Appendix C: Technology choice and network deployment

1.1 This appendix discusses in further detail the alternative network deployment choices likely to be considered by an efficient new entrant.

Trenching costs

1.2 The current pricing principles are based on a network deployment that involves a significant amount of underground cabling. Optus considers the key problem with this approach is that this is not the deployment decision that would be made by an efficient new entrant.

1.3 This reason this parameter is important is because trenching can be a significant cost when a carrier attempts to deploy a fixed line network. For example, the Analysys model considers that trenching in urban areas costs up to $240 per metre. In aggregate, approximately 71 per cent of the access network's total build cost is due to the cost of trenching.

1.4 The cost is so high due to the nature of the activity. Trenching involves not only digging into the existing surface structure to create the trenches themselves, but also reinstatement work afterwards to restore the surface to its former condition. Trenching and reinstatement costs can be particularly high in urban areas as surfaces are often covered with tiles or other unique materials that are expensive to both remove and restore.

1.5 In metropolitan and built-up areas the surface is generally covered concrete. For example the Telstra TEA model assumed that up to **CiC** per cent of the land in Band 2 areas is covered by concrete. In rural locations the surface is more likely to be covered with turf and therefore the cost of trenching and reinstatement in these regions is significantly lower.

1.6 Given that trenching costs have the potential to be a large contributor to the total build cost, an efficient new entrant would seek to minimise this cost as much as possible.

1.7 Optus submits that if a new entrant were to deploy a efficient new fixed line network it would be likely to consider the following deployment methods:

- Aerial cabling;
- Trenching methods that create minimal surface disruption; and
- Utilising space in existing ducts.

1.8 The degree to which of each of these methods would be deployed would depend upon both the relative costs, and any practical constraints that may arise – for example, there may be no space in existing ducts.

Aerial cabling

1.9 Optus considers that a new entrant would have the option of deploying new fixed network using aerial cabling.

1.10 It has been confirmed by the government that the NBN rollout in Tasmania will be deployed through aerial cable.[1] Aerial deployment can be built faster and cheaper than underground cabling. This is confirmed by Alcatel Lucent:

> *"Alcatel Lucent, one of the world's leading builders of fibre networks, says aerial deployments can be built four times faster than networks that require underground cabling.*
>
> *"The biggest cost determiner for the NBN will be whether it's built overhead or underground," Alcatel Lucent NBN lead adviser John Turner says. "Aerial will be very feasible in Australia and if either Telstra or Optus vend their assets in, then we can replace existing Foxtel cables with new NBN fibre cables so telegraph poles will look no different to what they do today."*
>
> *Mr Turner says the cost of laying fibre can range from between $200 to $2000 per home, depending on whether aerial or underground installations are used. Although aerial fibre deployments are more prone to environmental damage and are anathema to local councils that detest unsightly cables strung from telegraph poles, there is no doubting the significant cost benefits they carry. Optus believes the NBN could be built for as little as $l8bn if an aerial installation was used for 100 per cent of the NBN's cabling needs. Complete underground installation, on the other hand, could cost as much as $60bn.*
>
> *The reduced costs in going the aerial route also means a return on equity can be achieved sooner. Optus says that if the NBN was constructed with a 70 per cent aerial deployment, the cost to the government would be about $33bn. At this price, the NBN company could expect an equity return if penetration levels hit 60 per cent and a monthly wholesale access price of $50 was charged, Optus says."*[2]

1.11 A recent study conducted by Milner (2009) recognises that fibre cables can be deployed in the access network using a variety of techniques, including aerial deployment and various trenching options. Milner (2009) notes that:

> *"[a]erial deployment is a low cost approach for the deployment of fibre optic cable where existing poles are available and*

[1] Comms Day, *Tasmanian NBN services now due Q2'10 - tenders issued for fibre optic cable,* 17 July 2009

[2] Michael Bingemann, *The Australian,* 'Building the Snowy Scheme of the 21st century", 2 July 2009

permission can be obtained to string the cable onto the existing poles."[3]

1.12 Using the New Zealand broadband deployments as a basis, Milner has estimated that the relevant aerial costs for such a deployment are as follows:

- Initial deployment on existing good quality poles can be as low as $15 to $20 per metre – however it is not usually possible to consistently achieve this low cost for a widespread deployment; and
- Correcting for a number of factors, a more typical aerial cost is around $30 to $50 per metre – however it acknowledged that only 30 to 40 per cent of premises may be suitable for aerial deployment under ideal conditions. [4]

1.13 Under the various trenching options considered, Milner has estimated a range of trenching costs which vary depending on the surfaces likely to be affected. The range of costs likely to be faced is tabled below. [5]

Trenching technique identified	**Range of costs for fibre deployment**	**Surface applicable**
Shallow trenching – urban feeder networks and some distribution deployments	$70 to $90 per metre	Road surfaces
Micro trenching – distribution and lead-ins in the access network	$50 to $70 per metre $30-50 per metre	Along street curbs Along grass verges and premise lead-ins
Mole plough trenching – rural deployments	$20 to $40 per metre	Turf
Directional drilling	$50 to $70 per metre	Trenching through softer substrate surfaces required
Open trenching – traditional trenching method	$120 to $150 per metre $500 to $600 per metre	Simple trenching More complex trenching through hard substrates required
Directional drilling and open trenching – often used in conjunction, with a 80:20 weighting applied	$70 to $90 per metre $100 to $120 per metre	Suburban areas CBD areas

1.14 Aerial cabling has been criticised in the past as an impractical solution due to planning constraints enforced by with Local Councils. However

[3] Milner, *Fibre-to-the-premise cost study*, February 2009, p.14
[4] Milner, *Fibre-to-the-premise cost study*, February 2009, pp.14-15
[5] All cost figures sourced from Milner, *Fibre-to-the-premise cost study*, February 2009, pp.15-19

Optus submits that these concerns are not warranted and that a new entrant would be able to avail itself of aerial cabling as:

- Aerial cabling is used in other countries;
- The current State Planning Regulations are not overly prohibitive; and
- The Government has signalled that the new operator of the NBN is likely to use aerial cabling.

1.15 In the following sections Optus will expand on each of these points.

The current State Planning Regulations are not overly prohibitive

1.16 In Queensland and Victoria aerial cabling is not regulated and permits are not required.[6] In New South Wales there are restrictions on the use of aerial cabling, however these only apply if the cable is a telecommunications facility and therefore regulated under the *Telecommunication Act*. If the facility is to be used for some sort of electricity purpose (e.g. smart metering), regardless of what other uses the facility may have (i.e. as a fibre communications line), it is no longer regulated by the *Telecommunication A*ct.

1.17 This is outlined under s49 of the *Telecommunication Act*:

> *"49 Exemption - … (2) If: (a) the principal use of a network unit is use by an electricity supply body to carry communications necessary or desirable for: (i) managing the generation, transmission, distribution or supply of electricity; or (ii) charging for the supply of electricity; and (b) the remaining use of the unit is use by one or more carriers or by one or more exempt network-users, to supply carriage services and/or content services; Section 42 does not apply to the unit.*"

1.18 This ruling has also been confirmed in the case of Hutchison 3G Australia Pty Ltd v City of Mitcham ("Hutchison"). In Hutchison, during 2002 and early 2003, Hutchison erected a number of telecommunication facilities, known as "downlink sites" at five locations in suburban Adelaide (all fall within the area of the City of Mitcham, i.e. Council) without obtaining the local Council's approval.

1.19 The High Court ruled that the replacement of the stobie poles by Hutchison are not and do not become facilities for the purposes of the Telecommunications Act notwithstanding the installation on them of Hutchison's facilities:

> *"The definition of the expression "telecommunications network" has previously been set out in these reasons. That definition contemplates a "system" or a "series of systems" engaged in the carrying of communications by means of guided and/or unguided electromagnetic energy. In attempting to characterise the*

[6] This also including in respect of cabling affecting heritage listed areas or buildings.

function which was served or sought to be served by the replacement poles, the question thus arises: were the replacement poles intended for use in connection with a "system"?

The Case Stated indicates that the poles were replaced in order to meet the structural demands of carrying such facilities as the three panel antennae, the microwave dish and the mounting pole which together form part of a downlink site. In other words, the replacement poles were designed, in part, to accommodate the physical act of installing telecommunications equipment. However, there is nothing to suggest that, as such, they were intended to satisfy the requirements of a "system" or a "series of systems" of the sort described in the definition of "telecommunications network".

The locations of the poles, though conducive to the operation of a telecommunications network and recognised by Hutchison as such when it selected them as sites for the installation of its downlink facilities, were not selected in order to facilitate that operation. Instead, ETSA had erected poles at those locations as part of its electricity distribution business.

Moreover, it was not the set of requirements attendant upon the operation of a system which prompted the need for poles of a larger cross-section at the Colonel Light Gardens site, the Bellevue Heights site, the Torrens Park site and the Kingswood site. It was instead the requirements attendant upon the task of installing individual items of equipment on those poles.

Accordingly, question 1.1 in the Case Stated should have been answered in the negative. The replacement poles erected by ETSA were not facilities within the meaning of the Telco Act. Because of this, and because of the affirmative answer already given to question 1.2, Hutchison is entitled, in respect of the installation of its downlink sites, to the benefit of an exemption from the operation of the Development Act, as provided for in the Telco Act[36].” [7]

1.20 Furthermore, it is likely that Local Councils will be more receptive to aerial cabling in the future if it means that their constituents will be able to receive high speed broadband services.

1.21 The change in public sentiment is evidenced in NSW at least by the positive response to a recent proposal put forward by the NSW Government to alter the planning laws. The changes would amend the current planning regulations to allow the Federal Government to more easily deploy NBN infrastructure in NSW. Optus notes that the public response to the proposal appears to have been positive. Comms Day reported that the NSW Department of planning described the submissions in response that had been received “cover[ed] a whole

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[7] Hutchison 3G Australia Pty Ltd v City of Mitcham [2006] HCA 12; 80 ALJR 711; 225 ALR 615 (6 April 2006).

range of different issues, but they've all been very constructive submissions... none of the submissions are objecting to the proposal as a whole".[8]

1.22 Whilst it is still likely that some objections to aerial cabling and other telecommunications infrastructure will arise in regards to the forthcoming NBN development, or for that matter for a new network constructed by a hypothetical new entrant, in the end the demand for the high speed broadband and the services that a new network would support (e.g. IP TV) are likely to be considered more important than the potential losses in visual amenity.

The Government and the telecommunications industry has signalled that the new operator of the NBN is likely to use aerial cabling

1.23 A number of analysts in the telecommunication industry have made it clear that aerial cabling is likely to be used to deploy the NBN.. The major advantages of aerial deployments over 'traditional' underground deployments are related to the speed and cost of the deployment.

1.24 It ought not to be assumed that the current prohibitions on aerial cabling would be maintained if a new entrant was to deploy aerial cable. If a party sought to lay an alternative CAN for the benefit of telecommunications consumers, the Government would very likely change the rules, since it would make the deployment lower cost and more likely to be commercially feasible (just as it contemplates doing in the real world for the NBNCo). This view is confirmed by the ACCC also and it has stated that "there is evidence before the Tribunal that the position concerning aerial lines is undergoing change."[9]

1.25 However, whilst Optus submits that aerial cabling would be deployed by a new entrant it also concedes that it would be unlikely that the entire network could be built using this technique and underground cabling is still likely to be cost-effective in some circumstances (e.g. where there is duct space an so no trenching is required).

1.26 Alcatel Lucent, one of the world's largest builders of fibre networks, estimates that aerial deployments can be built four times faster than networks that require underground cabling. The major reasons for this are that there no trenching is required and pre-existing poles (e.g. power poles) can be used if there are any available.[10]

1.27 The fact that aerial networks minimise the degree of surface trenching required results in a significant cost saving. As stated previously by Optus (and others) one of the most significant factors influencing the total NBN build cost whether the network is built overhead or underground. This is because the typical cost for the initial deployment

[8] Comms Day, *Positive response to NSW's NBN planning changes*, Friday 24 July.
[9] ACCC, Oral submission to the Australian Competition Tribunal –Application by Telstra Corporation Limited, 27 August 2009
[10] Michael Bingemann, *The Australian*, 2 July 2009, "Building the Snowy Scheme of the 21st century".

on an existing pole is around $15 to $20 per meter as compared to trenching costs of between $30 and $240 per meter. [11] [12]

1.28 The effect of this cost differential is important when considering the effect on the total build cost. Optus estimates that if aerial cabling is used the cost of the NBN build could range from as little as $18 billion up to $33 billion. [13]

Trenching methods that create minimal surface disruption

1.29 If a hypothetical new-entrant were forced to trench surface to deploy a new network, it would be likely to use the most cost effective trenching method. The largest contributors to the cost of trenching are labour and re-instatement costs. As such an efficient operator would deploy a network using trenching methods that are create minimal surface disruption.

1.30 Optus considers that a hypothetical new-entrant would choose from the following three trenching methods:

- Shallow trenching,
- Micro-trenching, and
- Mole-plough trenching

1.31 These three techniques allow the installation of cable in urban areas with minimal surface disturbance. They are the most cost effective deployment approaches whenever it is necessary to bury cable.[14]

1.32 Shallow and micro trenching involves cutting trenches of around 300mm deep and 100mm wide within the surface of a road. This approach would mainly be used in the access network but could also be used in the distribution (core) network. The cost to deploy shallow trenching is approximately $70 to $90 per meter. [15]

1.33 The cost for the micro trenching varies considerably depending on the situation within which it is deployed. Along street curbs it can be in the range of $50 to 70 per meter. Alongside grass verges and for premise lead-ins it can be as low as $30 to 50 per meter. [16]

1.34 Mole plough trenching involves the use of a digger which ploughs a trench 600mm to 1200mm deep and 200mm wide into which a duct can be laid. The trench is then filled in a continuous run as the machine performs both operations sequentially. It is mainly used for deployment in rural areas as it only operate in soft ground (e.g. turf or

[11] Aerial deployment cost from Milner, M., *Fibre-to-the-Premise Cost Study*, Version 2.0, 2 February 2009, page 14.
[12] Trench cost from *Analysys cost model*, v2.
[13] $18 billion assumes 100% of the total NBN network uses aerial cabling, $33 billion assumes 70% of the total network uses aerial cabling.
[14] Milner, M., *Fibre-to-the-Premise Cost Study*, Version 2.0, 2 February 2009, page 16
[15] Milner, M., *Fibre-to-the-Premise Cost Study*, Version 2.0, 2 February 2009, page 16.
[16] Milner, M., *Fibre-to-the-Premise Cost Study*, Version 2.0, 2 February 2009, page 16.

clay), but it can be used to deploy in urban areas where the surface permits (e.g. nature strips and grass verges). The cost for deployment of fibre using a mole plough varies depending on the ground conditions, but typically lies in the range of $20 to $40 per meter. [17]

1.35 The main benefit of these techniques is that they cause minimal surface disruption. This not only means that re-instatement costs are lower (as a smaller surface area needs to be replaced), but it also allows operators to deploy the network more efficiently as they allow a faster network deployment than traditional trenching methods. Due to their compact machinery and, the ability to simultaneously trench and re-instate in a single pass they cause less traffic disruption.

1.36 Optus highlights to the Commission that this sort of trenching technology is being used by operators around the world today. Locally, the Government's NBN rollout in Tasmania will seek to use these low-impact trenching methods and a trench-digging machine was imported from France specifically for this task. [18] It is claimed that the "Cleanfast" machine can trench up 600 meters per day and preserve road foundations. [19]

Utilising space in existing ducts

1.37 It is likely that an efficient new entrant would lease space in existing duct as the cost of using Telstra's trenches and ducts and paying an appropriate price for their use is significantly lower than the cost of excavating and constructing new trenched ducts.

1.38 Given the difficulty and high cost of construction of new trenches, it would be more realistic and more efficient for a hypothetical new operator to at least consider renting space in the existing ducts and/or trenches instead. According to Europe Economics:

> *"an efficient new entrant would be able to use Telstra's trenches and ducts, paying an appropriate price for their use, rather than having to re-build or replace them."* [20]

1.39 The current charge for access to ducts, including tunnels, payable by Optus to Telstra is **CiC**. It is likely that a hypothetical new enrant would also be able to avail itself of lease prices similar to those which are currently offered to Optus.

[17] Milner, M., *Fibre-to-the-Premise Cost Study*, Version 2.0, 2 February 2009, page 17.
[18] Comms Day, *New Tasmanian NBN tender announced*, 22 September 2009
[19] http://www.lucas.com.au//Divisions/MaraisLucas.htm
[20] Europe Economics, *Pricing Principles for the Unconditioned Local Loop Service (ULLS) in Australia, The Conceptual Framework*, 2009, p.16

1.40 Optus also highlights that there are new cable technologies available in the marketplace that help an efficient new entrant to use space in existing ducts. Manufacturers have been able to improve the design of fibre optic cable such that they are thinner and more flexible.

1.41 In the past it was difficult (or simply not possible) for a fibre optic cable to be bent around a corner. Advances in technology mean that it is now possible to bend a fibre cable around a radius of only 10 millimetres. [21] A ‘slimline’ style cable has also being designed which allows operators to better utilise the space in existing ducts by sliding a thinner than normal cable in-between the gaps of surrounding cables.[22] Whereas traditional fibre is cylindrical in shape, slimline cables have a flat profile that allows the cable to slide more smoothly into gaps.

1.42 Optus considers that both of these cable technologies will allow operators to deploy fibre cable in situations where it was previously not possible. To that extent they would also be the type of technologies likely to be utilised by an efficient new entrant.

1.43 Given the existence of existing duct space and cables that improve the ability of operators to access that space, it is inappropriate for duct costs in the Analysys model to reflect the cost of excavating and constructing new trenched ducts.

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[21] For example, refer to product information sheet for *AllWave® FLEX ZWP Single-Mode Fiber (http://www.ofsoptics.com/).*
[22] For example, refer to product information sheet for *AccuRibbon DuctSaver® FX Cable (http://www.ofsoptics.com/).*