Published on *Telsoc* (https://telsoc.org)

Critique of the new NBN policy

Graham Shepherd [1]

Netfluency

AJTDE - Vol 2, No 4 - November 2014 [2]

[3]

☆ 92 [4]

Abstract

In December 2014 the Australian Minister for Communications released a policy destined to transform the NBN as conceived by the previous government. Its primary stated aims are to lower costs and introduce competition. The cost reductions are driven by significantly compromising the access speed and substantially but not entirely eliminating the lead-in cost. The policy also anticipates a competitive model, which risks creating islands of monopoly based upon the footprints of the proposed FTTN and HFC networks ? although the fixed wireless and satellite technologies should be able to operate competitively, if not profitably. This paper addresses the limitations of the policy as currently stated and proposes some changes in approach which share the objectives of the policy but without compromising access speed. The changes will eliminate the lead-in cost entirely and will introduce infrastructure competition in the long-term interests of end-users. They will accelerate the NBN roll-out and ensure that the national infrastructure is responsive to future technologies, market demands and business opportunities.

Introduction

On 11 December 2014 the Minister for Communications, Malcolm Turnbull, published a new government policy paper, ?Telecommunications Regulatory and Structural Reform? (Policy, 2014 [5]).

The policy requires, through carrier licence conditions destined to come into effect on the 1st of January 2015, that ?providers of superfast broadband networks providing services to residential customers to be functionally separated (that is, operate their networks and retail operations at arm?s length) and offer a 25/5 Mbit/s wholesale bitstream service at no more than $27 per month.?

Crucial aspects of this policy are that it establishes a relatively low speed access network compared with other countries and sets the scene for competition in the wholesale of broadband access. It leaves unaddressed some significant uncertainties in the costs of the NBN project, such as the lead-in cost; and it imposes some additional costs in preparing for future infrastructure competition.

This policy is based on a series of studies commissioned by the Minister, most importantly the Vertigan Panel Report (Vertigan, 2014 [6]) whose terms were announced in December 2013 (MoC Terms, 2013 [7]).

The headline terms of reference for the Panel to address were:

- What is the direct and indirect value, in economic and social terms, of increased broadband speeds, and to what extent should broadband be supported by the government?
- What are the optimal long-term ownership and regulatory arrangements for NBN Co?
- How should the activities of NBN Co be constrained given its mandate to efficiently build, operate and maintain a wholesale-only access network?
- How should NBN Co's capital investment, products and pricing be reviewed and regulated?

Vertigan Panel Report

The Vertigan Panel Report (Vertigan, 2014 [6]) in addressing these questions cites the Council of Australian Government?s Competition Principles Agreement (COAG, 1995 [8]), supporting competition and promoting the ? long-term interests of end-users**?** ? a key criterion for this critique. The Cost Benefit Analysis (Vertigan Vol. II, 2014 [9]) addressed the long term and set out to project outcomes to 2040.

The Panel concluded that ?a fully commercial rollout, to areas where demand covers costs, would yield net economic benefits of $24 billion? (NPV). And that the multi-technology mix (MTM) approach, basically FTTN, HFC and FTTP, would yield $16 billion greater benefits than relying solely on FTTP. It claimed that MTM can be upgraded and is ?robust to variation in the growth in demand.? This ?robustness? depends significantly on effective wholesale infrastructure competition to drive continuing investment.

The framework for the Cost Benefit Analysis and future projections was set by an economic analysis of today?s products, technologies, usages and business opportunities (Robson, 2014 [10]). This framework and the resulting cost benefit analysis were based on a peak download speed requirement of 25 Mbit/s possibly stretching to 50 Mbit/s.

The speed estimates factored into the model were from the Communications Chambers report of 26 May 2014 (Kenny, 2014 [11]).

The Panel observed that ?the growth rate of willingness to pay for higher speeds is a major source of uncertainty, as the nature of and willingness to pay for future applications are not readily predictable.? This observation is based on the assumption that higher speeds actually cost significantly more.

Whilst the published Cost Benefit Analysis has much of its information redacted, it is not clear that the Panel separated out all of the various components of cost, tested all of the sensitivities nor consider other designs and methodologies. In particular the lead-in cost from the street to the home is one of the largest costs to FTTP and the greatest cost and time uncertainty (apart from politics). FTTN does avoid this problem because the lead-in exists, but it does so by significantly compromising the access speed. HFC also avoids the lead-in problem but only for premises actually connected. FTTdp, a technology covered briefly below and elsewhere in this Journal, avoids the lead-in problem altogether and eliminates the access speed constraint (Watkins, Mar 2014 [12] and Watkins, Dec 2014 [13]).

Based effectively on the two assumptions that the maximum speed requirement is only 50 Mbit/s and that the lead-in cost can be avoided (to a certain extent), the Panel concluded that the MTM is significantly cheaper than FTTP alone.

Vertigan then went on to recommend ?that the Government move to disaggregate NBN Co along the lines of its underlying networks where each of the satellite, fixed wireless, HFC and FTTx networks would serve as the basis for a competing entity.?

Government policy paper

As a result of this substantial preparatory work, the Government?s new policy, ?Telecommunications Regulatory and Structural Reform? was published on 11 December 2014 (Policy, 2014 [5]).

Whilst maintaining that ?the Government does not support near?term disaggregation of NBN Co into business units based on access technologies? it retained the option ?for future restructuring or disaggregation ? to provide future governments with greater policy and financial flexibility.? It also expresses a preference for OSS/BSS IT systems to be readily separable, acknowledging that ?this may involve higher costs.?

NBN Co, Telstra and Optus: definitive agreements

On 14 December 2014 the Minister of Communications, NBN Co, Telstra and Optus announced new definitive agreements regarding the access and transfer of copper and HFC assets to NBN Co (Definitive Agreements Announced, 2014 [14]). The main changes to the definitive agreements were published in Telstra?s announcement to the ASX on 14 December 2014. (Telstra ASX Announcement, 2014 [15]). The agreements are confidential but certain information can be gleaned from the main changes described.

The headline $11 billion post-tax NPV price paid to Telstra remains unchanged. The ownership of the copper-pair and HFC assets will progressively transfer to NBN Co. Telstra will retain ownership of the ducts ? a major physical asset for which NBN Co will continue to pay substantial amounts annually, which leaves Telstra in a commanding competitive position with regard to duct usage. NBN Co will take over the remediation and maintenance costs of the ducts, pits and copper (and consequently the public liability). Telstra will also continue to deliver Foxtel services over the HFC. Telstra?s remediation obligations within FTTP regions have been capped.

Collectively these changes are significantly beneficial to Telstra although NBN Co obtains greater flexibility in the usage of assets. It might seem that the transfer of ownership of ducts and pits to NBN Co would have been a sensible move but Telstra has held all the cards in the negotiations and it remains politically too hard for governments to force the issue given the wide ownership of Telstra shares and the long history of share price problems.

Summary of issues

The Vertigan Panel Report and the Government Policy Paper present a range of issues all of which, if properly addressed, could result in a different set of conclusions and a different policy. The issues are summarised here and two in particular are addressed under the main headings of **Access Speed** and **Deep Fibre FTTdp** below.

The issues are:

- The access speed capability is the major determining factor, as assessed by the Vertigan Panel, in NBN cost. The forecast speed requirement was set by the Communications Chambers report at 25 Mbit/s possibly stretching to 50 Mbit/s (Kenny, 2014 [11]). This extraordinarily low forecast is in dramatic contrast with the massive investments being made by technology companies and carriers in driving access speeds for all types of fixed and wireless networks world-wide towards and beyond 1 Git/s per user or household. Admittedly, the Communications Chambers report openly acknowledges that it provides just one view in a subject open to debate. Unfortunately the debate appears not to have been given a full hearing by Vertigan or the Minister?s advisors.
- The lead-in cost and uncertainty are not addressed explicitly by Vertigan nor in any further policy

considerations. Nevertheless the avoidance of the lead-in cost is clearly the major advantage of FTTN over FTTP but with serious penalties in access speed and operational costs. HFC also avoids the lead-in cost where a connection already exists.

- The potential for HFC and FTTN to provide infrastructure competition is explicit but it is not clear how this will be effective for the benefit of end-users. The HFC networks have some particular characteristics. The two networks (Telstra and Optus) substantially overlap. And, of course, they also overlap the copper-pair network. Many premises (approximately 900,000) are passed by HFC but not connected. HFC coverage is also selective and would require fill-in in both commercial and residential areas if it were to become the only high-speed broadband access technology available in an area. The HFC infrastructure is 20 years old now and has had limited investment except for upgrading DOCSIS and digital TV. Telstra and Optus both stopped rolling out and promoting new consumer connections when confronted with low net growth, high roll-out costs, and increasingly high lead-in costs. John Goddard has written an excellent review of HFC and its potential as an alternative broadband technology demonstrating its capabilities to achieve high access speeds in the long term (Goddard, 2014 [16]). CCAP and Remote PHY are two technologies which extend the capability of HFC networks to offer 100+ Gbit/s access speeds (Brockett, 2013 [17]). But the existing Australian networks need serious and on going investment. In an HFC area without an FTTx competitor, there may be little incentive for such investments.
- NBN Co has announced a policy which effectively suspends FTTN deployment in HFC coverage areas (NBN Co, 2014 [18]). This is in conflict with the concept of effective infrastructure competition in the long-term interests of end-users ? a conflict which needs to be resolved.
- One transforming technology which was not explicitly discussed in the Vertigan Panel Report is fibre to the distribution point (FTTdp) (Watkins, Mar 2014 [12] and Watkins, Dec 2014 [13]). It avoids the major lead-in cost, offers 1 Gbit/s speeds and opens up effective competition options for the customer connection.
- By disaggregating NBN Co into business units based on the footprints of today?s technologies and eventually selling them off, the government will face the risk of setting up islands of monopoly with little incentive for investment in the future and no effective choice for customers. This was obviously not the intention of the Vertigan Panel, and it needs to be prevented. The government?s approach has been to defer disaggregation but to set up the conditions for it within NBN Co. Either way NBN Co will be distracted by the complexities and costs of multiple competing technologies.. The selling price obtainable by the government for a perceived monopoly would be higher than for a business facing real competition, but the former would not be in the long-term interests of end-users nor of Australia?s capability to engage in the global digital economy. It would give the unfortunate appearance of giving lip service to competition while paving the way for prospective monopolists as the new owners.
- Vertigan and the government policy both acknowledge that disaggregating the business units and their respective OSS/BSS IT systems will add additional costs, which could well be significant.

Access Speed

One of the critical (and startling) assumptions of the Vertigan report and the government?s response is that a peak requirement of 25 Mbit/s is enough per household, with 50 Mbit/s being an upper limit looking ten years out. This assumption drives the calculations of estimated cost and national economic benefit. The assumption is based on the Communications Chambers report (Kenny, 2014 [19]) but the debate surrounding it has not had an adequate hearing. The debate (or argument) has been raging within industry circles, but beyond the hearing of government and, it seems, without influence.

To the credit of the authors of the Communications Chambers report, they acknowledge that their findings are ? open to debate?, are ?limited in scope?, are subject to ?alternative assumptions? and are a ?contribution to a meaningful discussion rather than its conclusion?. Nevertheless one gets the strong impression that the report tries to talk down future data speed requirements to match the client?s expectations. The report also focuses heavily on current Internet usage, namely browsing and video downloads, giving much less attention to (and sometimes discounting) other uses or the potential for completely new applications which wide-spread download speeds of 1 Gbit/s overseas will undoubtedly spawn.

Clearly the rest of the world does not agree with the Communications Chambers findings. Scores of countries are rolling out FTTP networks to tens, possibly hundreds of millions of customers. Admittedly very few are on the geographical scale of the NBN as originally conceived, nor are as equitable, but the high average bit rates achieved by so many countries ahead of Australia indicate that FTTP penetration is very high and growing.

As at 13 December 2014, measurements in 41 countries indicate a ?rolling mean download speed? of 25 Mbit/s or more: Australia ranks 58th, at under 16Mbit/s (OOKLA, 2014 [20]). Australia is substantially behind the G8 (27.9), the EU (27.0), the OECD (26.7) and APEC (24.3). Akamai is another source of similar rankings, and its numbers are even less flattering to Australia (Akamai, 2014 [21]).

A number of arguments are presented by Communications Chambers that the demand for speed will slow. They start from the premise that video download is the major driver, that it is related to the number of users, not devices, and that users watch videos serially and therefore growth is limited. There is some validity in this but there is a long way to go before we reach a demand plateau, particularly as video over IP (for main stream movies or television) shows all the signs of becoming a dominant delivery mechanism ? and it has barely started.

The arguments include that data compression will continue to reduce bandwidth requirements. In fact improved compression techniques have taken place in steps several years apart but not progressively. H.265 or HEVC (2013) is the latest technique, which is said to double the efficiency of H.264 or MPEG-4 (2003). All these standards have complex intellectual property and royalty issues, which inevitably delay and restrict deployment. The additional compression offered is more than offset by increasing demand for higher resolutions. Communications Chambers acknowledges this offset but gives an overly strong weight to increasing compression.

Screen resolutions now exceed standard printing resolutions, HD TV is now the de facto standard (2K pixels on the long dimension). 50 inch (127 cm) 4K 3D TVs are available in Australia for under $2,000. 8K resolutions are also in development. Low cost 4K video cameras are also readily available, placing an increasing demand on upload speeds. Communications Chambers acknowledges this but projects a slow take up of 4K despite the low costs and ready availability even today.

Media compression techniques are usually but not always ?lossy?, compromising those parameters which are deemed to be least discernible to the eye or ear. (Those that are not lossy generally produce much larger files.) However, these kinds of compromises are becoming less acceptable for both consumers and for commercial reasons. Commercial advantages of higher accuracy of reproduction include improving the shopping experience. Colour fidelity and matching is one example (colour being the first parameter sacrificed in compression), and texture matching is likely in the future using 3D imaging. Another example is that higher resolution of sporting videos significantly improves the impact of fixed advertising even while cameras closely follow the action rather than the background. A number of companies are focused on significant improvements in colour fidelity for 4K video including Dolby Vision [22] and Technicolor [23].

It is argued that videos are watched serially and are limited by the number of users. However, the increase in imaging (multiple devices) in homes and offices for security, education, health, management and control would suggest that there is no end in sight (yet) to growth in demand for speed and capacity. Not every image or video taken and uploaded has to be watched.

The world-wide deployment of access networks capable of delivering 1 Gbit/s, together with globally distributed data centres, are removing the bottle necks for high speed downloads and are also removing the incentive for higher compression in favour of better reproduction accuracy.

Similar objections apply to the growth in number, range and capability of applications. Once certain bottlenecks are removed, the growth in traffic can increase very rapidly. Phone apps grew quickly once APIs were standardised, user interfaces simplified and app stores became available. Revolutionary improvements in download and upload access speeds will combine with these other revolutions to accelerate applications across the board. The revolution is not increasing the download speed to 25 or 50 Mbit/s but to 1 Gbit/s or 10Gbit/s, as it has in the commercial world. Big Data and the Internet of Things are upon us now. Australia has to be able to participate in the global scene.

One further consideration is that the growth in cloud storage and computing is at least as strong in the consumer market as in the business market. Images and videos are now being automatically backed up at full-resolution, often with unlimited bandwidth and sometimes to multiple cloud services. For example, Sony PlayMemories offers unlimited free photo storage at full resolution, regardless of whether you own a Sony camera or not. Entry level (paid) consumer cloud storage capacity jumped in one step in 2014 from 100 GB to 1TB for the same price (Dropbox, 2014 [24]). Apple, Microsoft and Google have followed suit.

All of these factors drive growth in economic activity and Australia should not be held back by a misalignment with the global directions on access speed, especially if its impact on cost is imagined rather than real.

Deep Fibre FTTdp

Fibre to the distribution point (FTTdp) is covered very comprehensively elsewhere in this Journal (Watkins, Mar 2014 [12], and Watkins, Dec 2014 [13]). It passes unmentioned by the Vertigan Panel and the new policy, even though it may be considered to be an end-game of fibre to the node (FTTN).

In summary FTTdp involves replacing all the copper pair cable in the access network (up to the property boundary) with optic fibre cable, and providing a pit mounted VDSL2 or G.fast node to connect one or more dwellings at up to 1 Gbit/s, using the existing copper pair lead-ins. The significant advantages of this technique are firstly that the lead-in replacement cost is avoided, and secondly that a choice of retailers can provide the customer connection rather that the wholesaler. This results in massive savings in construction, operations (compared with FTTN) and BSS/OSS costs to NBN Co, as well as creating a form of competition which is meaningful for the consumer. Nor does it preclude wireless as a competitive access methodology along the lines of Telstra?s Wi-Fi initiative (Telstra Wi-Fi, 2014 [25]) or a 4G or 5G mobile equivalent. Customers who want a direct fibre connection can also obtain it from competitive retailers.

A cost comparison between FTTN and FTTdp would entail the costs of the street-side cabinets, their power and maintenance plus the maintenance of the copper-pair cables versus the extension of more fibre (a significant proportion of premises would already be passed by fibre to reach the FTTN cabinets) and the relative costs of the FTTdp mini-nodes versus the FTTN nodes. Over a 25 year cost benefit comparison, the inevitable need to upgrade the FTTN periodically must be factored in.

The management advantage of an FTTdp roll-out versus an FTTN is that it becomes essentially a civil engineering project with a single wholesale BSS/OSS. By giving a singular focus to the NBN Co project team together with an aggressive and progressive improvement programme, costs can be driven down and the rate of deployment increased. Objectives can be set and incentives provided towards that end.

The greatest national economic benefit of FTTdp is that Australian businesses and entrepreneurs can then participate in the global digital economy on an equal basis to the rest of the world instead of being artificially and unnecessarily constrained in access speed to something 40 times less than that which the best of the rest of world is deploying.

FTTdp offers both a potential cost advantage plus the potential economic benefits flowing to Australia where 1 Gbit/s access speeds are available rather than 25 Mbit/s.

Recommendations

By making the following amendments, the NBN policy could be significantly improved:

1. **Declare the property boundary as the network boundary.**

This will eliminate the lead-in cost from the NBN Co project and enable a much tighter focus on what is the best delivery technology.

2. **Declare the customer lead-in as open to competition.**

This will provide effective competition for the benefit of end-users, not just in initial cost but for long-term ongoing support. It should be open for copper-pair, coaxial cable, wireless or fibre solutions depending only upon the customer and the retailer. Retailers should be licensed and meet certain basic requirements including APIs and service levels.

3. Consider selling the HFC networks sooner rather than later.

Minimum service requirements would have to be placed on the purchaser(s) but this would improve the immediate cash flow position for the government, and for NBN Co it would remove a significant management and engineering overhead, thus significantly tightening the focus of the project, with associated cost and delivery benefits.

4. Require NBN Co to pass all premises in the original FTTP footprint with optic fibre.

This will establish effective wholesale competition in the access network between FTTdp and HFC. The priorities should be determined by NBN Co on the basis of maximising the speed of the roll-out, without regard to existing HFC coverage.

5. Establish KPIs and incentives for NBN Co

The KPIs should include cutting its fibre deployment cost by X% per annum, increasing its rate of deployment by Y% per annum and increasing its maximum available speed by Z% per annum.

There must be a process whereby the objectives set for NBN Co are comprehensive, are genuinely challenging but are achievable.

Collectively this amended policy would:

- Provide effective competition and real choices for customers.
- Drive the capital and operating costs of NBN down dramatically.
- Lift the entirely unrealistic speed and performance caps in the proposed access network to world standards in a relatively short time frame.
- Establish a simple low-cost NBN wholesale infrastructure company which is open to competition in the short term, and in the longer term is saleable.
- Enable and energise Australia to participate profitably in the global digital economy.

Conclusions

With the recent run of government reports, policies and agreements, it might appear that the deal is done and that it is too politically difficult to make the necessary changes to such an improved policy. But this might not be the case.

The MTM is not actually incompatible with FTTdp and the proposed more competitive model advanced in this paper. FTTN and HFC both need to push fibre deeper into the access network to achieve world standard performance. NBN Co could make the transition over months with minimal further direction and the Minister could revise the policy accordingly after due consideration of costs and benefits.

The competitive model as described should be very attractive to the competitive carriers, large and small, and it should open up many opportunities for innovative solutions.

Most of all, great opportunities would be opened up for Australian businesses and entrepreneurs to participate in the global digital economy, unconstrained by ultimately irrelevant technical arguments about whether users should be limited in speed to 50 Mbit/s or 25 Mbit/s, when 1 Gbit/s is necessary and becomes entirely feasible at a reasonable cost.

Acknowledgements

This paper has benefitted greatly from the contributions of many people, not the least being the anonymous reviewers, all of whom have been studious and expert in their contributions and appraisals at both the strategic and tactical levels as well as in the fine detail. Nevertheless, all the flaws and weaknesses in the paper are entirely the responsibility of the author.

Glossary

COAG	Council of Australian Governments
LTIE	Long-term interests of end-users ? an objective of the COAG Competition Principles Agreement.
Copper-pair cable	Cable of bundled twisted pairs of copper wires which have provided the telephone connection for many decades. New technologies have made it capable of carrying high speed data.
Lead-in cable	The final connection between the external network and the internal premises network. It may be a twisted pair cable or a coaxial cable or an optical fibre. It may be short but because all premises are different the cost of provision is unpredictable and potentially very high.
FTTP	Fibre to the premises ? comprises an end to end optical fibre connection.
FTTH	Synonymous with FTTP except that it implies a residential connection.
FTTN	Fibre to the Node ? comprises optical fibre to a street-side cabinet with a dedicated copper-pair cable to the premises. Powered locally and contains battery backup power.
HFC	Hybrid Fibre Coax ? comprises optical fibre from the operators ?headend? to a ?node? with a shared RF modulated coaxial cable to the premises.
CCAP	Converged Cable Access Platform ? a fully digital HFC technology which facilitates high speed and a range of services.
Remote PHY	Remote PHY is an HFC node technology which dynamically manages the upstream and downstream bandwidths on shared HFC.
FTTdp	Fibre to the distribution point ? comprises optical fibre to a node very close to the premises with copper-pair distribution of broadband to individual premises. Very small nodes are often back-powered from the premises over the copper pair.
FTTx	A generalised term for any of the fibre and/or copper-pair technologies. Does not encompass HFC.
VDSL2	Very high bit rate Distributed Subscriber Line ? modulation technique used on copper-pair cable for the final connection to the premises. It is useable up to about 800 metres after which the speed falls off quickly.
G.fast	An evolution of VDSL2 intended for shorter lengths of copper-pair cable up to 250 metres. The access speed can potentially reach 1 Gbit/s.
MTM	Multi-Technology Mix ? comprises all of the broadband access technologies including FTTN, HFC, FTTdp, fixed wireless and satellite.
Deep fibre	Fibre almost to the premises ? may be applied to FTTN, FTTdp or HFC.
CPE	Customer premises equipment ? in this case a modem to covert the broadband signal to one or more Ethernet ports.
OSS/BSS	Operational Support Systems/Business Support Systems ? comprises both the processes and the IT systems which enable them.

References

Akamai. 2014, *State of the Internet*, http://www.akamai.com/stateoftheinternet/index.html [26], accessed 15 Dec 2014.

Brockett, Rei, 2013. *The evolution of CCAP*, http://www.lightwaveonline.com/articles/2013/09/the-evolution-of-ccap.html [27], accessed 18 Dec 2014

Comparison of international download speeds, OOKLA Net Index, http://www.netindex.com/download/allcountries/ [28], accessed 13 Dec 2014.

Council of Australian Governments, 1995. Competition Principles Agreement,https://www.coag.gov.au/node/52 [29], accessed 13 Dec 2014.

Dropbox cloud storage plans. 2014. https://www.dropbox.com/plans [30], accessed 13 Dec 2014.

Goddard, John. 2014. *The Untapped Potential of Hybrid Fibre Coaxial Networks*, http://telsoc.org/ajtde/2014-06-v2-n2/a40 [31], accessed 18 Dec 2014.

Kenny, Robert; Broughton, Tom. 2014. *Domestic bandwidth requirements in Australia - A forecast for the period 2013-2023*, http://www.communications.gov.au/__data/assets/pdf_file/0013/243040/Forecasting-Australian-Per-Household-Bandwidth-Demand-Commun.pdf [32], accessed 13 Dec 2014.

Minister for Communications. 2013. *Panel of Experts to conduct cost-benefit analysis of broadband & review NBN regulation*, http://www.minister.communications.gov.au/malcolm_turnbull/news/Panel_of_experts_to_conduct_cost-benefit_analysis_of_broadband_and_review_nbn_regulation [33], accessed 13 Dec 2014.

Minister for Communications Policy Paper. 2014. *Telecommunications Regulatory and Structural Reform,* http://www.communications.gov.au/__data/assets/pdf_file/0020/243902/Telecommunications_Regulatory_and_S _11_December_....pdf [34], accessed 13 Dec 2014.

Minister for Communications NBN Co definitive agreements. 2014. *NBN Co and Telstra sign revised Definitive Agreements*, http://www.minister.communications.gov.au/malcolm_turnbull/news/nbn_co_and_telstra_sign_revised_definitive_ [35], accessed 15 Dec 2014.

NBN Co media release. 2014. *NBN Co outlines principles for Multi-Technology rollout*, http://www.nbnco.com.au/corporate-information/media-centre/media-releases/nbn_co_outlines_principles_for_multi_technology_rollout.html [36], accessed 18 Dec 2014.

Robson, Alex. 2014. *Cost-Benefit Analysis of Public Investment in High Speed Broadband Network Infrastructure: An Analytical Framework*, http://www.communications.gov.au/__data/assets/pdf_file/0007/240766/5._NBN_CBA_Analytical_Framework_Fi [37], accessed 13 Dec 2014.

Telstra ASX Announcement. 2014. *Key changes to the original definitive agreements*, http://www.telstra.com.au/abouttelstra/download/document/asx-announcemen... [38], accessed 15 Dec 2014.

Telstra National Wi-Fi Network, https://www.telstra.com.au/broadband/wifi [39], accessed 15 Dec 2014.

Vertigan Panel Report to the Minister for Communications. 2014. *Independent cost?benefit analysis of broadband and review of regulation*, http://www.communications.gov.au/__data/assets/pdf_file/0009/243387/NBN-... [40], accessed 13 Dec 2014.

Vertigan Panel Report Volume II. 2014. *Cost Benefit Analysis*, http://www.communications.gov.au/__data/assets/pdf_file/0003/243039/Cost-Benefit_Analysis_-_FINAL_-_For_Publication.pdf [41], accessed 13 Dec 2014. (Useful cost information has been redacted)

Watkins, Craig; Lillingstone-Hall, Kelvin. 2014. *The FTTdp technology option for the Australian National Broadband Network*, http://telsoc.org/ajtde/2014-03-v2-n1/a26 [42], accessed 13 Dec 2014.

Watkins, Craig; Lillingstone-Hall, Kelvin. 2014. *A closer look at Deep-fibre FTTdp*, http://telsoc.org/ajtde/2014-12-v2-n4/a67 [43], accessed 13 Dec 2014.

Article PDF:
3_ajtde_v2n4a76_gshepherd_critique_of_new_nbn_policy.pdf [44]

Cite this article as:

Graham Shepherd. 2014. *Critique of the new NBN policy* . ajtde, Vol 2, No 4, Article 76. http://doi.org/10.18080/ajtde.v2n4.76 [46]. Published by Telecommunications Association Inc. ABN 34 732 327 053. https://telsoc.org [47]

NBN Policy [48] NBN Policy [48] National Broadband Network [49] NBN [50] FTTdp [51]

Links

[1] https://telsoc.org/journal/author/graham-shepherd [2] https://telsoc.org/journal/ajtde-v2-n4 [3] https://www.addtoany.com/share#url=https%3A%2F%2Ftelsoc.org%2Fjournal%2Fajtde-v2-n4%2Fa76&title=Critique%20of%20the%20new%20NBN%20policy%20%20%20 [4] https://telsoc.org/printpdf/1260?rate=iNOB8khT-vnxQcwbETBRo_u5dDDG8HUztj05QmXCQuI [5] https://telsoc.org/journal/ajtde-v2-n4/a76#Policy [6] https://telsoc.org/journal/ajtde-v2-n4/a76#Vertigan [7] https://telsoc.org/journal/ajtde-v2-n4/a76#Terms_of_Reference [8] https://telsoc.org/journal/ajtde-v2-n4/a76#COAG [9] https://telsoc.org/journal/ajtde-v2-n4/a76#Vertigan_Vol_II [10] https://telsoc.org/journal/ajtde-v2-n4/a76#Robson [11] https://telsoc.org/journal/ajtde-v2-n4/a76#Kenny [12] https://telsoc.org/journal/ajtde-v2-n4/a76#Watkins_mar [13] https://telsoc.org/journal/ajtde-v2-n4/a76#Watkins_dec [14] https://telsoc.org/journal/ajtde-v2-n4/a76#Definitive_agreements [15] https://telsoc.org/journal/ajtde-v2-n4/a76#Telstra_asx_announcement [16] https://telsoc.org/journal/ajtde-v2-n4/a76#Goddard [17] https://telsoc.org/journal/ajtde-v2-n4/a76#Brockett [18] https://telsoc.org/journal/ajtde-v2-n4/a76#NBNCo_MTM [19] https:///C:\Users\Grazzha\TelSoc\Journal\My%20papers\V2N4AGMS_ver01.docx#Kenny [20] https://telsoc.org/journal/ajtde-v2-n4/a76#Ookla [21] https://telsoc.org/journal/ajtde-v2-n4/a76#Akamai [22] http://www.dolby.com/us/en/technologies/dolby-vision.html [23] http://www.technicolor.com/en/who-we-are/press-news-center/press-releases/technicolor-introduces-two-certification-programs-deliver-color-accuracy-and-stunning-4k-content [24] https://telsoc.org/journal/ajtde-v2-n4/a76#Dropbox [25] https://telsoc.org/journal/ajtde-v2-n4/a76#Telstra_WiFi [26] http://www.akamai.com/stateoftheinternet/index.html [27] http://www.lightwaveonline.com/articles/2013/09/the-evolution-of-ccap.html [28] http://www.netindex.com/download/allcountries/ [29] https://www.coag.gov.au/node/52 [30] https://www.dropbox.com/plans [31] http://telsoc.org/ajtde/2014-06-v2-n2/a40 [32] http://www.communications.gov.au/__data/assets/pdf_file/0013/243040/Forecasting-Australian-Per-Household-Bandwidth-Demand-Commun.pdf [33] http://www.minister.communications.gov.au/malcolm_turnbull/news/panel_of_experts_to_conduct_cost-benefit_analysis_of_broadband_and_review_nbn_regulation#.VIuqeSvFLiw [34] http://www.communications.gov.au/__data/assets/pdf_file/0020/243902/Telecommunications_Regulatory_and_Structural_Reform_Paper_-_11_December_....pdf [35] http://www.minister.communications.gov.au/malcolm_turnbull/news/nbn_co_and_telstra_sign_revised_definitive_agreements [36] http://www.nbnco.com.au/corporate-information/media-centre/media-releases/nbn_co_outlines_principles_for_multi_technology_rollout.html [37] http://www.communications.gov.au/__data/assets/pdf_file/0007/240766/5._NBN_CBA_Analytical_Framework_Final_16_May_2014.pdf [38] http://www.telstra.com.au/abouttelstra/download/document/asx-announcement.pdf [39] https://www.telstra.com.au/broadband/wifi [40] http://www.communications.gov.au/__data/assets/pdf_file/0009/243387/NBN-Market-and-Regulatory-Report.pdf [41] http://www.communications.gov.au/__data/assets/pdf_file/0003/243039/Cost-Benefit_Analysis_-_FINAL_-_For_Publication.pdf [42] http://telsoc.org/ajtde/2014-03-v2-n1/a26 [43] http://telsoc.org/ajtde/2014-12-v2-n4/a67 [44] https://telsoc.org/sites/default/files/tja/pdf/3_ajtde_v2n4a76_gshepherd_critique_of_new_nbn_policy.pdf [45] https://telsoc.org/copyright [46] http://doi.org/10.18080/ajtde.v2n4.76 [47] https://telsoc.org [48] https://telsoc.org/topics/nbn-policy [49] https://telsoc.org/topics/national-broadband-network [50] https://telsoc.org/taxonomy/term/36 [51] https://telsoc.org/topics/fttdp