Comments on the ACCC's discussion paper

Telstra's undertakings for the PSTN Originating and Terminating and LCS Access services

A report prepared by
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GLOSSARY OF TERMS

21CN	21ST CENTURY NETWORK
ABUM	ADAPTABLE BOTTOM-UP MODEL
ACCC	AUSTRALIAN COMPETITION AND CONSUMER COMMISSION
AGH	ABOVE-GROUND HOUSING
ART	AUTORITE DE REGULATION DES TELECOMMUNICATIONS
ATM	ASYNCHRONOUS TRANSFER MODE
BT	BRITISH TELECOM
BU	BOTTOM-UP
CAN	CUSTOMER ACCESS NETWORK
CBD	COMMON BUSINESS DISTRICT
CCC	COMPETITIVE CARRIERS COALITION
CMUX	CUSTOMER MULTIPLEXER
DEA	DATA ENVELOPMENT ANALYSIS
DSLAM	DIGITAL SUBSCRIBER LINE ACCESS MULTIPLEXER
EAR	ENGINE ACCESS RAMP
EIN	ENGINE INTEGRAL SYSTEM
EPMU	EQUAL PROPORTIONATE MARK UP
ESA	EXCHANGE SERVING AREA
FA	FUNCTIONAL AREA
HAI	HATFIELD ASSOCIATES, INC.
IEN	INTER-EXCHANGE NETWORK
IP	INTERNET PROTOCOL
IRG	INDEPENDENT REGULATORS GROUP
ISDN	INTEGRATED SERVICES DIGITAL NETWORK
ITST	IT – OG TELESTYRELSEN (DENMARK)
LAS	LOCAL ACCESS SWITCH
LCS	LOCAL CARRIAGE SERVICE
LE	LOCAL EXCHANGE
LRAIC	LONG RUN AVERAGE INCREMENTAL COSTS
LRIC	LONG RUN INCREMENTAL COSTS
LRMC	LONG RUN MARGINAL COSTS

LTIE	LONG-TERM INTEREST OF END-USERS
MDF	MAIN DISTRIBUTION FRAME
MEA	MODERN EQUIVALENT ASSET
MGW	MEDIA GATEWAY
MJA	MARSDEN JACOB ASSOCIATES
MPLS	MULTI PROTOCOL LABEL SWITCHING
MSAN	MULTI SERVICE ACCESS NODE
MST	MINIMUM SPANNING TREE
NERA	NATIONAL ECONOMIC RESEARCH ASSOCIATES
NGN	NEXT GENERATION NETWORK
NPV	NET PRESENT VALUE
NTA	NATIONAL TELECOM AGENCY
NTP	NETWORK TERMINATION POINT
NTT	NIPPON TELEGRAPH AND TELEPHONE
NU	NETWORK UNIT
OA	ORIGINATING ACCESS
OLE	ORIGINATING LOCAL EXCHANGE
O&M	OPERATING AND MAINTENANCE
OTA	ORIGINATING AND TERMINATING ACCESS
PIE	PSTN INGRESS/EGRESS
PoC	POINT OF CONFLUENCE
PoI	POINT OF INTERCONNECT
POTS	PLAIN OLD TELEPHONY
PRA	PRIMARY RATE ACCESS (30B+D)
PSTN	PUBLIC SWITCHED TELEPHONY NETWORK
PTS	POST OCH TELESTYRELSEN (SWEDEN)
RAU	REMOTE ACCESS UNIT
RCU	REMOTE CONCENTRATOR UNIT
RPI	RETAIL PRICE INDEX
RPMU	RAMSEY PRICING MARK-UP
RSS	REMOTE SWITCHING STAGES
SDH	SYNCHRONOUS DIGITAL HIERARCHY
SFA	STOCHASTIC FRONTIER ANALYSIS

SIO	Service In Operation
SMT	Steiner Minimum Tree
S&S	Switching and Signal
STP	Signal Transfers Points
TA	Terminating Access
TE	Tandem Exchange
TELRIC	Total Element Long Run Incremental Costs
TeS	Telephony Server
TNS	Transit Network Switches
TSLRIC	Total Service Long Run Incremental Costs
UGH	Underground Housing
ULL	Unconditioned Local Loop
VoIP	Voice over IP

Summary of key issues

For the purpose of this report, we have not validated or formally audited the source code or internal workings of the PIE model. We have however, consulted the source code and query design when necessary to understand the workings of the model.

Our review of the core network part of the PIE II has uncovered what we believe to major problems with the methodology and approach. In particular we would like to highlight three issues:

- the PIE II cannot be regarded as a forward-looking cost model based on best practice network technology. The norm today is a Next Generation Network (NGN). Core networks have evolved significantly since the PIE II was originally developed and the design in PIE II is not reflective of forward-looking efficient costs;
- only very limited account is taken of non-PSTN demand. Failure to take proper account of this traffic in the modelling will result in inflated PSTN costs. Non-PSTN demand will increase over time as a result of broadband demand increasing its significance. This will impact both modelling and results over time; and
- no documentation has been presented by Telstra to suggest that its O&M costs used are efficient. Public announcements by Telstra suggest that there may be room for substantial efficiency improvements in Telstra's network operation. As a result we believe the O&M in the PIE II model are likely overstated. Where this is the case, indirect O&M will also be exaggerated.

In our opinion, the PIE II model in its current form cannot be relied on to provide an "accurate" price signal to the market. Looking forward, this inadequacy of the PIE II model will only be exacerbated with declining PSTN demand. In addition, the model lacks transparency. Any review of the model is both difficult and time consuming. Add to this that Telstra has provided only limited documentation means that the ability to assess the model is degraded even further.

In order to satisfy the statutory framework, Telstra must establish that its costs are efficient costs. We submit that this would require substantial revision of PIE II and much additional explanatory documentation. Even if it was accepted by the ACCC that the basic technological choices in the PIE II model where reasonable and consistent with an efficient forward-looking concept, there would still be insufficient documentation and explanation for the modelling choices to have faith in the cost outputs of the PIE II model.

We therefore urge the ACCC to commence modelling of a new core model that is able to capture the transition to NGN and which provides flexibility in service modelling and transparency to market participants. As a basis for this new core network model some of the basic country specific data in the PIE II may be used. Ideally, an access network model should be built at the same time to ensure that any overlaps in terms of sharing and costs are treated consistently.

In the interim we suggest that the PSTN Originating and Terminating and LCS Access Services costs be fixed at existing levels, until such a time that a new model has been developed.

In this report we also discuss various other issues raised in the ACCC discussion paper. In our view the most important are related to the packaged approach and two-part tariffs.

In MJA's opinion, the packaged based approach is inappropriate and inconsistent with TSLRIC principles. In addition it results in discriminatory (and potentially arbitrary) adjustments to service costs that are sold in different markets. Access seekers can buy PSTN OTA and LCS services separately from Telstra. Given these two services are inputs to downstream retail services that are often in different retail markets, there should be no obligation on the access seeker to buy the services as a bundle or package. Indeed, by tying these two services as a package Telstra would be unlikely to promote competition in such downstream markets because there is no alignment with TSLRIC principles.

In terms of two-part tariffs, it is MJA's view that prices for wholesale services, like the pre-select PSTN OA, should be offered using a default charging structure that reflects the underlying cost driver, i.e. traffic. If access seekers wish to depart from this charge structure and offer a two-part tariff, they can already do so. Using knowledge of their customer base, access seekers may engage in various forms of price discrimination including but not limited to two-part pricing. Although, we acknowledge that Telstra is proposing a charge structure that it believes is more efficient, additional analysis is required before departing fully from the basic cost driver allocation and pricing. However, if a pricing structure results in better utilisation and welfare enhancing increases in traffic levels between networks then it is worth pursuing. As a possible compromise, the two-part tariff could be implemented as an option for access seekers. In this way access seekers would have the choice of either the original traffic based option and the two-part tariff. This could yield greater flexibility and possibly encouraging the development of new and innovative retail tariff schemes.

1. Introduction

Marsden Jacob Associates (MJA) has been requested by the Competitive Carriers Coalition (CCC) to address certain questions related to the Australian Competition and Consumer Commission's (ACCC) discussion paper related to the Telstra undertakings for the Public Switched Telephony Network (PSTN) Originating and Terminating and Local Carriage Service (LCS) Access Services

The comments and opinions expressed in this paper are those of MJA and do not necessarily reflect those of the CCC.

The questions/issues addressed in this report are:

The use of the PIE II model

(a) Are there faults with the PIE II cost model and how should these faults be addressed?

(b) Has Telstra improved its PIE cost model? Is it necessary to construct an alternative cost model to Telstra's updated PIE II model?

Volume forecasting

(c) Are Telstra's estimates of declining use of PSTN services appropriate?

(d) Should alternative forecasts be used to calculate PSTN access charges?

(e) To what extent should the PSTN asset base be commensurably adjusted to reflect the lower traffic volumes being assumed?

(f) What services should be included in estimating traffic volumes on the Inter-exchange Network (IEN)?

(g) What costs and volumes will become relevant once core networks are fully upgraded to an Internet Protocol (IP) basis and should these be taken into account in the pricing of future fixed access services?

The "packaged" approach

(h) Is it appropriate to set prices for PSTN Originating and Terminating Access (OTA) and LCS as a package as proposed by Telstra?

(i) If so what are the likely benefits to the industry and the end-user?

(j) What are the likely impacts of the proposed charges on future Voice over Internet Protocol (VoIP) prices?

Extent of averaging/de-averaging

(k) Is it appropriate that Telstra set access charges on the basis of a partial de-averaged approach?

(l) What is the implication of such an approach on the Long-Term Interests of End-users (LTIE) objectives of promoting competition and sending appropriate price signals for the efficient use and investment in existing and new networks?

Flagfall/per minute allocations

(m) Is Telstra's proposed pricing structure with respect to its flagfall and per minute charge elements appropriate?

PSTN OA Two-Part Tariff

(n) Will end-users benefit from the proposed PSTN Originating Access (OA) two-part tariffs?

(o) What would the impact be on access seekers?

(p) Is a fixed monthly charge per customer on PSTN OA consistent with existing retail prices?

(q) Is Telstra's 50:50 allocation of fixed charges versus minute charges for preselected PSTN OA reasonable? If not, why not?

(r) Are there any issues associated with charging different access prices for preselected PSTN OA versus PSTN OT and non-preselected PSTN OA?

(s) Is the two-part tariff based on Ramsey pricing principles designed to maximise efficient outcomes?

Retail Minus Retail Cost (RMRC) for LCS

(t) Is the RMRC pricing principle an appropriate basis for setting the LCS undertaking charge?

(u) Is an alternative cost-based approach viable for setting charges for the undertaking period?

(v) Is Telstra's application of the RMRC pricing principle and its use of regulatory account data appropriate?

2. The use of the PIE II model

Are there faults with the PIE II cost model and how should these faults be addressed?

Has Telstra improved the PIE cost model? Is it necessary to construct an alternative cost model to Telstra's updated PIE II model?

2.1. Background

The PIE II model provides an estimate of the total cost pool of the Inter-Exchange Network (IEN). The cost of the IEN is the relevant cost pool for determining PSTN OTA prices.

The PIE II model has been used as supporting documentations in previous undertakings submitted to the ACCC. Compared with previous versions of the model only minor changes appear to have been made for the current undertaking.

Telstra has submitted a report to the ACCC from Dr Bridger Mitchell, reviewing its revised version of the PIE II model. Telstra claims Dr Mitchell endorses its view that the updated PIE II model provides for an optimised PSTN network, consistent with international best practice and forward-looking traffic or volume forecasts.

In the following section, issues related to MJA's review of the PIE II model are discussed; the core network is discussed in particular detail. The results of our review are used to answer the questions posed by the ACCC.

2.2. Review findings

MJA has undertaken a targeted review of selected parts of the PIE II model. We were not able to examine all aspects of the model within the timeframe for the review. Accordingly, we have focused on issues we believe are important for the ACCC in considering whether to accept or reject the Undertaking.

2.2.1. Overall network design

Total Service Long Run Incremental Costs (TSLRIC) and Total Element Long Run Incremental Costs (TELRIC) are forward-looking concepts and both models should include forward-looking technologies.[1] There are two types of switching technologies—conventional circuit switches and the newer packet switching technologies. Both

[1] Note that forward-looking technologies are technologies an operator would use today looking forward. They are not unproven technologies of the future.

technologies are likely to operate together in Telstra's network with circuit switches mainly used to carry PSTN traffic and packet switches used to carry broadband and other data services.

Circuit switches assign a dedicated line for the duration of the call. Historically, these switches were seen as the optimal method for handling voice telephony, but are now being actively replaced by packet switching technologies. Packet switching technologies are more efficient at carrying data services and internet traffic.[2]

Transmission costs have fallen since the PIE II model was originally created.[3] Although it is a major investment to dig and install cables in the ground, new technology makes it possible to carry capacities over a few optical fibres that would not have been possible five years ago. The cost of this extra capacity-producing equipment is also falling.[4] As a result of these two factors, the net cost per Mbit/s of capacity has fallen and continues to fall. This trend has a number of impacts on network design:

- only a few optical fibre cables are needed to produce a vast capacity at a low cost per unit (per Mbit/s and per Mbit/s km);
- lower transmission costs make the option of using transmission to reduce switching costs more attractive (switch systems costs have not fallen as rapidly as transmission costs); and

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[2] If we accept that circuit switched technology is optimal, the key optimisation driver is minimising the switching costs, i.e. to optimise the type and size of switches. The factors to consider in this optimisation process include:

- Voice switches can be made with very large capacity. Larger switches have lower unit costs due to economies of scale. When one large switch replaces several smaller switches, it:
  - reduces operational costs
  - needs less space
  - requires less duplication of common equipment.
- 'Access switches' (those that connect to customers) can either be 'simple concentrators' or fully functional switches. If the cost differences between these alternatives are relatively minor, ease of operations and reduced network capacity are likely outcomes of using fully functional switches at each node. However, where concentrators or multiplexers are less costly, it may be more optimal to centralise some of the intelligence in the network.

Based on these considerations alone the design in the PIE II model is likely to be reasonably optimal. However, if we relax the requirement to model circuit switched technology we do not believe PIE II is optimal.

[3] Recent price trend analysis suggests that transmission prices may currently be levelling off; see section 2.2.3 'Network costs' and section 2.2.4 'Annualisation of capital costs'.

[4] Note that termination equipment numbers (and costs) depend on the capacity of the link (more Mbit/s means more optics and SDH multiplexing equipment). However, there are economies of scale. The cost is not strongly driven by distance, since optical technology means that systems are required only at end points. Optical regenerator systems or optical amplifiers are only required if the link is very long.

- optical technology enables long distances to be covered, allowing a network design to have remotely placed intelligent switching that is not cost prohibitive.

The transmission structure used in the PIE II model appears to be fairly conservative, but it fits well within the technological framework adopted. However, if the nature of the switching technology is changed, there would be likely knock-on implications for the transmission design.

If an operator was to build a network today, it would be a Next Generation Network (NGN). This is evidenced by the Telstra Technology Briefing 16 November 2005, and by other operators actively rolling out NGNs. An NGN is characterised by the subscriber line terminating on an access gateway, often called a Multi-Service Access Node (MSAN). An MSAN functions like a simple concentrator, switch or media gateway. All service functions are controlled by a telephony server placed anywhere within the geographical boundaries of the network. The only requirement is there must be physical and logical connectivity between the server and the gateway for signalling and data transport.

Box 1 provides an example of the NGN strategy followed by British Telecom (BT) in the United Kingdom.

BOX 1: BT AND NGN

'Our 21CN [21st century network] programme will lead to the simplification of BT's complex multiple networks, making it easier for us, and other operators who interconnect with BT's network, to deliver compelling converged services.'

The 21CN program has three broad goals:

- to enhance the service experience, flexibility and value BT provides to their customers
- to accelerate the delivery of innovative new products and services to market
- to radically reduce costs.

Technical trials began in the 2005 financial year.

BT Wholesale Chief Executive Paul Reynolds said: 'The 21CN programme will deliver our vision of a converged, multimedia world where our customers can access any communications service from any device, anywhere—and at broadband speed. 21CN will drive a radical simplification of BT's operations including significantly lower costs and the capability to launch new services to market faster than we can today. It will empower all our customers, giving them control, choice and flexibility like never before."

The major elements of BT Group's overall strategy including ICT, mobility, broadband, net centricity, and portfolio transformation are underpinned by the 21CN initiative.

Over the next five years, 21CN will transform BT's business and its cost base, removing duplication across the current multiple service specific networks and creating a single multi-service network.

Source: MJA analysis of selected excerpts from BT public statements in Annual Reports and presentations

This example shows that a transition to NGN is seen by telecommunication companies as a necessary step to reduce costs. BT expects that 50% of their customer base will have migrated to NGN by 2007.

Note that in this paper, NGN is mainly considered in the context of the core network, i.e. an upgrade of transmission and switching equipment. However, the term NGN is also sometimes used to describe the deployment of fibre into the local loop, either to the incumbent's street cabinet or all the way to customer premises.

Some argue that it is still too early and inappropriate to incorporate NGN into cost models.[5] However, Danish regulator IT- og Telestyrelsen (ITST) recently published an update of their Long Run Incremental Costs (LRIC) models. For the core network, they chose to model the Ericsson Engine concept, which may be regarded as an NGN concept. ITST follows earlier LRIC modelling (2003) by the Swedish regulator Post och Telestyrelsen (PTS) who also adopted the Ericsson Engine concept in their modelling.

These developments suggest that the core network in the PIE II model cannot, as a matter of principle, be regarded as reflective of efficient, forward-looking costs. Hence the PIE II model fails the forward-looking 'test' and should not be relied on to calculate costs of core related services such as PSTN OTA. For example, the Local Access Switches (LAS) and Signal Transfer Points (STP) use the Ericsson AXE solution. To our knowledge, Ericsson no longer provides the complete AXE solution, but offers their Engine Integral Network (EIN) concept instead.

The EIN is a conservative starting point, compared with building a full NGN. It is a flexible system designed to give operators a natural migration path from traditional telephone technology to multi-service networks and future IP-based networks.[6] Because of this flexibility, the Swedish national carrier, TeliaSonera, uses EIN as the basis for their network.

An EIN consists of three main components:

- Telephony Server (TeS)
- Multi-Service Access Node (MSAN)[7]
- Engine Access Ramp (EAR) or Engine Access Switch Module (EASM).

5 One potential problem with incorporating NGN into cost models is quality of service. Traditional circuit-switched voice networks are highly reliable and offer very good quality of service. The main advantage of packet-switched networks is that they are very efficient in transporting information but historically have had a disadvantage with real-time services. However, technologies such as Multi Protocol Label Switching (MPLS) provide a solution to this problem. MPLS allows dedicated paths to be created in an IP network. IP/MPLS appears to play a crucial role in Telstra's NGN upgrade as 'a robust, scalable backbone for all services'. (Source: Presentation by Greg Winn, Telstra Chief Operations Officer, slide 3, 16 November 2005).

6 See [viewed 20 June 2006]:

http://www.ericsson.com/products/hp/Ericsson_Engine_Integral_Network_3_1__EIN_3_1___TSS_3_1__bs.shtml

7 MSANs cost considerably less than either local or tandem exchanges.

The TeS controls the media gateway (MGW) applications in the MSAN. It deals with processing calls and controls the switching resources in the MGW. The call processing technology in the TeS is based on an AXE-platform. Compared with the traditional circuit switched solutions the "intelligence" is centralised in the TeS.

Connections between MGWs can either be standard Synchronous Digital Hierarchy (SDH) or Asynchronous Transfer Mode (ATM). The choice of transmission equipment is likely to be driven by previous investment decisions.

An EAR may be regarded as the replacement for a Remote Switching System (RSS). An EAR is connected to an MGW either over a standard 2 Mbit/s interface or over STM–1 via add-drop multiplexing.

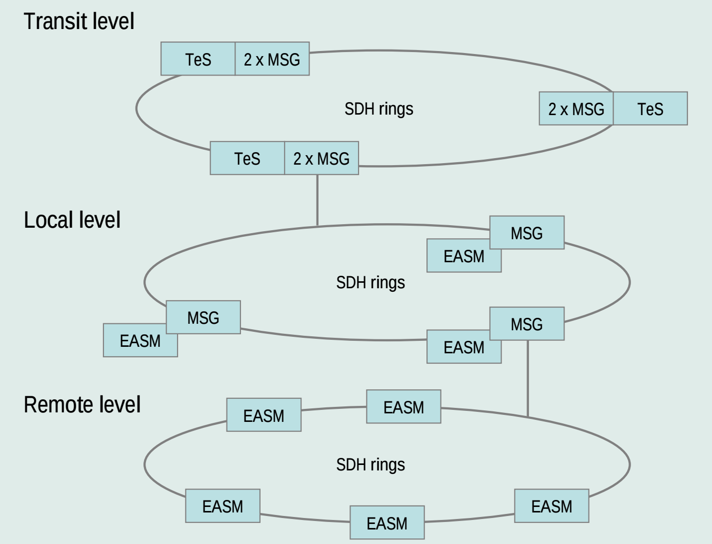
As an illustration of how Engine might be implemented, the physical network structure used in the Danish Hybrid model is shown in Box 2 below.

BOX 2: NETWORK STRUCTURE IN DANISH HYBRID MODEL

The model uses 5 TeSs, 10 transit MSG exchanges, 50 local MSG exchanges. EASM Equipment is placed on the 1,693 'scorched nodes'. The 5 TeSs are distributed between five transit areas.

All TeSs are co-located with a transit MSG, which again is co-located with a local exchange MSG. Further, all MSGs are co-located with an EASM. TeSs/MSGs communicate with the other MSGs by using ATM.

The transmission network is based on SDH rings connecting the EASMs to a ring of local MSGs and a supplementary set of rings that connect local MSGs to transit MSGs.



Source: MJA analysis of ITST model documentation

2.2.2. Modelled services

According to page 3 of the Discussion Paper, the PIE II model is described as including the following core network services:

- [c-i-c]
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MJA's review of the PIE II model indicates that these services are included in the model. Several services are aggregated in larger categories, which is a sensible approach in order to make the model more manageable, given the characteristics of the aggregated services are similar.[8]

A TSLRIC model needs to account for all services related to a particular increment. To exclude services would result in an under-dimensioned network and increased costs for the remaining (included) services, as costs are allocated across fewer services. Therefore, more services should be modelled than the actual number of services costed on the basis of the TSLRIC.[9] In addition to the services detailed above, the PIE II model includes leased lines. However, no other non-PSTN services appear to be included in the model. In MJA's opinion, this is serious omission and error. In the core network, non-PSTN services typically account for a very large proportion of capacity in the transmission network.[10,11] In addition there is tendency for this proportion to increase due, for example, to the impact of broadband and the need for transmission capacity to transport non-PSTN services across the transmission network. Without non-PSTN demand in the model to dimension the transmission network, network element costs related to transmission are likely to be excessive.

Although the importance of non-PSTN services will vary from country to country, a good and transparent example of the importance to costs of non-PSTN demand is illustrated by the Danish hybrid model. In this model a range of different transmission allocations to PSTN are made, depending on the type of transmission link under consideration. The calculated traffic intensity in busy hour for PSTN traffic defines the required number of 'Busy Hour Erlang' for each site category. This is converted into Mbit/s. The required capacity for leased lines and other services is then added to the PSTN requirements, to give the total transmission capacity for each site link category. The capacity is corrected (uplifted) for logical path diversity and used to dimension the transmission network. Once dimensioned, costs are then allocated to PSTN based on demand, i.e. PSTN's share of total capacity, see Table 1 below.

8 Depending on the database and tables consulted, this number varies from 15 to 17 categories. For the routing factor tables, services are aggregated even further into eight categories.

9 We note that it is conceptually possible only to model a subset of services within an increment. However, this would require adjustments be made to final service costs or cost inputs. These would likely be arbitrary and subject to error.

10 A telecommunications operator typically provides a mix of high capacity and lower capacity non-PSTN links. These may use the network in different ways: high capacity transport may not use cross-connects (or certain types of cross-connects) that are needed by low capacity transport. The model needs to correctly determine and dimension PSTN and non-PSTN capacity for each logical transmission link within the network and take account of possible 'bunching' of non-PSTN services on key routes.

11 Some incumbents may have dedicated networks for non-PSTN services. However, even in these cases there will be significant sharing.

TABLE 1: TOTAL REQUIRED CAPACITY (MBIT/S)

	RCU-LE	LE-LE	LE-TE	TE-TE
PSTN	12,576	4,262	8,844	2,354
Leased Lines	7,212	14,146	12,837	2,114
Mobile	3,092	298	7,379	3,890
WIN	-	64	12,778	22,363
Cable TV	-	69,057	50,506	1,563
Interconnect	1,017	6,818	3,217	364
DXX/DKM	3,028	1,580	3,097	1,004
Data	27,024	20,600	25,057	18,172
Total non-PSTN	41,373	112,563	114,871	49,470
Total	53,949	116,824	123,714	51,823
PSTN share of total	23%	4%	7%	5%
PSTN share of total excl. cable TV.	23%	9%	12%	5%

RCU = Remote Concentrator Unit, LE = Local Exchange, TE = Tandem Exchange

Source: MJA analysis of Danish Hybrid Model public version 1.3 (2005).[12]

The table illustrates the importance of non-PSTN traffic in dimensioning the transmission network and the effects sharing with non-PSTN is likely to have on the transmission costs allocated to PSTN. To omit non-PSTN demand in the dimensioning of the transmission network will result in inefficient cost estimates.

Non-PSTN traffic is therefore likely to account for a significant proportion of costs in the transmission network. The significance of non-PSTN traffic is also likely to increase over time as a result of broadband rollout.

2.2.3. Network costs

From the description of the PIE II model, it is unclear to what extent the methodology reflects Telstra's actual network and to what extent it reflects the network of an efficient operator within the technological solutions adopted. For example in the discussion of Remote Access Units (RAUs), the network seems to be based on the latter. However, the assumption that 55% of internet calls use the Dial IP platform, based on a June 2002 study of calls, suggests many assumptions are based on Telstra's actual network. In addition to the issue of using 2002 data, this apparent mix of different approaches is questionable.

The major cost categories making up core network services—switching and transmission—are discussed in the following sections.

12 Available at [viewed 16 June 2006]: http://www.itst.dk/static/LRAIC/LRAIC%20Hybridmodel%202005.zip

Switching

RAUs are used instead of Remote Switching Stages (RSSs). In principle, this approach appears reasonable as multiplexers are likely to be less costly than traditional concentrators. In addition, this is an upgrade strategy followed by many incumbent operators. However, it is unclear from the description of the PIE II model what the functionality of these units is. For example, the Above-Ground Housings (AGHs) and the Underground Housings (UGHs) appear to be simply multiplexers, and therefore have no concentration facility. This is because 'each remote CMUX needs to be sub-tended by an NU' with a sub-tend card fitted into the network unit (NU). Since there does not appear to be any port dimensioning, MJA concludes they do not have concentration capability.

In our opinion, some of the dimensioning parameters for the RAUs should be questioned. For example, 80% maximum capacity may be reasonable as a planning mechanism to indicate the need for a further RAU. However, if there are two or more RAUs on a site, it is unclear why all but the last RAU cannot be filled beyond an 80% capacity.

The rationale for the NU selection criteria[13] is also questionable because:

- up to 30 SIOs can be provisioned on a single CMUX POTS card;
- up to three shelves can be fitted on an NU; and
- up to 14 POTS cards can be fitted on a CMUX shelf.

This implies the maximum number of subscribers on an NU is 1,680, which appears to be consistent with the 1,200 criteria. However, given the 80% capacity, in reality the maximum number of subscribers would be far less. The NU would be expected to be economic when the number of subscribers is lower than the NU's effective capacity.

According to pages 9–10 of the Description of the PIE II model, the following rules have been adopted in dimensioning the network elements to build the LAS, STP, and Transit Network Switches (TNS):

> *(a) Each ESA is served by a single LAS for carriage of all call types and traffic generated by the SIOs within it.*
>
> *(b) LASs are classified into two categories:*
>
> > *(i) Type A LAS which serves CBD and Metro ESAs only;*
> >
> > *(ii) Type B LAS which serves all other types of ESAs (i.e the ESAs served by the LAS include at least one provincial or rural ESA).*
>
> *(c) For dual ended calls, originating traffic at the LAS is assumed to be equal to the terminating traffic at that LAS.*

[13] The minimum number of SIOs required within an ESA to provision a NU CMUX is 1,200.

> *(d) All LASs and STPs are Ericsson AXE and all TNSs are Alcatel System*
>
> *(e) No direct customer connections are supported at the TNS layer.*
>
> *(f) Each LAS is assumed to be STP capable (i.e it is attached to the SS7 signalling network).*
>
> *(g) The interconnect gateway, mobile gateway, intelligent network platform and international gateways are assumed to be outside the PSTN and are not included in the PIE II model.*
>
> *(h) The inter-exchange traffic is balanced between the direct path (LAS to LAS) and the overflow route (via the TNS) during the busy hour.*
>
> *(i) All LASs and TNSs are appropriately dimensioned to cater for traffic on the basis of routing factors. The routing factors specify the usage of network elements by each call type based on the path traversed by a call between its source and its destination.*
>
> *(j) Routing factors are different for Type A and Type B LASs, based on the call type.*

The description states that '*each ESA is served by a single LAS...*'. However, it also states that there are 5,030 ESAs. In other words, while each ESA is served by a single LAS, that LAS serves a significant number of ESAs. We understand from commentary by Bridger Mitchell that the PIE II model:[14]

> *…(a) optimises the choice of equipment located in remote access sites that are connected to a local area switch, (b) determines the locations of those remote sites, and (c) optimises the number of local area switches required at each site.*

While MJA agrees that such an optimisation approach is appropriate and should be conducted under the scorched node approach, we are unable to evaluate whether the design in the PIE II model is in fact optimal. No information is provided about the optimisation that has been performed or how the optimised network differs from Telstra's network.

Table 2 details the dimensioning variables of the PIE II model.

[14] Mitchell, Bridger (2005), *Appropriateness of Telstra's 2005 Cost Modelling Methodology,* Annexure D, p. 21, para 58.

TABLE 2: PIE II DIMENSIONING VARIABLES

Parameter/description	Value
Unsuccessful calls as ratio of total calls	33%
Ratio of terminating to originating calls	1
Busy days per year	250
Busy hours per day	10
Average answered call setup time in seconds	10
Average unanswered call duration in seconds	28
Number of 64Kbps VF channels per 2Mbps transmission link	28
Maximum number of GSS ports in a LAS	90,000
Erlang per GSS port	0.60
Erlang per TNS port	0.70

Source: PIE II Model

The percentage of unsuccessful calls is 33%. In our view, this percentage is relatively high given the increased use of answering machines and queuing systems. As a comparison, the Danish hybrid model uses 23% and Telefónica España use 5%.[15] MJA suggests Telstra should provide documentation to show the value is appropriate.

The ratio of terminating to originating calls is likely to be correct for Australia as a whole (it may differ from 1 because of fixed to mobile and mobile to fixed etc.), but would not necessarily apply at the level of individual areas. For example, users with relatively low calling rates may receive more calls than they make.

The number of busy days per year seems reasonable, but it should be noted that a percentage of calls will be made on weekends and this should be accounted for. Failure to do so could lead to over-dimensioning.[16] Without access to traffic profiles, it is difficult to comment on the number of busy hours per day. The busy hour calculations in the PIE II model use the number of busy hours per day and per year to generate a busy hour estimate. A more conventional approach is to use a busy hour percentage. This should be marked up to take account of variations in traffic by day and month of the year. In addition, we note that the applied busy hour conversions implicitly average out any variations between different services. Telstra should have access to data showing usage profiles for the different services that use the network.

It is difficult to comment on the average answered and unanswered call parameters. These are operator and country specific and should be based on measurements made by Telstra. Nevertheless, the average unanswered call duration in seconds, appears long.

15 The figure for Telefónica España is based on information provided by the LRAIC Forum during the consultation related to the latest update of the Danish Hybrid model.

16 We note that account of weekends could already be built into the busy days per year estimate, but if this is the case, it should be clearly specified.

Telstra assume that there are 28 64kbps channels per 2 Mbps transmission link. Thirty is the commonly assumed figure and it is unclear why Telstra uses only 28.

The term 'GSS port' is not defined. MJA assume from the figure of 90,000 for the maximum number of GSS ports in a LAS, and the Erlang per GSS port, that this is a 64kbps port. In our opinion, it is preferable to model switch utilisation rather than use Erlang utilisation assumptions. In practice, it is difficult to know whether these figures are reasonable. The use of 64 Kbits circuits depends on a number of factors such as purchasing modularities and the number of remote units linked to the switch.

The PIE II model contains blocking factors. These are shown in the Switching and Signal (S&S) module in the 'Network Assumptions' table:[17]

- LAS to LAS: [c-i-c]%
- LAS to TNS: [c-i-c]%
- TNS to TNS: [c-i-c]%

It is unclear how these blocking factors were derived. We suspect the values are sourced directly from Telstra's design engineers. If this is correct, are these the right values to use? Although they may be typical to Telstra, new operators in competitive situations will use different factors. A higher blocking factor may, at first, seem to be a retrograde step, but low blocking factors were designed at a time when incumbents engineered networks without giving consideration to competitive pressures. Nevertheless, it is unclear why there are large differences in blocking for these elements i.e. [c-i-c

].

In order to split costs into 'set-up' costs and 'call-related' costs, the PIE II model uses a simple percentage allocation between them. In the Interconnect database, this number is set to [c-i-c]% of the annual network element costs. MJA have been unable to assess whether this is appropriate within the specific modelling undertaken by Telstra. However, we agree that certain costs are incurred by a call attempt, whereas other costs are a factor of the duration of the call. For instance, the costs related to processing and signalling are driven by the number of call attempts, while the costs of exchange ports and transmission costs are driven by the number of minutes (in the busy hour). A more transparent approach would therefore be to dissect the network elements in the PIE II model to determine which elements are call-related.

17 The figures quoted by Telstra are 1 minus those above, i.e. for LAS to LAS the figure is 99.8%. We note that there is discrepancy between the figures in the S&S module and those shown in the Documentation module.

BOX 3: A TYPICAL CALL SET-UP SEQUENCE

When a caller dials, the originating local exchange (OLE) uses the digits to determine whether, and where, to establish a call. The OLE signals the address, via the SS7 signalling network, to the intermediate transit exchange, which establish a path, and to the terminating exchange. The terminating exchange alerts the call receiver (using one of three different signalling standards, depending on the line type), sends an 'address complete' signal back to the originating exchange, and switches a call progress tone to the established speech path i.e. a 'ring tone'[18]

The originating exchange uses the 'address complete' signal to switch the called party from its dialled digit receiver, to the established speech channel. The call enters the 'ringing' state. Acceptance of a call by the receiver creates a major state change in the switching network. When the receiver answers the call, the terminating local exchange switches the calling party away from the call progress tone, switches the receiving party speech path to the connection, and sends an 'answer' signal to the OLE. On receiving the answer signal, the OLE applies call set-up in the call detail record, begins duration monitoring for billing purposes, and continues to monitor the calling party for any 'disconnect' message. The call enters the 'conversation' phase. The network elements or categories used in this process should be allocated to call set-up.

There is no reason why a more transparent approach cannot be adopted within the PIE II model. MJA suggests the PIE II model be modified to more directly calculate the cost of call set-up. We note that the effect of sending costs to 'calls' as opposed to 'minutes', or vice versa, is not a major problem as long as the total costs are correct. However, there is no way of currently assessing whether the current allocation reflects cost causation.

Transmission

According to the description of the PIE II model on pages 10–11 the transmission modelling follows the following principles:

> *53. The cost of transmission links for connections between RAUs and LASs in Metropolitan and/or CBD ESAs, between LASs and between LASs and TNSs are inputs to the model.*
>
> *54. In respect of transmission links between non-metro RAUs and LASs the architecture used is such that a number of RAUs are connected to a Point of Confluence ("PoC"), which is located on an SDH transmission ring with a number of other PoCs. This provides a balance between ensuring redundancy of traffic flows (given by the SDHrings) and the cost of providing redundancy for every RAU.*

MJA notes the cost of some transmission links are direct inputs to the PIE II model. Where this is the case, the model will be invariant to changes in demand in these areas. In other words, these cost calculations are made off-line and hence are not part of the main model. In our opinion, off-line calculations should be minimised. While there may be certain parameter values, or cost inputs, that are aggregated, the main purpose of the costing model should be to calculate the network elements needed to cater for forecast demand. If some cost

18 A 'ring tone' is a continuous stream of traffic elements transmitted across the network, while 'ringing' is a specific signal to alert the called subscriber on an analogue line.

calculations are carried out off-line, it is not possible to update the model or to verify the cost calculations. This is particularly problematic for the PIE II model calculation because more than half the network costs are related to transmission.[19]

Calculation of transmission costs are dealt with in the transmission and IEN database.

The IEN database performs a number dimensioning tasks and has various resource outputs related to rings and links. Although all the calculations have not been analysed in detail, the database appears to be working correctly.

However, MJA is concerned about the workings of the transmission database. This database contains a price list, which sets the 'prices' for different transmission segments either by geographic region (exchange name) or by type. It is unclear how these unit costs have been derived and whether they are appropriate. The costs appear to relate to the cost of transmission links in metropolitan and/or CBD ESAs. As noted, we do not believe the direct cost inputs for network assets are appropriate for a model of this type. Results of the dimensioning process are imported from the S&S module and used together with transmission database's price list to derive costs for different transmission segments.[20]

The PIE II model assumes that PoCs are joined in optimised rings, containing no more than eight PoCs to their parent LAS. The rationale for an upper limit of eight PoCs in an optimised ring is unclear. This is a long way below the potential technical limit. Adding more PoCs could result in an increase in ring speed and, hence, an increase in the cost of transmission equipment per node; however, this is not a sufficient reason to set an upper ceiling of eight. An alternative rationale for an upper ceiling could be the danger of a ring break, but this would only be a problem if the rings were not dimensioned for protection capacity. Telstra's policy in relation to this issue is unclear.

Operators use different strategies with regard to rings and point-to-point links in their transmission networks. Telstra's mix of rings, with offshoots, seems reasonable, but without documentation to assist us in understanding how these decisions have been made, we have been unable to determine if it is cost effective.

An issue is that capacities on many routes appear to be quite low. This means that on point-to-point links, the transmission required is far below that of an STM–1, which would be modelled for cable infrastructure. Using point-to-point links means that it is necessary to

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19 Although we note that the majority of transmission (and infrastructure) costs and related to remote to local transmission elements which do appear to change according to changes in demand.

20 This off-line approach would appear to be confirmed by inspection of the cost outputs in the Telstra undertaking. On page 20 two tables are set out that contain upper and lower bound costs for the years 2006/7 and 2007/8. Both lower and upper bound estimates are the same for network elements 'TNS to TNS', 'LAS to TNS' and 'LAS to LAS'.

have equipment at either end of any link. This means that multiple pieces of equipment are required at the LAS node, or at an RAU with more than 800 SIOs serving as a PoC, whereas with rings, only one piece of equipment may be necessary. For this reason, the use of point-to-point links could increase transmission equipment costs, although it may lead to cost reductions in other areas (e.g. potentially less trench).

A comparison of network costs

Table 3 compares the split between different network element costs in the PIE II model with the Danish hybrid model (version 1.3 for 2005), Swedish hybrid model (version 3.1) and the BT regulatory accounts for 2005. Both the Danish Hybrid model and the BT network employ a three layer design similar to that of Telstra. The values in Table 3 are approximate and based on MJA's analysis of the BT data and the Danish and Swedish hybrid models.

TABLE 3: COMPARISON OF NETWORK COSTS

Network element	PIE II Model	Danish hybrid model	Swedish hybrid model	BT regulatory accounts
RAU	[c-i-c]%	25.0%	33.0%	49.4%
LAS	[c-i-c]%	41.6%	4.5%	15.6%
TNS	[c-i-c]%	9.4%	1.0%	6.1%
Total switching	36.5%	76.0%	38.5%	71.0%
RAU to LAS	[c-i-c]%	19.3%	56.9%	15.8%
LAS to TNS and LAS	[c-i-c]%	4.1%	3.6%	7.1%
TNS to TNS	[c-i-c]%	0.6%	1.0%	6.1%
Total transmission	63.5%	24.0%	61.5%	29.0%

Source: MJA analysis of the Danish hybrid model v 1.3 from 2005, Swedish hybrid model v 3.1, BT regulatory accounts 2005[21] and PIE II

While the PIE II model and Danish hybrid model appear similar in their cost splits for remote units, the two models differ considerably for local and transit exchanges. Further, the relative amount of costs related to 'remote to local' transmission is much larger in the PIE II model. Most striking is the difference in relative costs between the PIE II model and both the Danish model and BT for switching and transmission. Transmission costs in Australia would, however, expected to be considerably higher because of geographical layout and distance. This is evidenced by the relative costs in the Swedish model which are better aligned to PIE II. However, it should be noted that the Swedish model employs a newer and more efficient switching structure which may result in relatively more costs being allocated to transmission. Although this comparison does not suggest any fundamental problems in the

21 Available at [viewed 16 June 2006]: http://www.btplc.com/Thegroup/Regulatoryinformation/Financialstatements/2005/CurrentCostFinancialStatements2005.pdf

costing in the PIE II model, we still believe that the treatment of non-PSTN in the PIE II model needs to be addressed and costs re-examined.

2.2.4. Annualisation of capital costs

The PIE II model uses tilted annuities to annualise costs.[22] This is a reasonable approach for a bottom-up, fixed network model. However, a consequence of this approach is that results rely on the appropriate specification of asset lives and price trends.

In general, we believe that Telstra's methodology to derive price trends, using data from Current Cost Accounts and ABS, is a good starting point. In particular we acknowledge the importance of separating price changes for equipment from price changes for installation and labour. While prices for equipment are generally falling, this is not true of labour costs. To improve transparency, we recommend that equipment installation costs be shown separately from equipment costs and that separate price trends are used for each category.

Nevertheless, MJA has a number of concerns with the values used in the PIE II model. In our view:

- the price trends used are too aggregated i.e. they are applied to cost categories that are too broad
- a number of the price trends seem to be too negative (or are not positive enough).

In order to cross-check the price trends used in the model, we have reviewed recent (no more than six years old) publicly available information on the magnitude of price trends primarily used in regulatory proceedings.

Table 4 summarises these findings. Price trends from the PIE II model are included to facilitate a comparison. Note that due to the different categorisation of cost elements, comparisons are difficult and, in some cases, judgement was required. The most important cost categories are included.

[22] A standard annuity calculates the charge that, after discounting, recovers the asset's purchase price and financing costs in equal annual sums. In the beginning of an asset's life, the annualisation charge consists of more capital charges and less depreciation charges. This reverses over time resulting in an upward sloping depreciation schedule. The increase in the depreciation charge over time exactly counterbalances the decrease in the capital charge, resulting in the annualisation charge being constant over time.

A tilted annuity takes account of price changes, creating front-loading if prices are expected to fall and back-loading if prices are expected to increase.

TABLE 4: NOMINAL PRICE TRENDS (ANNUALPERCENTAGE CHANGE IN COSTS)

	Source:	*IRG*	*Europe Economics ABUM*	*Hybrid model*	*Analysys Municipal Duct model v1*	*Hybrid model*	*PIE II model*
	Country/region:	*France*	*Europe*	*Denmark*	*N/A*	*Sweden*	*Australia*
	Year:	*2001*	*2000*	*2005*	*2002*	*2004*	*2005*
Major grouping	Cost category						
Trench	Trench in the access network	0%		3%	2%	2%	[c-i-c]%
Trench	Trench in the core network	0%	1%	3%	2%	2%	[c-i-c]%
Duct	Duct in access network	0%		3%	2%	2%	[c-i-c]%
Duct	Duct in the core network	0%	1%	3%	2%	2%	[c-i-c]%
Copper cable	Copper	0%		6%		1%	[c-i-c]%
Tie cable	Tie cables			0%		-2%	
Fibre cable	Fibre cable (in the access network)			-5%		1%	[c-i-c]%
Fibre cable	Fibre cable (in the core network)	-5%	-5%	-5%		0%	[c-i-c]%
Cabinet/DP	Cabinets (including cabinet equipment)	0%		1%		2%	
MDF	MDF	0%		-2%		0%	
NTP	NTP			0%		1%	[c-i-c]%
Switching	Remote/local switchblock unit	-5%	-8%	-6%		-4%	[c-i-c]%
Switching	Remote/local processor unit		-8%	-6%		-5%	[c-i-c]%
Switching	Remote/local software (unit)		-8%	-6%		-4%	[c-i-c]%
Switching	Remote/local port unit		-8%	-6%		-3%	[c-i-c]%
Switching	Tandem Switch switchblock unit	-5%	-6%	-6%		-4%	[c-i-c]%
Switching	Tandem Switch processor unit		-6%	-6%		-5%	[c-i-c]%
Switching	Tandem Switch software (unit)		-6%	-6%		-4%	[c-i-c]%
Switching	Tandem Switch port unit		-6%	-6%		-3%	[c-i-c]%
Transmission	STM multiplexers	-5%	-10%	0%		-5%	[c-i-c]%
Transmission	STM cards		-10%	0%		-5%	[c-i-c]%
Transmission	Cross-connects	-5%	-10%	0%		-4%	[c-i-c]%
Transmission	Signalling points		-5%	-6%		-4%	[c-i-c]%
Buildings	Buildings		-1%	2%		1%	[c-i-c]%

Sources for Table 4 are the MJA analysis of:

- IRG–France: information received by ITST from the French regulator ART in relation to a data request sent out to members of the Independent Regulators Group (IRG) in connection with the Danish LRAIC process.
- Europe Economics ABUM—Adaptable Bottom-Up Model, Europe Economics: available at the EU website (http://europa.eu.int/ISPO/infosoc/telecompolicy/en/Study-en.htm).
- The Danish hybrid model — version 2.1 of the LRAIC model: used by the ITST to set the prices of access services, switched interconnection services, and co-location services. Available at the ITST website (http://www.itst.dk).
- Analysys Municipal Duct model. Available at the Analysys website (http://www.analysys.com).
- The Swedish hybrid model: LRIC model used by the Swedish Regulator PTS to set the prices of access services, interconnection, and co-location services. Available at the PTS website (http://www.pts.se)

While Table 4 indicates there is some dispute on the price trend for fibre cable, it shows general agreement on a positive price trend in the benchmarked data for duct (conduit) and trench, and negative price trends for transmission and switching equipment.

Another observation from Table 4 is that asset categories that contain a large labour component tend to have a more positive price trend. For example, trench and duct categories should have a large labour component.

Comparing the PIE II model price trends with the international data we put most weight on the more recent data, i.e. Denmark and Sweden. For trenching, the price trends are reasonably well aligned, although the PIE II trends are [c-i-c]. Based on this comparison alone, we are inclined to suggest a price trend of [c-i-c]%. This would result in a [c-i-c] in core service costs. On the other hand, the price trend for fibre is [c-i-c]in the PIE II model, compared with the international data. While we regard a [c-i-c] price trend as reasonable, there is scope to make it less [c-i-c] in the PIE II model. This would result in an [c-i-c] in core service costs.

On average, switching and transmission price trends in the PIE II model are reasonably aligned with the international data. However, the most recent price trends for transmission in the international data (the Danish hybrid model) are zero. This could suggest that prices for transmission equipment are no longer falling.

MJA notes that these asset lives should correspond to the economic life of the assets. Book asset lives are likely to be shorter than economic asset lives due to conservative accounting practices.

As with price trends, we believe the asset lives used in the PIE II model are too aggregated. Although the issue is less pronounced for asset lives, it is nevertheless a concern. While a TSLRIC model may be very accurate at estimating equipment numbers, and hence gross replacement costs, this is only one step in the modelling process. These costs should be converted into annual costs. If the model makes no attempt to accurately model the economic characteristics of assets by applying economic asset lives and price trends at a sufficiently detailed level, the original detailed modelling of the underlying equipment numbers is discounted. The same argument applies to the operating cost mark-up approach in the PIE II model, which is also too aggregated (for more on operating and maintenance (O&M) costs, see section 2.2.7).

Table 5 shows publicly available information on the magnitude of economic asset lives used in regulatory proceedings. The asset lives are compared with those used in the PIE II model.

TABLE 5: ASSET LIVES—PART I

	Source Country/region Year	IRG France 2001	IRG Switzerland 2001	IRG Spain 2001	IRG Austria 2001	IRG UK 2001	IRG Germany 2001	Europe Economics ABUM Europe 1999
Major grouping	Cost category							
Trench	Access trench	20.0	30.0	30.0	30.0		35.0	
Duct	Access duct	30.0		30.0	30.0		35.0	
Trench	Core trench	30.0	27.0	30.0	30.0		35.0	38.0
Duct	Core duct	30.0	27.0	30.0	30.0	42.0	35.0	38.0
Poles	Poles							
Copper cable	Copper cable	20.0	20.0	9.6	20.0		20.0	
Line card	Line cards		11.5					
Tie cable	Tie cables							
Fibre cable	Fibre cable (in the access network)						20.0	
Fibre cable	Fibre cable (in the core network)	20.0	16.0		20.0	24.0	20.0	23.0
Cabinet/DP	Cabinets/distribution points	20.0		7.0			8.0	
MDF	MDF	20.0						
NTP	NTPs							
Switching	Switchblock unit	12.0	14.0	5.7	10.0	14.0	10.0	13.0
Switching	Processor unit	12.0	11.5	5.7	10.0	14.0	10.0	11.0
Switching	Software		5.0		10.0		4.0	12.0
Switching	Port unit	12.0	11.5	5.7	10.0	14.0	10.0	11,5
Transmission	STM multiplexers	10.0	9.4		8.0	13.0	10.0	10.0
Transmission	STM cards		10.0			13.0	10.0	10.0
Transmission	Synchronisation		10.0		8.0	13.0	10.0	16.0
Transmission	Cross-connects	10.0	9.5		8.0	13.0	10.0	10.0
Transmission	Signalling points		10.0			13.0	10.0	16.0
Switching other	Power supply unit		10.0	15.0	5.0			
Switching other	Air conditioning unit		10.0	15.0	5.0			
Buildings	Buildings	30.0	30.0	24.2	40.0	42.0	35.0	37.0

TABLE 6: ASSET LIVES—PART II

	Source	HAI Model	NERA	NTT TD model	LRIC Study Group Model	Hybrid model	Hybrid model	PIE II
	Country/region	USA	Australia	Japan	Japan	Denmark	Sweden	
	Year	1998	1999	1998	1998	2005	2005	2005
Major grouping	Cost category							
Trench	Access trench	51.1	29.0	27.0	27.0	40.0	40.0	[c-i-c]
Duct	Access duct	51.1	29.0	27.0	27.0	40.0	40.0	[c-i-c]
Trench	Core trench	51.1	34.0	27.0	27.0	40.0	40.0	[c-i-c]
Duct	Core duct	51.1	34.0	27.0	27.0	40.0	40.0	[c-i-c]
Poles	Poles	30.3					20.0	
Copper cable	Copper cable	20.5	22.0	13.0	13.0	20.0	25.0	[c-i-c]
Line card	Line cards		10.0			10.0	10.0	
Tie cable	Tie cables	15.7				15.0	15.0	
Fibre cable	Fibre cable (in the access network)	23.7		10.0	11.2	20.0	20.0	[c-i-c]
Fibre cable	Fibre cable (in the core network)	23.7	24.0	10.0	11.2	20.0	20.0	[c-i-c]
Cabinet/DP	Cabinets/distribution points	19.0	17.0			15.0	15.0	
MDF	MDF		12.0			15.0	15.0	
NTP	NTPs	19.0	17.0				20.0	[c-i-c]
Switching	Switchblock unit	16.4	10.0	6.0	11.9	10.0	10.0	[c-i-c]
Switching	Processor unit	16.4	10.0	6.0	11.9	10.0	10.0	[c-i-c]
Switching	Software	6.3	10.0	6.0	11.9	10.0	10.0	[c-i-c]
Switching	Port unit	16.4	10.0	6.0	11.9	10.0	10.0	[c-i-c]
Transmission	STM multiplexers	10.2	10.0			10.0	10.0	[c-i-c]
Transmission	STM cards	10.2	9.0			10.0	10.0	[c-i-c]
Transmission	Synchronisation	10.2	9.0			15.0	10.0	[c-i-c]
Transmission	Cross-connects	10.2	10.0			10.0	10.0	
Transmission	Signalling points	10.2	9.0			10.0	10.0	[c-i-c]
Switching other	Power supply unit					15.0	10.0	[c-i-c]
Switching other	Air conditioning unit					15.0	10.0	
Buildings	Buildings	47.7	20.0	22.1	33.0	30.0	30.0	[c-i-c]

Sources for Table 5 and Table 6 are the MJA analysis of:

- IRG—different European countries: information received by ITST from a number of European regulators in the relation to a data request sent out to members of the IRG in connection with the Danish LRAIC process.
- Europe Economics ABUM—Adaptable Bottom-Up Model, Europe.
- HAI model: Appendix B—HAI Model Release 5.0a Inputs, Assumptions and Default Values, February 16, 1998.
- ACCC/NERA: Estimating LRIC of PSTN Access, Final Report for ACCC, NERA, January 1999, tables B1 and B2.
- NTT TD model—Summary of Final Report of LRIC Study Group, 1998.
- LRIC Study group model—Summary of Final Report of LRIC Study Group, 1998.
- The Danish hybrid model—version 2.1 of LRAIC model: used by the ITST to set the prices of raw copper, switched interconnection services, and co-location services.
- The Swedish hybrid model: LRIC model used by the Swedish regulator PTS to set the prices of access, interconnection, and co-location services.

Tables 5 and 6 indicate that the asset life for trench (and duct) generally is regarded the same in different parts of the network. An asset life of 40 years for trench and duct is appropriate. This is also in line with recent developments in the United Kingdom, where the asset life for trench is 40 years.[23] The asset lives for certain transmission equipment and, to a lesser degree, fibre cable are [c-i-c] compared with international data. [c-i-c] adjustments in these categories would result in a slight [c-i-c] in core services costs.

2.2.5. Estimating trench length

To estimate trench lengths, two issues need consideration:

- the length measure used to connect nodes in the network
- the algorithm used to connect the nodes.

Generally two distance concepts are used in cost modelling:

- Cartesian distance
- rectilinear distance.

23 See *Valuing copper access— Final statement*, Ofcom 19 August 2005: Available at: [viewed 16 June 2006]: http://www.ofcom.org.uk/consult/condocs/copper/value2/statement/statement.pdf

The two-dimensional Cartesian distance (or radial distance) is sometimes called the 'crow flight' distance and is by definition the shortest possible distance between two points.[24] The rectilinear distance (or Manhattan distance) between two points is measured along axes at right angles.[25]

The PIE II model uses a rectilinear distance with no correction factor. When the geographical characterisation of an area resembles a grid-like structure, a rectilinear distance with no corrections is appropriate. However, when this is not the case, the accuracy of unadjusted rectilinear distance is reduced. Therefore, the accuracy of the unadjusted rectilinear distance declines the more rural the area, where a grid-shaped layout is less common.

The rectilinear measure could be improved by conducting studies of representative areas and developing correction factors. Telstra relies on the unadjusted rectilinear distance. On average, MJA considers the unadjusted rectilinear distance as a fairly conservative assumption for the core network, because a large proportion of core network trenching is outside built-up areas. The Cartesian measure is not appropriate within any part of the network, unless in extreme circumstances. It needs to be adjusted upwards to reflect intervening obstacles and to consider rights of way and accessibility.

In terms of the algorithm used to connect points in the network, the PIE II model uses a Minimum Spanning Tree (MST) algorithm. For the core network, this is likely to be an appropriate approximation; however, for the access network, the Steiner Minimum Tree (SMT) is superior to the MST. While Steiner nodes introduce additional costs, these costs should be compared against the reduction in trench and conduit length and other savings in support structures such as manholes, distribution points and maintenance costs.

2.2.6. Trench sharing and new estates

The PIE II model calculates the amount of sharing in each ESA. For sharing between Telstra and third parties, the PIE II model uses the distance of sharing and assumes an absolute cost that can be recovered from other operators. For trench sharing between the access and core networks, costs are shared equally. However, it is not clear whether sharing has been applied to other relevant structure costs such as manholes.

The PIE II model assumes that, each year, estate developments represent approximately 1% of all PSTN access services nationwide and that the corresponding trenches in new estates will not be a cost to Telstra. The model therefore excludes trenching costs for services in new estates.

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24 In a plane with p_1 at (x_1, y_1) and p_2 at (x_2, y_2), it is $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$.

25 In a plane with p_1 at (x_1, y_1) and p_2 at (x_2, y_2), it is $|x_1 - x_2| + |y_1 - y_2|$.

The underlying reasoning for this approach is Telstra's view that 'costless' trenches in new estates require infrastructure to be built concurrently and to co-ordinate burying cables.

The key to analysing this argument lies in the interpretation of 'time' in the forward-looking concept. The forward-looking perspective can be interpreted as the cost of building the network today, taking account of future demand. This suggests that the network is built over a very short period (some may even argue overnight). This is of course not practically possible and would, for example, present problems relating to choice of equipment price and labour costs, and effectively result in zero trench-sharing with third parties.

For the purpose of modelling, it is therefore often assumed that the network is built overnight (or instantaneously) from a technical perspective, but all input parameters (trench sharing, equipment prices, etc.) are verifiable and reflect the costs of actual networks built over time. This means that equipment prices may follow from normal operator purchases and sharing may reflect normal planning and construction activity, where co-ordination of trench sharing and co-diggings may be planned years ahead with other operators and utilities. The PIE II model uses the existing (historical) degree of sharing levels in their network as a proxy for trench sharing. This also means that trench sharing in new estates should reflect a cumulative (or historical) trench sharing measure. It is appropriate to assume a long-term 'equilibrium' new estate trench amount (proxied by historical developments) held constant over the regulatory period, subject to review after each regulatory review period.

Sharing between core and access increments in a scorched node environment should also occur more often in a forward-looking network than can be historically measured. Both the core network and the access network are assumed to be rebuilt in the same timeframe and hence could occur when there are coincident routes.

In addition to sharing between the core and access networks, there is should also be sharing within the core network between the different network elements. For example, the transmission connecting RAU to the LAS may share infrastructure with transmission between the LAS and the TNS.

According to Bridger Mitchell:[26]

> *160. The PIE II model assumes that all main cables in the CAN and the IEN are placed underground, running in ducts in the CBD areas, and are either placed in ducts or ploughed directly into the ground in the metropolitan, provincial areas, and rural areas*

26 Mitchell, Bridger (2005), *Appropriateness of Telstra's 2005 Cost Modelling Methodology,* Annexure D, p. 49, para 160, 162 -163.

> …..
>
> *162. Two or more cables that follow the same route for a portion of their length may be able to share a common trench, reducing the total cost of trenching required in the network. For example, in some locations the copper main cable in a section of the CAN and the optical fibre cable in the IEN connecting a RAU to the LAS can be run in separate ducts within the same trench along one side of a road.*
>
> *163. The opportunities for CAN and IEN cables to share trenches will vary greatly. The PIE II model assumes that throughout the CAN, nearly all (98%) of the total length of the trenches housing main cables can be shared with another cable, provided that main cable lengths are at least 1,000 metres. Trench sharing is thus determined separately in each ESA.*

In terms of sharing between main and distribution cable the PIE II model would therefore appear to share 98% of trench with main (CAN and IEN) cable with distribution cable providing that the trench containing the main cable is more than 1,000 metres (within the ESA).

The trench sharing database deals with sharing between core and access network elements. The trench sharing module contains the sharing algorithms and is where the main calculations are carried out. The PIE II model calculates the amount of sharing in each ESA taking account of ploughing, radio etc.

In the database we find the figure of 98% which is referred to as the percentage of main cable shared with distribution cable. Another figure used is sharing between main cable trenching and IEN trenching. This figure is set to [c-i-c] %. This is referred to by Telstra as the "Main Cable sharing ratio" and is like other sharing parameters inputs that may be changed. Another parameter is the "Main Cable trenching trigger" which is set at 1,000 metres. This is the minimum amount of main cable trenching within an ESA to enable main and IEN trench sharing. In other words, the core and access network are not assumed to share trench if main cable trenching is less than 1,000 metres.

Figures for route sharing are expressed in terms of percentages (except for the trigger). There is therefore a need to be specific regarding the meaning of the input data: what is a percentage of what. The figure of 98%, would appear to be main cable trench as a percentage of distribution cable trench and [c-i-c] % is main cable trench as a percentage of IEN cable trench.

While we would agree with the inter-CAN sharing percentage of 98%, we are concerned with the sharing percentage assumed between main and IEN trench. Generally we would expect the proportion of IEN (Core) routes that could be shared with the CAN (were the network built today) to be relatively high (ranging for most ESA's from 70% to 100%), while the proportion of CAN routes that may be shared with core is likely to be less than

20% on average.[27] Although these ranges are not directly comparable to the [c-i-c]% figure used by Telstra, we believe this figure may be too low. Further, when account is also taken of the trigger assumption, the sharing percentage becomes even lower (on average). A higher sharing factor will, *ceteris paribus*, result in lower core network costs.

We have been unable to find justification for any of the sharing assumptions used (other than that they would appear to reflect historical practices) and suggest Telstra provide adequate documentation in this respect.

In addition, we have not been able to identify how and where the PIE II model deals with inter-core network sharing, i.e. sharing between different network elements within the core network. Although unlikely to be as important for service costs as sharing between the IEN and CAN, failure to take into account of inter-core network sharing will result in inflated costs.[28]

2.2.7. Operating and maintenance costs

Telstra's PIE II model splits operating and maintenance (O&M) costs by asset category and applies them as mark-ups.

The use of mark-ups for O&M costs is practical, but not ideal. Mark-ups used in the PIE II model are aggregate (composites). O&M costs should be specified at a detailed level, given that Telstra has access to its own accounts.

However, relying on the historical O&M costs in a forward-looking model assumes that these costs are efficient. No documentation is presented to suggest that Telstra's O&M costs are efficient. For example, a detailed efficiency study[29] was carried out by the Danish regulator ITST of the Danish incumbent TDC's operating costs before setting O&M mark-ups.[30] This study suggested that TDC was 90% efficient and their O&M mark-ups were adjusted accordingly.

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27 We would expect greater scope for sharing in the areas with higher teledensity (with their more expensive mix of digging surfaces) and perhaps less scope in rural areas.

28 A final issue which should be mentioned is cost sharing. When trench is shared an assumption is necessary to share the cost related to digging the trench. The PIE II model would appear to use a pragmatic 50/50 split. Any changes in this split would impact service results in both CAN and core network.

29 Different methodologies can be used to conduct an efficiency assessment exercise. The two most common are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). Both have strengths and weaknesses (see, for instance, Coelli et al, (1998) for an introductory analysis of both DEA and SFA). ITST used both methods.

30 The O&M mark-ups used in the Danish Model were calculated using data from TDC's top-down LRAIC model.

In November 2005, Telstra Chief Executive, Sol Trujillo, announced that the company plans to shed up to 12,000 jobs over the next five years.[31] This suggests there may be room for substantial efficiency improvements in Telstra's network operation.

As a consequence, the O&M in the PIE II model is most likely overstated.[32] Where this is the case, indirect O&M will also be exaggerated, since these costs are calculated as a percentage of direct O&M.

The calculation of O&M costs in a bottom-up framework is not easy and, historically, has been an area of controversy in cost modelling exercises. Ideally, O&M costs should be calculated from first principles and reconciled with operator practices and costs. This requires a detailed understanding of network operations—knowledge that Telstra should have.

Another approach Telstra could use is to calculate O&M costs, driven by the number of events per major cost component. Events could include:

- new lines in existing areas or new developments on a green- or brown-field site;
- fault detection, monitoring, and diagnosis;
- fault repair (different costs for different types of repair); and
- any routine maintenance or renewal of equipment.

However, this approach is better suited for the access network than core network.

Another approach used in other jurisdictions[33] is the so-called Functional Area (FA) approach. This methodology was developed as an attempt to overcome some of the shortcomings of relying on mark-ups over equipment costs as an estimate of direct network O&M costs. The FA approach is briefly described in Box 4.

31 See [viewed 16 June 2006]: http://www.theage.com.au/news/national/pm-under-fire-for-telstra-job-remarks/2005/11/16/1132016861389.html

32 Telstra indicate that some of the costs are based on new generation assets. We acknowledge that this is appropriate and does to some extent limit our concern over the use of historic estimates. However, no information or justification is provided to support the costs making it impossible to verify their validity.

33 Sweden and the most recent version of the Danish hybrid model (version 2.3).

BOX 4: THE SWEDISH FUNCTIONAL AREA APPROACH

The Functional Area (FA) approach relies on identifying a number of functional (or operational) areas of the telecommunications business. Each of these areas is dimensioned. For example, for staff costs: (X) number of staff type (Y) in area (Z) needed for every (N) local exchanges or for the entire company.

The number of staff type (Y) is multiplied by the average annual cost of that staff type to yield the annual pay costs for staff (Y) in area (Z). Summing the annual cost of different staff types within that area yields the total pay costs for that area. An estimate of annual non-pay costs of that area is added to yield the total annual cost of area (Z).

The annual cost of each element is allocated to final services using either a routing factor technique (where FA costs are allocated to a network element and to services using a routing table) or a simple mark-up approach.

More generally, the process of implementing an FA approach may be described in three stages:

1. define the operational areas to consider;
2. define the size of each area in terms of staffing and estimate the cost of each area using inputs on annual salary and non-pay costs; and
3. allocate the cost of each area related to direct network costs, to network elements so that the total is equal to the sum of the functional areas and allocate remaining non-network (or unallocated) costs as mark-ups.

Source: MJA analysis of Swedish hybrid model and documentation

Finally, the PIE II model includes a mark-up related to network planning. It is unclear why network planning has been given special treatment in the PIE II model.

It is common practice to include network planning within O&M since it is usually considered an integrated part of the ongoing maintenance of the network. Some network planning costs can be captured in an indirect network cost category. For example, computers may be divided into PCs, equipment for network planning, network management, and billing systems. Further, the use of a forward-looking TSLRIC concept means that a model should cost the optimised network as if it were already in place and exclude any major network planning costs related to building the network.

2.2.8. Indirect capital costs and indirect O&M costs

Like operating costs, indirect costs are difficult to estimate in a 'pure' bottom-up way. It is therefore not uncommon to use mark-ups sourced from operator accounts to estimate these costs. MJA has not been able to establish whether the indirect costs applied in the PIE II model reflect efficient costs. We have attempted various comparisons to benchmarks in other jurisdictions, but our analysis has been inconclusive and subject to error due to differences in cost classification. A proper and detailed evaluation of indirect costs would require access to the dataset used to derive the estimates used in the PIE II model.

We note, however, that network building and land costs are based on a direct input from Telstra's estimate of the current market value of these assets and an O&M factor. Buildings and land should be valued at their market value and this approach is consistent with TSLRIC principles. However, these values may need to be adjusted. This is especially the case where the value used is sourced directly from Telstra's accounts. For example, there will be vacant space in many exchange buildings, often reflecting the fact that they were built to accommodate older switching equipment, which has a larger footprint than new equipment.

The need for some spare capacity (space) where it represents an economically sensible contingency, e.g. due to future demand for co-location space, should also be taken into account. However, inefficient vacant space is not part of TSLRIC and should be excluded.

Taking these amounts directly from Telstra is likely to result in exaggerated costs related to network land and buildings. A true and detailed bottom-up approach should estimate the space associated with the equipment modelled. The space requirements and the market value per square metre could then be used to calculate the value of buildings and land.[34]

2.3. Response to questions

Are there faults with the PIE II cost model and how should these faults be addressed?

It is difficult to point to actual modelling faults or coding errors. However, it is clear from our review that there are aspects of the core network model that need further investigation or clarification from Telstra.

The main finding is that only leased line traffic appears to be included in the dimensioning of the transmission network. Clearly, non-PSTN traffic is likely to account for a significant proportion of costs in the transmission network. Also, the significance of non-PSTN traffic is likely to increase over time as a result of broadband rollout. While there may be no, or a very limited amount of non-PSTN traffic on some 'spanning trees', there will be non-PSTN traffic on most rings and links. This observation is confirmed by comparing the relative costing in the PIE II model with outputs from other available cost exercises.

In MJA's opinion, some of the dimensioning parameters for the RAUs should be questioned. For example, the 80% maximum capacity may be reasonable as a planning mechanism to indicate the need for a further RAU. However, if there are two or more

[34] Care should be taken to take proper account of common building-related costs (or site costs), i.e. site security, power supply units, and air conditioning. These costs need to be allocated between different network elements. It is currently unclear how these common building costs are treated in the PIE II model.

RAUs on a site, it is unclear why all but the last, cannot be filled to a capacity level in excess of 80%.

We have also raised concerns about the input parameters used. Some of the parameters, such as the percentage of internet calls and number of unanswered calls, are likely to evolve significantly over time and in particular deviate from the developments in other services.[35] However, the PIE II model shows these parameters as constants. Also the percentage of costs allocated to call set-up is a set input parameter and cannot be explained by consulting the model.

Trench sharing should be more appropriately set to a long-term 'equilibrium' new estate trench amount (proxied by historical developments), held constant over the regulatory period and subject to review after each period.

We also consider the O&M costs used in the PIE II model are likely to overestimate efficient O&M costs as the model uses historical costs, which are assumed and not demonstrated to be efficient.

While unable to comment in detail on the indirect costs allocation in the PIE II model, we note that building and land costs are based on a direct input derived by Telstra. These may need adjustment, to reflect, for example, where land and building have a bigger footprint than is needed for efficient equipment placement. Inefficient vacant space should not be part of a TSLRIC (or TELRIC) estimate.

Finally, even if all of these issues where explained and addressed by Telstra, the model is not forward-looking and cannot be regarded as calculating efficient costs. NGN networks are being deployed on a worldwide scale and NGN elements have even been used for cost modelling in other jurisdictions. As such, the PIE II model fails the most basic of tests.

Has Telstra improved its PIE cost model? Is it necessary to construct an alternative cost model to Telstra's updated PIE II model?

MJA was not involved in the review of the PIE model during the previous Undertaking process. Therefore, we are unable to comment on whether the model has been improved.

We would have expected Telstra to provide a list of changes to the PIE II model. As far as we are aware, such a list, or document, does not exist. In our view, it is good modelling

[35] We note for example that Telstra assume a larger decline in internet calls than other services (see Table at para 48, p 14 in the Telstra Undertaking). Further in footnote 1 in the Telstra Undertaking it is noted that: "*Further migration to mobiles and the internet saw volume reductions across most call types and reduced yields. Similarly, in Telstra's media release 246/2005 on 2004/05 full year results Mr Stanhope said that the second half saw an accelerating decline in PSTN voice revenues and significant product substitution emerging.*"

practice to transparently indicate any changes made over time. This does not mean changes should be set out in minute detail. It is sufficient to indicate the changes in summary form. This type of document would greatly assist in transparency and allow interested parties to focus on aspects of the model that have changed, rather than waste resources trying to understand how, and why, the model has changed.

In terms of alternatives to the PIE II model, there are a number of features of the current model that make it imperative to build an alternative model. These features include:

- *PIE II is not forward-looking*. As discussed, the PIE II model fails the basic test of being forward-looking. The forward-looking concept is an integrated part of the TSLRIC concept.[36] If the model is unable to satisfy this basic requirement, it cannot be relied on to calculated the cost of services.
- *PIE II is not transparent*. Few jurisdictions set (or estimate) prices or costs with reference the incumbent's cost models as Telstra does by using PIE II.[37] The obvious reason for this is that cost models must be subject to thorough industry scrutiny before there is confidence in the results. Due to the complexity and non-transparency of incumbent cost models, regulators have typically elected to produce their own models creating a common ground for evaluating costs.

  Although the model has a reasonable (but not ideal) user interface, the documentation is poor and manipulation of the model is practically impossible (at least for a new user). Much of model's key workings are hidden in Visual Basic code making it difficult and time consuming to audit. There is some commentary in the code, but it is far from satisfactory. In MJA's view, transparency could be greatly improved by providing a detailed user or training manual that also comprehensively details the way the different modules and code scripts work together. In our experience, these manuals can easily amount to a thousand pages of explanation and commentary.
- *The risk of error is high.* As with all cost models, there is a risk of error in the PIE II model. However, in the PIE II model, there are more than a thousand pages of source code. This greatly increases the risk of error. Even if MJA agreed with all the dimensioning and costing decisions in the model, we would still be reluctant to rely on the results without a more formal audit of the source code.

In our view, the only way forward for the ACCC is to create a new core and access model. A new access model could use much of the information already in the PIE II model, such as the geographical and demographical data. It would also be possible to include Unconditioned Local Loop (ULL) specific costs in the model and providing for a more transparent treatment of these costs.

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36 In principle TSLRIC could be defined with reference to historic costs, but this would be contrary to the underlying intentions of TSLRIC as a costing principle for wholesale services.

37 If this is the case, a top-down model methodology is typically used.

The core network model could adopt a forward-looking design incorporating some NGN elements and be flexible enough to adequately deal with the introduction of new services.

Ideally, both the core and access network models should be modelled together, to ensure any overlaps of sharing and costs are treated consistently; for example, the treatment of the boundary between the core and access network as the network is upgraded to a more forward-looking design. Although, it is possible to model each increment separately and coordinate the modelling at a later date, there are economies of scope of constructing both at the same time.

3. Volume forecasting

Are Telstra's estimates of declining use of PSTN services appropriate?

Should alternative forecasts be used to calculate PSTN access charges?

To what extent should the PSTN asset base be commensurably adjusted to reflect the lower traffic volumes being assumed?

What services should be included in estimating traffic volumes on the IEN?

What costs and volumes will become relevant once core networks are fully upgraded to an IP basis and should these be taken into account in the pricing of future fixed access services?

3.1. Background

Telstra's submission to the ACCC notes public statements of expected declining use of PSTN services, particularly local and long distance services.

Telstra contends that the proposed substantial increase in PSTN access charges result from an expected decline in the use of PSTN services and reflect increasing unit costs since PSTN costs, including hypothetically efficient costs, are largely fixed.

Telstra's submission and media statements also refer to a migration from fixed line services to mobile services and the greater use of broadband for the internet and other uses including the growing use of 'voice over IP' (VoIP).

The ACCC notes with the prospect of significant decline in PSTN use over the next two to three years, it is not clear to what extent Telstra's PSTN asset base has also been adjusted downwards to reflect the lower estimated volumes. This raises the issue of whether alternative services, over an IP core, will be increasingly used by Telstra and access seekers to interconnect and obtain access to Telstra fixed line customers.

3.2. Discussion

The issue of declining PSTN volumes is new to cost modelling and the regulatory treatment is not well understood. Historically, PSTN volumes have risen; it is only recently that volumes have started to fall, making it a new regulatory issue. Therefore, Telstra estimates of declining PSTN service use is appropriate and reflects international developments. However, given that the core network modelled by Telstra only includes demand related to an outdated circuit switched technology, and only includes leased line traffic, it is inappropriate to artificially understate the service volumes on the basis that traffic currently using the PSTN may migrate to other (ATM or IP or mobile) networks. Although traffic may be falling in the PSTN network total traffic across all networks and all services is likely to be rising.

Before we specifically address the specific questions set out above, it is appropriate to raise a number of issues relating to costing when demand is declining.

It is important to understand the dynamics of declining volumes for the cost of services—do we expect unit costs to increase or decrease? Secondly, are there any cost recovery issues that need specific attention? When demand is declining, Telstra will be earning less revenue over time to cover the cost of the network.[38] Thirdly, do declining volumes change the way the model is updated over time?

3.2.1. Effect on unit costs

The cost per unit of service in the PIE II model is estimated by calculating the required network costs and the specific service costs, using a routing table method. The total service cost is then divided by the volume to produce the unit cost.

Required network costs should be based on dimensioned demand, which is the maximum of existing demand and forecast demand. Thus, if demand is declining, required network costs should be estimated using existing demand. When demand is declining, failure to base costs on existing demand would result in a network unable to cater for today's demand.

When demand is declining, the network needs to service a smaller amount and therefore, *ceteris paribus*, cost is reduced. However, with total traffic going down, per minute and per call charges of the services tend to go up due to the presence of economies of scale. In other words, the total cost of the network shrinks because it needs to service less demand. This decrease in the network total cost, however, is less than proportional to the decrease in total demand. Fixed costs do not allow for a one-to-one relationship between total costs and total demand and, as a consequence, service unit prices tend to go up. The converse is true when demand is increasing.

For example, assume that volume is 1,000 in Year 1, and 500 in Year 6 and, for simplicity, the network is dimensioned for the volumes of the year in which the network is to be built. Firstly, consider the duct requirements. The amount of duct required is exactly the same in Year 1 as in Year 6. Therefore, a new operator entering the market in Year 6 would have to lay the same amount of duct as the operator coming in at Year 1. If the total cost of the duct is 500 in Year 1 and Year 6, the unit cost would be 0.5 and 1.0

[38] Note that we are a not concerned with historical cost recovery. The access provider should only receive compensation for efficient forward-looking costs, not what it actually incurs.

respectively, i.e. unit costs have increased since there is less demand to cover the costs. Secondly, assume dimensioning a variable cost, such as ports.[39] In this case, the volume of ports required is much lower in Year 6 than in Year 1. The operator coming in at Year 6 would need to provide fewer ports than the operator coming in at Year 1. In this situation, the unit cost will increase, but the relationship is less clear due to the variable nature of the cost. The combination of fixed and variable costs in a telecommunications network results in a non-proportional relationship between demand and costs.

To summarise, with declining demand, unit costs would be expected to increase.

However, in addition to the traditional PSTN voice services, Telstra also provides leased lines, data services and other services. A TSLRIC model needs to account for all of these services. To exclude some would result in an under-dimensioned network and increased costs for the remaining services because costs, such as ducts, would be allocated to fewer services. Therefore more services need to be modelled than the actual number of services costed on the basis of TSLRIC.

So although demand may be declining for PSTN services, demand may be increasing for other services. Increases in demand for other services may have an offsetting effect on the unit cost of PTSN services. With increasing non-PSTN traffic, a larger share of costs should be allocated to these services.

For example, assume that PSTN volume is 2,000 and non-PSTN volume is 3,000. Total cost is estimated to be 10,000. Assuming both services use the network in the same way, the unit cost of both services is 2. Now consider a decrease in PSTN volumes to 1,000 and an increase in non-PSTN to 4,000. In this situation, the unit cost would remain the same. If however, non-PSTN had not increased, the unit cost would have increased to 2.5.

Of course the effects of non-PSTN on the PSTN unit costs are not as simple as this illustrative example. In particular, the effects will depend on the allocation methodology used to split costs between PSTN and non-PSTN. The effects will also depend on how the different services use the network. However, increases in demand for other services will have a dampening effect on the expected decline in PSTN costs. A fall in PSTN costs is, in MJA's opinion, a likely outcome, but unchanged unit costs could certainly also be an outcome.

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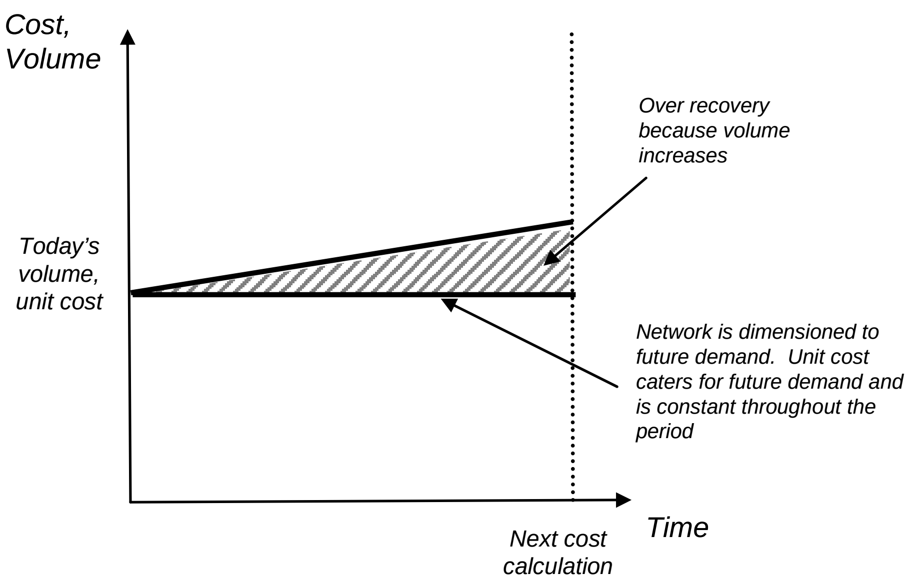
39 Port costs are in fact semi-fixed, but this is assumed away in the example.

3.2.2. Cost recovery

Dividing the total annual costs of the network costs by today's volumes is the conventional approach to establish cost-based prices (unit costs). This approach includes the additional cost of the future volume-based capacity.

For example, if volumes are expected to rise over the next couple of years, Telstra will have additional revenues, compared with a situation where demand was constant, resulting in an over-recovery of costs in the period. With increasing volumes, the total revenue generated will increase over time. This situation is shown in Figure 1.

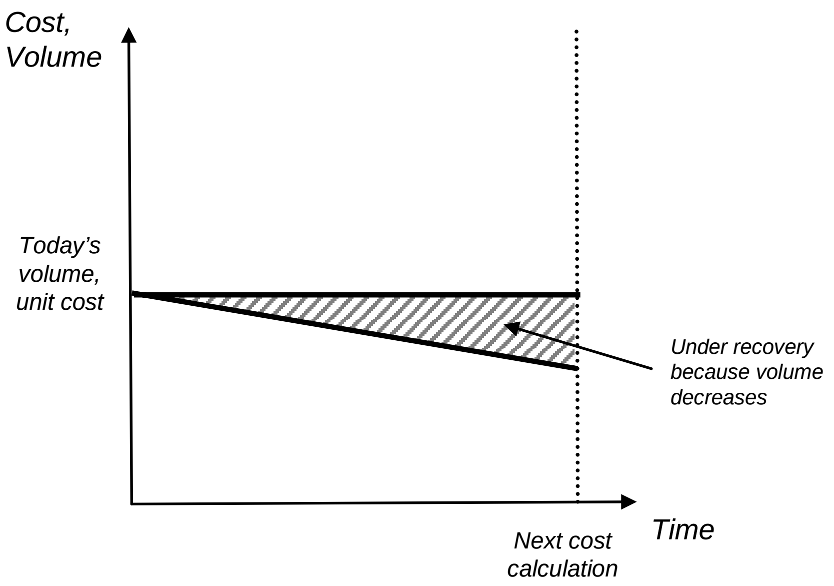
FIGURE 1: COST RECOVERY WITH INCREASING VOLUMES



Source: MJA

However, as stated above, Telstra now faces falling demand for its PSTN products. As a result, there is a negligible requirement to provide additional future capacity; demand over the next year will be less than it is today. This situation provides Telstra with less revenue than if volumes and prices were constant and there was an under-recovery of costs. This situation is depicted in Figure 2.

FIGURE 2: COST RECOVERY WITH DECLINING VOLUMES AND UNCHANGED UNIT COST



Source: MJA

However, under-recovery may be counteracted by increases in unit cost due to the decreases in demand and annualisation assumptions. When demand is falling, the network is dimensioned to cater for less demand. The result is to increase unit costs. In addition, the principles of economic depreciation indicate that an operator should be able to recover a larger share of the investment in the early years, if economic asset lives are reduced.

The principles behind this are as follows: if output is declining, assets need to be depreciated more rapidly where the cost is variable because another operator entering the market at a later date can provide the service with fewer fixed assets. This effectively means that the earlier operator needs to depreciate to take account of:

- wear and tear;
- price changes; and
- the need to recover the costs of the stranded assets.

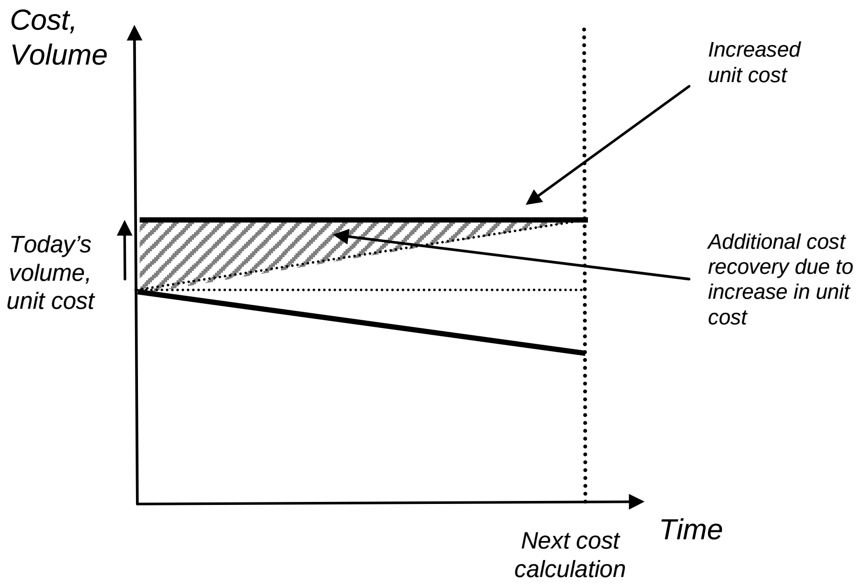
With declining demand, depreciation of network specific assets in the early years may therefore need to be increased. Estimating the amount depreciation needs to be increased by for each asset type, requires detailed consideration, based on:

- forecasts of the likely fall in volumes;
- the degree of variable costs as opposed to fixed costs; where costs are fixed, the depreciation profile is not affected by volume declines or increases (the price change per unit of output precisely offsets the volume change); and

- the consequent risk that assets may cease to generate revenue at an earlier date than would have otherwise been the case.

This issue does not arise when volumes are increasing, since if the network is expanding from year to year, there should be no risk of assets becoming stranded.[40] A more precise depiction of the cost recovery situation is shown in Figure 3. Compared with the situation in Figure 2, unit costs are increased and hence additional costs are recovered.

FIGURE 3: COST RECOVERY WITH DECLINING VOLUMES AND INCREASED UNIT COST



Source: MJA

Care should be exercised with any additional compensation through depreciation. Firstly, the cost model may have already sufficiently rewarded the operator for the risk of falling volumes in the cost of capital. In this case, allowing increased depreciation would amount to allowing Telstra to charge other operators twice for the same cost.

Secondly, although the network has less PSTN traffic, it is increasingly being filled with non-PSTN traffic. The majority of assets used for providing PSTN will also be used for non-PSTN services. So, although traffic may be decreasing for PSTN, the ability to generate revenue is preserved because of increasing demand for other services that use the same assets. The total net revenue effect may be zero (or even positive) and assets are not stranded because they are increasingly used to provide other services.

40 Assets may be 'stranded' for other reasons, including technological advances and mistakes in investment decisions.

In MJA's view, any requirement for additional compensation should be carefully considered; in our opinion it is unlikely to be appropriate.

3.3. Response to questions

Are Telstra's estimates of declining use of PSTN services appropriate?

Our review of the data cannot confirm the accuracy of Telstra's estimates. However, falling volumes should be expected. As indicated above, the net effect of falling volumes is likely to be slightly increased unit costs. Failure to take account of non-PSTN demand suggests that Telstra's cost estimates may be exaggerated and should probably be adjusted downwards.

Should alternative forecasts be used to calculate PSTN access charges?

Alternative forecasts are important from a modelling perspective. Running the model with different forecasts will test its ability to accurately adapt to different traffic forecasts.

The outcome of such an analysis is difficult to predict and will depend on the nature of alternative forecasts. Even if the model is populated with a forecast suggesting lower traffic than the base case scenario, this does not necessarily mean total costs will decrease. The network should, as a minimum, be dimensioned to cope with existing demand in a declining market. In addition, many telecommunication costs are invariant to changes in demand. An example is duct. The amount of duct required will not, on average, change if volumes decrease. A new operator entering the market in the future would most likely have to lay down exactly the same amount of duct in that year as the operator laying down duct today.

To what extent should the PSTN asset base be commensurably adjusted to reflect the lower traffic volumes being assumed?

As previously indicated, the PSTN asset base (i.e. the asset base that can be directly assigned to the PSTN services) should be adjusted to reflect changes in demand. TSLRIC modelling should be based on dimensioned demand, which is the maximum existing demand and forecast demand. If demand is declining, the asset base should be estimated on the existing demand. To dimension the network based on a forecast demand that is less than existing demand would result in a network that would unable to carry existing traffic.

What services should be included in estimating traffic volumes on the IEN?

The IEN, as defined by Telstra, includes the transmission network, which comprises the following network elements:

- RAU to LAS
- LAS to LAS
- LAS to TNS
- TNS to TNS.

In addition to traditional PSTN voice services, Telstra provides leased lines, data services and other services. All these services make use of these network elements. A TSLRIC model needs to account for all of these services. To exclude any of these services would result in an under-dimensioned network and increased costs for the remaining services because costs, such as ducts, would be allocated to fewer services. Therefore more services need to be modelled than the actual number of services costed on the basis of TSLRIC.

What costs and volumes will become relevant once core networks are fully upgraded to an IP basis and should these be taken into account in the pricing of future fixed access services?

It is difficult to predict the type of service that might be available in the future. The transition to a full NGN will ultimately mean the current system of interconnection arrangements will have to be renegotiated in a way that is beneficial to both the telecommunication industry as a whole and to end-users.

The first step in this process is to ensure that appropriate consideration is given to this issue in future cost modelling projects. The PIE II model does not currently cater for, or allow for, the inclusion of more advanced services in the costing. This is understandable given the out-dated technological solutions used in the model. The issue of IP and future fixed access services will be important for future modelling work, but cannot be incorporated within the current PIE II model. Any corrections for newer services would ultimately be ad hoc.

4. The "packaged" approach

Is it appropriate to set prices for PSTN OTA and LCS as a package as proposed by Telstra?

If so what are the likely benefits to the industry and the end-user?

What are the likely impact of the proposed charges on future VoIP prices?

4.1. Background

According to Telstra, the package consisting of PSTN OTA and LCS allows full cost recovery on a competitively neutral basis across both access seeker traffic and Telstra's own retail traffic and across all PSTN services.

Telstra argues that it is not possible to assess the proposed price for LCS in isolation from the proposed prices for PSTN OTA, as the two are dependent on each other. According to Telstra, if it were determined that the LCS rate should be lower than proposed by Telstra, then the PSTN OTA rates would need to increase to ensure full cost recovery on a competitively neutral basis across all services, and vice versa.

4.2. Response to questions

Is it appropriate to set prices for PSTN OTA and LCS as a package as proposed by Telstra? If so what are the likely benefits to the industry and the end-user?

Assume all of Telstra's services were set with reference to a TSLRIC model. Any reduction in the cost of one service without any compensation in others would result in under recovery of the total TSLRIC costs. If the purpose of regulation is to ensure full cost recovery of the TSLRIC of all services we would therefore need to adjust the cost of other services. However, the main purpose of TSLRIC is not to ensure full cost recovery across all services. The main purpose of the TSLRIC methodology is to assess the efficient cost level for individual services to ensure appropriate and efficient price signals are sent to the market. To adjust the cost of individual services away from TSLRIC would result in a lost clarity of cost.

Any adjustment is also complicated by the need to resolve how to make a compensating correction to other services (regardless of whether all or a subset of services are regulated). Does one service bear all the additional costs or are they distributed evenly across all remaining services? Based on economic principles we might even consider an allocation based on Ramsey pricing.

In reality not all of Telstra's services are regulated and costs calculated with reference to a TSLRIC model. In addition, the PSTN OTA and LCS prices are determined using different methodologies. PSTN OTA prices are determined using a cost based approach, while the LCS price is determined using retail minus.

Let us assume that the PSTN OTA is set at efficient level TSLRIC levels. If it were determined that the LCS charge should be lower because the retail costs where assessed to be higher this would not necessarily mean that Telstra would under recover efficient costs. The implicit wholesale cost estimate based on retail-minus does not necessarily reflect efficient forward-looking costs. On the contrary, it would be highly unlikely that this would be the case. To reduce the LCS would therefore not automatically imply that an adjustment should be made to the PSTN OTA charges – indeed no adjustment should be made when they are set with reference to TSLRIC. An increase in PSTN OTA would also imply that Telstra would over-recover the forward-looking efficient costs of that service.

Now let us assume that the PSTN OTA charge is set with reference to the PIE II model. As we have discussed elsewhere in the paper, we do not believe the cost estimates provided by the PIE II model are reflective of forward-looking efficient costs. Indeed we believe the outputs of the PIE II model are likely above what would be regarded as efficient. A downward adjustment of PSTN OTA would simply result in a transfer of inefficiency from one service to another. The same result would apply had we adjusted the PSTN OTA charge based on a change in the cost of LCS.

In MJA's opinion the packaged based approach is inappropriate and inconsistent with TSLRIC principles. In addition it results in discriminatory (and potentially arbitrary) adjustments to service costs that are sold in different markets. Access seekers can buy PSTN OTA and LCS services separately of Telstra. Given these two services are inputs to downstream retail services that are often in different retail markets, there should be no obligation on the access seeker to buy the services as a bundle or package. Indeed, for Telstra to tie these two services as a package would be unlikely to promote competition in such downstream markets because there is no alignment with TSLRIC principles.

What is the likely impact of the proposed charges on future VoIP prices?

MJA appreciate the desire to look forward and understand how a decision in one service market might affect other in the future. However, at this stage we are not able to comment comprehensively on the likely impact of future VoIP services that are still in their infancy. Nevertheless, to the extent that services within this undertaking are defined so broadly as to also include VoIP, then clearly any determination will have an impact on VoIP prices.

An issue that most likely will arise, if no comprehensive cost modelling is carried out to deal with existing and future services both in the core and access network, is how to allocate costs between the different services using the network. Of particular importance is to understand the nature of service specific costs, i.e. costs that can be directly and unambiguously related to a specific service. Without a more detailed and coherent cost modelling framework with which to evaluate the cost allocated to each service, any claims or otherwise of specific allocations will be subject to considerable dispute as has already been witnessed for the line sharing service offered by Telstra. Again, as has been noted elsewhere in this report, MJA is of the view that Telstra's Undertaking has not adequately supported or justified the charges sought.

5. Extent of averaging and de-averaging

Is it appropriate that Telstra set access charges on the basis of a partial de-averaged approach?

What is the implication of such an approach on LTIE objectives of promoting competition and sending appropriate price signals for the efficient use and investment in existing and new networks?

5.1. Background

The PSTN OTA charges in the Undertaking are structured so that only half of the contribution to the total recoverable IEN cost pool is by de-averaged (per minute/call) charges. Previously, all of these costs were recovered on a de-averaged basis.

Telstra argue that partial deaveraging of the rates is needed to reduce the per minute price in rural areas.

For PSTN TA and PSTN non-preselect OA, partial de-averaging is done by allocating half the cost to all four costing bands and deriving an average cost for all bands. The other half of the cost is recovered as geographically de-averaged costs in each band.

For the PSTN preselect OA service, Telstra proposes a geographically averaged, fixed per customer fee of $1.44 per month to meet 50 per cent of this group's contribution to the IEN cost pool. The per minute component charge is then de-averaged across the four costing bands.

5.2. Response to questions

Is it appropriate that Telstra set access charges on the basis of a partial de-averaged approach?

Access charges should be cost-based. This means that prices should reflect the value of the resources used in the production of the service. De-averaging is essentially a way of following this principle and about creating the right incentive for operators to make efficient build/buy decisions. For example:

- *Incentive to buy*: Encourage the use of existing facilities of the incumbent operator where this is economically desirable, avoiding inefficient duplication of infrastructure costs by new entrants.
- *Incentive to build*: Encourage investment in new facilities where this is economically justified by:

– new entrants investing in competing infrastructure
– the incumbent upgrading and expanding their network.

When access charges are based on forward-looking economic costs (such as the TSLRIC standard) they do not distort the build/buy decision of entrants. Entrants are encouraged to use existing facilities if, and only if, it is economically desirable. Further, cost-based access charges will also retain investment incentives for incumbents to upgrade or extend the existing network when new technology is available.

When charges are based on TSLRIC, facilities-based competition is encouraged in areas where it is efficient to have competing infrastructure; service-based competition is encouraged in areas where the investment in competing infrastructure is not efficient.[41]

TSLRIC does not in itself provide guidance on the degree of de-averaging. TSLRIC does, however, adopt the notion of cost-based pricing.

Costs for core network services differ depending on how the network is used, which is defined by the routing factors for the specific services under consideration. In theory, every call uses the network differently and incurs a unique cost. Even repeat calls may be routed differently, depending on the capacity of different network elements at any particular point in time. However, in practice, average routing factors are defined and used to characterise certain call types and how they use the network.

For an access service, a call is established between the Point of Interconnect (PoI) and the receiving party in the incumbent network. In all cases, the connection between the interconnected networks may be set up on different network levels and in different geographic regions. The extent of the service required from the access seeker depends on the geographical location and type of network elements the access provider needs to 'produce' to convey the service between the calling or called subscriber and the PoI.

It is widely accepted that there should be a correlation between charges for access services and the network elements used. The element-based approach adopted in the PIE II model ensures that the level of charges rises with network use. This means the incentives for access seekers to build their own core network infrastructure is not

[41] In essence TSLRIC provides a solution to two, often polarised, views of regulation by incumbents and new entrants. Incumbents will argue for infrastructure competition and a hands-off approach to regulation. Clearly, infrastructure competition alone is not enough. Given economies of scale in telecommunications, pure infrastructure competition will tend towards an oligopoly. Competition, which is based purely on an oligopoly of vertically integrated operators, will not offer the same benefits of service and price innovation as a market that allows access to service providers with limited or no infrastructure. Entrants argue that service competition should be promoted. Equally, service competition alone is not enough. Without effective infrastructure competition, incumbent operators retain a monopoly on large parts of the market. The incentives on them for greater efficiency and technology innovation are often weak and extensive regulation is required in the long-term, which may jeopardise investment incentives.

distorted. Building their own network structures enables access seekers to scale back access charges by providing services themselves and by reducing their reliance on the access provider's network. However, should the element-based approach take account of geographical differences?

From the perspective of estimating costs, the geographically de-averaged approach should be preferred as it ensures a more accurate cost reflectivity. The key issue is whether averaging these costs in pricing will cause distortions in the market (build/buy signals) and therefore encourage inefficient arbitrage and investment.

In most countries, and in particular across Europe, the effect of distance and geographical characteristics on conveyance costs is weighted less heavily than the number of network elements (exchanges and transmission paths) used. However, Australia is unique in its geography and has markedly different costs and distances than most countries. This is evidenced by the output of the PIE II model.[42] In tis situation, distortions are expected when prices are not de-averaged.

By partial de-averaging, Telstra are biasing the investment incentives for access seekers to build more in urban areas and less in rural areas.

With only partial de-averaging, the access price is below efficient, forward-looking costs. Access seekers are therefore inclined to rely on access provided by Telstra. Partial de-averaging discourages investment that would allow for more efficient supply of services in rural areas.

On the other hand, with partial de-averaging, prices in urban areas are above efficient, forward-looking costs. Access seekers may be more inclined to invest in their own network infrastructure in urban areas even though, from society's point of view, it is more efficient to use the Telstra network.

From Telstra's perspective, a partially de-averaged approach may also provide disincentives to roll-out or upgrade in certain areas of the network.

Although we believe de-averaging is important and should be promoted, MJA notes that the case for de-averaging is less clear for core network services than access services. Nevertheless, access charges should be set to encourage efficient entry and exit decisions and to enable more efficient providers to attract and retain customers from less efficient providers. The more access charges are averaged, the greater the prospect of inefficient market outcomes.

42 Note that MJA has reservations about the model being an accurate reflection of transmission costs and suspect these costs may be exaggerated.

What is the implication of such an approach on LTIE objectives of promoting competition and sending appropriate price signals for the efficient use and investment in existing and new networks?

As discussed, partial de-averaging sends signals to market participants that bias investment incentives and may result in inefficient market entry in some parts of the market. Such conditions create market distortions, and reduce productivity, and reduce dynamic efficiency.

Productive inefficiency results because the total cost (to society) is driven up by inefficient entrants who displace more efficient production of the incumbent. When inefficient entrants out-compete the incumbent on the basis of an artificial cost advantage, the normal competitive process is damaged and the ability of the market process to 'discover' and reward more efficient firms is compromised. This leads to dynamic efficiency losses in the long run.

The LTIE will not be served if the access price is not set at the dynamically efficient level. A de-averaged access price is needed to create appropriate incentives for access seekers to choose to build infrastructure, rather than compete through resale. This promotes competition and encourages economically efficient investment by both the access provider and the access seeker.

6. Flagfall and per minute allocations

Is Telstra's proposed pricing structure with respect to its flagfall and per minute charge elements appropriate?

6.1. Background

The PSTN OTA charges in the Undertaking are structured so that 20% of the total revenue raised by the charges comes from a flagfall element and 80% from a per minute charge.

Telstra states that this allocation was chosen for a two of reasons. Firstly, it was chosen to ensure that access seekers requiring services with higher than average call times, are not disadvantaged relative to access seekers with lower than average call times. Secondly, a 20:80 revenue split accords with Telstra's retail pricing structure of PSTN services, with revenues raised from fixed line rental charges, compared with variable time-based charges.

6.2. Response to the question

Is Telstra's proposed pricing structure with respect to its flagfall and per minute charge elements appropriate?

As discussed in section 2.2.3, prices should reflect the underlying cost drivers. The process of setting up a call has cost drivers that differ from (and may be separated out from) the duration of the call. As such, MJA believes it is appropriate to split prices in a flagfall element and a per minute duration related element.

To examine the appropriateness of Telstra's price structure we suggest the cost allocations between call set-up and call duration in the PIE II model be re-examined to ensure they reflect the underlying cost drivers.

7. PSTN OA Two-Part Tariff

Will end-users benefit from the proposed PSTN OA two-part tariffs?

What would the impact be on access seekers?

Is a fixed monthly charge per customer on PSTN OA consistent with existing retail prices?

Is Telstra 50:50 allocation of fixed charges versus minute charges for preselected PSTN OA reasonable? If not, why not?

Are there any issues associated with charging different access prices for preselected PSTN OA versus PSTN OT and non-preselected PSTN OA?

Is the two-part tariff based on Ramsey pricing principles designed to maximise efficient outcomes?

7.1. Background

Telstra has proposed a two-part tariff on PSTN OA where that traffic belongs to the same access seeker that is the pre-selected carrier. The PSTN OA Undertaking proposes:

- A \$1.44 and \$1.48 monthly charge for each customer for 2006/07 and 2007/08 respectively; and
- A headline rate of \$0.0119 per minute and \$0.0124 per minute for 2006/07 and 2007/08 respectively.

In determining the allocation between the fixed monthly charge and the per minute charge, Telstra allocates these charges on a 50:50 basis. By contrast for PSTN TA and non-preselected PSTN OA Telstra proposes a headline rate of \$0.0218 per minute and \$0.0228 per minute for 2006/07 and 2007/08 respectively, which is double the rates of originating access charges which incorporate a fixed charge.

Telstra submits that implementation of a two-part tariff structure where appropriate will improve efficiency. It argues that the efficiency benefits of a two-part tariff are the result of lowering the variable component of the price toward variable costs encourages more efficient use of the PSTN.

7.2. Response to questions

Will end-users benefit from the proposed PSTN OA two-part tariffs? What would the impact be on access seekers? Is a fixed monthly charge per customer on PSTN OA consistent with existing retail prices?

The origination service carries a call from the A-party to the Point of Interconnect (PoI), and the termination service carries the call from the PoI to the B-party.

Hence in all three cases the service provided is a call service. As we have argued elsewhere in this paper, the conventional approach is to recover a call related cost on a per call and minute basis as this reflects the major cost driver of the core network – traffic. There are typically no directly subscriber related wholesale costs in the core network.[43] Subscriber related wholesale costs are found in the access part of the network.

The main driver (apart from distance) in the core network is traffic, hence it is appropriate to seek to recover the cost of the core network through traffic related charges.

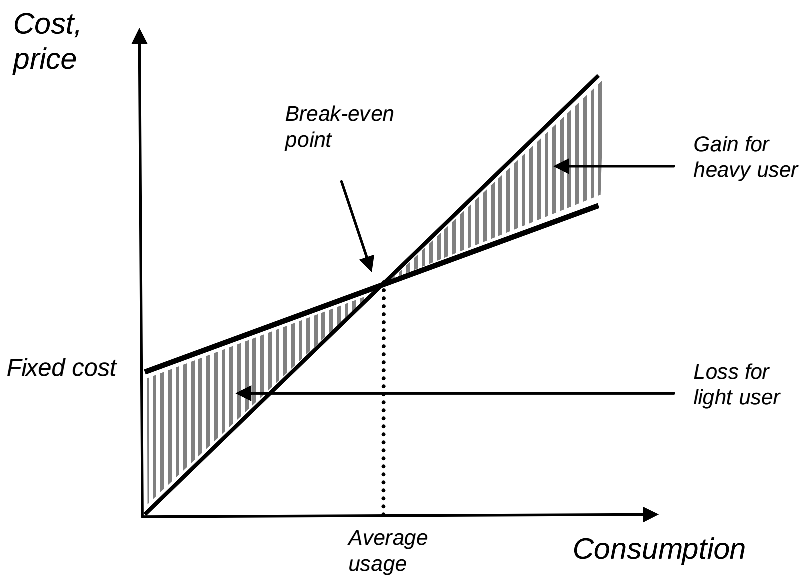
With Telstra's suggested tariff structure some of the traffic related costs will be recovered as fixed monthly customer related fee. Such a fee is not consistent with existing retail prices which are recovered on a per call basis or with the main cost driver as discussed above.

For access seekers the impact, should they choose not change their retail charge structures, will depend on the traffic flows of their subscriber base. A customer with high traffic levels will be become more profitable, while one with low levels will become less. Those access seekers that choose to align their tariffs with the Telstra's suggested tariffs will eliminate this uncertainty in their revenue stream.

The impact on end-users is illustrated in Figure 4 below.

43 Except for the line card that is found in the exchange but is typically allocated to the access increment or network.

FIGURE 4: IMPACT ON END-USERS OF TWO PART TARIFF



Source: MJA

In MJA's view, it is generally inappropriate and potentially inefficient to dictate a charging principle that is not aligned with the major cost driver for wholesale services

For economic efficiency to be achieved, prices should be cost based. Otherwise, consumers will either underestimate or overestimate the true costs to society when deciding on the number and duration of the calls they make. The most efficient structure of prices depends critically on a detailed understanding of network capacity constraints, the costs of network capacity expansion and the responsiveness of end-users to changes in these charges.[44] Clearly, if a pricing structure results in better utilisation and welfare enhancing increases in traffic levels between networks then it is worth pursuing.

In MJA's view, prices for wholesale services like the pre-select PSTN OA should be offered using a default charging structure that reflects the underlying cost driver, i.e. traffic. If access seekers wish to depart from this charge structure and offer a two-part tariff, they can already do so. Using knowledge of their customer base, access seekers

[44] A similar example relates to peak load pricing. Capacity can be utilised more efficiently if demand is spread more evenly over the day, which is encouraged by higher prices at times of peak demand and lower prices at times of off-peak demand. When interconnection charges are set on a per minute basis, it would be desirable for them to differ by time of day if retail prices do so. If a uniform price were applied throughout the day, the interconnect charge signals faced by interconnecting operators would encourage them to set retail prices that are lower than incumbent prices at peak times and higher than incumbent prices at off-peak times. Thereby, the time of day profile of demand would be made even more "peaky" - the opposite of the desired outcome. In other words, an interconnect regime without a time gradient would in this case encourage inefficient use of the network with too much demand at peak times, leaving capacity under-utilised at off-peak times.

may engage in various forms of price discrimination including but not limited to two-part pricing.

The access seeker may regard the price of pre-select PSTN OA as an "outsourced" production cost. This cost of production is added to retail costs and should be recovered from end-users in a manner that is most beneficial for the access seeker.

Although we acknowledge that Telstra is proposing a charge structure that it believes is more efficient, we believe additional analysis is required before departing fully from the basic cost driver allocation and pricing (although as stated above traffic is not the only cost driver for core network services).[45] However, there would appear to be merit in having additional options for access seekers to specify how production costs are incurred. This would particularly be the case when the wholesale tariff structure is simply rolled into the retail tariff structure. By having additional options, (pre-select) access seekers are provided with greater flexibility. This may encourage development of new and innovative retail tariff schemes.

Is Telstra 50:50 allocation of fixed charges versus minute charges for preselected PSTN OA reasonable? If not, why not?

As discussed above there is no motivation from a cost driver perspective to allocate any costs to a fixed charged component. Any allocation to a fixed charged component would therefore appear to be wholly arbitrary.

Are there any issues associated with charging different access prices for preselected PSTN OA versus PSTN OT and non-preselected PSTN OA?

In MJA's view, the general principle should be that the same charge should be levied for origination and termination services. This is common practice and reflects the fact that the cost structures of origination and termination are usually symmetrical. However, there may be cases where number analysis or number portability mean that either termination or origination may be higher (depending on whether these services are carried out by access seeker or access provider). As such there may be slight difference in cost between the three services.

We have dealt with the two-part tariff structure above.

45 Even if the access seeker was reluctant to convert to the variable wholesale component to a partially fixed component, it would still be the possible to recover retail costs as a fixed charge.

Is the two-part tariff based on Ramsey pricing principles designed to maximise efficient outcomes?

According to standard textbook economic theory, prices should be set at marginal cost since, in the absence of externalities, this maximises economic welfare. This is because such prices reflect the costs involved in providing an additional amount of output. Where the user values an extra unit more than it would cost to produce it, it is economically efficient to produce that unit, and vice versa. Setting prices equal to marginal cost means that users will continue purchasing extra units until it is no longer economically efficient to produce them at that price. Marginal cost based pricing therefore sends signals to consumers and producers encouraging them to balance the benefits obtained by consuming a good or service with the costs of providing it. To set the regulated price equal to marginal cost is known as the *first-best solution.*

The problem with this first-best solution, when dealing with network industries, is that it does not allow the recovery of fixed costs. No standalone utility could invest in infrastructure if prices were set equal to marginal cost, unless compensated in some way. Demand-side efficiency would be achieved at the expense of supply-side efficiency.

Coase's solution[46] to the competing needs of demand-side efficiency and supply-side efficiency was the introduction of a two-part tariff. Incremental consumption is priced at marginal cost but the fixed charge is set so that total revenue covers total costs

In the Australian water industry, two-part tariff structures are widely applied. They can be described by the following revenue requirement:

$$\textit{Revenue from annual charges} \quad = \sum_{i=1}^{N}(A_i + C_i \times Q_i)$$

The first part of the tariff recovers the fixed portions (i.e., the connection and the access charges, denoted *A*) of the utility's annual costs. The second part recovers the variable, or marginal, costs of the operation by way of a volumetric charge (denoted *C*) multiplied by the quantity demanded (*Q*).[47]

In telecommunications TSLRIC is used instead. TSLRIC is relevant for entry decisions, while marginal cost is relevant for decisions to expand output.[48] As opposed to marginal

46 Coase R. (1946). *The Marginal Cost Controversy,* Economica, 13 (8), 169-89.

47 The variable component is commonly estimated with reference to Long Run Marginal Costs (LRMC).

48 See for example, Ingo Vogelsang, undated, *Price Regulation of Access to Telecommunications Networks.* Available at [viewed 20 June 2006]:
http://www.purc.org/documents/VogelsangonInterconnectionPricing.pdf

cost, TSLRIC accounts for scale economies by using the additional ("incremental") cost incurred by the operator in providing the entire service or increment when all other services or increments are maintained at an unchanged level (divided by the number of units of the service produced). Thereby fixed costs are included. For interconnection all the relevant incremental costs associated with delivering the interconnection service are added up and averaged out over the total amount of traffic/call minutes generated by the operators seeking interconnection as well as the operator providing interconnection. Common and joint costs are added to TSLRIC to ensure cost recovery and supply side efficiency.

The two-part tariff enables a decomposition of the traffic related component, into a fixed and variable (traffic) related part. The link between Ramsey and the two-part tariff is found by considering the elasticities of the different components of this tariff structure. If end-users are relatively inelastic to paying a fixed amount, it may be that welfare is improved by lowering the cost of the traffic component (bringing it closer to marginal cost).

As noted above Telstra has chosen a seemingly arbitrary allocation between the fixed and variable component. As an alternative, one could argue that only the common and joint cost should be allocated to the fixed tariff component (again depending on elasticities). Such an option is not discussed by Telstra. We suggest more analysis is needed to find the optimal balance between any fixed and variable component, if this is deemed an appropriate pricing principle to pursue. And in doing so it should be ensured that any two-part tariff arrangement or non-linear price schedule does not distort competition in downstream markets.

8. Retail Minus Retail Cost for LCS

Is the RMRC pricing principle an appropriate basis for setting the LCS undertaking charge?

Is an alternative cost-based approach viable for setting charges for the undertaking period?

Is Telstra's application of the RMRC pricing principle and its use of regulatory account data appropriate?

8.1. Background

The proposed LCS charge in the Undertaking is based on the application of a Retail Minus Retail Cost (RMRC) pricing principle where the starting point is Telstra's unbundled local call price for non-preselected end-users.

Telstra states that its estimate of retail costs, or the local call and basic access costs it avoids in supplying the LCS to wholesale customers, is based on an approach consistent with the ACCC's previous views on pricing methodology.

The ACCC's most recent draft determination on LCS pricing has provisionally recommended the continuation of an RMRC pricing principle, albeit as an interim approach in the absence of a cost model (other than PIE II) suitable for determining a TSLRIC-based price for the LCS. The ACCC observed that the conclusions underlying the continued use of RMRC as an interim approach are finely balanced, and heavily dependent on the relativity between retail prices and costs.

8.2. Response to questions

Is the RMRC pricing principle an appropriate basis for setting the LCS undertaking charge?

The RMRC approach is an appropriate regulatory response where markets are relatively new and are competitive or moving towards a competitive structure. In these circumstances, a cost based approach may be considered a disproportionate response to the degree of market power being exercised.

There are several problems and difficulties with the current RMRC approach.

Firstly, it is necessary to define a starting point retail tariff. In this case it is Telstra's unbundled local call price of 22 cents per call (or 20 cents per call excluding the GST) for non-preselected end-users. It is unclear to us that this starting point is "optimal" and hence appropriate. If for example, the unbundled local call price is set too high, the access seeker will face a very high LCS price. A price that may be higher than the stand-alone costs of providing the service. Then, in theory, it would be profitable for the access seeker to by-pass Telstra's infrastructure, even though the cost of doing so would be substantially higher than the cost Telstra faces. All other things equal, ignoring the indirect benefits of entry, society loses.

MJA understands from discussions with the CCC that the "effective" LCS charge averaged across both bundled and unbundled plans is substantially below the unbundled price of 22 cents making it difficult to provide a standalone (unbundled) profit making LCS services in some customer segments. This potential price squeeze problem is a key weakness of the current methodology and needs careful and ongoing monitoring.

Secondly, the RMRC approach implicitly implies that competitors will be paying for any cost inefficiency Telstra may have and it offers limited incentive for Telstra to eliminate any wholesale inefficiency.

Thirdly, the basis for the RMRC approach is the estimate of a retail cost. While these costs are fairly easy to identify, they fall in the same category as overhead costs and common costs. These cost types are difficult to separate out and allocate between services without relying on more or less arbitrary measures. Hence deciding upon the specific amount of retail cost to be related to the LCS is difficult and ultimately a subjective task.

Fourthly, with the current methodology employed by Telstra, the price of the PSTN OTA increases, while the price of LCS decreases. This development is inconsistent with the underlying developments in demand.

We would recommend the ACCC move to a cost based approach ensuring consistency across the treatment of related services. That is, the wholesale price of the LCS should be charged on the same basis as interconnection rates for wholesale PSTN OTA charges, reflecting the recovery of the cost of infrastructure and systems necessary to deliver the service to the particular access seeker. Such an approach is particularly appealing with a cost model already in place, although we understand the ACCC's reluctance to rely on the PIE II model. The cost based approach would provide an estimate as a combination of call and duration related costs. This would have to be converted to a per call basis.

Is an alternative cost-based approach viable for setting charges for the undertaking period?

Without the option of using the PIE II model or NERA model for setting charges for the undertaking period, there would only appear to be one viable option, i.e. to create a new cost model. A "cost"-based approach like benchmarking, would in our opinion constitute a retrograde step and be inappropriate for setting charges.

Is Telstra's application of the RMRC pricing principle and its use of regulatory account data appropriate?

We are not able to evaluate whether the information provided in the regulatory accounts is appropriate to assist in applying the RMC principle. We note, however, that most retail costs are operating costs hence it would be reasonable to use actual figures from the regulatory accounts as the starting point.

To allocate these between different services according to cost causation is likely to be a difficult task. Retail costs will often be shared between many services. Sales and marketing costs for example are related to the entire portfolio of retail products offered including both subscription service, traffic and more advanced services. Without specific recording of time and cost against specific services, activity based accounts allocation of retail costs to specific services is likely to follow fairly arbitrary rules. In essence, retail costs may from a cost allocation perspective, be regarded much like a common business costs or overhead costs, where allocations typically follow different mark-up regimes because of inability to allocate these to specific events or services.

In our view, a comprehensive list of cost items would need to be mapped out and an allocation for each determined. To our knowledge this has not been done.