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# Review of the economic principles, capital cost and expense calculations of the Telstra Efficient Access cost model

## A Report to the ACCC

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The TEA Model used in this review is version 1.0, delivered to the ACCC on 3 March 2008.

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# Executive Summary

The purpose of this report is to review and inform the ACCC of the economic principles, capital cost and expense calculations of the Telstra Efficient Access cost v1.0 model ("TEA model"). It reviews the underlying economic principles and assesses whether the model reflects the economic costs of the service accurately and results in an appropriate return to Telstra Corporation Limited ("Telstra"). The costs should emulate, to the greatest extent practicable, the prices that would result in a fully competitive market for the ULLS costs of a replacement CAN for all 584 Band 2 ESAs. The calculated monthly costs should reflect the costs of an efficient operator.

The TEA model estimates the unconditioned local loop service ("ULLS") costs of a replacement Customer Access Network ("CAN") for all 584 Band 2 Exchange Service Areas ("ESAs"). According to Telstra the TEA model has been developed following the ACCC's Pricing Guidelines and is a Total Service Long Run Incremental Cost (TSLRIC) model estimating the efficient cost of replacing the CAN using forward-looking, best practices engineering standards and placement procedures and best equipment. Telstra claims the TEA model[1]:

- is forward-looking, replacement CAN comprised of unconditioned copper facilities;
- reflects sound engineering standards;
- reflects demographic, topological and infrastructure characteristics of an exchange service area to accurately and efficiently design a replacement CAN;
- reflects costs for Band 2 exchanges.

On the contrary, our findings suggest that the TEA model does not fully comply with TSLRIC+ principles and there are problems with the approach. The main failings include:

- The TEA model cannot be regarded as forward looking as the cost values used to calculate the cost of the network in the TEA model are historic. The costs have not been re-valued but are averages from Telstra's three Access and Associated Services contracts;
- The modelled network does not contain sufficient efficiency savings;
- The TEA model contains costs not directly attributable to the ULLS costs of a replacement CAN for all 584 Band 2 ESAs;
- There are inconsistencies in the TEA model – one example includes the number of Band 2 lines. The number of Band 2 lines in the TEA model ranges from 7,504,097 to 7,532,793 lines.

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[1] Telstra Corporation Limited, "ULLS Undertaking, Telstra Efficient Access (TEA) Model Overview", 21 December 2007

- There are function errors in the model including missing links. Changes in the TEA model user interface may not feed through to the formulae in the TEA model. As a result, the TEA model estimated monthly ULLS charge is misrepresented. The TEA model figure appears to be higher than it otherwise would be if the function errors were corrected.
- The estimated WACC value submitted to the ACCC is too high based on international benchmarks. Compared to other international LRIC cost model benchmarks, the Telstra WACC value ranks the highest. Ovum believes that the WACC value should be no more than 11.14%.
- The cost factors, used to calculate the operational and maintenance costs, indirect costs etc., are over estimated.

The TEA model reflects the costs of Telstra's current topology. There is no evidence that the model:

- has been optimised;
- contains efficiency factor savings; or
- costs that reflect today's design standards.

Ovum concludes that the monthly ULLS cost has been inflated for Band 2 ESAs and does not reflect that of an efficient operator.

# 1 Background

On 3 March 2008, Telstra Corporation Limited ("Telstra") submitted the Telstra Efficient Access cost model v1.0 ("TEA model") to the ACCC in support of its ULLS monthly charge undertaking. Telstra also submitted supporting documentation including a user guide, technical specifications and engineering assumptions used in the TEA model.

The TEA model estimates the unconditioned local loop service ("ULLS") costs of a replacement Customer Access Network ("CAN") for all 584 Band 2 Exchange Service Areas ("ESAs"). The TEA model should estimate the costs that a new entrant would incur to supply the ULLS product.

Telstra[2] indicates that the TEA model:

- calculates a forward-looking, replacement CAN comprised of unconditioned copper facilities;
- reflects sound engineering standards;
- reflects demographic, topological and infrastructure characteristics of an exchange service area to accurately and efficiently design a replacement CAN;
- reflects costs for Band 2 exchanges.

The TEA model is a hybrid model between standard Bottom-Up ("BU") and Top-Down ("TD") standards. Instead of taking costs from Telstra's audited accounts as the starting point, as one would find in most Top-Down models, the model estimates the cost of the network by reviewing the investment costs needed to meet the demand in Band 2 ESAs. This methodology is typical as starting base for building BU models.

The investment costs of building the network in the TEA model are identified; these are then annualised using the annuity method, in which the annual charge, the sum of depreciation and return on capital employed, is the same in each year of the defined asset life. The network is built up based on a scorched-node approach and engineering design parameters that are based upon actual Telstra records. The base data, stored in the access database (TEA-Data-v1.0), is compiled from actual engineering records for all exchanges in Band 2. Every exchange is modelled from this data and the data for every exchange includes the actual location of all end users and all network structures.

Operating and maintenance ("O&M") costs are calculated outside the TEA model. The factor calculations are contained in an additional worksheet "Factor Calculation – Final.xls". The O&M expenses are calculated using a top-down approach. According to Telstra, the O&M expenses associated with each category of network

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[2] Telstra Corporation Limited, "ULLS Undertaking, Telstra Efficient Access (TEA) Model Overview", 21 December 2007

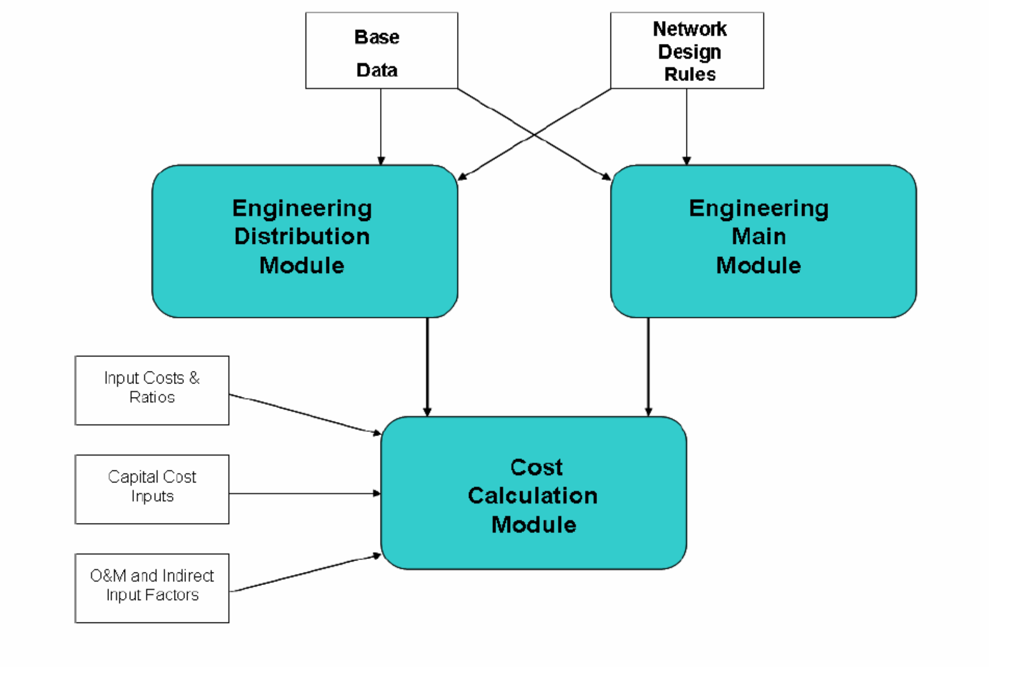
plant and equipment are calculated by multiplying the level of investment modelled for each category of plant and equipment by the relevant O&M factor.  These factors are based on Telstra's accounts prepared under the Regulatory Accounting Framework ("RAF") 2005/06.

## Software

The Telstra cost model application runs in .NET framework[3] and also utilises Dynamic Link Library[4] routines.  At this stage, the application has not been reviewed, as details of the code have not been submitted.  The application is not transparent, and is difficult to review.  The running of the application can be slow, especially when changing engineering assumptions for several ESAs.

The TEA model is comprised of three main modules, each of which relies on a set of inputs.  Two are engineering modules and the other is a cost calculation module as seen in the Figure below.

**Figure1.1:  TEA Model Structure**




Source: Telstra

[3] .NET Framework is an integral Windows component that supports building and running of applications and XML Web services.

[4] A dynamic-link library (DLL) is a module that contains functions and data that can be used by another module (application or DLL).

The Economic Review mainly reviews the costing module and how the engineering modules link through to the Telstra application.  The output of the engineering modules feed into the cost calculation module.

The costing module calculates the annual capital costs associated with the investments and calculates the operating and maintenance ("O&M") expenses and indirect costs. The total annual costs are then divided by 12 to derive the monthly cost.

# 2 Underlying economic principles

According to Telstra[5] the TEA model has been developed following the ACCC's Pricing Guidelines and is a Total Service Long Run Incremental Cost (TSLRIC) model estimating the efficient cost of replacing the CAN using forward-looking, best practices engineering standards and placement procedures and best equipment. Telstra[6] further states:

> "*As a TSLRIC+ model, the TEA model estimates the annual incremental or additional cost the firm incurs in the long run in providing the CAN, assuming all of the firm's other production activities remain unchanged. The model is "long run" because all factors are treated as variable*."

In this section, we review in detail whether the TEA model reflects a network of an efficient operator and meets standard TSLRIC+ principles. Principles such as:

- *Network topology*: The design of the network should reflect that of an optimal operator;
- *Forward looking:* The cost of the network should reflect today's values. An operator should only be able to recover costs necessary for maintaining future real-asset values in a competitive market. Therefore the asset valuation should be derived from current cost accounting methodologies.
- *Only access costs:* Only costs "attributable" to the running of the ULLS costs of a replacement CAN for all 584 Band 2 ESAs are included;
- *Efficiency savings*: Costs for future use or costs that are not efficient (and hence in the long run will be avoided) should be excluded. Cost should reflect that of an efficient operator. The new assets may have greater capability, functionality and operational savings.

## 2.1 Network Topology

The network design is based on engineering design parameters[7] that are based upon actual Telstra records. Actual engineering records are used to calculate the data for exchanges in Band 2. In this section we will review the costing of the equipment.

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[5] Telstra Corporation Limited, "ULLS Undertaking, Telstra Efficient Access (TEA) Model Overview", 21 December 2007

[6] Telstra Corporation Limited, "ULLS Undertaking, Telstra Efficient Access (TEA) Model Overview", 21 December 2007

[7] Details of the engineering assumptions and the equipment appropriateness can be found in the Ovum "Review of the network design and engineering rules of the Telstra Efficient Access cost model".

Every exchange in Band 2 is modelled in the TEA model; however there are no topology differences between each exchange. Through averaging, the unit prices of access equipment such as cables, conduits, pits, building terminal lead-ins and lead-ins are the same. As a result, the equipment unit costs of each ESA in Band 2 are identical. The individual unit costs of equipment can be found in Appendix 1.

The difference in ULLS monthly costs if individual ESAs in Band 2 are selected is due to the demand of line types as the total ULLS cost is calculated by multiplying the equipment unit costs by the volume of equipment/lines needed to reach the number of businesses and residential homes.

It is not unusual to find averaging methodology used in bottom-up models. However, if the model was used to select, say, only a few ESAs in Band 2, then the results could significantly overestimate or underestimate the actual costs of supply. There is a terrain parameter that can be used to vary the input capital unit costs in each ESA.

### Scorched-Node approach

There are two main approaches to modelling the network in a LRIC model:

- Scorched Node;
- Scorched Earth.

A scorched-node approach is one that bases the costs of the network on the existing network topology while, on the other hand, a scorched-earth approach is based on a network with an ideal network topology that would meet the demands of a fully efficient operator.

The TEA model uses a "scorched node" approach. The main nodal locations are fixed, which in this model include: the telephone exchange locations, the Distribution Area ("DA") boundaries, the Pillar locations at the edge of each DA, and the customer locations. The model then dimensions a traditional access network to meet the customer demand using the locations specified. This method is appropriate but its design should be modified. In Europe and across the world many regulators have adopted a modified scorched-node approach.

A modified scorched-node approach takes the existing topology as a starting point, but then modifies the network by eliminating inefficiencies. The technology between the existing nodes is optimised to meet the demands of a forward-looking efficient operator. There is little evidence of the network being optimised and the design is inefficient in some aspects. See the accompanying engineering review for further details.

Further details of the engineering assumptions in designing the network can be found in the "Review of the network design and engineering rules of the Telstra Efficient Access cost model".

### Underground Equipment

The topology of an ESA plays an important role in structure and the associated costs of its network. The model also assumes that all cables have been laid underground and no alternative usage of other technologies such as aerial cable has been included. Other regulatory LRIC models may include alternative technologies. However, in Australia there is no alternative. Ovum believes local councils will not accept such usage of alternative equipment. With such an assumption in place the model has been modelled fairly to represent no alternative technologies. However, with this assumption in place, capital and operational costs will tend to be higher. The approach to modelling underground placements is described in the accompanying engineering review.

## Conclusion

The network design is based on engineering design parameters that are based upon actual Telstra records. All cables have been laid underground and no alternative usage of other technologies such as aerial cable has been included. The existing exchanges and locations are fixed, and have not been modified to reflect a new network design of an efficient operator, a new design eliminating inefficiencies. There is no evidence that the technology is optimised to meet the demands of a forward-looking efficient operator. **The new design is unfit and does not seem to reflect that of an efficient operator.** Further details of the engineering assumptions in designing the network can be found in the "Review of the network design and engineering rules of the Telstra Efficient Access cost model".

# 2.2 Forward Looking

The TEA model seems to estimate the cost of the network with historic costs, despite stating that the model is forward-looking[8]. There is no evidence that the network costs submitted in the model have been re-valued and made forward looking.

In contrast, the costs in the model are historic. The costing inputs are sourced from Telstra's engineering department[9], and are mainly drawn[10] directly from the

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[8] Telstra Corporation Limited, "ULLS Undertaking, Telstra Efficient Access (TEA) Model Overview", 21 December 2007

[9] Telstra Corporation Limited, "Access Network Modelling Costing Information, Issue 1.1, Confidential", March 2008. The "Access Network Modelling Costing Information" refers to the various activities required to construct a copper CAN in Band 2 and lists the costs of these activities.

[10] Telstra Corporation Limited, "Access Network Modelling Costing Information, Issue 1.1, Confidential" , March 2008

averaged costs from Telstra's three Access and Associated Services ("A&AS") contracts.

The equipment costs should be valued at today's cost. According to the Independent Regulators Group[11] ("IRG"), the concept of forward-looking costs requires that assets are valued using the cost of replacement with the modern equivalent asset (MEA).

> *The MEA is the lowest cost asset, providing at least equivalent functionality and output as the asset being valued. The MEA will generally incorporate the latest available and proven technology, and will therefore be the asset that a new entrant might be expected to employ.*

The figure below compares the latest cable costs with the cable costs currently in the Telstra TEA model.

**Figure2.1: Cost of cable**

**[c-i-c]**

Source: Ovum

In all cases except for the largest cable size (which is also the most commonly used size), the benchmark price of cable is somewhat lower. We conclude overall that the cost of cable is broadly in line with international benchmarks. However, the other equipment prices in the TEA model should be lower. In general, equipment prices have fallen around 5%-15% per annum over the last 5 years.

If the cable costs are adjusted to the numbers above and other equipment prices are reduced by 10%, then the final ULLS cost falls by 6%.

## 2.3 Access only costs

Only costs attributable[12] to the running of the ULLS costs of a replacement CAN for all 584 Band 2 ESAs should be included. This includes access network costs such as cables and trenching. Costs relating to retail and other business units such as the mobile network should be excluded.

Our findings suggest:

- Direct capital costs: The direct network costs have been overvalued and contain costs relating to other businesses. Fibre costs and fibre-related costs have been included. They should be excluded as the ULLS cost is for copper-based facilities only.

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[11] Independent Regulators Group, "Principles of implementation and best practice regarding FL-LRIC cost modelling", 24 November 2000

[12] ACCC, "The Pricing of Unconditioned Local Loop Services (ULLS), Final Report" March 2002

- O&M costs: The O&M costs in the TEA model have been over-valued. Further details of the methodology and assumptions behind the O&M calculations can be found in section 2.4 and section 3.
- Indirect factors: "Product and Customer" expenses as well as intangibles should be removed from the indirect factor list.
- ULLS costs: The ULLS costs of a replacement CAN for Band 2 ESAs are over-estimated.

## Indirect factors

### Product and Customer expenses

The model is only concerned with access ULLS costs. The product and customer expense is not associated with the running of the ULL service and should be excluded from the TEA model. The expense should be allocated to the retail business unit of the organisation. Such costs as marketing, sales, billing, customer service and retail elements of finance and human resource also belong to the retail increment.

An alternative operator should not have to pay for costs such as marketing, customer support or sales etc., as they will have their own retail expenses.

### Intangibles

In general, financial calculations do not include intangibles because they are non-monetary and/or are difficult to measure. In this case, Ovum suggests that the intangibles should be removed as they are not part of the access network costs. Intangibles do not affect the running of the ULL service and should be removed from the TEA model.

## ULLS costs

### Number of lines

The total number of lines associated with Band 2 ESAs has been inconsistent throughout the model and needs to be reviewed. Entries of the total number of lines have been included in several places:

- Factor Calculation: In order to calculate total investment for "Ducts and Pipes" and "Copper Cables", the model uses the total number of ULL Band 2 lines and a ratio of Band 2 lines;
- Economic module: the total number of ULL Band 2 lines is used as an input in the "Inputs Capital Cost" sheet, to calculate the conduit sharing revenue;
- Economic module: the total number of ULL Band 2 lines is used as an input from the engineering module in the "Results Main-Qtys" sheet.

The number of lines used is illustrated in the figure below.

**Figure 2.2: Number of lines and ratios used in different Telstra modules**

| Module | Band 2 lines | Band 2 Ratio |
|---|---|---|
| "Factor Calculation" Module | 7,504,497 | **[c-i-c]** |
| "Economic Module" (Input Capital Cost) | 7,504,097 | **[c-i-c]** |
| "Economic Module" (Results Main-Qtys) | 7,532,793 | **[c-i-c]** |

Source: Ovum assessment of the models

In each case, the ratio of Band 2 lines is higher than figures submitted in the SIOs and other data sources provided by the ACCC. The figure shows the totals in the data provided by the ACCC. (The numbers quoted for the TEA model are not exactly the same as in the model database.)

**Figure 2.3: Number of lines provided from ACCC**

| | SIOs (from Telstra CAN RKR) | SIOs (from TEA model) | GNAF | Approx. premises (maximum of the previous three) |
|---|---|---|---|---|
| Band 1 | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| Band 2 | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| Band 3 | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| Band 4 | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| **Total Lines** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| **Band 2 Ratio** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |

Source: ACCC, March2008QuarterESAs_Excel.xls

According to the data above, the ratio of Band 2 lines to total lines should be **[c-i-c],** instead of **[c-i-c]** as considered in the TEA model. The cost of ULLS in a replacement CAN for all 584 Band 2 ESAs is over-estimated. If the lower percentage is used in the factor calculation sheet, for example, then the O&M factors of "Ducts and Pipes" and "Copper Cables" decrease by 10%, Network support factors decrease by 9.1%, and Indirect asset factors by 5%. As these factors are used as inputs in the economic module, the costs associated with the above factors decrease by the same percentages.

**Exclusion of Shared Revenues**

The following formula is used to calculate the total annualised costs attributed to ULLS Band 2:

***(Total annual costs) = (Annual direct capital costs) + (Annual indirect capital costs) + (Annual support capital costs) + (O&M direct costs) + (O&M indirect costs) – (Sharing revenue).***

As seen in the above formula, out of the total annual costs, the model excludes **sharing revenue** that may be applied. The only source of revenue used in the TEA model is the conduit leasing revenue that applies to the ducts and pipes of the *main* network. Telstra submits in the model user guide that a provider wishing to share Telstra's conduit can do this by leasing the conduit through Commission-approved lease rates. To reflect this sharing of conduit costs the model has a set of inputs to ensure these leased revenues reduce the overall cost of the distribution network.

Conduit leasing annual revenues are calculated in the TEA model as a percentage of the total Conduit Sharing Annual CAN revenue as follows:

***(Conduit leasing revenues) = (Conduit Sharing Annual CAN Revenue) / (Number of lines in band 2) * (Percent CAN) * (Percent of Band 2)***

The following comments could be made about the revenue calculation:

- Although in the model guide it is mentioned that conduit leasing applies to the distribution network, in the TEA model, the cost of ducts and pipes in the main network have been reduced by the amount of conduit leasing revenue.
- This is a cost model and therefore we would expect that only costs are included or excluded. We therefore believe that the assumption has been made that the revenue collected from the operators that lease the conduit is equal to the associated cost of this activity, which means that profit margin is zero.
- The values of the factors in the above equation (apart from the Number of lines in Band 2) are inputs to the model and there is no reference to how they are calculated. We would expect the revenue value to derive from RAF, but this could not be reconciled with RAF data.
- The number of lines in Band 2 used in the formula is not the number of lines calculated in the model. This is a value that cannot even be flexed in the Telstra Cost Model user interface.
- As there is no reference to how the values of the inputs used in the formula are calculated, the conduit leasing revenue would be fixed and independent of the number of exchanges considered in the grouping module.

Our view is that the model could have considered only one input value which is the percentage of conduit that is leased out of total conduits in the distribution network. This logic was applied in the main network where conduit was shared between the CAN and the IEN.

The accompanying engineering review notes that leasing could be determined from the basic cable data and could be entered by conduit run in the base input data.

## 2.4 Efficiency savings

Most regulators stipulate efficiency factors to be added to the model. A good example is applying optimal and new technology. The technology between nodes should be optimised to meet the demands of a forward-looking efficient operator and new technologies may have developed since the existing asset's installation. The new assets may have greater capability, functionality and operational savings.

### Operational and maintenance costs

The figure below illustrates the current operational and maintenance factors used in the TEA model; they are compared to their corresponding historical rates. In the majority of Bottom-Up models, the modelled efficient operator will have equal or lower operational costs than that of the incumbent.

**Figure 2.4: Comparison of factor mark-ups**

**[c-i-c]**

Source: TEA model[13]

Currently in the TEA model the operational and maintenance factor is higher for each plant and equipment item, except for ducts and pipes alone, when compared to the historic cost factors. The operational costs should be equal to or lower than their historic counterparts. Therefore, the factors are inappropriate and include inefficiencies in the network. Modern access plants are inherently reliable and that it is interventions and work practices that drive fault rates[14]. It is unlikely newly laid equipment such as copper lines require as much or more maintenance costs as older copper lines.

The new assets modelled in the network should be at least equivalent to the current network or have greater capability, functionality and operational savings. If there are efficiency savings, the accountable adjustments should be estimated for each year of the asset life. The difference should then be discounted by the relevant cost of capital and summed.

In theory, the O&M figures should be lower than the historic factors. Thus, O&M factors for the Customer Access Network – Ducts and Pipes, Copper Cables, Pairs Gain Systems – should have factors lower than **[c-i-c], [c-i-c],** and **[c-i-c]** respectively. Detailed studies have shown that modern access plant is inherently reliable and that it is interventions and work practices that drive fault rates.

If we take the lowest factor for each CAN equipment, namely

- Ducts and Pipes **[c-i-c]**
- Copper Cables **[c-i-c]**
- Pair Gain Systems **[c-i-c]**

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[13] The factor calculations are based on figures obtained from the Telstra Corporation Limited worksheet "Factor Calculation – Final.xls"

[14] France, Paul (ed.), "Local Access Network Technologies", IEE Telecommunications Series No. 47, 2004

the costs fall by 1.4% down to a ULLS charge of $**[c-i-c]** per month. Further analysis on O&M costs can be found in the next chapter.

# 3 Capital cost and expense factor calculations

All cost calculations are performed in the Cost Calculation Module (Default file name: Calc-Engine-v1.0). The costing module calculates the annual capital costs associated with the investments and calculates an estimate of the annual expenses necessary to operate the new, efficient replacement CAN.

In this chapter, we examine the Cost Calculation Module in detail and comment on the appropriateness of:

- Annualisation: Comments on the NPV calculations, timing of cash flows, and the depreciation rate applied to each asset;
- Asset Lives: Comments on the asset lives;
- WACC: Benchmark to worldwide WACC figures used in LRIC models and comment on whether the value in the model is appropriate for an incumbent in Australia;
- Cost factors: Whether Telstra has correctly calculated capital and expense cost factors. We examine the method of incorporating O&M expenses, common network and indirect costs; and benchmark these factors with methodologies used in other LRIC cost models.

We review the capital costs and expenses and validate the NPV calculations, and the timing of cash flows. The calculations should satisfy TSLRIC standards for costing ULLS and CAN services. The results of the TEA model are then compared and benchmarked to other LRIC models worldwide.

## 3.1 Annualisation

There are three main sheets in the Excel cost calculation module, which calculate the final annualised cost. The functions of the sheets according to Telstra are[15]:

- Capital Cost Calculation: The capital cost worksheet develops composite capital cost factors for each category of plant used in the model. These factors account for the cost of financing throughout the plant's life (i.e. equity and debt), the annual depreciation accruals throughout the life of the plant for each plant category, and the taxes associated with the equity return component of capital costs. These are all combined into a single factor for each category of plant that can be applied to the investment levels developed on the other worksheets.

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[15] Telstra Corporation Limited, "Telstra's Efficient Access Model, Model Documentation", 3 March 2008

- Investment Summary: The worksheet accumulates all the investment costs on the two network cost worksheets by category and divides by the total number of lines. This produces an investment cost per line for each category of plant in the TEA model.
- Annual Cost Summary: First, the capital cost factors developed in the Capital Cost Calculation worksheet are applied to each of the investments for the various plant categories identified in the Investment Summary worksheet. Next, the direct and indirect expense amounts are calculated by asset category. Finally, indirect asset costs are derived by asset category. These various costs are then combined to identify the annual and monthly costs associated with providing the ULLS.

This section reviews the three main sheets and examines the final calculations of annualisation of capital costs in the TEA model.

### Annual Cost Summary

According to Telstra[16] the annualisation methodology calculates "both the return on capital that has been invested (depreciation) and the return on that capital, which reflects the opportunity cost of that investment taking account of the risk (opportunity cost of capital)".

The TEA model multiplies the investment capital cost by its corresponding capital cost factor, which is comprised of depreciation and the opportunity cost of capital. The assets are depreciated using the straight-line method and the opportunity cost is calculated by applying Telstra's WACC to the written-down value of the asset for each year. This is achieved in the formula below by multiplying the WACC by the proportion of the asset value remaining at the beginning of the year t.

***Factor = Depreciation + WACC * WrittenDownValue***

***Factor = D + WACC *(1-$t_{-1}$ *D)***

Where:

- D is the depreciation rate: D=1/N where N is the economic life of the asset;
- t is the relevant year of the asset's life;
- $t_{-1}$ denotes the asset value remaining at the beginning of the year t;
- WACC is the post-tax vanilla WACC adjusted for tax, that is,
  WACC=WACC $_{\text{post-tax}}$* (1+TaxGross-up)
  where the Tax Gross-up= (WACC $_{\text{pre-tax}}$/WACC $_{\text{post-tax}}$ -1).
  This of course is equivalent to the pre-tax WACC.

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[16] Telstra Corporation Limited, "Telstra's Efficient Access Model, Model Documentation", 3 March 2008

The TEA model then calculates the Net Present Value of the capital cost factors across all the years (1 to N) and using a discount rate equal to the **post-tax WACC**. The formula used for the NPV calculation of each asset is the following:

$$NPV = \sum_{t=1}^{N} \frac{Capital\ Cost\ Factor_t}{(1 + WACC_{post-tax})^t}$$

The model calculates the final capital cost factor by using the PMT Excel formula as follows:

$$\textit{Capital Cost Factor} = NPV / \{ [ 1-( 1 / (1+WACC_{post-tax})^N ) ] / WACC_{post-tax} \}$$

The same result can be extracted by applying the PMT Excel function as follows:

$$\textit{Capital Cost Factor} = - PMT(WACC_{post-tax}, N, NPV)$$

Finally, annualised capital costs are calculated as:

***(Annualised Capital Costs) = (Capital Cost Factor) * (Capital Investment)***

This method could potentially overcompensate (undercompenstate) Telstra if the values of assets are increasing (falling). In most Bottom-Up LRIC models, the chosen depreciation methodology is the annuity method. The advantage of an annuity calculation is that it takes account of the discount rate (cost of capital), which generally suggests that it is rational to delay depreciation payments to some extent. However, this creates a "back-loaded" depreciation profile (i.e. more depreciation later in the asset life). This may be considered inappropriate for telecommunications assets because real prices tend to be declining, which means that future entrants will be able to purchase cheaper assets, and so incumbents will typically wish to "front-load" unit cost recovery. Tilted annuities are designed to alleviate the problem of "back-loading" to the extent justified by the annual reduction in asset values. With this methodology, the sum of the depreciation charge and the return on capital employed declines over time consistent with the reduction in the replacement value of the asset.

In summary, tilted annuity depreciation:

- recovers both the depreciation charge and the cost of capital,
- revalues assets at their modern equivalent, which is consistent with an economically efficient network,
- is consistent with the preferred approach by a number of regulators (e.g. ComCom in New Zealand, PTS in Sweden, Telestyrelsen in Denmark).

We recommend the tilted annuity methodology. With this methodology implemented, and with no other parameter or calculation changes, the result of the TEA model produces a monthly rate of $**[c-i-c]** per line, instead of the default figure of $**[c-i-c]**. Here we have assumed no price changes, as we cannot identify the prices changes, if any, Telstra has applied in the TEA model. The monthly rate may increase or decrease however, depending on annual price changes. If the equipment price increases (falls), then the provider will incur a holding gain (loss) from holding asset.

## 3.2 Asset Lives

The purpose of this section is to compare the asset lives used in the TEA model with asset lives of equipment used in other publicly available models. Here we compare the asset lives in the TEA model with the following models:

- ITST Consolidation Model v2.4[17];
- PTS Hybrid Consolidation Model Public v3.1[18];
- C&W FLRIC model for Commonwealth of Dominica (Caribbean)[19].

In addition, the assets lives used in the TEA model are also compared to the asset lives reported in Telstra's financial accounts[20].

**Figure 3.1: Comparison of Asset Lifetimes**

| Asset Categories | ITST | PTS | C&W | TEA model | Financial statement 30 June 07 | Financial statement 30 June 06 |
|---|---|---|---|---|---|---|
| Duct | 40 | 40 | 38 | **[c-i-c]** | Ducts & pipes<br>Main: 40<br>Distr: 30 | Ducts & pipes<br>Main: 40<br>Distr: 30 |
| Copper cables | 20 | 25 | 15 | **[c-i-c]** | 4 - 25 | 4 - 25 |
| Fibre cables | 20 | 20 | 15 | **[c-i-c]** | 4 – 25 | 4 - 25 |
| Power supply unit | 15 | 10 | | **[c-i-c]** | | |
| Buildings (network) | 30 | 20 | | **[c-i-c]** | 8 – 40 | 8 - 40 |
| Buildings (other) | | | | **[c-i-c]** | 55 | 55 |
| Transmission equipment | 10 | 10 | 10 | **[c-i-c]** | 1 – 25 | 2 – 25 |
| IT, cabling and PCs | 6 | | | **[c-i-c]** | | |
| Switching software | | 10 | | **[c-i-c]** | | |
| Multiplexers | | 10 | | **[c-i-c]** | | |
| Local Switching | | 10 | | **[c-i-c]** | 2 – 12 | 4 – 12 |
| Network Management | | | | **[c-i-c]** | | |

[17] http://en.itst.dk/interconnection-and-consumer-protection/filarkiv-lraic/lraic-pa-fastnet/ITST31.10.07%20Hybrid%20LRAIC%20model%20v2.4%20off.zip [Accessed 9 June 2008]

[18] http://www.pts.se/upload/Documents/SE/PTS_Hybrid_Model_v3.1_PUBLIC_051216.zip [Accessed 9 June 2008]

[19] http://www.ectel.int/ectelnew-2/consultations_files/LRIC/Dom/DOM%20fixed%20LRIC%2005-dec-06_pub.xls [Accessed 9 June 2008]

[20] http://www.telstra.com.au/abouttelstra/investor/docs/tls565_2007annualreport.pdf [Accessed 17 June 2008]

| Asset Categories | ITST | PTS | C&W | TEA model | Financial statement 30 June 07 | Financial statement 30 June 06 |
|---|---|---|---|---|---|---|
| Other Indirect (Fleet, etc.) | | | | **[c-i-c]** | | |
| Software | | | | **[c-i-c]** | 6 | 6 |
| Lead-Ins | | | | **[c-i-c]** | | |
| Buildings fitout | | | | **[c-i-c]** | 10 – 20 | 10 – 20 |

Source: Ovum, Telstra Annual Report & Model references

According to Telstra[21], the asset lives are from the accounting department:

> *"The depreciation lives for each category of asset are inputs into the model. These lives were provided by Telstra's accounting department and were based on studies of Telstra's actual asset lives. These factors are applied to the projected plant balances to determine the annual depreciation accruals."*

Although the asset lives are sourced from Telstra's accounting department, the asset lives used in the TEA model **do not** match the asset lives as reported in the Annual Report. The asset lives in the TEA model are lower. Consequently, lower asset lives mean that assets are replaced earlier than the actual or historical replacement date and therefore the calculated monthly ULLS cost in the TEA model is higher. If the modelled asset lives in the TEA model are replaced with the actual reported asset lives, then the ULLS monthly charge decreases by 2%– 3%.

The asset lives should be re-valued to their economic lives, the period of time during which an asset is usable. According to Donald McGauchie[22],

> *By the early part of this century, over 30 per cent of the copper pairs in the Australian network were more than 30 years old, with more than 5 per cent pre-dating 1950.*

Following this principle and Telstra's statement, the asset lives could be further extended, at least in the case for copper cables. In the case of longer asset lives, the calculated monthly ULLS cost in the TEA model will decrease. Ovum urges the ACCC to further review the asset lives.

### Operability of asset lives

Not all of the asset lives are linked through the model. If the model user decides to change the asset lives of these asset categories, for certain asset lives listed below, the changes to the asset lives will have no impact upon the final result:

- Network Management;

[21] Telstra Corporation Limited, "Telstra's Efficient Access Model User Guide", 3 March 2008

[22] Donald McGauchie, "It's Time to Get Serious About Australia's next generation network", 23 June 2008

- Support Structures;
- Building Fitouts;
- Buildings;
- Switching Software.

This is because there are missing links in the "Capital Cost Calculation" sheet. The listed asset lives which feed into the "Input Capital Cost" do not feed through to the "Capital Cost Calculation". The asset lives of the listed asset categories have instead been hard coded, and hence changes to them have no impact on the monthly ULLS cost.

The figure below compares the asset lives used in the TEA model and the lifetimes projected or thought to be used in the TEA model.

**Figure 3.2: Asset lifetime values in the model**

| Asset | Asset lifetime in "Capital Cost Calculation" | Input lifetime in "Inputs Capital Cost" |
|---|---|---|
| Network Management | **[c-i-c]** | **[c-i-c]** |
| Support Structures | **[c-i-c]** | **[c-i-c]** |
| Building Fitouts | **[c-i-c]** | **[c-i-c]** |
| Buildings | **[c-i-c]** | **[c-i-c]** |
| Switching Software | **[c-i-c]** | **[c-i-c]** |

Source: Ovum

The asset lives used in the model for the assets shown above are lower than those implied in the default scenario in the application. Consequently, the monthly ULLS cost is higher than it otherwise would be if the model was working properly, as the investment costs are recovered earlier than expected.

This lack of link or connection between the two sheets reduces the model's transparency and is a modelling error. This could be corrected by fully linking the "Inputs Capital Cost" sheet with the annualisation "Capital Cost Calculation" sheet.

## 3.3 Weighted average cost of capital ("WACC")

In most jurisdictions, regulators and operators have chosen to use a pre-tax WACC, that is, a WACC adjusted to allow for corporation tax payments. Treatments of pre-tax WACC can be found in Bahrain, Belgium, Denmark, Spain, Finland, France, Ireland, Italy, Israel, Jordan, Malta, Singapore, The Netherlands, Poland, Portugal, Sweden, UAE, UK and many other countries worldwide. The pre-tax WACC gives the company the profits needed to finance tax and interest payments and to give shareholders their required return.

The TEA model's estimated WACC (post-tax vanilla WACC adjusted for tax) or pre-tax WACC of **[c-i-c]**% is based on a CAPM framework. The pre-tax WACC is calculated as follows:

(i) $WACC = WACC_{post\text{-}tax} * (1+TaxGross\text{-}up)$

where in the TEA model[23]

$Tax\ Gross\text{-}up = (WACC_{pre\text{-}tax}/WACC_{post\text{-}tax} - 1)$

(ii) Combining the two equations, we then obtain:

$$\begin{aligned} WACC &= WACC_{post\text{-}tax} * (1 + (WACC_{pre\text{-}tax}/WACC_{post\text{-}tax} - 1)) \\ &= WACC_{post\text{-}tax} * (WACC_{pre\text{-}tax}/WACC_{post\text{-}tax}) \\ &= WACC_{pre\text{-}tax} \end{aligned}$$

The WACC used in the model, however, is not the same calculated WACC that Telstra submitted in its latest submission to the ACCC, "Weighted Average Cost of Capital document, 4 April 2008".

Differences lie in the cost of equity and cost of debt values. In the TEA model, the cost of equity and cost of debt are **[c-i-c]**% and **[c-i-c]**%, respectively. The model documentation suggests higher figures for cost of equity and cost of debt. More specifically, the model document suggests that appropriate levels of cost of equity and cost of debt are **[c-i-c]**% and **[c-i-c]**%. If we consider the latter values, then the post-tax and pre-tax WACC in the TEA model will be equal to **[c-i-c]**% and **[c-i-c]**%, respectively.

Based on the submitted WACC[24] input parameters, the calculated pre-tax WACC of **[c-i-c]**% is very high when compared to the cost of capital calculated in other countries. The figure below compares the calculated WACC value based from Telstra's submitted input parameters with the WACC values of other countries.

**Figure 3.3: Fixed Networks pre-tax Nominal WACC in selected countries**

**[c-i-c]**

Source: Ovum

In fact, the calculated WACC of **[c-i-c]**% is the highest among the other countries and much higher than the average WACC value of 10.38%. If instead Telstra's TEA model WACC value is 10.38%, the TEA model's monthly ULLS cost will fall to $**[c-i-c]**, 73% of the original value.

[23] This formula is sourced from the economic module of Telstra's TEA model; in cell F59, in the "Input Capital Cost" sheet.

[24] Telstra Corporation Limited, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

It should be noted that the values of cost of capital included in this graph derive from NRAs' assessment of WACC. These individual assessments contain country specific elements, such as inflation, interest rate risk and different risk-free rates. Differences in these parameters may increase or decrease the WACC value. In order to identify the impact on WACC of parameters other than the risk-free rate we have built the following graph. The graph below indicates the contribution of the risk-free rate and of other parameters to the WACC value.

In this calculation, the revised Telstra's WACC value excludes the issuance cost, as it is not included in the other countries. The countries considered are Finland, France, Ireland, Spain, Sweden, UK, Denmark and Luxembourg. The resulting average WACC for these countries is 9.76%, slightly lower than the 10.38% calculated for a broader set of countries.

**Figure 3.4: Comparison of the impact of WACC parameters**

**[c-i-c]**

Source: Ovum

The figure highlights that even if we exclude the impact of risk-free rates on the WACC, the other parameters (debt and equity premium) are set at high levels compared to other countries.

The breakdown of Telstra's submitted WACC can be found in the figure below. The figure below compares the WACC parameters Telstra submitted in calculating the **[c-i-c]**% WACC with the parameters used to derive WACC values in the countries shown in the figure above.

**Figure 3.5: Fixed Networks pre-tax Nominal WACC Parameters in selected countries**

| WACC parameters | Range in selected countries | Telstra's estimates |
|---|---|---|
| Risk Free Rate | 3.40% - 4.75% | **[c-i-c]%** |
| Debt Risk Premium | 0.50% - 1.55% | **[c-i-c]%** |
| Debt Issuance Cost | 0% | **[c-i-c]%** |
| Cost of Debt | 3.94% - 6.30% | **[c-i-c]%** |
| | | |
| Equity Risk Premium | 3.75% - 6.70% | **[c-i-c]%** |
| Equity beta | 0.560 - 1.380 | **[c-i-c]** |
| Equity Issuance Cost | 0% | **[c-i-c]%** |
| Cost of Equity | 7.16% - 10.46% | **[c-i-c]%** |
| | | |
| Debt Ratio | 16.8% - 50.0% | **[c-i-c]%** |
| Tax | 12.50% - 34.93% | **30%** |
| Imputation factor | 0 | **[c-i-c]** |

Source: Ovum, Telstra

What can be inferred from the above figure is that the debt risk premium and debt issuance cost that Telstra submits are very high compared to other countries, contributing to higher cost of debt. Direct comparison of the risk-free rate cannot be done due to different economic conditions that apply in each country, such as interest rates and inflation. Additionally, Equity Risk Premium is high and contributing to higher cost of equity. Other parameters such as Debt and Equity Issuance Costs have not been included in any of the countries we consider in our comparisons.

In some countries, a separate pre-tax WACC has been calculated for the purpose of the ULLS charges. The table that follows, sourced from Europe Economics[25], presents the cost of capital used for ULLS charges calculated in a number of countries.

**Figure 3.6: Cost of Capital used for calculation of ULLS charges**

| Country | Pre-tax WACC |
|---|---|
| Austria | 9.34% |
| Belgium | 12.88% |
| Denmark | 10.85% |
| France | 10.40% |
| Germany | 8.00% |
| Greece | 12.12% |
| Ireland | 12.00% |
| Italy | 13.50% |
| Netherlands | 10.7% - 13.4% |
| Spain | 12.34% |
| Sweden | 15.00% |
| UK | 13.50% |

Source: Europe Economics

Based on the above table, the average pre-tax cost of capital is 11.83% for ULLS offerings, considerably lower than the WACC value submitted by Telstra, as well as the WACC value used in the TEA model. In all cases the TEA model and submitted WACC, when compared to other international benchmarks whether it is specifically calculated for the fixed network as a whole or for the ULLS network only, is high.

We recommend that the submitted WACC should be recalculated. Below we review the assessment of cost of capital in further detail. We review all input parameters and discuss their affects on the cost of capital. Naturally, parameters such as the risk free rate are out of the control of Telstra and may contribute to higher calculated WACC than seen in other countries. Nevertheless the WACC is still deemed high. The input parameters are explained in further detail in the following

[25] http://europa.eu.int/comm/competition/liberalization/pricing_open_loop.pdf [Accessed 9 June 2008]

sections. We review the input parameters for suitability in calculating an appropriate WACC.

## Assessment of Cost of Capital

Based on the ACCC's Telecommunications Industry Regulatory Accounting Framework[26] pre-tax WACC is calculated as follows:

$$WACC = \frac{r_e}{1-\left[T_e \cdot (1-\gamma)\right]} \cdot \frac{E}{V} + r_d \cdot \frac{D}{V}$$

Where:

- D is the market value of total capital financed out of debt
- E is the market value of total capital financed out of equity
- V is the market value of total capital including debt and equity
- $\gamma$ is the imputation factor which is the value of franking credits to the extent which shareholders in the company can reduce their tax liability. The value of the imputation factor can range between zero and one.
- $r_e$ is the rate of return on equity
- $r_d$ is the rate of return on debt
- Te is the effective tax rate.

The rate of return on equity is determined based on the following formula:

$$r_e = r_f + \beta_e \cdot \left(r_m - r_f\right)$$

Where:

- $r_f$ is the risk free rate of return, which is the rate on government bonds
- $r_m$ is the market rate of return
- $r_m$ - $r_f$ is the market risk premium, which is the rate of return the investors need to earn over and above that offered on government bonds
- $\beta_e$ is the equity beta, which is the degree of correlation between a particular asset's earnings and those of the market in general and is determined using the following formula:

$$\beta_e = \beta_\alpha + \left(\beta_\alpha - \beta_d\right) \cdot \left[1 - \frac{r_d}{1+r_d} \cdot \left(1-\gamma\right) \cdot T_e\right] \cdot \frac{D}{E}$$

Where:

- $\beta_\alpha$ is the asset beta
- $\beta_d$ is the debt beta.

[26] ACCC , "Telecommunications Industry Regulatory Accounting Framework", October 2003

The effective tax rate is:

$$T_e = \frac{Actual\ tax\ paid}{Revenue - Operating\ expenses - Net\ interest\ paid - Depreciation}$$

The Telecommunications Industry Regulatory Accounting Framework does not provide a formula for the calculation of rate of return on debt. The rate of return on debt may be determined based on the following formula:

$$r_d = r_f + DRP + DIC$$

Where:

- DRP is the debt risk premium
- DIC is the debt issuance cost.

In the following sections we review the WACC parameters and present suitable point estimates in calculating the WACC.

### Risk free rate

In defining a best practice methodology to assess the WACC, IRG[27] identifies that freely traded investment-grade government bonds can generally be regarded as having close to zero default risk and zero liquidity risk. The second thing to define is the relevant market, concluding that the domestic market may be used, although other country's bonds could be used as a proxy. Further, the maturity of the bonds may be based on:

- The investment horizon: the period that investors expect to be compensated for making long-term investments;
- The planning horizon: the average life of the group of assets making up the investment project that is being assessed with the cost of capital;
- The time horizon of the regulatory review period.

Finally, the type of data to be used is important, as the risk-free rate could be based on current or historical values. IRG notes that historical data is logical to be used when assessing past historical cost of capital over a period of time, while, when evaluating forward-looking costs of capital, current yields would reflect expectations of future earnings and should be the appropriate measure of risk-free rate. However, in practice the rates observed on a particular day could be influenced by anomalies and are prone to significant cyclical variations.

ITST, the regulator in Denmark, has considered that the risk-free rate for calculating the forward-looking nominal risk free rate is the effective interest rate

[27] IRG, "Regulatory Accounting, Principles of Implementation and Best Practice for WACC calculation", February 2007

on government bonds with duration of 10 years[28]. The effective rate has been estimated as an average of the daily observations throughout a full year due to the fact that a year period is sufficient, as it makes possible the use of relatively recent information and all short term fluctuations in the market are levelled.

In Ireland, Comreg calculated the risk-free rate taking account of recent regulatory decisions, the nominal historical benchmarks for the five and ten year maturities over one and five years, as well as spot rates[29].

The Swedish regulator[30], for the calculation of risk-free rate, considers the 6 month average over a 5 years period of 10-year maturity nominal governmental bonds. The rationale for restricting the average to 6 instead of 12 months average is that the risk-free rate can be based on the expectation of future returns, as opposed to historical returns. Also, it is noted that the risk-free rate can be an average of historical observations or the last observation and also that the last observation is generally considered to best include future expectations of the risk-free rate.

EPT[31], the regulator in Luxembourg, considers that the risk-free rate is one month's average of 5-year maturity bonds.

In Bahrain, TRA[32] considers that the risk-free rate is an average rate of 10-year government bonds over a period of the past 12 months and the past 24 months.

In previous regulatory decisions,[33] the ACCC has considered that the appropriate risk-free rate is equal to the average yield of 10-year maturity governmental bonds of the past ten days leading up to the last observation.

In comparison, Telstra in its submission[34] considers that the appropriate risk-free rate is the closing yield on 10-year government bonds on 31 December 2007,

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[28] ITST, "Report on the LRAIC Model, Revised Hybrid Model (version 2.3)", December 2005.

[29] Oxera, "eircom's cost of capital, prepared for Commission for Communications Regulation", November 2007

[30] Copenhagen Economics, "WACC for the Fixed Telecommunications net in Sweden", 26 October 2007

[31] EPT, "Weighted Average Cost of Capital (WACC)", October 2007

[32] TRA, "Determination on Batelco's Cost of Capital", 20 November 2005

[33] ACCC, "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006 and ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008

[34] Telstra, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

which was applied as an unbiased estimate of the rate applicable at the opening of trading on 1 January 2008.

If we consider a regulatory period starting 1 January 2008, then we have calculated the following rates:

**Figure 3.7: Calculation of risk-free rates for different periods**

| Period covered | Rf (%) |
|---|---|
| Closing value 31 Dec 2007 | 6.33 |
| Average of 10 days leading to 31 Dec 2007 | 6.31 |
| Average of month | 6.20 |
| Average of year | 5.99 |

Source: Ovum's calculations on data from RBA

It should be noted that as Telstra submitted this Undertaking on 3 March 2008, it has set the risk-free rate ex-post. It can be argued that ex-post observation dates are generally not preferred, as dates that produce higher rates could possibly be selected to the benefit of Telstra. Ovum urges the ACCC to set an agreed appropriate risk-free rate before the process of the model.

**A rate of 6.31% is an appropriate estimation of risk-free rate.**

### Debt risk premium (DRP)

In a previous regulatory decision[35] the ACCC stated that DRP is estimated for asset-specific costs rather than Telstra as a whole and that in practice the debt premium observed in the market for Telstra bonds gave the best measure of the premium required by investors, as it would be based on their assessment of Telstra's credit rating. The ACCC's 1.02% debt premium estimation was based on benchmark debt premium for an A-rated benchmark bond and was supported by data sourced from Bloomberg that indicated that the current debt premium for Telstra as a whole as at 23 December 2005, the date that Telstra submitted the undertaking, was 1.01%. The value of 1.02% has been used in a recent regulatory decision by the ACCC[36].

Telstra[37] submits that the Telstra-wide DRP is an appropriate indicator of the DRP relative to the CAN-related assets and that the **[c-i-c]**% that was the Telstra DRP as at close of trading on 31 December 2007 is the appropriate value to be used.

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[35] ACCC, "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006

[36] ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008.

[37] Telstra, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

IRG[38] notes that company-specific debt premium can be obtained by observing published credit ratings that specialist credit agencies assign to that company. This approach ensures that the cost of debt is forward-looking and therefore avoids transitional effects such as temporary holdings of debt.

According to Standard & Poors, Telstra Corporation Ltd credit rating is A[39]. Debt margin can be calculated on the basis of the 10 year A-rated Australian corporate bond yields. This is the preferable maturity, as this period was used for the calculation of risk-free rate. For the risk-free rate, we considered as an appropriate rate the average of the past 10 days leading to 31/12/2007. The same principle is applied for the calculation of debt premium. The average of 10 past days leading to 31/12/2007 of 10 year A-rated Australian corporate bond yields is 8.31%. **Therefore if we consider a risk free rate of 6.31% (see previous section), then an applicable debt premium is 2%.**

**Debt issuance cost**

In previous undertakings[40], the ACCC had accepted the inclusion of debt issuance costs in the case that these costs were not able to be placed in the cash flows. In the same study, the ACCC considered that a methodology developed by Allen Consulting Group (ACG) could be employed in order to calculate debt issuance costs. According to the ACCC, CAN accounted for 40% of Telstra's total assets and a benchmark debt issuance cost of 8.3 basis points per annum was calculated.

Telstra has included debt issuance costs in its WACC calculations and has concluded that a range of **[c-i-c]** basis points with a mid-point of **[c-i-c]** is appropriate[41].

Our view is that the ACCC's methodology should be employed in order to calculate debt issuance costs. Based on Telstra's annual report[42], the book value of debt for year end June 2007 is AUD 14,587 millions and, based on Telstra's RAF statement, CAN related assets account for **[c-i-c]**% of total assets. ACG's report was updated

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[38] IRG, "Regulatory Accounting, Principles of Implementation and Best Practice for WACC calculation", February 2007

[39] Standard & Poor's corporate credit rating, http://www2.standardandpoors.com/portal/site/sp/en/au/page.ratingssearch/ratings_search/2,1,1,5,0,0,0,0,0,0,0,0,0,0,0,0.html?cspage=rd&entId=112761&debtType=ICR&SearchType=O [Accessed 4 June 2008]

[40] ACCC , "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006

[41] Telstra, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

[42]http://www.telstra.com.au/abouttelstra/investor/docs/tls565_2007annualreport.pdf [Accessed 17 June 2008]

by the Australian Energy Regulator for current costs in 2007 and the results are shown in the following table.

**Figure 3.8: Estimated Debt Issuance Cost from ACG report**

| Fee | Explanation / Sources | 1 Issue | 2 Issues | 4 Issues | 6 Issues |
|---|---|---|---|---|---|
| Amount raised | Multiples of median MTN issue size | $200 million | $400 million | $800 million | $1,200 million |
| Gross Underwriting Fees | Bloomberg for Aust. Intl. issues, maturity adjusted | 6 | 6 | 6 | 6 |
| Legal and road | $75K-$100K: Industry sources | 1 | 1 | 1 | 1 |
| Company credit rating | $30K-$50K: S&P Ratings | 2.5 | 1.3 | 0.6 | 0.4 |
| Issue credit rating | 3.5 (2-5)bps up-front: S&P Ratings | 0.7 | 0.7 | 0.7 | 0.7 |
| Registry fees | 3K per issue Osborne Assoc. | 0.15 | 0.15 | 0.15 | 0.15 |
| Paying fees | $1/$1m Osborne Assoc. | 0.01 | 0.01 | 0.01 | 0.01 |
| Totals | Basis points* p.a. | 10.4 | 9.1 | 8.5 | 8.3 |

Source: AER study quoted on ARTC Access Undertaking[43]

Combining these figures with ACG's benchmark methodology may provide an appropriate value for debt issuance cost for Telstra's CAN services. **We believe that debt issuance costs will be closer to the ACCC's previous estimate of 8.3 basis points rather than Telstra's point estimate of [c-i-c] basis points**.

### Market risk premium

The market risk premium is the difference between a rate of return and the risk-free rate of return. Telstra's argument is based on calculation of historical values of MRP, on Professor Bowman's benchmarking approach, as well as with reference to a number of other studies, and concludes that a reasonable range for the MRP would be around **[c-i-c]**% with a point estimate of **[c-i-c]**%. On the other hand, the ACCC in previous decisions[44] concluded that an MPR of 6% would be an appropriate rate. This is at the lower end of the range of historically observed values.

Dimson *et al*[45] look at the historical equity premium for a number of countries around the world including Australia, calculating a range of rates equal to 6.22%-

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[43] ACCC, "Draft Decision, Access Undertaking – Interstate Rail Network, Australian Rail Track Corporation", April 2008

[44] ACCC, "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006 and ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008.

[45] Dimson, Elroy, Marsh, Paul and Staunton, Mike, "The Worldwide Equity Premium: A Smaller Puzzle" (April 7, 2006), EFA 2006 Zurich Meetings Paper Available at SSRN: http://ssrn.com/abstract=891620

7.81% when considering geometric and arithmetic mean, respectively, for a period between 1900-2005. After decomposing the historic geometric equity premium into its constituent parts, they calculate a rate of 6.42% for Australia. Dimson *et al* support that a long-term projection of the annualised equity premium might at the very least involve making adjustments to the historical record for components of performance that cannot be regarded as persistent. A forward-looking calculation of MRP needs a downward adjustment of 1% - 2% in order to account for unanticipated cash flow growth and unanticipated declines in business and investment risk. They suggest removing the non-repeatable expansion in the price/dividend ratio as markets become integrated, which results in a reduction of 0.46% in the rate. Adding back the expected change in the real exchange rate will result in a geometric average of 6.2%. In addition, Dimson *et al* suggest that, if current dividend levels are a guide to the future, then the prospective mean dividend yield is likely to be lower than the historical average by at least 0.5%-1%. This means a current equity premium of 5.2%-5.7%. If we also assume that the arithmetic mean is 1.6% higher than the geometric, then the arithmetic mean MRP is within a range of 6.8%-7.3%. Therefore, a proposed MRP between 5.2% and 7.3% with a point estimate of 6.2% is likely to be an indicative value for Australia.

In another study[46], Neville Hathaway calculates an unbiased geometric average of 6% when considering all the data between 1875-2005 and an adjusted geometric average of 4.5% when considering the most recent period and 10-year market returns.

Fama and French (2002)[47] argue that for the half-century 1951–2000, the equity premium estimates from the dividend and earnings growth models are far below the estimate from the average return. The high average return for this period is due to a decline in discount rates that produce large unexpected capital gains. In other words, the conclusion is that market risk premium is declining over time.

Brailsford *et al* study on historical premiums results in a rate of 5.9% - 6.2% which corresponds to the geometric and simple average rate for the period 1900 – 2000[48].

Current surveys of investment bank brokers tend to indicate a forward-looking MRP of 6% per annum or less. The same source of information was also quoted by the

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[46] Neville Hathaway, "Australian Market Risk Premium", Capital Research, January 2005

[47] Fama, Eugene F., and French, Kenneth R. (2002), "The Equity Premium", *The Journal of Finance*, Vol. 57, No. 2, April 2002.

[48] Brailsford, Timothy J., Handley, John C. and Maheswaran, Krishnan, "A Re-Examination of the Historical Equity Risk Premium in Australia", April 2007 http://www.melbournecentre.com.au/Finsia_MCFS/Monday/Stream%201/JohnHandley_Presentation.pdf

ACCC on the Access Undertaking for ARTC in April 2008. In this study the ACCC considered a MRP value of 6%.

**Figure 3.9: Summary of Broker MRPs**

**[c-i-c]**

Source: Capital Research[49]

**Based on our analysis and reference to different sources of information, Ovum believes that a rate of 6%, which is in line with previous ACCC decisions, is a fair estimate of MRP.**

### Effective tax rate

According to IRG[50], in the long run, a profitable company operating in one country may be expected to face the headline rate of tax. However, there are many occasions where a company may pay an effective rate of tax which varies from the headline rate. Differences between the headline and effective rates of tax payable may be attributed to the utilisation of capital allowances and other timing differences, relief from past losses or the impact of operating in a number of countries, each with different tax rates and tax regimes. In deciding the appropriate tax rate to be used in the WACC calculation, it is important to consider the reasons for the differences between the headline and effective rates of tax. Therefore, as IRG concludes, an appropriately normalised tax rate will adjust the effective rate to remove the impact of short-term or transitory effects which are unlikely to endure, but will incorporate any adjustments to the headline rate that appear likely to represent a permanent difference between the headline and effective rate. Having done that, the tax rate will not reflect any short-term fluctuations in the amount of tax payable by the company, but will reflect any aspects particular to the company that give rise to an effective tax rate that is structurally different from the headline rate.

In the past, as part of the 2000 PSTN decision, the ACCC has estimated 20%:

> *Depending on the asset life and tilt factor for an asset, the estimated effective tax rate can range from anywhere between 9.7 and 26.5 per cent. For the vast majority of estimates, however, the effective tax rate lies between 13 and 26 per cent.*[51]

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[49] Capital Research, "Telstra's WACCs for Network ULLS and the ULLS and SSS Businesses", Review of Reports by Prof. Bowman, March 2006

[50] IRG, "Regulatory Accounting, Principles of Implementation and Best Practice for WACC calculation", February 2007

[51] ACCC, "A Report on the Assessment of Telstra's Undertaking for the Domestic PSTN Originating and Terminating Access Services", July 2000, p. 84, http://www.accc.gov.au/content/index.phtml/itemId/356283

The same methodology was applied previously by the ACCC[52] where the effective tax rate was considered as appropriate compared to the statutory tax rate. In this case, the effective tax rate was 20%. On the other hand, Telstra applies in the calculation of WACC the corporate tax rate of 30%.

In a recent decision the ACCC[53] has shown a preference for the effective tax rate but notes that a reliable estimate of the effective tax rate may not be possible and therefore, just for the specific case, a corporate tax was considered for the calculation of WACC.

**In the revised WACC calculation the effective tax rate in the assessment of cost of capital is applied in line with the ACCC's previous considerations. The 20% tax rate is considered in the WACC value and is based on the ACCC's calculations and previous decisions cited above.**

### Asset and equity beta

Beta is a measure of the risk of the risky asset relative to the market risk. The beta reflects the extent to which possible future returns are expected to co-vary with the expected returns on a broad portfolio of assets. Essentially it is the non-diversifiable risk, or market risk, investors bear when they invest in an asset. This non-diversifiable risk is the only risk that should be compensated with a risk premium under the CAPM assumptions and is commonly measured by regressing the equity's returns against the returns on the overall market. IRG[54] notes that a number of methods could be considered in estimating a firm's beta value.

- Historical beta: Beta is calculated through regression analysis of historical information and can provide an approximation, but estimation errors are likely due to the fact that betas may vary over time. Therefore, a forward-looking approach may also complement the historical approach.
- Adjusted historical beta: Historical beta may be adjusted through various formulae using Bayesian, Blume or log adjustment.
- Bottom-up beta: Beta is estimated through benchmark from the betas of specific firms. It has the advantage of eliminating the need for historical stock prices and reducing the standard error created by regression betas.

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[52] ACCC, "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006

[53] ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008.

[54] IRG, "Regulatory Accounting, Principles of Implementation and Best Practice for WACC calculation", February 2007

In a previous decision[55], the ACCC stated that the method favoured by the ACCC is de-levering and levelling using the Monkhouse formula relating asset beta and equity beta. After several studies as far as the equity beta is concerned, the ACCC conducted a direct estimation and concluded that the 18-month daily estimate was likely to be the most appropriate indicator of Telstra's equity beta. This suggested a value of 0.68 based on data from Bloomberg. The final value of equity beta, though, was 0.827 based on the Monkhouse formula and on a 0.5 value for asset beta. The ACCC was of the view that benchmarking is a useful approach for beta estimation and, based on results of an empirical analysis, concluded that an asset beta of 0.5 is an appropriate reflection of the systematic risk of PSTN.

In a recent draft decision[56], the ACCC states that "Common financial market practice is to use the past 5 years of monthly equity return data to estimate a firm's equity beta".

Telstra in its submission[57] has derived information from a number of sources and by applying different methodologies – Telstra-wide asset beta, average estimate of the betas of the remaining RBOCs and income elasticity –concluded that an average of **[c-i-c]** with a point estimate of **[c-i-c]** is a reasonable estimate of the CAN asset beta.

We followed a direct estimation method to derive the equity beta based on data sourced from Bloomberg[58]. Unadjusted beta was calculated based on trailing 18-month and 5-year prices, on a monthly, weekly and daily basis, relative to the S&P/ASX 200 index. The results are presented below.

**Figure 3.10: Direct estimation of Telstra's equity beta**

| Period covered | Frequency | Beta |
|---|---|---|
| 18 months at 31 December 2007 | Daily | 0.587 |
| 18 months at 31 December 2007 | Weekly | 0.655 |
| 18 months at 31 December 2007 | Monthly | 0.553 |
| 5 years average | Daily | 0.556 |
| 5 years average | Weekly | 0.534 |
| 5 years average | Monthly | 0.394 |

Source: Bloomberg

[55] ACCC, "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006

[56] ACCC, "Draft Decision, Access Undertaking – Interstate Rail Network, Australian Rail Track Corporation", April 2008

[57] Telstra, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

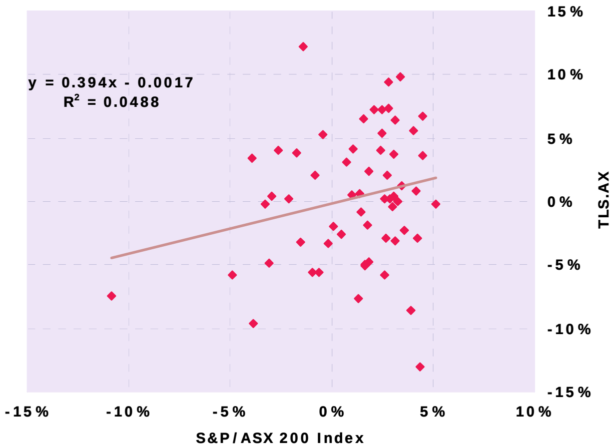
[58] Bloomberg [Accessed 13 June 2008]

Based on a study[59] prepared for the Swedish NRA, daily observed beta values are not preferable as they can lead to estimation problems such as:

- Non-synchronous trading bias – where information about the company and market are not translated into prices simultaneously;
- Weekend heteroscedasticity – where weekend returns may have greater variance than consecutive weekday returns;
- Other issues such as serial correlation, deviations from the normal distribution.

Following the ACCC's recommendation in the latest draft decision for the ARTC, that monthly observed beta of last 5 years is likely to be appropriate, **we conclude that an equity beta of 0.394 could provide an appropriate estimate of Telstra's equity beta**. The following graph shows the calculation of equity beta.

**Figure 3.11: TLS 5 years monthly average equity beta calculation**




Source: Ovum

For the calculation of asset beta from equity beta, we use the simplified Monkhouse formula that considers debt beta of zero. The calculation of the other parameters used in the following formula is explained in the next sections.

$$Be = Ba \cdot \left[1 + \frac{D}{E} \cdot \left(1 - \frac{Rd}{1 - Rd} \cdot (1 - \gamma) \cdot T\right)\right]$$

**The calculated value of asset beta is 0.32.**

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[59] Copenhagen Economics (2007), "WACC for the fixed Telecommunications net in Sweden"

### Debt beta

Based on previous regulatory decisions[60], debt beta is set to zero.  This is also in agreement with Telstra's considerations[61].

### Gearing ratio

The ACCC has supported a debt ratio of 40% and an equity ratio of 60%[62].  This value was based on comparisons against observed estimates of competitors and regulatory decisions.  Recently the ACCC has also supported a target debt ratio of 40% which is in accordance with the Telstra-wide historic book value and overseas fixed line regulation[63]. Telstra states that gearing ratio in book value terms has a target value of **[c-i-c]**%, which corresponds to a market gearing of **[c-i-c]**%, with a point estimate of **[c-i-c]**%, a value that was also supported with benchmarks across a peer set suggesting a market based gearing around **[c-i-c]**%[64].

Based on data for incumbent operators in a number of countries, sourced from regulatory decisions, we calculate an average gearing ratio of 32%.

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[60] wik-Consult, "Mobile Termination Cost Model for Australia, Report for the Australian Competition and Consumer Commission", January 2007 and ACCC, "Assessment of Telstra's PSTN and LCS Undertaking Final Decision, Public version", 29 November 2006

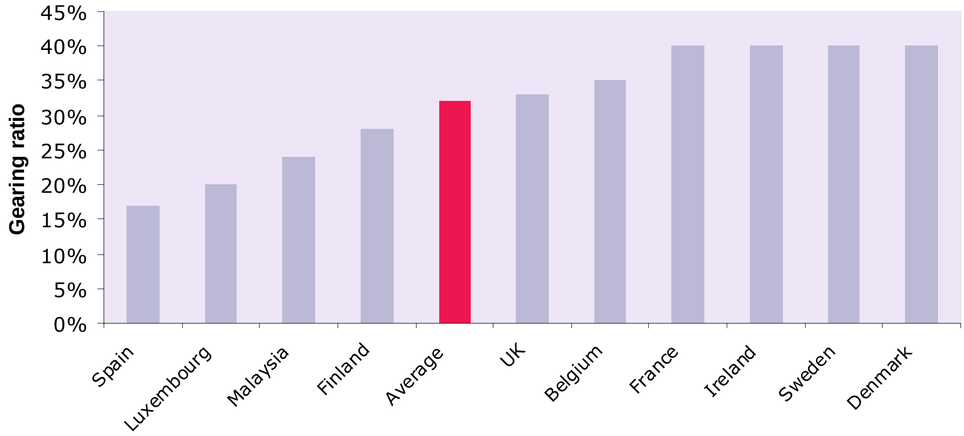
[61] Telstra, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

[62] ACCC, "Assessment of Telstra's PSTN and LCS Undertaking Final Decision Public version", 29 November 2006

[63] ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008

[64] Telstra, "ULLS Undertaking, Weighted Average Cost of Capital (WACC)", 4 April 2008

**Figure 3.12: Gearing ratios for fixed operators**




Source: Ovum assessment of NRAs' decisions

Based on information derived from Telstra's year end June 2007 accounts[65]: "During 2007, our strategy was to maintain the net debt gearing ratio within 55 to 75 percent". This gearing ratio is in book value terms and, in order to be used, we need to convert to market value ratio. The following table was created:

**Figure 3.13: Gearing ratios for Telstra, book and market values of equity/debt**

| | Book values (As at 30 June 2007) | Implied book values (floor) | Implied book values (ceiling) | Implied market values (floor) | Implied market values (ceiling) |
|---|---|---|---|---|---|
| **Net debt** | 14,587 | 15,376 | 37,740 | 15,376 | 37,740 |
| **Total equity** | 12,580 | 12,580 | 12,580 | 52,087 | 52,087 |
| **Total capital** | 27,167 | 27,956 | 50,320 | 67,463 | 89,827 |
| **Gearing ratio** | **53.7%** | **55%** | **75%** | **23%** | **42%** |

Source: Ovum

The market equity has been calculated based on data from Bloomberg[66] that show that, for year ending 30 June 2007, average share price was 4.144 and that the number of shares issued as at 12 June 2008 was 12,569m (including 2,198m shares held by AU Government). This shows that the gearing ratio is between 23%-42% with an average level of 34%. In comparison, Telstra in its submission

[65] http://www.telstra.com.au/abouttelstra/investor/docs/tls565_2007annualreport.pdf [Accessed 17 June 2008]

[66] Bloomberg [Accessed 16 June 2008]

calculated a market based gearing ratio between **[c-i-c]**% with a point estimate of **[c-i-c]**%.

**We consider that the average ratio of 34%, supported by the benchmark, is an appropriate value for Telstra.**

### Imputation factor

The value of the imputation factor depends on the extent to which the company pays franked dividends and the value of the franked dividends in the hands of investors. In the main WACC formula, the factor (1-γ) is multiplied with the effective tax rate, meaning that an increase in the imputation factor results in a decrease in the tax and therefore the cost of capital decreases.

In a previous study[67], the ACCC concluded that an imputation factor value of 0.5 is an appropriate one and is in accordance with available empirical evidence. This estimate was driven by a study from Associate Professor Hathaway who presented a range for the imputation factor between 0.25-0.45, while a practitioner survey showed that imputation factors were close to and higher than 0.5. For the calculation of WACC for mobile networks, it was stated that, although in prior decisions the ACCC had based the determination of WACC on the assumption of 100% Australian ownership, it was considered that the mobile operators are mainly owned by overseas investors for which the possibility of tax credits granted according to Australian Taxation Law does not exist and therefore the imputation factor was considered to be zero[68]. A recent regulatory decision supports the value of 0.5 for the imputation factor[69].

Telstra is of the opinion that the imputation factor should be zero. Telstra cites Professor Bowman's study who concludes that the marginal investor for most (if not all) Australian listed entities is likely to be an international investor and therefore it is likely that the valuation of imputation by the marginal investor that establishes share prices is by an international investor that cannot utilise these imputation credits and therefore attaches no value to them. In addition, Telstra refers to a number of other studies on the estimation of imputation factors and concludes that the estimates support the view that gamma is less than 0.5, with six estimates (of the 12 reported) suggesting that gamma should be 0. In addition, Telstra submits that a value of gamma of 0.355 could be a second best option, based on a Hathaway and Officer latest study.

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[67] ACCC , "Assessment of Telstra's PSTN and LCS Undertaking Final Decision Public version", 29 November 2006

[68] wik-Consult, "Mobile Termination Cost Model for Australia, Report for the Australian Competition and Consumer Commission", January 2007

[69] ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008.

Based on information from Telstra regarding half year results: *"Telstra's directors resolved to pay a fully franked interim ordinary dividend of 14 cents per share, representing a total payment of $1.74 billion. Shares will start trading excluding entitlement to the dividend on 3 March 2008. The record date will be 7 March 2008. Payment will be made on 4 April 2008"*[70]. This implies that a percentage of the company's profits are paid through franked dividends and, therefore, the imputation factor should be higher than zero. **We conclude therefore a point estimate imputation factor of 0.5 based on the ACCC's previous studies.**

**Equity issuance cost**

In previous WACC assessments[71], the ACCC was of the view that it is appropriate that EIC is recovered, but not through the WACC. EICs should be ideally recovered through a specific allowance when they arise and they should be capitalised and included as part of the asset base of the regulated firm. The ACCC[72] believed that Telstra's claim of **[c-i-c]**% uplift for EIC was materially not important and allowed the cost into the WACC calculation. In a recent regulatory decision, the ACCC[73] has not included EIC in the WACC. In addition, the decision states that, should such costs be relevant, they can be considered for inclusion within the efficient cost pool as an operating-type expense.

In its WACC report, Telstra submits that the appropriate methodology to be considered for the calculation of EIC is the annualisation of EIC over a period of 35 years, which is, according to Telstra, the expected useful life of the CAN-related assets. Based on Lee *et al* study[74], the amount of equity relevant for the CAN-related assets is between 3.25%-5.72% of the amount of equity raised, for Seasoned Equity Offerings ("SEOs") and Initial Public Offerings ("IPOs"), respectively. We should note that this percentage corresponds to non-utility offerings and for equity raised above $500 million. For utility offerings the percentage that corresponds to IPOs is not available, while the percentage that

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[70] Telstra announcements, "Telstra delivers strong earnings growth, exceeds analyst consensus, raises guidance", 21 February 2008, http://www.telstra.com.au/abouttelstra/media/announcements_article.cfm?ObjectID=41857 [Accessed 9 June 2008]

[71] ACCC , "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006

[72] ACCC , "Assessment of Telstra's ULLS monthly charge undertaking Final Decision, Public version", August 2006

[73] ACCC, "Unconditional Local Loop Service Access Dispute Between Telstra Corporation Limited (access provider) and PowerTel Ltd (access seeker), Statement of Reasons for Final Determination", March 2008.

[74] I. Lee, S. Lochhead, J. Ritter and Q. Zhao, "The Costs of Raising Capital," Journal of Financial Research, Vol. XIX, No. 1, Spring 1996, pp 59-74.

corresponds to SEOs is 2.31. The annualisation of these costs results in an uplift of cost of equity of **[c-i-c]**% as Telstra submits.

ACG[75] recommends that an SEO transaction cost benchmark of 3% is appropriate for regulated infrastructure companies and a median transaction cost of 3.83% is appropriate for an IPO. If we use this range of issuance cost, a recovery period of 35 years and an equity ratio of 65%, we calculate an equity issuance cost of 0.23%-0.30%, with a point estimate of 0.26%. If Equity Issuance Cost was allowed in the WACC calculation, and if we followed Telstra's methodology, then a point estimate of 0.26% could be an acceptable rate, which is **[c-i-c]** than Telstra's submission.

Our view, though, is in line with Neville Hathaway's study[76] that suggests that it would be quite inappropriate for the ACCC to recompense a regulated business for costs that it most unlikely would never incur. **Our view is that, for the purpose of this study, Equity Issuance Cost should be equal to zero**.

### Calculation of WACC

Our assessment of the cost of capital parameters results in an estimation of pre-tax WACC of 9.22%, as opposed to the **[c-i-c]**% of Telstra's point estimate. This level of WACC is in line with the range of WACC values as determined by NRAs in a number of countries (Figures 3.3 and 3.6).

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[75] The Allen Consulting Group, "Debt and Equity Raising Transaction Costs", December 2004

[76] Capital Research, "Telstra's WACCs for Network ULLS and the ULLS and SSS Businesses", Review of Reports by Prof. Bowman, March 2006

**Figure 3.14: Ovum's and Telstra's view of WACC**

| | Page | Calculation methodology | Ovum | Telstra | | |
|---|---|---|---|---|---|---|
| | | | | Point estimate | High estimate | Low estimate |
| Risk Free Rate | 31 | Average of 10 days leading to 31/12/2007 of 10-year maturity government bonds | 6.31 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Debt Ratio | 40 | Calculated gearing ratio supported by benchmark of fixed operators | 34% | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Debt Risk Premium | 32 | Average of 10 days leading to 31/12/2007 of 10-year maturity of A rate Australian corporate bond yields | 2% | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Debt Issuance cost | 33 | Based on ACG's benchmark study | 0.083 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Cost of Debt pre tax | | Calculation $r_d = r_f + DRP + DIC$ | 8.39 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Debt beta | 38 | Based on previous regulatory decision | - | - | - | - |
| Equity beta | 38 | Telstra's historic value based on 5 years of monthly equity return | 0.394 | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| Equity Issuance cost | 42 | It is not appropriate this cost to be recovered through the WACC | 0 | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Market Risk Premium | 35 | Historical value supported by previous regulatory decisions, Broker MRPs, assessment of Dimson *et al* methodology and Neville Hathaway's study | 6.00 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Cost of Equity post tax | | Calculation $r_e = r_f + \beta_e \cdot (r_m - r_f)$ | 8.67 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| Tax | 36 | Effective Tax rate sourced from previous regulatory decisions | 20% | 30% | 30% | 30% |
| Imputation factor | 41 | Based on ACCC's previous study | 0.5 | **[c-i-c]** | **[c-i-c]** | **[c-i-c]** |
| **WACC pre-tax** | | | 9.22 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |
| **WACC post-tax** | | | 8.58 % | **[c-i-c]**% | **[c-i-c]**% | **[c-i-c]**% |

Source: Ovum

## 3.4 Cost Factors

### Loading factor for indirect overheads

The model calculates the unloaded direct investment cost of network elements which are afterwards marked up by making use of the loading factor. The "Loading factor for indirect overheads" is the mark-up factor used in the model. This is an input in the model and there is no reference in the model as to how this factor has been calculated. Due to all types of costs calculated in the model (direct/indirect/ support, capital, O&M) being dependent on the capital investment costs, the loading factor directly impacts the total annualised costs of ULLS. That is,

***(Total annualised costs of ULLS) =***
***(unloaded total annualised costs of ULLS) * (1+loading_factor)***

It should be noted that the sharing revenue, which is deducted from the ULLS costs, is not marked up by the loading factor. Hence, the final result of the model – the monthly cost of ULLS Band 2 – is not directly marked up with the loading factor.

An assessment of the value considered by Telstra is given in section 3.5.

## Operational and maintenance ("O&M") costs

The O&M costs are calculated in the model by multiplying the level of investment modelled for each category of plant and equipment by the relevant O&M factor. These factors are based on Telstra's accounts prepared under the Regulatory Accounting Framework ("RAF") 2005/06 using a top-down approach and are calculated outside the TEA model. The O&M factors are contained in a separate worksheet "Factor Calculation – Final.xls". The O&M factor for each category of plant and equipment is calculated as:

***(O&M Factor) = (operational expenses) / (investment)***

It is not unusual to calculate factors using a top-down approach, but, where this is applied, the latest information has been used. As the 2007 RAF accounts are available, we believe that the TEA model should be using 2007 data. Although a proper examination of O&M factors based on 2006-2007 RAF accounts could not be made due to lack of inputs, our estimate is that the O&M costs for the period 2006-2007 are approximately **[c-i-c]**% lower than 2005-2006 costs. This is a significant amount and the operational and maintenance costs in the model should be recalculated. We have already pointed out that the costs currently in the model are higher than those seen historically.

Other concerns include:

- the model using the model calculated investment for some asset categories, while other types of investment are taken from the RAF accounts (historical investment);
- the model assumes that the unit investment cost per line of ULL Bands 1, 3 and 4 is equal to the investment costs of ULL Band 2;
- outputs of the model (investment per line) are used to calculate inputs (O&M factors). This creates circular references which are sources of potential error and decrease the accuracy and flexibility of the model.
- The investment per line of "ducts and pipes" and "copper cables" asset categories and the number of lines in Band 2 used in the factor calculation sheet are not the same as the ones that the model calculates.

The investment costs per line that were calculated from the TEA model and used in the factor calculation sheet are supposed to be direct investment costs per line. From these costs, a certain amount is deducted because it is considered to be inclusive of support assets investment cost. This implies that the direct investment costs calculated in the TEA model include an amount of support assets investment costs. If this is the case, then the TEA model is double counting the network support assets investment costs. This is the case for ducts and pipes and copper cables asset categories. When Telstra refers to asset reclassification, it states: "*For the purposes of calculating O&M and indirect factors, Telstra has effectively reversed this allocation to separately identify costs associated with support assets. This is required since the factors are applied to the direct asset costs produced by the model. These direct asset costs do not include an allocation of support asset investment*"[77]. This is correct, as the direct expenses calculated in the TEA model should not include any network support costs. What is therefore not clear is that the factor calculation module deducts a certain amount of support costs from the model-calculated direct investment costs.

As mentioned above, for ducts and pipes and copper cables assets categories, the factor calculation sheet considers as investment cost the TEA model calculated cost, from which is deducted the support cost mapped to these categories and sourced from RAF accounts. The support cost mapped to these assets has not been adjusted in order to account for the much higher model calculated investment cost. Instead of considering the historic support cost of ducts and pipes and copper cables, the factor calculation model should have considered an adjusted support cost in order to account for the higher investment cost.

## Indirect Operational and Maintenance expenses

The indirect O&M expenses are calculated by applying indirect O&M expense factors, which are considered as inputs in the model and are equal to a percentage of total direct O&M costs. The model considers the following categories of indirect O&M cost categories:

- Product and Customer Costs
- General Administration
- Information Technology
- Accommodation & Property
- Other Non Comm. Asset Costs
- Other Organisational Costs

### Calculation of indirect O&M expense factors

The indirect O&M expense factors are calculated in the factors calculation sheet by applying the following formula:

***(Indirect Expense Factor) = (Indirect Expense) / (Total Direct Expenses)***

The indirect O&M expenses are sourced from the Capital Adjusted Profit Statements of the 2005/2006 RAF data. A number of adjustments have been made to these costs.

[77] Telstra Corporation Limited, "ULLS Undertaking, Operations and Maintenance and Indirect Cost Factor Study", p. 21

The following issues could be raised from these calculations:

- There are no references to how the adjustments were made and where the values were sourced from. For example, the model is eliminating depreciation but there is no reference to the origin of this cost or how it is calculated.
- ULL specific costs have been excluded from the indirect operating costs. These costs are sourced from the Factor Calculation (Confidential ULLS Specific Cost Input) sheet, and are based on the "Annexure A - revised specific costs model". First of all, these costs are not just ULLS specific but include LSS specific costs as well. In addition, it is not clear why O&M (IT) costs of $**[c-i-c]**, which are supposed to be direct opex, are mapped to IT indirect costs. O&M (Indirect) costs of $ , which include Connection Group and Product management indirect costs, are also mapped exclusively to Other Organizational costs instead of to indirect product costs. Lastly, it is not clear why O&M (Product) costs of $**[c-i-c]**, which include direct wholesale product management and connection group costs, are mapped to indirect marketing costs. If it is correct to exclude these costs, then the model needs to make sure that they are deducted from the correct cost categories. As far as the inclusion of both ULLS and LLS costs is concerned, the ACCC has stated that ULLS specific costs should be combined with LSS specific costs and then be allocated across the active number of ULLS, LSS and ADSL lines[78].
- The product and customer indirect expenses include costs of Marketing, Sales, Billing, Interconnection, etc. These are clearly Retail related costs and should have been excluded in the LRIC model.
- Depreciation has been eliminated from Indirect Expenses. Indirect operating expenses are operating expenses, which are different from capital investment expenses. Therefore, why is there a depreciation associated with these costs?
- The total direct expenses used as denominator in the formula above are equal to the total direct O&M expenses. Why is the model not considering the operating expenses after the relevant adjustments? It should be noted that, for the calculation of the O&M factors, the adjusted operating expenses were considered.

## Network support assets costs

In the TEA model, an annualised capital cost has been allowed for network support assets. Total network support capital costs are calculated based on network support factors multiplied by the total level of investment. The calculation of network support factors is made outside the TEA model in the factor calculation sheet.

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[78] ACCC, "Unconditional Local Loop Service (ULLS), Final pricing principles", November 2007.

**Calculation of network support assets factors**

According to the operations and maintenance and indirect costs factor study, network support factors are calculated as follows:

***(Network support assets factor) =***
***(CAN network support assets cost) / (CAN total direct investment)***

According to the factor calculation sheet, from the total network support costs, **[c-i-c]**% is related to CAN network and has been classified as CAN support asset costs. From total network support costs, only the support costs of copper cables, multiplexing systems and Radio Bearer equipment are regarded as CAN related costs. The next step is that the CAN support costs are allocated to the following cost categories, using as allocation driver each category's share of the total network support cost.

- Network Land
- Network Buildings
- Network Building Improvements
- Network Power Systems
- Network Management Systems
- Support Structures.

In terms of calculating the CAN total direct investment, the cost of the following network assets has been considered:

- Ducts and Pipes
- Copper Cables
- Pair Gain Systems.

An assessment of the value considered by Telstra is shown in section 3.5.

## Indirect assets costs

In the TEA model, an allowance has been made for indirect asset costs as well. In the first place, the model calculates total indirect asset costs, by multiplying total investment costs with an indirect asset factor, and then annualises them. The following categories of indirect assets have been considered in the model:

- Land
- Building improvements
- Information technology
- Other indirect (Fleet etc)
- Software
- Intangibles.

The values used for the indirect asset factors have been calculated outside the model in the factor calculation sheet.

**Calculation of indirect assets factors**

The formula used to calculate the indirect asset factors is the following:

***(Indirect asset factor) = (Indirect asset cost) / (Total investment)***

As far as the indirect asset costs are concerned, they are sourced from the 2005/06 regulatory accounts. The actual cost values have been adjusted in order to:

- Add back the accumulated depreciation
- Remove retail depreciation
- Remove non-communications assets
- Remove retail investment costs
- Remove ULLS specific costs
- Remove other investments and receivables.

A couple of issues could be raised about these adjustments:

- First of all there is no reference source for most of these adjustments and, more specifically, about the accumulated depreciation and the non-communications related amount.
- ULL specific costs have been excluded from indirect investment costs. These costs are sourced from the Factor Calculation (Confidential ULLS Specific Cost Input) sheet. First of all, these costs are not just ULLS-specific but include LSS-specific costs as well. In addition, it is not clear why Capex (Direct) costs of $**[c-i-c]** are mapped to indirect costs and deducted from the indirect software costs. As far as the inclusion of both ULLS and LLS costs is concerned, the ACCC has stated that ULLS-specific costs should be combined with LSS-specific costs and then be allocated across the active number of ULLS, LSS and ADSL lines[79].
- We would expect to see in the model actual accumulated depreciation of retail investments instead of calculated figures.

As far as the investment is concerned, the model considers the total adjusted investment, after deducting support asset investment and after considering the TEA model calculated investment for ducts and pipes and copper cables.

## 3.5 Assessment of cost factors

The purpose of this section of the report is to compare the costs calculated in the TEA model with outputs from other publicly available models. There are three access models available in the public domain that could be used as reference when

[79] ACCC, "Unconditional Local Loop Service (ULLS), Final pricing principles", November 2007

comparing access related costs. The outputs of these three models are summarised and compared to the Telstra model calculated costs.

- ITST Consolidation Model v2.4[80]
- PTS Hybrid Consolidation Model Public v2.1[81]
- PTS Hybrid Consolidation Model Public v3.1[82]

**Figure 3.15: Costs breakdown in PTS and ITST models**

| | ITST (mDKK) | PTS 2004 (mSEK) | PTS 2005 (mSEK) |
|---|---|---|---|
| Implied Direct capital investment | 27,458 | 73,603 | 67,125 |
| Indirect capital investment | 1,756 | 4,627 | 4,119 |
| **Total Investment** | **29,213** | **78,230** | **71,244** |
| | | | |
| Direct Annual Capex | 1,765 | 7,592 | 6,116 |
| Indirect Annual Capex | 322 | 919 | 770 |
| **Total Capex** | **2,087** | **8,512** | **6,886** |
| | | | |
| Accommodation (indirect) | 13 | 254 | 235 |
| Power (indirect) | 15 | | 55 |
| Air Conditioning (indirect) | 11 | | 48 |
| Management and Planning (indirect) | 16 | 171 | 162 |
| Maintenance | 458 | 1,617 | 1,583 |
| Installation | 50 | 130 | 130 |
| **Total OPEX** | **564** | **2,172** | **2,213** |
| | | | |
| Total Annual Costs (exc. mark up) | **2,651** | **10,684** | **9,099** |
| | | | |
| **Overheads** | **384** | **302** | **292** |
| **Other costs** | **7** | **23** | **23** |
| | | | |
| **Total Annual Costs (inc mark ups)** | **3,042** | **11,009** | **9,414** |

Source: Ovum assessment of the models

The following table provides information on the range of cost factors as they were calculated in the PTS and the ITST model and compares them with the TEA model outputs.

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80 http://en.itst.dk/interconnection-and-consumer-protection/filarkiv-lraic/lraic-pa-fastnet/ITST31.10.07%20Hybrid%20LRAIC%20model%20v2.4%20off.zip [Accessed 9 June 2008]

81 http://www.pts.se/upload/Documents/SE/PTS%20Hybrid%20model%20v2.1%20Public.zip [Accessed 9 June 2008]

82 http://www.pts.se/upload/Documents/SE/PTS_Hybrid_Model_v3.1_PUBLIC_051216.zip [Accessed 9 June 2008]

**Figure 3.16: Cost factors comparison**

| | Range (PTS & ITST) | TEA model |
|---|---|---|
| Indirect and support investment / Direct investment | 6.1% - 6.4% | **[c-i-c]**% |
| O&M expenses / Direct investment | 1.9% - 2.8% | **[c-i-c]**% |
| Indirect expenses / O&M expenses | 7.5% - 18.0% | **[c-i-c]**% |
| Indirect overheads | 2.8% - 14.5% | **[c-i-c]**% |

Source: Ovum assessment of the models

In terms of the overheads, the TEA model considers a "Loading factor for indirect overheads". The direct investment and annualised capital expenses are increased by **[c-i-c]**% in order to account for the indirect overheads. Due to the fact that both support and indirect assets costs and O&M expenses are calculated as a percentage of investment costs, this mark-up increases total annual costs by this mark-up percentage. In both the ITST and the PTS models, indirect overheads are added as a mark-up to total costs of services (annual capex and opex). Compared to the PTS and the ITST models, although the mark-up key considered in the TEA model is close to the high end of the range, it can be considered as acceptable.

All factors except indirect expenses seem acceptable in the model. The indirect expenses in the TEA model compared to the publicly available models are extremely high. If we reduce the indirect expense factor to the average of the publicly available models, that is 12.75%, then the monthly cost falls by approximately 8% to $**[c-i-c]**, compared to the $**[c-i-c]** that is Telstra's estimate.

# 4 Conclusion

The TEA model currently **does not** reflect a network of an efficient operator and fails to meet standard TSLRIC+ principles.  Instead it reflects Telstra's current topology and practices.  The TEA model contains a few minor errors, such as missing links or cell connections, and is not regarded as being forward-looking. The costs do not reflect that of an efficient operator.

The key failings include:

- The TEA model is not forward-looking; and historic cost values have been used to calculate the cost of the network;
- The modelled network does not contain sufficient efficiency savings.

The network is built based on a scorched-node approach, as the main nodal locations are fixed, and dimensions a traditional access network to meet the customer demand based on engineering design parameters that are based upon actual Telstra records.  The modelled network is a fair starting point, but the model should be modified to eliminate Telstra's inefficiencies.  The TEA model contains a network that is based on Telstra's current status and has not been optimised.  The network design is inefficient.

No efficiency factors have been added to the model.  Costs for future use or costs that are not efficient (and hence in the long run will be avoided) should be excluded.  A good example is the review of the estimated operational and maintenance factors in the TEA model.  The operational and maintenance costs do not reflect an efficient operator and are in many cases higher than the historic costs.  The factors need to be reviewed and re-assessed to reflect that of an efficient operator.  We would expect a fall in operational and maintenance costs, as today's modern access plant is inherently reliable and there are operational and maintenance savings.  Most of the operational and maintenance costs are driven by the number of interventions and work practices.  The operational and maintenance costs should be lower than the historic costs when forward looking.

The cost of the network should reflect today's values.  An operator should only be able to recover costs necessary for maintaining future real-asset values in a competitive market.  Therefore the asset valuation should be derived from current cost accounting methodologies.  No documentation has been submitted or details provided of how today's equipment costs associated with the ULLS costs of a replacement CAN for all 584 Band 2 ESAs are valued.  The TEA model seems to estimate the cost of the network by using historic costs.  The costing inputs are provided by Telstra's engineering department, and are based on the averaged costs from Telstra's three Access and Associated Services contracts.

There are a few inconsistencies in the TEA model, one of which is the number of Band 2 lines.  The number of Band 2 lines in the TEA model differs in different workbooks, mainly having the effect of increasing the ULLS monthly charge.  The Band 2 line numbers range from 7,504,097 to 7,532,793 lines within the TEA model. This needs to be further examined. One suggestion would be to use data from the SIOs. Adjusting the share of Band 2 lines to SIO estimates reduces the O&M factors of "Ducts and pipes" and "Copper cables" by 10%, network support assets factors by 9.1%, and indirect asset factors by 5%.

Other functional issues include missing links. As a result the TEA model estimated monthly ULLS charge appears to be higher than it otherwise would be if the function errors were corrected.

Other major issues in summary include:

- The TEA model contains costs not directly attributable to the ULLS costs of a replacement CAN for all 584 Band 2 ESAs;
- The estimated WACC value submitted to the ACCC is too high. Compared to international benchmarks, the Telstra WACC value of **[c-i-c]**% is the highest. We estimate the WACC value should be around 9.22%.
- The cost factors, used to calculate the operational and maintenance costs, indirect costs, etc., are over-estimated and in some cases lack transparency.

#### Weighted Average Cost of Capital

We recommend that the submitted WACC should be further reviewed and recalculated. The submitted Telstra estimate of pre-tax nominal WACC of **[c-i-c]**% is extremely high compared to the average 10.38% WACC of a range of other fixed network operators. The figure was the highest in the comparison. Model results are very sensitive to WACC values. Our general estimate and assessment of the WACC parameters conclude that the pre-tax WACC should be approximately 9.22%. This results in a fall of 27% in the ULLS monthly charges.

#### Operational and maintenance costs

The underlying assumption is that O&M factors specific to ULL Band 2 are the same as the total network's factors. There are questions about the use of 2005-2006 RAF accounts instead of 2007 ones. Inputs like the number of lines and the share of Band 2 lines to total lines used in the factor calculation model are not in line with TEA model outputs. Finally, although a proper estimation of O&M factors based on 2007 accounts could not be made due to lack of inputs, direct O&M costs for the period 2006-2007 are estimated to be approximately **[c-i-c]**% lower than 2005-2006 costs. This results in 4.2% lower monthly charges.

#### Indirect operational and maintenance expenses

There are concerns about the lack of reference to the calculation of indirect expenses. There is a lack of references to the sources of adjustments made in the model as well as details of ULL specific costs mapped to the appropriate cost categories.

The indirect expenses in the TEA model are unreasonably high compared to other publicly available models. Adjusting the indirect expense factors to be in line with other models' considerations results in an 8% reduction of the monthly charge.

### Network support and indirect assets costs

There are concerns about the lack of reference to the sources of inputs used for the calculation of assets costs and about the potential incorrect mapping of costs to cost categories. Without detailed information on the sources of the underlying factors, it is not possible to make any meaningful conclusion in this area.

# Appendix 1: Unit equipment prices

The two tables below illustrate the main equipment unit prices in the TEA model.

Figure 1: Unit equipment prices in the default scenario

**[c-i-c]**

Source: TEA Model

Figure 2: Unit equipment prices in the default scenario

**[c-i-c]**

Source: TEA Model

# Appendix 2: Corporate and Government Bond yields

## Australian Government Bond Yields

Figure 3: Australia Government Bond Yields

| | Treasury Bonds | | |
|---|---|---|---|
| Date / Maturity | 2-years | 5-years | 10-years |
| 14/12/2007 | 6.78 | 6.55 | 6.26 |
| 17/12/2007 | 6.80 | 6.55 | 6.30 |
| 18/12/2007 | 6.80 | 6.55 | 6.29 |
| 19/12/2007 | 6.83 | 6.58 | 6.29 |
| 20/12/2007 | 6.82 | 6.54 | 6.23 |
| 21/12/2007 | 6.85 | 6.57 | 6.25 |
| 24/12/2007 | 6.91 | 6.65 | 6.36 |
| 27/12/2007 | 6.91 | 6.66 | 6.41 |
| 28/12/2007 | 6.90 | 6.64 | 6.38 |
| 31/12/2007 | 6.86 | 6.59 | 6.33 |

Source: http://www.rba.gov.au/Statistics/HistoricalInterestRatesYields/1993_to_2008.xls

## Australian Corporate Bond Yields

Figure 4: Australia Corporate Bond Yields

| Date / Maturity | 3M | 6M | 1Y | 2Y | 3Y | 4Y | 5Y | 7Y | 8Y | 9Y | 10Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14/12/2007 | 7.64 | 7.67 | 7.81 | 8.02 | 8.24 | 8.29 | 8.28 | 8.24 | 8.25 | 8.25 | 8.25 |
| 17/12/2007 | 7.63 | 7.65 | 7.8 | 8.03 | 8.25 | 8.3 | 8.27 | 8.26 | 8.27 | 8.27 | 8.27 |
| 18/12/2007 | 7.67 | 7.69 | 7.84 | 8.08 | 8.31 | 8.35 | 8.33 | 8.3 | 8.32 | 8.32 | 8.31 |
| 19/12/2007 | 7.66 | 7.69 | 7.84 | 8.1 | 8.32 | 8.36 | 8.33 | 8.28 | 8.3 | 8.3 | 8.29 |
| 20/12/2007 | 7.66 | 7.68 | 7.84 | 8.1 | 8.34 | 8.37 | 8.32 | 8.27 | 8.27 | 8.27 | 8.26 |
| 21/12/2007 | 7.63 | 7.65 | 7.82 | 8.1 | 8.34 | 8.36 | 8.31 | 8.26 | 8.26 | 8.25 | 8.24 |
| 24/12/2007 | 7.55 | 7.59 | 7.77 | 8.06 | 8.29 | 8.34 | 8.3 | 8.26 | 8.27 | 8.26 | 8.25 |
| 27/12/2007 | 7.65 | 7.69 | 7.87 | 8.16 | 8.4 | 8.45 | 8.4 | 8.38 | 8.4 | 8.39 | 8.38 |
| 28/12/2007 | 7.7 | 7.74 | 7.92 | 8.22 | 8.41 | 8.5 | 8.46 | 8.43 | 8.45 | 8.45 | 8.44 |
| 31/12/2007 | 7.67 | 7.71 | 7.89 | 8.18 | 8.37 | 8.46 | 8.41 | 8.38 | 8.39 | 8.39 | 8.38 |

Source: Bloomberg [Accessed 14 July 2008]