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Inquiry into the Business Case for the National Broadband Network (NBN)

This is a personal submission, I hope of relevance to the Joint Standing Committee on the NBN. I am an innovation researcher, whose area of research is innovation theory, adoption of new technology, creation of value, and the business and economics of innovation. My recent Technology and Innovation Management PhD (add ref) was about how and why consumers adopt smartphones within the broader context of emerging broadband technologies. Within my PhD I tested my theory against innovation policy documents including then recent NBN McKinsey report into the NBN (add ref). My recent publications (add ref) include financial analysis of FTTN and FTTP costs of delivering NBN. I have a business background (15 years as a Chartered Accountant) so I understand financial statements and budgets. I work on a \$120M federally funded innovation project (ANDS - add ref), so I understand the challenges of encouraging new users to adopt a new technology. As part of my work at ANDS, I work in the arena of data science and Open Science. I have a keen interest in data visualisation, and tools to manage data models, such as Jupyter Notebooks, and a new tool called an Observable Notebook. I use in this submission, an Observable Notebook (hereafter, the model), as a rapid-prototyping tool to understand the financials and economics of the NBN. An Observable Notebook is interesting for an Open Scientist, because it creates a public, interactive, calculation tool, where the software code that makes it work is visible easily to see how it works; a user of the tool can change the settings and instantly see how results are changed. The result in this model's case is the value of NBN in 2040 (or other year a user selects; at a discount rate the user selects), or the impact of the NBN on Australia's GDP (gross domestic product; ie Australia's economic output).

In summary, I created a model (add ref) of NBN Financials from 2021 to 2040 and beyond, based on several user-selectable options, of interest to this Committee including:

- level of non-NBN use (mobile only households; **(MOHH)**)
- ability of NBN users to upgrade to gigabit services, with higher revenue and profit for NBN **(GBPS)**
- level of users switching away from NBN, when FTTN reaches the end of its life (modelled at ten years(2031), but adjustable in the model) if FTTN was not upgraded **(EOL_FTTN)**
- level of NBN customer satisfaction (with low satisfaction selections seeing users stop using NBN and slowing usage, and high selections see more NBN users, and more NBN use; **CSAT**)
- timing of repayment of NBN loans; **(DEBTpay)**, and
- lastly, the financial cost and revenue impact of replacing FTN with either FTTC or FTTP, when NBN finances allow; **(FTTNupgrade)**.

Thus the topics of interest to the Committee, are covered by some of the options in the model, include (from my level of interest/analysis):

- the key financial indicators in the Corporate Plan 2018-2021, and underlying financial forecasts out to 2040
- the competitive risks facing the multi-technology mix
- revenue generation
- the impact of alternate pricing structure on the economics of the NBN
- other matters relevant to the commercial viability of the NBN
- the Commonwealth's accounting treatment of the government debt/investment in NBN
- the prospect of future sale in whole or part of NBN.

Comparing the model variables and the Committee's interest (see Table 1), shows a strong overlap. The model variable (all except debt repayment) affect all issues of interest to the Committee except for alternate pricing. On pricing I would say, the budgeted profits suggest expected prices are set appropriately, and raising prices would threaten expected case profits (EBITDA).

Committee Topics of interest / Model Variables	MOHH Table 2.	GBPS T3	EOL_FTTN Table 4.	CSAT Table 5.	DEBTpay	FTTNupgrade Table 6,7.
Key Financial Indicators	✓✓	✓	✓	✓✓		✓
Competitive Risks	✓		✓	✓		
Revenue Generation		✓		✓		✓
Commercial Viability	✓	✓	✓	✓✓		✓
Alternate Pricing						
Accounting Treatment	✓	✓	✓	✓		✓
Future Sale	✓	✓	✓	✓		✓
Impact on NBN Value: MAX (\$B)	64	54	30	52		21-42
Impact on NBN Value: MIN (\$B)	14	30	23	-27*		16-37
Likely NBN Value (\$B)	30	40	28	31		42

Table 1: Which Model variables relate to which Committee Topics. Two ticks indicate especially significant for that topic. In all cases, but one*, NBN debt is repaid and substantial value created. The value is the cash accumulated through operations at Yr 20.

Key Financial Indicators 2018-2021

Version 1 of the Model shows the NBN 2018 - 2021 Corporate Plan. To date I have been concerned at the level of losses, each quarter and half the NBN Co reports. But the Corporate Plan, provides a positive story about the financial position at NBN at the end of the current build in 2021. See Figure 1 below. The analysis shows that:

- while NBN will have racked up \$20 billion(B) in debt (ref) by the end of the build
- NBN also generates substantial cash operating surplus each year (around \$2.5B per year; the gap between the bar - costs, and the line - revenue). Thus the Model shows NBN would repay its \$20B loan in under ten years, if (1) reality followed NBN Corporate Plan 2018 - 2021, and (2) over the next ten years, there were no changes to that plan's assumptions. But what could go wrong? The model (v1) also allows increasing the number of non-NBN users, or so-called mobile only households. If Telstra, Optus, Vodafone etc can attract low end users, with little broadband demand, then the revenue of NBN would fall, putting NBN Co's assumptions at risk. But even if up to 40% of households didn't use NBN, NBN can still repay its \$20B debt, but is worth much less at \$14B (see Table 2 below). The Corporate Plan assumption does appear reasonable, but if NBN is generating over \$2B annually, there is a strong incentive for the telcos to try to take some of those customers. NBN will not suit everyone, but how many won't use NBN is unknown.

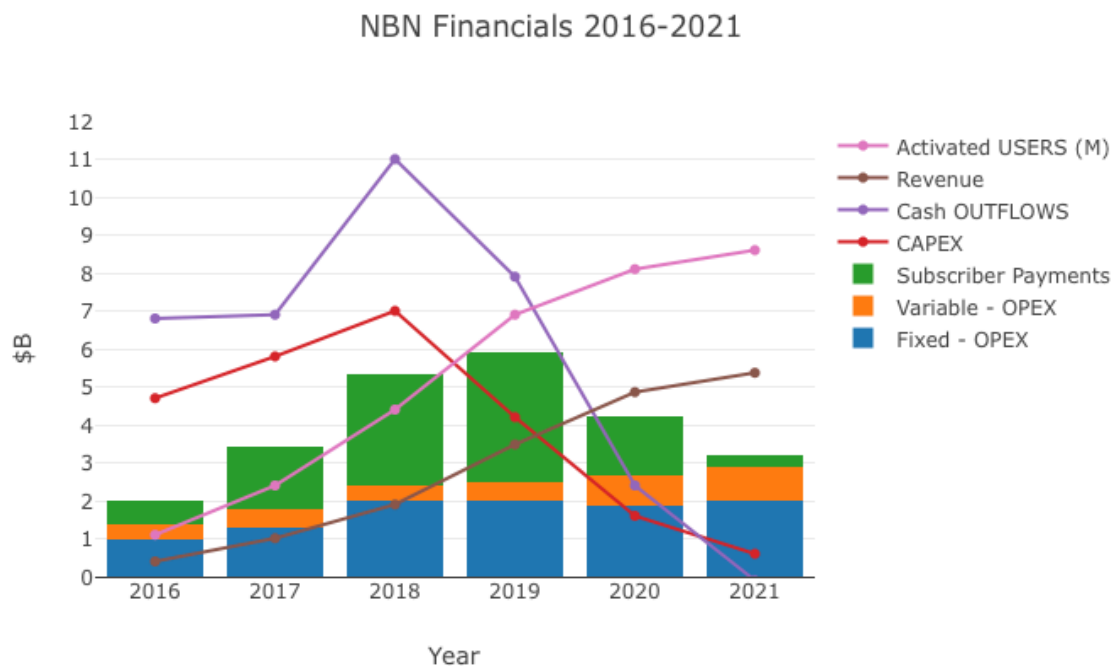


Figure 1. NBN Financials during the NBN Build. Debt \$20B. Cashflow positive in 2021.

- NB: The figures modelled do not include inflation, price rises, interest earned or paid. Thus, they are current prices, discounted at inflation and assuming no real price rises.

MOHH	Min	Corporate Plan 2018	Max
Mobile only households	0%	26.5%	40%
NBN value at Yr 20	\$B 64	\$B 30	\$B 14
Cash per year (EBITDA)	\$B 4pa	\$B 2.4pa	\$B 1.6pa
Year Debt \$20B paid	Yr 5	Yr 8	Yr 13

Table 2. **Mobile Only homes.** Impact on Value and debt-repayment of NBN

GBPS	Min Corp Plan 2018	Mid/low	Moderate	High
Usage of Gigabit NBN	0%	10%	30%	75%
NBN value at Yr 20	\$B 30	\$B 33	\$B 40	\$B 54
Cash per year (EBITDA)	\$B 2.4pa	\$B 2.55pa	\$B 2.85pa	\$B 3.5pa
Year Debt \$20B paid	Yr 8	Yr 8	Yr 7	Yr 6

Table 3. **Gigabit NBN Usage.** Impact on Value and debt-repayment of NBN

NBN will allow very fast internet in the next couple of years, but only across some of the multi-technology mix (MTM) technologies. The FTTP, FTTC and HFC services are all likely to enable gigabit services. Currently the Wireless, Satellite and some or most of the FTTN are not likely able to support gigabit services. Table 3 shows increase in revenue, value and cashflow capacity for NBN providing enhanced services at gigabit level. I modelled users paying twice current average prices for gigabit services, with cost rising only \$20 per month for NBN for each service, with no impact on fixed costs. At high usage of gigabit services, NBN is close to twice as valuable (\$54B vs Corp Plan \$30B). It is quite possible that a moderate to high level of NBN gigabit services could become the norm within 20 years.

EOL_FTTN	Min Corp Plan 2018	Mid/low	Moderate	High
Leaving FTTN at End of Life (ten years)	0%	20%	50%	80%
NBN value at Yr 20	\$B 30	\$B 28	\$B 25	\$B 23

Cash per year (EBITDA)	\$B 2.4pa	\$B 2.2pa	\$B 1.9pa	\$B 1.6pa
Year Debt \$20B paid	Yr 8	Yr 8	Yr 8	Yr 8

Table 4. **FTTN End of Life.** Negative Impact on Value and debt-repayment of NBN of not replacing FTTN.

FTTN is a concern because its length of life is quite short compared to other fixed line technologies (add ref). Within the near future, FTTN will have to be replaced or upgraded, but at what cost, with what timeframe, and with what impact on the NBN finances. The model seeks to estimate the costs and revenues of the FTTN situation under a number of scenarios. The First scenario is do nothing. One outcome of this is decreasing satisfaction, specially if there is large uptake of gigabit services which are not possible on FTTN. FTTN is also used by many millions of NBN customers, so upgrading is likely to cost many billions of dollars. In the order of \$15-20B for an upgrade to FTTP, at a cost of \$4400 per house, currently NBN estimate. However, as we will see, this upgrade can be paid for from NBN operating profits, to be completed in as little as ten years.

If the FTTN problem is ignored, the impact on NBN is small to moderate. For some low level users of NBN, for instance the elderly, the slower NBN of FTTN may be of little hardship. However, for families, young adults, and workers generally, over time, FTTN is likely to be less attractive. After ten years, if nothing is done, large numbers of users are likely to vote with their feet. So loss of 50% of FTTN customers at FTTN end of life is not unlikely. Yet the financial impact of this on NBN is relatively minor; a loss of \$5B in value (around 15%) and a loss of \$B 0.5 in operating profit (Table 4 above).

CSAT	V.Poor	Poor	Moderate	High	V.High
Customer Satisfaction (0 - 100)	10	30	50	70	90
NBN value at Yr 20	\$B -27	\$B 3	\$B 21	\$B 31	\$B 52
Cash per year (EBITDA)	\$B -0.3pa	\$B 1.1pa	\$B 2.0pa	\$B 2.4pa	\$B 3.5pa
Year Debt \$20B paid	Never	Yr 18	Yr 10	Yr 8	Yr 6

Table 5. **Customer Satisfaction.** Significant Impact on Value and debt-repayment of NBN of care of customers.

How NBN operates, what they charge, the quality of their service, how they keep people informed all affects customer satisfaction. I modelled a Customer Satisfaction score (from 0 - 100) which had various impacts on NBN financially. A high score meant more people joined NBN and used more services, while a low score meant the opposite. While a single score was used across all technologies, it is likely to vary across technologies, with FTTN and Satellite having lower scores, due to their lower and more variable performance, while FTTC, FTTP and HFC score higher more better capacity

and reliability. Assuming, 0% of NBN customers take up gigabit services, and 0% of FTTN users leave NBN when it reaches end of life, Table 3 shows the impact on NBN value and cashflow, for various levels of customer satisfaction (At CSAT = 60, NBN Value = \$31B). It is likely to show that there is a big effect on the financials when people are both happy and / or sad. A score of 60 / 100 would mean no change in financials.

It is interesting that customer satisfaction has a very high and significant impact on NBN financials (see Table 5 above), both annually and across the time range to impact NBN value. There is more than a \$50B variation between high and low satisfaction levels, suggesting that NBN should be keeping a close eye on and responding to customers satisfaction. Importantly customers from my perspective are NBN end users, not the RSPs that NBN traditionally treats as customers. RSPs pay NBN, but households are the ultimate customers and their satisfaction has a great impact on NBN and their level of success.

FTTNupgrade	V.Low	Low-Moderate	Moderate	High	V.High
Investment of surplus cash in FTTN upgrade	20%	40%	60%	80%	100%
NBN value at Yr 20	\$B 21	\$B 16	\$B 16	\$B 17	\$B 16
Cash per year (EBITDA)	\$B 2.4pa	\$B 2.4pa	\$B 2.4pa	\$B 2.4pa	\$B 2.4pa
Year Debt \$20B paid	Yr 8	Yr 8	Yr 8	Yr 8	Yr 8

Table 6. **Upgrade FTTN.** Impact on value and cashflow of varying investments replacing FTTN. Assuming no gigabit service users, and no FTTN EOL leavers.

The model also examines the financial and cash impact of replacing FTTN with FTTC or FTTP, out of NBN operating cashflows. No further debt is required to replace FTTN (using current install prices; \$2,900 per house for FTTC, and \$4,400 per house for FTTP; add REF). Debt may also be repaid as a priority before upgrading FTTN. The timing of both debt repayment and upgrading FTTN, is modelled as a percentage of surplus cash. Thus debt can be paid with 100% surplus cash, as highest priority, then upgrading FTTN as the next priority. Alternatively, a percentage can be applied to debt (say 20%, 40%, 60%), paying a portion the debt. Similarly, a proportion of free cash can be applied to FTTN users to shift them to FTTC or FTTP. A user can choose either one or other technology, or a mix. A formula calculates how much cash is available for upgrade, allocates them to technology, and based on the price for user, calculates the number of users who upgrade. Those upgraded can then access gigabit services, and are not longer counted in those proportion leaving FTTN as it approaches end of life.

Of significant surprise, is that FTTN can be fully funded and replaced with FTTC in as little as four years (FTTP in six years), if no debt is repaid (V5 of the model). Assuming Ultra-broadband adopters is 0%, and FTTN leavers is also 0%, the NBN financial impact on upgrading FTTN is shown in Table 4. Base Case NBN value is \$31B. After upgrading FTTN, if there is no gigabit usage, NBN value is \$16-17B, since the cash has been spent, but no extra revenue generated. So FTTN replacement is not

valuable. However, if Ultra-broadband adopters are 50% and FTTN EOL leavers is 50%, the impact is as shown in Table 5 (and also increases Base Case NBN value to \$38B; and pre FTTN EOL profit to \$3.2B and post FTTN EOL to \$2.3B)

FTTNUpgrade	V.Low	Low-Moderate	Moderate	High	V.High
Investment of surplus cash in FTTN upgrade	20%	40%	60%	80%	100%
NBN value at Yr 20	\$B 37	\$B 40	\$B 42	\$B 42	\$B 42
Cash per year (EBITDA)	\$B 3.6pa	\$B 3.7pa	\$B 3.7pa	\$B 3.6pa	\$B 3.6pa
Year Debt \$20B paid	Yr 6	Yr 6	Yr 6	Yr 6	Yr 6

Table 7. **Upgrade FTTN**. Impact on value and cashflow of varying investments replacing FTTN. Assuming 50% gigabit service users, and 50% FTTN EOL leavers.

When all people shift to gigabit services, NBN value rises from \$31B to \$63B, with no FTTN upgrade (80% \$56B, 60% \$50B). If all FTTN users also abandon NBN, then NBN value drops to \$46B, which is recovered to \$68B when FTTN is replaced.

CONCLUSION:

When all people shift to gigabit services, NBN value rises from \$31B to \$63B, even with no FTTN upgrade (80% \$56B, 60% \$50B). If all FTTN users also abandon NBN, then NBN value drops to \$46B, which is recovered to \$68B when FTTN is replaced.

BEST CASE SCENARIO for NBN; highest satisfaction, 27% mobile use, FTTN replaced, 100% gigabit usage, debt all repaid; VALUE NBN: \$105B at Yr 20.
10% mobile use: VALUE NBN: \$156B.
No mobile use: VALUE NBN: \$171B

WORST CASE SCENARIO for NBN: very low satisfaction (10%), 40% mobile use (high), 10% gigabit use, debt unpaid, FTTN abandoned by 90% at end of life, no FTTN upgrade; VALUE NBN -\$19B;
0% gigabit use, FTTN abandoned 100%; VALUE NBN: -\$23B.

The true value of the NBN in 2041 (Yr 20 of this analysis) lies between -\$23B and \$171B. I hope the Model has helped clarify some of the ways that the value can be greater or lesser.

Notes on NBN 2021 projected Financials

The model (add ref) shows NBN's projected build costs until 2021, including costs, revenue, capex (capital expenditure; NBN build cost), derived from Corporate Plan 2018 - 2021, and NBN Annual Report 2016-17.

1. The Subscriber Payments are significant, at over \$10B. These payments are to telcos to transfer customers on to NBN.

2. There are substantial annual fixed costs, in the order of \$2B per annum. It is unclear to what extent these relate to the NBN Build (or may reduce after the build phase), so I have continued with these costs in the years after the build completes. Even with these substantial annual costs, NBN still makes a substantial annual cash profit (EBITDA) by 2021 (around \$2.5B). It is possible, since NBN is expected to be substantially profitable (at least at EBITDA level), that these \$2B are flabby and inefficient operation. If NBN was sold, it is likely or possible a private purchaser would try to slash these costs to maximise the return on their investment.

Appendices:

https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/How_to_make_a_submission

The best submissions:

- clearly address some or all of the terms of reference—you do not need to address each one
- are relevant and highlight your own perspective
- are concise, generally no longer than four to five pages
- begin with a short introduction about yourself or the organisation you represent
- emphasise the key points so that they are clear
- outline not only what the issues are but how problems can be addressed, as the committee looks to submissions for ideas to make recommendations
- only include documents that directly relate to your key points
- only include information you would be happy to see published on the internet.