a multi-product firm. If price is greater than true economic costs, consumers will purchase less than the optimal quantity; if price is less than cost, consumers will purchase more. In either case, there is a loss of "social welfare" due to the misallocation of resources. The amount of welfare loss in any given situation

[20] Assuming the same quality of service, of course.

depends on two factors: the difference between price and cost, and the sensitivity of demand to price (i.e., the price elasticity of demand). Hence, policies that prevent prices from reflecting economic costs and demand conditions are directly contrary to allocative efficiency.

2.5.7 Moreover, with emerging competition, buyers can turn to alternative sellers (often unregulated), so the quantity purchased becomes much more sensitive to prices. Consequently, the more competition in the market, the greater the social costs of inefficient prices. If the prices of competitive services are not economically rational, competitors will target their efforts at customers of services priced above competitive levels, while neglecting customers or services that are priced below competitive levels.

2.5.8 **Dynamic economic efficiency** refers to the optimal rate of technological change, including the rate of innovation and the rate of adoption of innovations. One of the chief benefits of an enterprise economy is that competition stimulates the development and adoption of new technologies, (i.e., methods of production which reduce the quantity of inputs needed to produce a given level of outputs). While technical efficiency is a static concept (i.e., it assumes that technology is fixed), dynamic efficiency is a measure of technological progress. Pricing can influence the rate of technological progress in two different ways: (1) if prices are set too low, competitors may not adopt better, lower cost technology for providing the service in question; and (2) if prices are set too high, competitors may adopt inferior technology, even though the cost of providing service is higher than the existing technology.

2.5.9 Although estimating TSLRIC with logically inconsistent or unreasonable input assumptions will reduce technical, allocative, and dynamic efficiency, it is common for users of TSLRIC models to make logically inconsistent assumptions. For example,

- **Sharing** assumptions: It is inconsistent to assume that a hypothetical entrant would "instantly build" a network in order to use best available technology and size of the network exactly right, yet assume that hypothetical entrant could share trenches in new developments to an extent that could occur only over a number of years. Relatedly, it is inconsistent to assume that the hypothetical entrant will serve 100 percent of existing customers, yet will be able to share placement costs with competitors. A firm serving 100 percent of the existing customers will have few, if any, competitors ready and willing to share the cost of placing facilities.

- **Asset lives** and **economic depreciation:** It is illogical to adopt and implement prices and regulations on the grounds that they will promote competition, yet assume that the hypothetical entrant will not lose any market share to facilities-based competitors over the lives of long-lived assets and not face accelerated technological innovation and investment that will shorten the economic depreciation lives of some, or all, of its assets.

2.6 Importance of appropriate network design assumptions in estimating TSLRIC costs

2.6.1 Accurate and objective cost estimates begin with the design of a network that is as realistic as possible within the TSLRIC+ methodology. Simulating a realistic network is a complex task made more difficult by the lack of detailed data about customer locations and network routes needed to recreate the paths of the real-world network. As a result of insufficient data, the sophisticated models in common use today simulate hypothetical networks. These networks have suffered a wide range of serious problems, such as missing network components, assuming that customers move to distribution routes rather than building routes to existing customers, and placing cables on top of lakes and through buildings. Due, at least in part, to these problems, some modelers have put greater distance between their models and reality by proffering estimates of distribution distances based upon hypothetical route minimization methodologies.

2.6.2 If the data are available, a far better solution is to base the network in a TSLRIC+ model on the existing network after eliminating inefficiencies inherent in any network built and reinforced over an extended period of time. Even a forward looking replacement network would face constraints related to existing rights-of-way. This, in fact, is a distinguishing characteristic of the TEA model.[21] The TEA model starts with an actual,

[21] Though the FCC, in its TELRIC NPRM, tentatively concluded that going forward: "TELRIC rules should more closely account for the real-world attributes of the routing and topography of an incumbent's network in the development of forward-looking costs." TELRIC NPRM, ¶52.

rather than a hypothetical, lay-out of its network based upon Telstra's detailed records of the locations of its facilities and customers. To my knowledge, Telstra is the only major telecommunications company that has provided the detailed network data necessary to build a cost model on the foundation of an actual network that reaches actual customer locations. This is a substantial advantage over models that, by necessity, begin with a hypothetical network to reach hypothetical customer locations, and usually do so by "placing routes" over and through all sorts of natural obstacles and right-of-way limitations.

2.6.3 A second distinguishing characteristic of the TEA model, which also makes use of Telstra's detailed network data, is that the network in this model is designed to reach the existing locations of the pillars in Telstra's network. Basing costs on the actual network layout, including the locations of pillars, has the advantage of accounting for existing rights-of-way and the associated costs, and it makes the model adaptable for the examination of sub-loop unbundling, if this emerges as a concern at some point in time. Against these advantages, there is the possibility that a more hypothetical network that followed engineering guidelines, accounted for rights-of-way issues, and obeyed natural laws, could relocate a portion of the pillars and realize a lower cost. Based on our experience with the analysis of cost models, the fact that this network will need to cover essentially the same ground to reach the same customers, and the fact that relocating pillars may lead to cost increases related to acquiring rights-of-way, our rational expectation is that placing pillars in alternative positions will have little, if any, negative impact on the cost of building the network. In fact, Telstra's analysis shows that the network specified in the TEA model reaches customers with approximately 35 percent less trench kilometers than are in Telstra's existing network.[22] Given the substantial amount of cost related to trenching, this is a significant gain in efficiency.

2.6.4 A final observation regarding the use of actual network information is that, although the paths of the network in the model follow existing routes in Telstra's network, the routes used in the model avoid duplicative cable runs present in networks that were built over extended periods of time. The lay-out of the network in the TEA model is, therefore, based upon a realistic and efficient forward-looking design and satisfies the TSLRIC+ standard in this respect.

2.7 Market share assumptions

2.7.1 Even though TSLRIC is supposed to model the costs of a hypothetical firm, TSLRIC models typically assume that the firm serves (i.e., spreads the costs across) 100 percent of the incumbent's existing customers. This assumption incorporates 100 percent of scale and scope economies to the hypothetical entrant, which reduces cost estimates below what any actual entrant could attain with a copper loop network.[23] In fact, a TSLRIC network is designed to replace the incumbent's network and serve the incumbent's entire customer base in order to extend the incumbent's economies of scale to entrants, while removing inefficiencies in a network built over decades. Furthermore, an underlying assumption is that the TSLRIC network will continue to provide service to this base of customers over the economic lives of the network assets. Extending economies of scale associated with these assumptions provides entrants with attractive cost-based prices.

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[22] Measure of the TEA Model Efficiency: ULLS Band 2, Telstra's Network & Technology Fundamental Planning, September 2008.

[23] The availability of Telstra's loops at TSLRIC-based prices are a factor for consideration in the build versus buy decisions of entrants that are using or considering the use of different technologies, such as mobile wireless, fixed wireless or hybrid fibre-coax cable, all of which have markedly different cost characteristics than Telstra's network.

2.7.2 TSLRIC models, including the TEA model, typically assume the network will continue to serve all existing users over the life of the assets. Given the likelihood of continuing loss of market share to facilities-based competitors, this assumption biases ULLS cost estimates downward, by "spreading" network costs across customers. Even if the incumbent loses just 1 percent market share per year, over the lives of long-lived investments, this would substantially increase the cost per remaining customer. A more realistic economic assumption would be to spread the fixed costs of the network over fewer customers over time.

2.7.3 There are two approaches to reflecting the potential loss of market share in the TEA model: either reduce the number of lines over which fixed network costs are spread (i.e., lower the realized fill), or, in the alternative, incorporate the risk of market share loss in the cost of capital and economic depreciation lives of assets. The first approach opens the door to a highly contentious and difficult process of forecasting future levels of network utilization and other important inputs to the model that are expected to change. The second, which simulates the process that real-world firms face every day is clearly preferable. On a related point, the recovery of network investment should not be "back loaded," or pushed into the future using a tilted annuity, which drives down near term costs by back loading the cost recovery into later years, by which time it is likely that Telstra will have lost significant market share and/or installed new technology. Market share losses and accelerated technological change are normal byproducts of increased competition.

2.7.4 It is noteworthy that losing or gaining revenue-producing access lines, and thereby, realizing lower or higher utilization rates, have very different impacts on cost per active line than using lower or higher fill factors in the design of the network. For setting the price for the CAN, what is important is the cost per unit, i.e., the cost per line, and the cost per line is calculated by dividing the total cost of constructing and operating the CAN (the numerator) by the number of revenue producing lines (the denominator).

Cost per Line = Total Cost of the CAN / Number of Lines

Fill factors used to design the network affect the total cost of building the network, and, for a number of reasons discussed below, changing fill factors across a relatively wide range has little impact on the total cost of the CAN. Most of the cost associated with constructing outside plant is accounted for by the activities required to place cables (such as digging trenches and restoring the ground or roadway after placing conduit and cables in the ground), and these costs are incurred in very much the same manner (and at the same cost) regardless of the size of the cables that are placed in the ground. That is, changing the fill factors used to design the network changes the size of the cables placed in the ground but has little or no impact on the cost of digging trenches or restoring the surface to its original condition. For this reason, changing design fill factors across a relatively wide range has little impact on the total cost of the CAN and, therefore, little impact on the cost per line used to set prices. For example, the default fill for distribution facilities in the model is 60 percent. Increasing this to 90 percent in the Blackburn exchange service area ("ESA") decreases the monthly ULLS cost estimate by $0.21, or less than one-half of one percent.[24]

2.7.5 In contrast to the impact of changing design fill factors, realizing lower utilization rates due to a loss of revenue producing lines has a direct impact on the denominator of the cost per line equation shown above and a much more significant impact on the cost per line. Consider the following illustrative example:

[24] Due to the time required to create new engineering data for all of Band 2, we ran this sensitivity for a single ESA. The default monthly ULLS cost estimate for the Blackburn ESA is CIC [redacted] Increasing the distribution design fill from 60 to 90 percent decreases this cost to CIC [redacted]

Total Annualized Cost of the CAN = $600,000
Total Revenue Producing Lines = 1,000
Cost per Line = $600,000 / 1,000 = $600 per year ($50 per month)

For the reason described above, changing the design fill factors will have very small impact on the total cost of the CAN and the cost per line. This is demonstrated by running the TEA model, or any properly constructed cost model, which explains why the debate about design fill factors receives little attention in properly focused debates about costs per line. If, however, the firm in this example loses 10 percent of its lines to competitors, it will experience a significant increase in its cost per line, as shown below.[25]

Cost per Line = $600,000 / 900 = $667 per year ($56 per month).

As shown in this illustrative example, losing access lines can have a significant impact on the cost-based prices for the CAN. The costs estimated in the TEA model reflect the cost of serving all of Telstra's existing customers. Changing the design fill factors has only a small impact on this cost, but the same is not true for a future loss of customers to competitors, which lowers the realized fill.

2.7.6 The point of this discussion is as follows. The rational expectation is that, as competition expands, any firm that serves all of the incumbent's access lines will lose customers and have fewer revenue producing access lines over which it can spread its costs. Given this expectation, adopting an assumption that the owner of a TSLRIC network will continue to serve all of the incumbent's access lines will bias ULLS cost estimates downward relative to what any firm could hope to achieve. We emphasize the importance of keeping this downward bias in mind when considering assumptions

[25] The relatively small decrease in costs caused by a loss of customers is ignored in this illustrative example. The bigger point is that the incumbent will incur the cost related to building an outside plant network to serve all existing customers, and it will need to recover these outside plant costs from a declining number of customers.

related to depreciation and the cost of capital and of refraining from exacerbating this downward bias with a back-loaded depreciation schedule, which would require a firm to capture an even larger portion of its costs from a smaller number of revenue producing access lines.

3 THE TEA MODEL AS A TOOL FOR COSTING ULLS

3.1 Overview of analysis of the TEA model

3.1.1 Experience with cost models reveals that it is much easier to reach general agreement about the definition of TSLRIC than it is to reach agreement about the selection of a model and the input values that are used to estimate these costs. Experience has also taught that there are a number of guidelines for negotiating a path toward the selection of a model and the most reasonable values for key inputs. For our analysis of the TEA model, we examined the model in the context of these guidelines, as described below.[26]

3.1.2 We began with an examination of the overall structure of the model to determine if it is consistent with sound cost modeling practices and the specific goal of estimating the forward-looking, efficient incremental costs for the CAN. Taking this one step further, we delved into the model structure to determine if it is sufficiently comprehensive and detailed to reflect all categories of costs, sufficiently flexible to examine costs across reasonable ranges of values for key inputs, and organized in a manner that is open to independent examination and verification. Also included in this step was the examination of the internal consistency of the model. That is, are the assumptions in the structure of the model consistent with each other such that a careful user of the model can include all costs yet avoid accounting for costs that are inconsistent with each other? The final step was to examine whether or not the reaction of the model to

[26] We are informed that there are four geographic bands of areas for ULLS based upon the densities of customers. The version of the model that we examined is for Band 2 = Urban.

changes in values of key inputs is in line with economic intuition and experience in terms of direction and magnitude.

3.2 Consistency with sound modeling practices

3.2.1 To maintain clarity, our examination and this discussion of the model structure follow the three distinct, though interrelated components of a cost model:

1. **Investment**: This includes the capital outlay for the main and distribution (including lead-ins) portions of the network and for indirect assets, such as software and motor vehicles.
2. **Capital Costs**: In this portion of the model, the investment from above is translated into monthly costs per line using depreciation lives, cost of capital, and tax rates.
3. **Expenses**: This portion of the model uses factors based upon filed information to add-on all other costs, such as maintenance, administrative, and common costs.

3.2.2 This is the underlying structure of all credible cost models that we have worked with and analyzed, and it is the structure of the TEA model.

3.2.3 Investment takes two forms – direct investment in the main and distribution portions of the network that connects customers and investment in supporting assets that are necessary for providing high-quality service. Direct investment in the network represents the majority of the cost of the CAN. These costs are driven by the layout of the physical network, quantities and prices of components, such as cable and conduit, and the cost of placing the facilities.

3.2.4 Investments in assets other than those directly estimated in the main and distribution portion of the model, such as investments in software and motor vehicles, are included in the model using factors based upon cost categories submitted by Telstra to the ACCC in the Regulatory Accounting Framework ("RAF"). This factor methodology follows methodologies used in other cost models.[27] Although the values of the factors are often subject to debate, our analysis addresses the model itself, not specific values of inputs. It is noteworthy, however, that much of the past debate over input values stemmed from mistaken interpretations of the long-run incremental costing methodology. For example, there is often the misperception that "long-run" means "a long time," when, in fact, the long-run criteria in the TSLRIC+ methodology simply means that a model includes the costs of replacing the entire network that is used to provide a service. That is, even long run assets, which are assets that do not change in the short run, are totally replaced in a credible TSLRIC+ model, as they are in the TEA model.

3.2.5 In the capital cost section of the model, investments are translated into monthly costs using a weighted average cost of capital, a tax rate, and depreciation lives. There is again nothing new or different in how this is accomplished, nor should there be. Investments are captured in the cost estimate by annualizing investments in each class of asset over their economic lives using a weighted cost of capital and dividing the annual costs into monthly amounts. This results in a cost that is levelized, meaning that the costs are the same for every year and month.[28] The model allows for the analysis of costs across a range of user adjustable input values, including the components of the weighted average cost of capital (rates of equity and debt, and the relative amounts of equity and debt), a tax rate, and depreciation lives for the relevant classes of assets.

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[27] For example, the factor methodology used in the TEA model is used in the HAI model, the Benchmark Cost Proxy Model (BCPM), and the FCC's Synthesis Model. The HAI and BCPM models are TSLRIC+ models that were developed and refined during the implementation of the Federal Telecommunications Act of 1996 in the United States.

[28] Again, the process of restating total cost as a levelized amount follows the methodology used in cost models in common use, including the HAI model and the BCPM. We are aware of instances in which direct attempts by Cox Communications to "back-load" costs, and thereby decrease the current cost per line, were rejected by regulators in Nebraska and Arizona.

3.2.6 Expenses are included in the model using factors, again based upon costs submitted by Telstra to the ACCC in the RAF reports and aggregating costs using the cost categories in these reports. Once again, the TEA model follows the accepted methodologies used in other long-run incremental cost models that we have reviewed.

3.3 Consistency with the purpose of model

3.3.1 We are instructed that the TEA model was designed for the immediate and specific purpose of estimating the cost of the CAN such that the network would satisfy the requirements that: (1) the network reflects the economies of scale from providing service to Telstra's existing customers; and (2) ULLS meets the regulatory product service description.

3.3.2 Our examination indicates that the TEA model is structured to fulfill these requirements. The model captures the economies of scale by including all of Telstra's customers and customer locations in the basic access version of the model, and, in the ULLS version, the model includes all customers that can be served by all-copper-fed loops. The ULLS version of the model uses larger gauges of cables to extend copper into the network, but there remain a number of fibre-fed distribution areas where ULLS is not currently available. The model continues to capture the economies of scale from these fibre-fed areas in the main portion of the network, but the costs and lines are excluded from the distribution portion of the network when estimating ULLS costs. Capturing the economies of scale associated with providing service to all or most of Telstra's customers has important implications for the values of other model inputs (that will no doubt be debated at a future date), including the amount of sharing that could otherwise occur from potential facilities-based competitors.

3.3.3 As indicated by this discussion, the structure of the model is consistent with the immediate and specific purpose of estimating the TSLRIC+ of the CAN subject to the constraints described. In the ULLS version of the model, all copper loops are capable of providing service without requiring a competitor to place facilities anywhere other than exchange buildings.

3.4 Consistency with an appropriate level of detail

3.4.1 As discussed above, the paths of Telstra's actual network and the actual locations of Telstra's customers are the foundation of the TEA model. This level of detail allows for a simulation of a real-world network in the TEA model that other models do not, and cannot, approach. It is also important to examine whether the structure provides: (1) a sufficient level of detail to produce realistic costs estimates; (2) the ability to allow for the identification of key inputs; and (3) the flexibility to examine costs across a reasonable range of values for these inputs.

3.4.2 Once the paths of the network are established, the facilities are sized as prescribed by the "Access Network Dimensioning Rules" provided by Telstra.[29] As described, these rules "represent efficient engineering best practices that a network provider would use in designing and deploying a copper wire customer access network in Band 2 today."[30] Materials costs are then estimated by applying prices to quantities estimated in the model as shown in the "Access Network Modeling Costing Information."[31] An examination of the main and distribution sections of the model reveals that the level of detail in these rules are in line with other models we have reviewed and sufficient for the purpose of estimating the forward-looking incremental costs of the CAN.

3.4.3 The cost of placing facilities is a function of the costs of a variety of activities, such as trenching and boring, as well as cutting and restoring concrete and asphalt, the costs of

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[29] "Access Network Dimensioning Rules, Long run incremental cost modeling input," Network & Technology Fundamental Planning, Telstra Confidential Document.

[30] "Access Network Dimensioning Rules, Long run incremental cost modeling input," Network & Technology Fundamental Planning, Telstra Confidential Document, p. 3.

[31] "Access Network Modelling Costing Information," Telstra Fundamental Planning, Telstra Confidential Document.

these activities in rocky and "normal" conditions, and how often each activity is used. Once again, the structure is similar to other cost models we have reviewed and includes sufficient detail to identify key inputs and examine the cost impacts of changing the values of these inputs.

3.4.4 As described above, the model estimates the costs of indirect assets and expenses using information provided by Telstra to the ACCC; it appears to include these assets and expenses at a sufficient level of detail. There are many other user adjustable inputs, including inputs to account for sharing between the main routes and the inter exchange network and to account for cost savings when a developer supplies trenches for telecommunications facilities.

3.5 Consistency of changes in cost estimates with changes in input values

3.5.1 The final step in our investigation of the model structure was a test of the sensitivity of the model to changes in inputs values. We tested the model's reaction to changes in a wide range of inputs, with special focus on inputs similar to those that received considerable attention in dozens of proceedings in which we participated. For these inputs, we tested the sensitivity of the model to changes in values of inputs taken one at a time and to changes to the values of various combinations of inputs.[32]

3.5.2 A subset of the inputs that were changed in the investment section included the design fill factors (used to size cables with sufficient stand-by capacity), the tapering toggle for main cables (which allows for the tapering of cable sizes), the amount of route sharing between the CAN and the inter exchange network, the portion of trenches provided by developers, the overhead percent, and several of the inputs associated with placement costs (per metre costs for placement activities, portions of facilities placed by trenching

[32] Our sensitivity tests were run on one ESA at a time, for the Blackburn and Brooklyn Park ESAs, respectively.

in turf, and the relative occurrence of rocky conditions). In the capital cost section, we tested the model's reaction to changes in the components of the weighted average cost of capital and the economic lives of assets, and, in the expense section, we tested the sensitivity of the model to changes in the major indirect expense categories.

3.5.3 The directions and magnitudes of the model's reactions to changes in input values are consistent with our expectations for a properly constructed model. For example, changing the design fill for distribution facilities from 60 percent to 90 percent has a minimal impact on distribution investment and an even smaller impact on monthly cost estimates. Given that realized fill is often much lower than design fill and that fill effects the size of cables but not the larger costs associated with placing cables, a large impact from changing the design fill would have warranted further investigation. Also as expected, changing the inputs associated with the cost of placing cables had more significant impacts, as did changing the capital cost inputs. Finally, changes in expense factors leads directly to corresponding changes in expenses, as expected.

4 SENSITIVITY ANALYSIS OF THE TEA MODEL

4.1 Overview

4.1.1 Although there are numerous inputs in each of three main model components (Investment, Capital Costs, and Expenses), resolving debates related to the appropriate input values requires identifying the most important inputs (in terms of having material impacts on cost estimates from the model) and ensuring that the values chosen for these inputs are consistent with the underlying TSLRIC assumptions, with each other, and with the best available information regarding forward-looking costs. In this section of the report we identify a number of variables that are likely candidates for meaningful debate, and we use these variables as a format for describing issues related to the selection of consistent input values. This section also describes the impacts of changing the values for these inputs on the costs estimated by the model.

4.2 Input values must be consistent with TSLRIC, with each other, and with the best available information

4.2.1 Even a perfectly specified model will provide inaccurate and unreliable results unless care is taken to populate the model with appropriate values for key inputs. To produce accurate cost estimates, inputs should be consistent with the purpose and definition of TSLRIC and with each other. Inputs should reflect current, Australia-specific information where that information is consistent with a forward-looking environment and the practices and technologies used by an efficient carrier.

4.2.2 Inputs and assumptions should interact and "build on" each other to depict a consistent view of the process being modeled. If we were modeling the cost of building and operating an automobile, the assumptions about the weight of the car, engine size, and gas mileage should be consistent with each other and consistent with the type of car that we are planning to build. Otherwise, the model is likely to depict a mongrel machine with mismatched parts and unrealistic operating parameters. In the same vein, it is important to recognize that even a well-constructed model may allow for the insertion of inconsistent inputs. It is the responsibility of the user of the model to select a set of inputs that are consistent with each other and with the purpose of the modeling exercise. Our car model may allow us to specify inputs for a large automobile with an undersized engine and high gas mileage. The fact that the model accepts these inputs does not guarantee that such a car will serve our purpose, or even move, if it is actually built.

4.2.3 Current experience provides a useful guide, or at least a useful starting point, for specifying the forward-looking values of a number of key inputs, including the number of access lines, sharing of placement costs, per metre placement costs, depreciation lives, the cost of capital, network operating expenses, and overhead costs.

4.3 Network investments – serving all of Telstra's access lines

4.3.1 The TEA model was designed for the specific purpose of estimating the cost of the CAN such that the network would satisfy the requirements that: (1) the network reflects the economies of scale from providing service to Telstra's existing customers; and (2) ULLS can be used to provide broadband service.

4.3.2 To achieve these goals, the TEA network is designed to serve all of Telstra's customers and customer locations that can be served by all-copper-fed loops. Capturing the economies of scale associated with providing service to all of these customers has important implications for the values of other model inputs, such as the amount of sharing that could otherwise occur from potential facilities-based competitors.

4.3.3 As is discussed below, extending the economies of scale from serving almost all of Telstra's current access lines with all-copper-fed loops also has important implications for the risks faced by the hypothetical TSLRIC firm and the associated values for the cost of capital inputs and depreciation lives in a TSLRIC model. Extending Telstra's economies of scale to the TSLRIC firm brings with it the risks associated with investing in this network at a time when this industry is growing increasingly competitive and firms are competing with a range of alternative technologies. It is our understanding that from the period 2003-04 to 2006-07 the demand for existing access lines over Telstra's network declined by an average of [redacted] percent per year.[33] This is in line with the results reported in the Australian Communication Media Authority ("ACMA") in 2006. In its Final Decision in Telstra's Local Carriage Service and Wholesale Line Rental exemption applications, the ACCC observed that "mobile subscription in 2005-06 has increased by 247 per cent since 1999-00 while fixed services had a steady increase in subscriptions to a peak in 2003-04 followed by a 1.8 per cent decline in years 2004-05

[33] Telstra's Ordinary Access Undertaking for the Unconditioned Local Loop Service: Response to the ACCC's Discussion paper dated June 2008, 12 August 2008 ["Telstra's Response"], p. 8.

and 2005-06 respectively."[34] In its decision, the ACCC concluded that mobile services are an effective substitute for fixed line services in only a small percentage of cases. There is no need to debate this point here, because, as stated earlier (see section 2.7.2), even if the incumbent loses just [redacted] percent of its lines each year, over the lives of its assets this will cause a significant increase the average cost of its lines that remain active.

4.4 Summary of the sensitivity analysis

4.4.1 The impacts for the sensitivity analysis described in this section are summarized in Figure 1. In all cases, the sensitivity of the model is relative to the default monthly loop cost estimate for Band 2 of $47.86.

[34] ACCC, final Decision and Class Exemption, Telstra's local carriage service and wholesale line rental exemption applications, August 2008, p. 45.

Figure 1. Sensitivity of the TEA Model's (version 1.2)
Monthly ULLS Cost Estimate to Changes in the Values of Selected Inputs

	Default Value	Sensitivity Value	Monthly ULLS Cost per Line	Difference from Default	Percent Difference
Default Monthly Line Cost	-	-	**$47.86**	-	-
Network Investments					
Cable Placed in an Open Trench	6.95%	16.95%	**$46.65**	-$1.21	-2.5%
Conduit Sharing	5%	10%	**$47.73**	-$0.13	-0.3%
Placement Costs per metre	-	+10%	**$50.33**	$2.47	5.2%
	-	−10%	**$45.40**	-$2.46	-5.1%
Trench Adjustment %	varies	+5%	**$47.20**	-$0.66	-1.4%
	varies	−5%	**$48.53**	$0.67	1.4%
Rock %	10%	15%	**$49.98**	$2.12	4.4%
	10%	5%	**$45.75**	-$2.11	-4.4%
Capital Costs					
Depreciation: Copper Cables	10	12	**$47.47**	-$0.39	-0.8%
	10	8	**$48.49**	$0.63	1.3%
Cost of Capital (COE & COD)	11.86%	12.86%	**$50.72**	$2.86	6.0%
	11.86%	10.86%	**$45.05**	-$2.81	-5.9%
Debt Ratio	30%	40%	**$45.68**	-$2.18	-4.6%
	30%	20%	**$50.07**	$2.21	4.6%
Expenses					
Copper Cable O&M Factor	[redacted]	[redacted]	**$48.67**	$0.81	1.7%
	[redacted]	[redacted]	**$47.06**	-$0.80	-1.7%
Overhead (Loading Factor)	[redacted]	[redacted]	**$49.14**	$1.28	2.7%
	[redacted]	[redacted]	**$46.59**	-$1.27	-2.7%

This analysis demonstrates the sensitivity of the model to changes in the values for inputs. It is not meant as an exploration of the range of reasonableness for the values of these inputs.

4.5 Network investment - sharing assumptions

4.5.1 Sharing inputs reflect the expectation that some of the costs of placing the TSLRIC network would be incurred, not by the TSLRIC firm but, by real estate developers that create trenches for service providers, by the shifting some of the cost onto the inter exchange network when routes overlap, and by leasing conduit. Inputs related to the sharing of placement costs often play prominent roles in debates over the estimation of TSLRIC, and they provide an opportunity to examine the importance of maintaining consistency in the selection of input values.

4.5.2 A TSLRIC network built to serve Telstra's current access lines reflects significant cost reductions related to economies of scale. These economies of scale are only available, however, if the hypothetical firm is able to provide service to all of these lines. This eliminates the possibility of sharing placement cost with direct competitors. If the hypothetical TSLRIC firm were able to coordinate its placement activities with direct competitors (that would take shares of the access lines currently served by Telstra), it could reduce its placement costs, but it could not simultaneously achieve the economies of scale from serving all of these access lines. Even in the hypothetical world of TSLRIC, you cannot have this both ways.

4.5.3 Second, recall that TSLRIC is based upon the matching assumptions of a single-vintage network and timeless construction. There are cost advantages associated with these assumptions, including the absence of interest during construction and an absence of "mistakes" inherent in building a network over time with mixed vintages. These assumptions are inconsistent, however, with an assumption that the hypothetical firm could achieve lower placement costs by placing facilities in developer supplied trenching over a prolonged period of several years.

4.5.4 The TEA model has three inputs to reflect sharing opportunities, one for the percent of time distribution conduit can be placed in an open trench, one for conduit used for providing local and long distance calling (Conduit Sharing Between Main and IEN), and one for leasing conduit to other firms. The default values for the first two sharing inputs are 6.95 percent and 5 percent respectively. The impact of leasing conduit to other firms is estimated based upon the actual dollars Telstra receives from this practice and the portion this conduit that is attributed to the CAN in Band 2.[35]

4.5.5 The default value for the "Cable Placed in an Open Trench" reflects both trench sharing inherent in the model's network design and the use of developer provided trenches. It is our understanding that Telstra measured the actual sharing of trenching inherent in the model's network design between the distribution and main networks and, to a lesser extent, between two separate distribution routes. We are informed that this type of sharing occurs in 5.95 percent of distribution routes in the model. Another one percent sharing is due to the use of open trenches provided by developers of new estates. This reflects the reality that each year access lines related to new estates represent approximately one percent of Telstra's total access lines. If it took a hypothetical firm one year to replace Telstra's network, that firm could, thus, expect to place one percent of its lines in developer supplied trenches. Given the underlying assumption of an instantaneous build-out, this is a reasonable value for this variable. It would be inconsistent and unreasonable to assume that the network is built with a single vintage of facilities (and include the cost savings discussed that accompany this assumption, see section 2.4) and also assume that sharing would take place as if the network is built over many years (as is proposed by Optus and Marsden Jacob Associates[36]).

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[35] Telstra receives approximately [redacted] from leasing conduit. This is spread across Telstra's 7.5 million access lines and adjusted for the portion of the revenue that is attributed to the CAN in Band 2. The end result is an annual cost offset of [redacted] per line, or approximately [redacted] for the monthly ULLS cost. Given the relatively small size of this cost offset, we did not consider this sharing input in our sensitivity analysis.

[36] Optus Public Submission to Australian Competition and Consumer Commission on Telstra's Access Undertaking for the Unconditional Local Loop Service: Response to Discussion paper, August 2008, pp. 45-48; Review of the TEA Model, A report prepared for the Competitive Carriers Coalition, Marsden Jacob Associates, 12 August 2008, pp. 9-10.

4.5.6 In our sensitivity analysis, increasing the Cable Placed in an Open Trench input from 6.95 percent to 16.95 percent decreases the estimated monthly ULLS cost by $1.21. Increasing the conduit sharing between Main and IEN from 5 percent to 10 percent decreases the monthly ULLS cost estimate by $0.13. Recall that the changes in our sensitivity analysis are used only to assess the sensitivity of the model to changes in input values. The responses of the model to changes in the sharing input values are in-line with our expectations.

4.6 Network investment – placement costs

4.6.1 The cost of placing the CAN is driven primarily by per metre costs of the activities used to place facilities (such as trenching, boring, and breakout and reinstatement of asphalt and concrete) and the relative use of these placement activities. We examined the sensitivity of the model to changes in: (1) the per metre placement costs for the various placement activities; (2) the portion of the time that facilities are placed by trenching in turf (rather than trenching or boring under footpaths, drives, and roads); and (3) the portion of the placement that occurs in rocky conditions.

4.6.2 We are instructed that the default values in the TEA model for per metre placement costs for the range of placement activities are driven by vendor rates for placing facilities, and it is our understanding that these rates were derived from a competitive bidding process. This is described in the TEA Model Documentation and Telstra's response to the ACCC's discussion paper and in the statements of [redacted] and [redacted] To the extent that these rates represent the costs of these activities in the environment that exits today, and to the extent that they are the result of a competitive selection process and reflect Telstra's significant purchasing power (as described by [redacted]), these rates provide a reliable guide for the costs of constructing a TSLRIC network. Increasing and decreasing all of the per metre placement costs by 10 percent increases and decreases the monthly loop cost estimate by approximately $2.50.

4.6.3 The activities used to place facilities include trenching in turf, trenching under road crossings, trenching under footpaths and drives, boring under footpaths and drives, and boring under roads. As makes sense, it costs less to trench in turf than it does to trench or bore under roads, footpaths, and drives. Likewise, placing facilities using any of the activities costs less in non-rocky conditions relative to the costs in rocky conditions.

4.6.4 In the default run of the model, the portion of the facilities that are placed by trenching in turf is a function of population and line densities, as described by the five density groups in the model. In high density areas, conditions limit this form of placement, and in the default run of the model trenching in turf occurs [redacted] percent or less of the time. As density decreases, conditions allow for greater amounts of trenching in turf, and in the least dense areas, [redacted] percent of the facilities are placed by trenching in turf. For our sensitivity analysis, we examined how the model responded to increasing and decreasing the percentage of the time that facilities are placed by trenching in turf. When this percentage is increased and decreased by 5 percent across all density groups the monthly ULLS cost estimate decreases and increases by less than [redacted]

4.6.5 In the default run of the model, 10 percent of the placement is assumed to occur in rocky conditions. Increasing and decreasing this by 5 percent, increases and decreases the monthly loop cost estimate by approximately $2.10. It is worth noting that the responses to the three changes described above are not strictly additive. That is, the cumulative impact of making all three of the changes described above is not equal to the simple addition of the impacts of the individual changes taken one at a time. For example, lowering the per metre costs by 10 percent, increasing the portion of trenching in turf by 5 percent, and decreasing the portion of rocky conditions to 5 percent has a cumulative impact of minus $4.91 on the monthly ULLS cost estimated by the model.

This is a smaller impact than −$2.46 − $0.66 − $2.11 = −$5.23, because the 10 percent reduction of per metre costs has a larger dollar impact on the more costly placement activities, and these activities occur less often due to the increase in trenching in turf and decrease in rocky conditions.

4.7 Capital costs – the competitive context

4.7.1 Because the objective of TSLRIC pricing is to emulate pricing in a competitive market, the depreciation lives and cost of capital used to estimate TSLRIC need to reflect the risks associated with participating in such a market.

4.7.2 Just as the TSLRIC firm captures all of the economies of scale from serving all of Telstra's access lines, the TSLRIC firm faces similar risks that Telstra faces from competitors for the customers served over those access lines. In fact, the risks associated with technological obsolescence are even greater for the hypothetical TSLRIC firm that invests in a CAN network that is focused on providing copper-fed loops, as required by the ACCC. The growing demand for higher capacity circuits will place increasing pressure on facilities-based providers to install fibre deeper into their networks in order to meet this demand. This will render some of Telstra's copper facilities obsolete.

4.8 Capital costs - depreciation

4.8.1 Economic depreciation lives are one mechanism for recognizing the increased cost associated with operating in a competitive environment. Specifically, depreciation lives are generally shortened by competition.

4.8.2 Competition is expected to achieve the public policy goals for communications by promoting innovation and investment in new technologies, and consumers are expected to benefit from a growing range of choices among high quality services. A necessary corollary, however, is that assets used to provide services in an industry characterized by accelerated innovation and investment have shorter depreciation lives because they will be displaced by assets used to provide future innovative services.

4.8.3 We are instructed that the expected economic life of main copper cables is a possible area for debate related to depreciation lives. The default depreciation life for these cables in the TEA model is 10 years. Decreasing this to 8 years increases the monthly loop cost estimate by $0.63, and increasing this to 12 years lowers the monthly loop cost estimate by $0.39.

4.9 Capital costs – levelized versus tilted annuity

4.9.1 A generally accepted procedure in cost modeling is to spread investment costs evenly over the expected life of an asset by calculating what is called a levelized annuity.[37] This creates a known and steady cost-based price for the incumbent and entrants alike. To the extent that material changes occur, such as a change that significantly increases the overall costs or a change in the numbers of access lines that significantly changes the per unit cost, then one or more firms can petition for a reassessment. At least as likely are competitive losses of access lines served by Telstra, which will increase average costs per loop.

4.9.2 We are instructed that, rather than using a levelized annuity, the ACCC has recently applied what is known as a tilted annuity approach to depreciation, and that this annuity reduces current cost-based prices and increases future prices. A problem with using such an annuity is that the ACCC cannot guarantee the TSLRIC firm will be in a position to raise its ULLS prices each year in accordance with a tilted annuity without

[37] Given that the entire investment for a TSLRIC network is incurred with no time component, the capital costs are, in a sense, front loaded. Assume for example that straight line depreciation is used for a $1M asset with an expected economic life of 10 years. Although the depreciation expense is a level $100,000 each year, for calculation purposes, the amount of debt and equity outstanding and the returns to debt and equity are highest in year one and decline as the net value of the asset is reduced each year. Rather than set a declining price trajectory in line with the declining cost trajectory, the generally accepted procedure is to simply restate the cost as an annuity with equal annual payments over the life of the asset.

accelerating its loss of market share. Given an increasingly competitive environment, adopting the ACCC's tilted annuity will increase the risk that the TSLRIC firm (or Telstra) will not recover its costs. This increase in risk would have implications for other input values in the TSLRIC model, beginning with a reassessment of the risk-adjusted cost of capital.

4.9.3 It is our understanding that the ACCC's consideration of using a tilted annuity is driven by the expectation that cable and conduit prices will increase each year, and that using a tilted annuity to estimate the monthly loop cost would tilt the recovery of investments in the CAN into the future. That is, a greater portion of the cost recovery will need to come from revenue bearing access lines in the future. This is highly unlikely, however, given the rapid substitution of fibre for copper world-wide.

4.9.4 Even if losses in access lines by the TSLRIC firm were not an issue, to recover TSLRIC+ as estimated with a tilted annuity would require raising the price of loops each year. Although it is not difficult to calculate this increasing price trajectory, cost recovery would depend upon: (1) following through with annual increases; and (2) the ability to increase prices in an environment of increasing competition, including price competition from wireline, wireless, cable-based competitors, without hastening the loss of access lines to competitors. Recall that a primary reason for reducing regulation and promoting competition is to secure lower prices for consumers. The competitive process that drives these price reductions will imperil Telstra's ability to increase prices without hastening the loss of access lines.

4.9.5 The expected loss of access lines is, in fact, an issue facing Telstra, and this expectation undercuts the logic for using a tilted annuity. Even with TSLRIC+ prices based upon a levelized annuity, the expected loss of access lines served by the TSLRIC network poses a serious threat to Telstra's ability to recover the cost of the CAN, even without tilting the payments into the future. Tilting the annuity in the presence of declining wired access lines served by Telstra (or the hypothetical TSLRIC network service provider) amplifies this threat by requiring Telstra to recover a greater share of its costs from a declining share of access lines. Attempting to recover its costs under a tilted annuity approach may, therefore, push Telstra into a dangerous spiral of higher and higher prices driving lower and lower market shares. This spiral will prove even steeper if firms leasing the CAN begin deploying their own facilities. We have reviewed the report of Henry Ergas, paying particular attention to Section 4.3: Assessment of the Choice of Depreciation Profile, and we agree with his conclusion that "the tilted annuity approach with its reliance on back-loaded depreciation would…seem to contradict a number of trends that, if anything, would lead to more front-loaded depreciation profiles."[38]

4.10 Capital costs - cost of capital

4.10.1 While the list of risks is long for a firm that would replace, operate, and maintain the CAN, financial analysts and markets summarize risk succinctly by determining the appropriate cost of capital for an investment. Higher risk projects demand a high cost of capital to gain funding. Specifically, the cost of capital related to an investment is determined by the expectations of debt and equity holders, and, with increasing competition in communications markets, these investors expect returns on their investment commensurate with the greater risks presented by this market structure.

4.10.2 Expanding competition increases the risks facing a firm that would replace the CAN. One of the risk-increasing factors is that for an increasing number of customers, basic local services that are produced over the CAN are no longer considered necessities. According to the July 2007 statement by Dr. Paul Patterson (submitted in conjunction with Telstra's LCS and WLR exemptions applications), at that time there were 11.3

[38] Ergas, Henry, Report: Depreciation, August 2008, p. 50.

million fixed voice services and 19.7 million mobile telephone services in operation in Australia.[39] Fixed voice services include basic access, local calls, national and international long distance calls and fixed to mobile calls. Because mobile wireless service long ago replaced fixed voice service as the predominant form of connection for voice communications in Australia, it is not surprising that customers are increasingly substituting wireless for wireline usage. As other firms lease ULLS, diminishing contributions from retail services offered over the CAN also increase risks associated with this investment.

4.10.3 The default values for the cost of capital inputs in the TEA model result in a weighted average cost of capital of 11.86 percent. Changing the costs of debt and equity in equal proportions to increase and decrease this 100 basis points (to 12.86 percent and 10.86 percent) increases and decreases the model's monthly loop cost estimate by approximately $2.85.[40]

4.10.4 The default debt to equity ratio in the TEA model is 30:70, i.e., 30 percent debt and 70 percent equity. Using the default rates of return to debt (8.18%) and equity (13.44%) and increasing and decreasing the portion of the higher priced equity capital by 10 percent increases and decreases the monthly loop cost estimate by approximately $2.20.[41]

4.11 Expenses – general expense modeling issue

4.11.1 Expenses are included in the model using factors that are based upon costs submitted by Telstra to the ACCC in the RAF reports and these expenses are aggregated using the

[39] Statement by Dr. Paul Patterson of CRA International for Mallesons Stephen Jaques on Economic Considerations for LCS and WLR exemptions, 9 July 2007, p. 27.

[40] Increasing the cost of capital to 12.86% increases the estimated monthly loop cost by $2.86, and decreasing it to 10.86% decreases the cost estimate by $2.81.

[41] A debt to equity ratio of 20:80 increases the monthly loop cost estimate by $2.21, and a ratio of 40:60 decreases it by $2.18.

cost categories in these reports. Like other credible cost models, these factors act as direct links between investment estimates in the TEA model and many expense estimates in the model. These links are modeling shortcuts that are not necessarily based on functional relationships. For example, through the application of expense factors, an increase in the amount of placement sharing in the model reduces the amount of loop maintenance expense estimated by the model. There is a functional relationship between the amount of placement sharing and investment dollars to place the network, but there is no such relationship between the amount of sharing and the expenses necessary to maintain the network.

4.11.2 Impacts from changing the values of expense inputs are incremental to the impacts that already occur if and when changes are made to investment estimates. Prior to making explicit changes to expense inputs it is, therefore, important to first assess the implicit impacts of any investment changes on expense estimates. For this reason, if the ACCC chooses to examine the response of the model to changing a combination of input values, it is appropriate to make changes to investment inputs first and assess the impacts that these changes have on expense levels prior to making additional changes to expense inputs. If investments are raised/lowered by 10 percent, and there is no reasonable expectation that this change would increase/decrease expenses, it is necessary to adjust the factors to keep expenses unchanged. This will prevent the model from making unintended changes to expense estimates, thereby keeping the overall cost estimate consistent with rational expectations.

4.12 Expenses – operating and maintenance expense

4.12.1 Operating and maintenance expenses account for approximately 10 percent of the estimated monthly ULLS cost, and nearly 9 of this 10 percent is accounted for by operating and maintenance costs related to copper cables. Increasing or decreasing the operations and maintenance expense factor related to copper cables by 10 percent increases and decreases the estimated monthly ULLS cost by approximately $0.80. This includes the direct impact on operating and maintenance expense and the impact on indirect expenses, which are directly tied to the levels of direct expenses estimated in the model.

4.13 Expenses - overhead

4.13.1 Joint and common costs are costs incurred for multiple network elements or services. These costs are often referred to as overhead expenses. There are efficiency reasons for the existence of overhead expenses for such functions as legal services and human resources. If the functions included in overhead expenses were separate for each network element or service, there would be substantial duplication of effort and an increase in cost for all services and network elements. Overhead expenses are real costs of operating almost any business efficiently, and it is necessary for prices of network elements to contribute to the recovery of these expenses.

4.13.2 To reach efficient, cost-based prices for the CAN, it is necessary to allocate reasonable portions of overhead expenses to the costs of providing ULLS. This is done in the TEA model with a Loading Factor for Indirect Overheads. The default value for the Loading Factor for Indirect Overheads is [redacted] percent. [redacted] percent decreases and increases the monthly loop cost estimate by approximately [redacted]

4.14 Concluding point

4.14.1 Although TSLRIC is a hypothetical construct, it is capable of depicting a coherent and consistent basis for estimating forward-looking costs if, and only if, a TSLRIC model is populated with input values that are internally consistent. This is a difficult but manageable process, but one that can become untenable if the ACCC chooses the path of using forecasted values for key variables, such as access lines served over the TSLRIC network.

4.14.2 We have left the safe and steady world of the regulated past, when recovering investments was a simple matter of trending access line growth and setting prices accordingly. In the competitive future, the costs of cables and conduit are not the only important variables that will change. If the Commission decides that it is necessary to account for expected changes in the prices of cables and conduits, maintaining modeling consistency would include the complex and contentious process of forecasting values of other important variables, such as market share, when there is a strong expectation that future values will differ significantly from present values. We do not recommend this course.

5 SUMMARY AND CONCLUSIONS

5.1 The TEA model is consistent with TSLRIC principles

5.1.1 The TEA model is primarily designed to estimate the cost of providing services over unconditioned copper loops from customers' locations to the locations of Telstra's exchange buildings, and our analysis indicates that the TEA model has a sound economic foundation for estimating TSLRIC+ and achieving this purpose.

5.1.2 The network in the TEA model is more realistic than the network in any other cost model with which we are familiar. Because it is based upon Telstra's actual cable routes and customer locations, the model is capable of producing more accurate cost estimates than models that have built-in inaccuracies that are inherent in hypothetical networks (especially those that employ unrealistic assumptions about network design and the conditions under which an entrant would be building a new network in today's environment). Due to a lack of data regarding cable routes, rights-of-way, and customer locations, other models, such as the HAI, the BCPM, and the FCC's Synthesis Model, are forced to hypothesize cable routes using a variety of methodologies. This has led to extensive analyses that demonstrate the shortcomings of the methodologies (such as cable routes that are often far too short to reach actual customer locations or run through mountains, lakes, and buildings) and debates regarding the impacts of these shortcomings on cost estimates from proxy models. Furthermore, Telstra's analysis shows that the network specified in the TEA model has 34.5 percent fewer trench kilometers than are in Telstra's existing network.

5.1.3 The model also fulfills the fundamental criteria for estimating TSLRIC+. It estimates the cost of providing the totality of ULLS to all of the customers that it can reach with a network capable of providing this service on unconditioned copper loops from a Telstra exchange building. It fulfills the long-run requirement by estimating the cost of replacing the entire network to provide this service and by using the real-world engineering guidelines and fact-based costing information cited above. Finally, the model accounts for other costs in a complete and reasonable manner by applying factors that are based upon information submitted to the ACCC in the RAF reports cited above.

5.1.4 In addition to employing a realistic network design, the data structure of the TEA model is sufficiently detailed to reflect all categories of costs, yet flexible enough to examine costs across reasonable ranges of values for key inputs, and organized in a manner that is open to examination and verification. No internal inconsistencies were uncovered in our analysis, and changes to a wide range of input values drove changes in costs estimated by the model that are in line with economic intuition and experience. In summary, the TEA model is suitable for accurately estimating the TSLRIC+ of ULLS and focusing the examination of the issues related to costing and pricing this service.

5.2 Trade Practices Act criteria and ULLS pricing

5.2.1 We have reviewed Sections 152AH and 152AB of the TPA, as well as discussions of those legislative criteria in various reports of the ACCC. If estimated correctly, ULLS prices based on TSLRIC+ would comply, in our opinion, with all of the relevant criteria of the TPA.

5.2.2 To meet the TPA criteria of encouraging economically efficient investment in and use of infrastructure, TSLRIC+ cost estimates must pass three tests. First, the cost model must be based on sound economic principles and realistic network design assumptions. Second, the model must be structured to accurately account for and calculate all relevant network components and costs, as well as the costs of maintaining and operating the network. Third, all input values must lie within a range of economic reasonableness and must reflect actual conditions and forward-looking assumptions.

5.2.3 In our opinion, the TEA model clearly passes the first two tests. The network design assumptions on which it is based are realistic, yet efficient and forward-looking. In contrast, "scorched node" network design assumptions, as typically employed, are not appropriate for estimating the TSLRIC of ULLS, and prices based on such cost estimates would not comply with the TPA criteria. Such unrealistic assumptions do not reflect the cost of an entrant and understate the cost of building and operating an efficient, forward-looking network. Estimating ULLS costs by assuming away the reality of installing an extensive network under actual conditions may favor the short-run interests of a subset of competitors and provide the illusion of competition, but it will undermine the incentives necessary for future investment and innovation by both entrants and incumbents.

5.2.4 The third test of a cost model requires the use of input values, such as cost of capital, depreciation lives, and operating expense factors, that are based on sound economics and realistic assumptions about the construction and operation of an efficient, forward-looking network. Because the TEA model allows users to choose input values across a large range, there is no question that it allows for the use of reasonable input values. It is important to note, though, that because so many of the input values are user variable, the costs estimated by the TEA model are only as reasonable as the input values used to run the model.

5.2.5 Prices for ULLS that are based on cost estimates from the TEA model, when the model is run with input values selected from within a reasonable range, based on sound engineering information and economic principles, will promote the long-term interests of end-users in Australia.

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4 November 2008