Peer review of GQ-AAS model of transmission capacity services

A REPORT PREPARED FOR THE ACCC

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Contents

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1 Introduction

Frontier Economics (Frontier) has been engaged by the ACCC to undertake a review of aspects of the transmission cost model prepared for the ACCC by Gibson Quai-AAS Pty Ltd (GQ-AAS). Frontier has undertaken this review with the assistance of Consultel IT&T on certain technical matters.

The purpose of this review is to provide advice to the ACCC on whether the GQ-AAS model is appropriately specified and constructed to estimate the TLSRIC of providing transmission capacity services between capital-regional locations in Australia.

Specifically, the ACCC requested that Frontier provide advice on:

- the extent to which the model accurately describes a 'best-in-use' optical fibre transmission network;
- whether the linkages and formulas contained in the model accurately calculate model outputs; and
- whether the model captures the effects of 'economies of scale' inherent in providing different transmission capacity rates (as measured by bandwidth), and if not, how could the model be adjusted to reflect these effects.

In the remainder of this report, we discuss and provide comments on these issues.

2 Model structure

2.1 INTRODUCTION

GQ-AAS note that its model is intended to be based on Telstra's network, as the Telstra transmission network is considered to "have the scale required for the purpose of Access Seekers requiring transmission capacity to a broad range of sites." The model uses a mix of technologies to determine the 'best in use' configuration of Telstra's network (e.g. SDH and WDM equipment).

The model estimates the TSLRIC of particular transmission routes. Four types of route are catered for in the model designs:

- Link transmission capacity;
- Inter-exchange transmission capacity;
- Tail transmission capacity; and
- Undersea cable transmission capacity.

Further explanation of these types of routes is provided in the GQ-AAS 'Description of Operation' manual accompanying the spreadsheet model.

Further discussions with the ACCC suggested that a key issue with respect to the structure of the model was whether the services modelled by GQ-AAS accurately reflects the way in which routes would be operated on Telstra's network.

At a broad level, our view is that the models put forward are likely to follow current Telstra practice, and are an appropriate starting point for analysis of specific transmission routes. However, to test the model in greater depth, a 'real life' fact collection exercise is likely to be required. Some of the issues that were raised in submissions, or identified by us, suggest that the TSLRIC estimates produced by the model may not be accurate – but it is difficult to determine whether these issues are likely to cause *material* estimation errors.

Our review of the model and accompanying submissions to the ACCC has raised the following specific issues with the model:

- the modelling of routes as rings rather than point-to-point routes;
- the approach to infrastructure sharing, for example, whether it could accurately estimate costs where main route and backup route have different sharing, utilisation assumptions, contention, etc.;
- the model's derivation of (unit) TSLRIC estimates based on service capacity rather than service demand;
- the use of optical fibre systems as opposed to microwave;
- the ability of the model to estimate the costs of transmission capacity between mobile networks and Telstra's transmission network.

We provide comments on each of these issues below.

2.2 RINGS OR POINT-TO-POINT ROUTES

The GQ-AAS model is based on a network architecture that includes the arrangement of optical fibre routes as sequential rings of optical fibre cable linking exchanges and the deployment of transmission technologies located at exchange sites to complete the transmission capability.

Our view is that the ring model as presented is appropriate in the circumstances where there is:

1. a clear primary path;
2. a clear secondary path for redundancy;
3. no contention in either path;
4. the same level of sharing in both paths; and
5. the paths are approximately the same length.

These conditions would be likely to apply only in some circumstances. In most networks, there are multiple paths that may appear to be ring models but in reality are a series of point-to-point links with different dimensions for each. The following is an example of a link from Perth to the North West Shelf near Karratha.

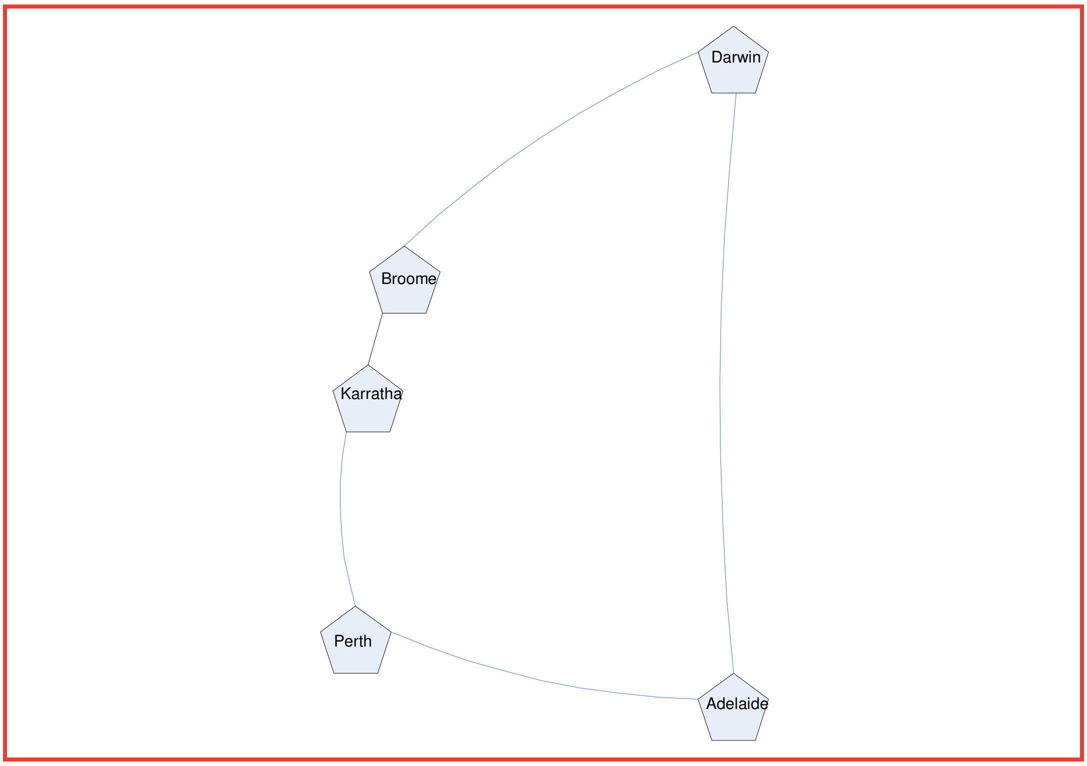

Figure 1: Illustration – ring topology and point-to-point links

In this (perhaps extreme) illustrative example, the link from Perth to Karratha has a return path via Darwin and Adelaide. To price the Perth to Karratha link on the basis of the complete cost of the loop could result in extremely high prices, relative to the cost of a point-to-point link. On this same basis, the model appears to cost the same amount for any two points on the loop whether it is Perth to Darwin or Karratha to Broome.

In such circumstances, the cost of offering a guaranteed redundant path would be very high and, in reality, the access seeker would probably seek to get around such problems by purchasing lower quality redundancy. Often there is contention, so that should there be a break in the primary link, the full bandwidth may not be offered in the disaster recovery mode. That could be reflected in a costing model by discounting the costs attributed to the return path.

This point links to Telstra's submission (p. 8) which notes issues with the ring model to do with cost allocation between longer and shorter paths. Telstra indicates that its commercial practice is to address the issue above by adopting radial distance pricing. Rather than pricing the route based on the costs of the entire ring, we understand that Telstra effectively segments the ring to recover more of the costs on the primary path and less on the (shared) return path. Telstra suggests that the model should allow cost allocation of the ring to reflect the ability of competitors to bypass the larger ring with a point-to-point route. That would require cost allocations that differentiated between shorter and longer routes within the ring.

Optus raises certain issues with the ring topology; in particular, that it believes the majority of current network transmission architecture is best conceived as being physical point-to-point structures rather than ring topologies. Optus also states that ring topologies are not appropriate for high density routes (p. 8). It is not clear to what extent these criticisms are valid. The model is only likely to apply to relatively 'thin' metro-regional or regional-regional routes, as most (or all) high density routes are not declared.

We conclude that while the ring structure of the model is basically appropriate, further granularity in the model structure would be required to address the issues raised above (including enabling the rings to be broken up into segments with different characteristics for primary and return paths). Where there are pure ring environments, all parameters could be maintained consistently. In scenarios where there is variation, the ring segments should have varying parameters to reflect this, e.g. to reflect different levels of sharing or service quality, or, if it is desired to estimate the cost of a pure point-to-point links, one leg could have no infrastructure resulting in just half a ring.

Our review of the model suggests that adapting the model structure to reflect these considerations would not be straightforward. We therefore recommend that before prior to engaging in significant redesign of the model, it would be useful to further understand the materiality of the problems we identify in an actual situation. We comment on the need for this fact collection exercise in relation to other aspects of the model in the following sections.

2.3 DEMAND- OR CAPACITY-BASED ESTIMATES

The TSLRIC model has a couple of features that could be considered unusual. One is that unit costs in the model appear to be derived by costing the access seeker's demand against total system capacity, not total system demand. A second feature is that the model contains no explicit rules for deriving the efficient amount of capacity, given a set of demand estimates. This is assumed to be done 'off-line', perhaps by using the generic demand estimates sheet as a basis for determining efficient capacity. We discuss the issues with that approach in the following section.

On its face, a capacity-based approach to deriving unit costs seems likely to favour access seekers. This is because capacity is likely to run ahead (and perhaps well ahead) of current demand. Telstra, in particular, is critical of that costing approach:

> "The model calculates capacity-based average costs rather than demand-based average costs. That is, total costs are divided by the amount of capacity assumed to exist in the transmission network, rather than the actual or forecast demand for transmission services. The effect of capacity-based average cost pricing is to allocate only a small fraction of transmission costs to the actual or forecast users of transmission services…Given the lumpy nature of investment in transmission networks, capacity could be well in excess of demand meaning capacity-based pricing will result in an under-recovery of costs."

Having said that, for reasons we shall explain, these comments do not appear to take into account important adjustments within the model that implicitly reflect demand for the particular service.

It is useful to assess the use of capacity- or demand- based estimates within the context of how the costing model fits in the determination of transmission prices. Figure 2 contains an extract from the ACCC's transmission pricing principles on the methodology it will employ to determine transmission prices.

6.1. TSLRIC procedures

The procedures the Commission is likely to follow to determine transmission prices are:

1. Specification of the relevant market, service or route into which the transmission element falls (e.g. regional-regional, CBD tails, Melbourne-Morwell) reflecting common functional or volume characteristics, etc.;
2. Identification of the commercially available efficient technology for providing the transmission capacity for that element for the current volume of demand, making a 'scorched node' approach[29] to the link concerned and all related links or services. Given the declared services are by definition not competitive, it can be assumed that

this will provide an estimate of the efficient costs for Telstra (as the integrated incumbent), thereby capturing its economies of scale and scope;

3. Make an allowance for efficient excess capacity for the level of existing demand (i.e. that for managing faults, or unexpected fluctuations in traffic volumes) reflecting industry norms or best practice;

4. Specify the aggregate equipment and its costs required to provide the volume of demand and efficient excess capacity specified in point 3 above. In the case of fibre capacity this is likely to include cable, trenching, switching costs including installation costs and associated efficient operating and maintenance costs;

5. Make adjustments for any equipment and maintenance costs that are shared with other services (e.g. the CAN, other transmission links or services) using an appropriate cost allocator. These need to reflect efficient practices and could require volume estimates for the other services to serve as allocators in many cases. It is noted that trench sharing factors may be able to be derived from previous PSTN modelling in certain instances;

6. Estimating TSLRIC+ implies the inclusion of common costs, such as a contribution to non-network costs (e.g. corporate overheads). These costs are likely to be imputed as a percentage of capital and operating costs. Proxy percentages for these costs could be taken from the percentages for modelling of PSTN origination or termination;

7. Annualise capital costs taking into account asset lives and add a cost of capital component. The Commission's preliminary view is that a suitable cost of capital would be that calculated for Telstra's PSTN;[30] and

8. Derive a unit price by dividing by the volume applicable to the service concerned (e.g. the number of 2 Mb/s links, number of leased lines, etc.).

Figure 2: Extract from ACCC's Transmission Pricing Principles, 2004

We read principles two and three as suggesting that the ACCC expects to use estimates of demand to determine the efficient capacity required to serve a specified route. The GQ-AAS model appears to be designed to assist with the first of those functions:

> "The 'Transmission Demand Estimates' sheet is designed to inform the model user about the capacity that would typically be required to service the needs of all customers of the telecommunications network operator in a CCA. Knowing the total capacity required by a CCA and adjacent CCA's to service all of the transmission capacity needs of these areas allows rational decisions to be made about an 'efficient' design to cater for the needs."

The eighth point is somewhat ambiguous, as it could be read to refer to estimates of either demand or capacity.

In any event, and as we noted above, the model does not only use capacity factors to derive unit costs and prices. Estimates based on total capacity of the system are scaled by utilisation factors. These factors appear to have two functions:

- to reflect the maximum efficient 'technical' usage of the systems on the route (set to 75%); and
- to reflect the 'typical' usage of certain network elements or support services (it is unclear how these have been set, but these are all able to be altered).

Model structure

Some of these assumptions are contained in the 'technology selection' sheet. For example, the following assumptions are used in relation to the utilisation of routers and cross-connects.

MTH System Configurations	Port Capacity (Gbps)	No of Ports	No. of Ports in Use	Utilisation
Router	2.5	500	200	40%
DXC	2.5	500	200	40%

Figure 3: Extract from GQ-AAS model, Technology selection sheet

Source: GQ-AAS

From this, it appears that the utilisation parameter is being used as a combined measure of actual demand and sharing possibilities. That is, the access seeker would pay an access price calculated on the basis that the existing level of demand on that route, or demand on shared routes, was accounting for the use of 200 of the 500 available ports. So the particular element (e.g. the router) is allocated 1/200th of the annualised cost of that router, reflecting actual usage of the router. A true capacity-based cost would only include 1/500th of the router cost.[1]

In the 'Accommodation' sheet, utilisation factors appear to be used to produce an estimate based on actual usage and sharing, with MTH utilisation factors higher than for LTHs. It could also be argued that sharing factors applied to cables and trenches fulfil a similar function. The cable and trenching factors ('Trench and Optical Fibre Cable' sheet) allow sharing factors to be inputted based on actual data.

Our view is that it is most appropriate to calculate TSLRIC by dividing element costs (appropriately shared between services) by actual or forecast demand for services. While a capacity-based approach is simpler to apply, the lumpy nature of infrastructure investment, and the degree of judgement required to 'second guess' the investment decisions of the access provider favour taking the more cautious approach.[2] While the GQ-AAS model does appear to implicitly take into account

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[1] Another way to think of this is that it would not be possible to over-recover costs in a capacity-based costing, because costs would not vary with actual usage. That is not the case in the GQ-AAS model.

[2] We note in particular the difficulty of accounting for uncertainty in looking at firms' investment decisions *ex post*. Suppose an access provider is making a decision as to how much capacity to build in its network investment. It will make that capacity decision based on estimates as to (uncertain) future demand. The access provider knows that incremental cost of adding capacity later is very costly relative to adding it now. The decision will therefore be weighted towards adding the capacity now, even if there is a relatively small probability of that demand actually materialising. This means that it may not turn out to be necessary to need the capacity, but that it was prudent and efficient to allow for it. In competitive markets, one might expect that the risk here would be borne by the access provider – if demand is 'low', they might not recover the value of the excess capacity, but if the demand is 'high', they would earn sufficient profits to compensate for the risk of a 'low' outcome. However, if returns are regulated, and no 'excess' returns are allowed if demand turns out to be 'high', then it would seem inappropriate to allow cost recovery *only* if the 'high' demand outcome eventuates (i.e. is observed *ex post).* If that was the regulator's rule, then it would deter the access provider from making efficient capacity investment decisions.

actual usage, we would argue that it would be preferable to link these assumptions directly with the demand for services of a particular route. While the 'utilisation' parameters can be used to achieve a similar function (i.e. by dropping utilisation one effectively assumes that less of the capacity is used and more cost is allocated to the individual services using the route), this is less transparent than using explicit demand and sharing estimates.

On one level, the model could be adapted in a reasonably straightforward way. Essentially, two alterations are required:

- the capacity required on the route should be explicitly determined with regard to actual route demand (and, as we note below, forecasts of future demand); and
- to the extent this is not already done, the costs of route elements should be divided by the usage or expected usage for the element, rather than the total capacity of the element.

There are two other issues with the use of demand information in the model:

- we are not clear why the model appears to limit traffic estimates to those related to residential use – efficient dimensioning of transmission routes will require consideration of all types of traffic regardless of end-use; and
- ideally, the model should contain a number of years of route-specific demand forecasts. The model as it stands is purely static and would only produce prices reflective of today's demand and capacity decisions. Building in robust demand estimates would allow efficient capacity, costs and prices to be determined for a number of years, rather than on a one-off basis. Again this functionality should be built into the model and populated with appropriate parameters for particular routes.

Our recommendation is that the model should be augmented with specific linking of the demand with the costing sheets to ensure that it transparently produces results that would be consistent with a demand-based approach to TSLRIC estimation. This may be performed in conjunction with a fact collection exercise which will assist in determining the reasonable of cost estimates produced by the model. That will also require further consideration of appropriate dimensioning rules to cater for an efficient level of capacity, and sharing capabilities, which we now turn to.

2.4 THE COST OF PROVIDING TRANSMISSION CAPACITY ON PARTICULAR ROUTES

A second feature of the model is that it estimates the cost of supplying capacity on a particular (unspecified) route, rather than on a route within Telstra's integrated transmission network. Routes are categorised by generic type.

Our understanding is that the model was designed in this way because it is likely to be used by the ACCC to resolve disputes about the costs of providing capacity on particular routes. As such, the relevant increment in the TSRLIC calculation is the service over the route, not services across the (national) network.

The problems with this approach relate to how the route should be dimensioned and how sharing should be incorporated between routes.

As we note in the previous section, there are no explicit dimensioning algorithms relating demand to installed capacity in the model. This is assumed to be done 'off-line' based on data gathered on that route. Sharing assumptions currently enter into the model in relation to trench and cable sharing (including a trench sharing factor; the number of cables in trench; and the number of fibres per transmission system (cable). The first type of sharing relates to physical trench sharing (e.g. between Telstra and third parties), the second relates to service sharing (between transmission route and other transmission routes) and third to intra-service sharing (between Telstra and the access seeker).

The major criticism of the modelling approach adopted is that it will be difficult to determine efficient capacity on shared routes, and to determine an appropriate degree of sharing between routes. In that context, MJA (on behalf of the CCC) noted the following:

> …..a key element of different transmission services is that they will share infrastructure and transmission elements with each other. Currently, it would appear that the approach used is to identify the type of route subject to costing and proceed with specific modelling of this type of route. The amount of sharing is in this case a largely arbitrary input. This is problematic and a significant shortcoming of the model as sharing can have a very substantial influence on transmission service costs. The model needs to consider not only the routes subject to declaration but also other (competitive) routes to accurately determine the amount of sharing. Indeed the conventional approach to TSLRIC modelling is not to focus on a subset of an increment (in this case the transmission and infrastructure network) but to model a whole increment or sometimes even several additional increments to ensure the appropriate dimensioning and design of the network.."

We largely agree with this view. A more developed model including both non-declared and declared routes would allow for more accurate estimates of efficient capacity and sharing. The ACCC's procedures (as outlined above) for determining transmission prices envisage that (point 5) sharing should be accounted for by using an "appropriate cost allocator", which "could require volume estimates for the other services to serve as allocators in many cases".

Having said that, it is not necessarily clear how such an approach could be modelled in a generic way, i.e. applied in advance of knowing which routes are to be the subject of pricing disputes. Construction of a model of Telstra's national transmission network would undoubtedly provide a better indication of sharing opportunities, but would also be a far larger, more complex and costly exercise.

Telstra's main concern with the route-by-route model structure is that it might undermine overall cost recovery:

> Telstra notes that the model applies to only one part of the national transmission network, which is made up of many rings. Thus, while the model might be used to determine the average cost of a subset of rings, there is nothing in the model that ensures that the costs of all the rings that make up the national transmission network are recovered. This is an important consideration, since access seekers

> are likely to purchase transmission services in higher-demand and lower-cost routes and the average costs of transmission in lower-demand routes are not necessarily recovered from services that utilise transmission.[3]

This problem seems overstated, as it is likely that high demand routes are not declared as they are already subject to competition. We would question whether it would be appropriate – if the problem does exist – to allow cross-subsidisation across routes within the model to address it. It seems better addressed within a USO-type framework, and would not invalidate the results of the model *per se*.

Telstra also takes particular issue with the values entered in the sharing parameters. Its view is that sharing factors are adopted for the three parameters above that raise questions as to what exactly the trench, cables and fibres are being shared with.

While we have no issue with Telstra's particular comments about the extent of sharing, it is necessary to note that the figures actually used in the spreadsheets are merely indicative. Application of the model to particular circumstances will require a separate data collection exercise which should inform the values chosen. To the extent that no sharing is thought feasible, then presumably no sharing will be provided for in the model's application to a particular transmission route. Separately, the ACCC may also consider whether any excess capacity in the transmission route is prudent, bearing in mind the lumpy nature of the costs of transmission investment.[4]

This issue is an example of where the model would benefit from being populated with real data, as this would assist in identifying the importance of these factors. If some of these factors have only marginal impact on the cost outcomes, then an average value can be allocated and effort can be concentrated on those factors that do have significant influence.

There is one further concern with the sharing assumptions in the model. That is the extent of their application. MJA state that:

> The way sharing works in the GQ-AAS model it is not possible to transparently take into account these different forms of sharing. For example, apart from trenches, buildings will be shared between services, certain transmission equipment may be shared with the PSTN traffic and auxiliary equipment like a reserve power supply may be dimensioned to cope with failures that are not only particular to the transmission network.[5]

As we note above, sharing seems to be allowed for other equipment such as accommodation via a parameter for total capacity. For example, the MTH is assumed to have one SDH system per route, but 40 units of capacity in the router at the MTH. Presumably the transmission route is then assumed to share (with its allocation being $1/40^{th}$) of the capacity with other transmission services. Similar to our previous comments, it seems more appropriate to estimate the

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[3] Telstra submission, paragraph 9.

[4] See also our comments in footnote 2.

[5] MJA submission, p. 25.

number of systems actually supported (including the access seeker's demand and including any sharing with other transmission services as appropriate), not the total number of systems able to be supported.

Our conclusion is that applying the model to particular routes could well be problematic. That will depend on the actual level (or efficient level, if that is different) of sharing between routes. The model should produce reasonably accurate estimates on relatively isolated routes. Where the route of interest shares infrastructure with other transmission services, a significant amount of information will need to be collected to ensure that the model produces an accurate estimate of costs. Against that, the amount of route sharing is probably correlated with the competitiveness of the route. Again, we conclude that these considerations point towards the potential usefulness of a specific fact collection exercise on a particular route or routes.

2.5 EXCLUSION OF MICROWAVE TRANSMISSION SYSTEMS

In its submissions, Optus and MJA raised the issue of the exclusion in the model of microwave-based transmission systems. It is understood that Microwave is still being installed in many instances today on the basis that, compared to optical fibre, it can be installed much more quickly and cheaply where there are not significant bandwidth requirements. It therefore can be seen to be best in use technology on certain 'thin' routes.

Having noted that, the ACCC has indicated that it has not been considered an appropriate technology for the purposes of model design (so that this is not really an issue with the model itself). GQ-AAS notes ACCC's preference may stem from the its conclusion that:

> In light of information received during this (declaration) inquiry, it is now inclined not to consider microwave services as a viable substitute on capital-regional routes given that it cannot be utilised effectively across the entire range of downstream demands. Further, the Commission considers that alternative tail-end transmission technologies such as ULLS, HFC, LMDS and MMDS cannot match optical fibre in terms of capacity or customer acceptance for the full range of transmission requirements at this stage.[6]

While we have no issue with these comments, it is not clear to us that this would provide a good justification for exclusion of costing of microwave technologies in all circumstances. As a general rule, the end-to-end cost of a microwave system is lower than for an optical-fibre based system in low capacity scenarios (up to 625Mbps). However, as optical fibre systems have much greater capacity, the unit price of capacity is also likely to be higher than for optical fibre systems. The particular characteristics of a route may need to be further considered at the time a dispute is raised.

[6] ACCC, Transmission Capacity Declaration Inquiry, April 2004.

2.6 TAIL-END MOBILE TRANSMISSION

Telstra, Vodafone and Optus all raised the issue of the linking of transmission networks with mobile base stations. Vodafone's comments are replicated below.

> The declaration for the domestic transmission capacity service defines tail-end transmission as being between an end customer's locations and the nearest local exchange — where an end customer includes another service provider, in this case Vodafone[1]. In Vodafone's context, tail-end transmission occurs between Vodafone base stations and Telstra local exchanges, or a Telstra Regional Local Transmission Hub.
>
> However, the draft transmission cost model assumes that 'the Access Seeker requires the transmission service to terminate on its equipment located in the Telstra Exchange Building Access (TEBA) space within the local exchange'[2]. Vodafone believes that this assumption is not accurate and should be amended to include transmissions services that terminate on Access Seekers' equipment located outside the local exchange, such as mobile base stations.

Figure 4: Extract from Vodafone submission

The issue is largely whether the model can be readily adapted to include other termination points, such as a mobile base stations. It does not seem that the costs involved in transmission between a regional LTH and a mobile base station should be very different to LTH-local exchange transmission from a modelling point of view. Local exchange – base station transmission may, however, involve a further step to the current model. Having said that, before recommending model alterations, it would be useful to further understand the significance of this problem (including how (and how many) transmission tails between local exchanges and mobile base stations are dimensioned). In the absence of a current arbitration between mobile carriers and transmission providers, it may be unnecessary to follow this point further at the moment.

3 Model audit

The second task was to determine whether the model contains any errors, independent of the assumptions used in the model.

Our view is that the model is well laid out and that inputs and formulas are readily identified. This view appears to be shared by parties that provided submissions to the ACCC. We did not identify any errors in the model.

Aside from the identification of some minor calculation errors, there were two further modelling-related suggestions contained in submissions:

- MJA commented that there was a lack of cross checks of the input numbers, for example between the number of nodes and number of links. Such crosschecks are part of good modelling practice. While we did not pick up any errors in our review, further use of crosschecks would prevent the model from producing results that are calculated correctly, but inconsistent with assumptions in the model design.
- MJA also suggest that the annuity formula used by GQ-AAS does not properly take account of inflation, and that an alternative formulation would be preferable. This appears to be correct. The appropriate formula and its derivation are set out in further detail in the WIK report *Mobile Termination Cost Model for Australia* (January 2007), which is available on the ACCC website.

4 Converting costs into prices

4.1 COST CALCULATIONS

The GQ-AAS model calculates annualised costs for transmission equipment, being the sum of capital costs (including a return of and on capital) and O&M costs (which are expressed as a fixed percentage of capital costs). Services are then put together using routing and system utilisation factors to derive a unit cost for capacity. That can be seen as an average cost calculation, as the cost of each basic unit of capacity is the same.

It has been suggested that a potential weakness of the model is that the unit costs it generates are purely a function of the speed of the transmission service. That is, a 2mbps service is estimated to cost 1/17th of a 34mbps service. Costs may not, however, be incurred in such a linear fashion. The cost of trenches, for example, is fixed in relation to the capacity of the service offered. Therefore, the actual costs of providing higher capacity services may be relatively lower when expressed on a bandwidth basis (average costs per mbps fall). Support from that may be derived from comparisons with retail transmission-type services in Australia[7], as well as evidence from a benchmarking exercise conducted by the EU that indicates that for wholesale leased lines, the marginal price of capacity declines in many European jurisdictions.[8]

Having said that, the problem with such an inference is that firms operating in imperfectly competitive markets where there is lumpy investment will price to demand as well as cost. It is therefore difficult to ascertain to what degree such pricing reflects differences in cost, or differences in demand conditions (perhaps reflecting differences in bargaining positions between smaller and larger customers). Along these lines, the ACCC has noted that pricing structures for transmission services might also efficiently reflect differences in length of commitment, volumes purchased and the breadth of services purchased from the access provider.[9]

The problem here derives from the nature of a TSLRIC modelling exercise. Bottom-up TSRLIC models essentially derive a 'lump' of cost associated with a total service at a given level of demand, so that unit costs derived are essentially averages. The issue raised here is how 'mark-ups' over marginal cost for particular services should be structured to recover the TSLRIC of the

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[7] See, for example, Telstra's price list for Fastway DDS services (for sub 2mbps links), which indicates that per 64kb unit of capacity, prices for a 1984kbit/s link are 47% of those for a single 64kbit/s link (Metro monthly charges). http://www.telstra.com.au/customerterms/docs/bg_part_d_dds_fastway.pdf

[8] See Commission Staff Working Document, *Methodology, reference configuration and data of leased lines in Member States related to the Commission Recommendation of 29 March 2005 on the provision of leased lines in the European Union, Part 2 - Pricing aspects of wholesale leased line part circuits, (notified under document number C(2005) 103)*, available at http://ec.europa.eu/information_society/policy/ecomm/info_centre/documentation/recomm_guidelines/index_en.htm

[9] ACCC, Competition in Data Markets, 1998, p. 67.

transmission service. It is a well-known precept of economics that consumption should be encouraged wherever the consumer's willingness to pay is greater than the (short run) marginal cost to the supplier. Compared to the benchmark of marginal cost, TSLRIC costs are higher because they involve recovery of long run costs (rather than short run costs) and the recovery of the costs of the total service (rather than particular customer's demands as increments). Prices are also usually further inflated to recover a contribution to organisation-level common costs (resulting in 'TSLRIC+').

4.2 ASSESSMENT OF THE MODEL

In assessing this part of the model, the first question we considered was whether the GQ-AAS methodology approaches the cost / price issue in a way that is consistent with the ACCC's *Transmission Pricing Principles* (April 2004).

The relevant principle is principle eight on the ACCC's list (reproduced above), which states that a unit price will be derived by "dividing by the volume applicable to the service concerned (e.g. the number of 2 Mb/s links, number of leased lines, etc.). The GQ-AAS model is consistent with that principle, although as we note above, it is arguable that this should be calculated with reference to the actual or forecast demand, not capacity.

The second question is whether the 'unit cost' pricing approach could be adjusted to more accurately reflect marginal costs. The current approach may not promote efficiency in use in some circumstances, and clearly it would be desirable to set access prices to reflect efficient recovery of fixed costs and maximise usage, as long as it did not compromise the legitimate interests of the access provider. Two relevant options for implementing such a structure are:

1. introducing a fixed cost component and then a variable cost component that is proportional to the bandwidth[10]; or
2. producing a non-linear (e.g. logarithmic) relationship between cost and bandwidth (e.g. a doubling of bandwidth will result in a unit increase in cost).

Non-linear pricing schemes have desirable properties, because they can more closely align marginal capacity prices with marginal costs. However, it is difficult to do this in way that:

- is transparent and objective;
- is likely to fully recover costs; and
- avoids allegations of anti-competitive behaviour against the access provider (particularly against smaller access seekers).

While not directly reflected in the Part XIC provisions, this difficulty is reflected in the Part IIIA provisions of the TPA:

[10] There may well be additional costs incurred in providing lower bandwidth services, for example, additional multiplexing equipment may be required to bring the data stream out at a 2Mbps level that may not be required for a 34Mbps stream.

Section 44ZZCA

(b) Access price structures should:

(i) allow multi-part pricing and price discrimination when it aids efficiency; and

(ii) not allow a vertically integrated access provider to set terms and conditions that discriminate in favour of its downstream operations, except to the extent that the cost of providing access to other operators is higher.

Relative to the proposed charging structure, introducing fixed charges would have the effect of (perhaps efficiently) penalising smaller access seekers who demand lower capacity services. Such an approach would need to be informed by further cost studies. A logarithmic approach seems more objective, but, similarly, in the absence of further cost studies which confirm that this is consistent with how costs vary, it may simply encourage arbitrage and therefore offer few efficiency benefits.

In our experience, the efficient cost recovery problem is not commonly addressed in detail in TSLRIC models. Telstra has addressed this issue with regard to PSTN OTA, where it recovers around 20% of cost from flag-fall (fixed) charges and 80% from per minute (variable) charges. Telstra has also recently sought to introduce per customer charges for PSTN OTA (again limited by recovery of a total cost pool derived from its PIE II model).[11] WIK's mobile termination cost model (recently produced for the ACCC) also provides costs and prices for mobile termination in cents per minute with no fixed charges or volume discounts.[12]

Our conclusion is that it is difficult to be prescriptive about the best approach here. Clearly, there is some evidence to suggest that a number of relevant costs are fixed in relation to capacity, so that doubling the bandwidth of a service will not double its costs, and that it would promote efficiency to reflect this in access prices. However, in the absence of further studies, it is difficult to offer a simple pricing principle that will improve upon the existing linear approach. Some alternatives in the absence of further studies could be to:

- adjust the pricing structure to reflect the structure of prices (not the price level) found on competitive routes; or
- encourage parties to commercially negotiate an alternative to the current pricing structures.

Telstra may also wish to give this issue further consideration in an undertaking. Obviously, it will be important to ensure that any approach adopted is consistently applied to all access seekers to avoid any cost over-recovery.

[11] See Telstra's PSTN OTA and LCS undertakings, November 2006.

[12] See WIK, *Mobile Termination Cost Model for Australia*, January 2007, p. 10.

4.2.1 Adapting the model

We have also examined the model to determine whether another pricing approach could be overlayed.

The simplest method would be to simply deal with the pricing structure as the final stage. The model currently produces a cost figure for the relevant route segment (e.g. for the inter-exchange model, it currently produces a TSLRIC of around $672k per annum, based on certain utilisation factors). Unit costs are derived by dividing this figure by the relevant unit of capacity. Rather than dividing by the unit of capacity, it would be possible to re-weight the units to reflect a cost / price structure that made higher bandwidth services relatively less expensive (on a per mbps basis). Again, the key would be to ensure that the weighting factors had some relevance to the cost of providing different bandwidth services.

If there are, in fact, few cost savings from providing a single higher bandwidth service than a number of lower bandwidth services, but the pricing structure gives a large discount for the higher bandwidth service, then we can expect to see some access seekers purchasing higher bandwidth services and then re-selling them to access seekers. That could potentially undermine cost recovery by the access provider.

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