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Australian Government
Department of Broadband, Communications
and the Digital Economy

Peter Harris

Secretary

Ms Sharon Bird MP
Chair
House of Representatives Standing Committee on
Infrastructure and Communications
PO Box 6021
Parliament House
CANBERRA ACT 2600

Dear Ms Bird

I refer to your letter to Senator Stephen Conroy dated 9 December 2010 indicating that the House of Representatives Standing Committee on Infrastructure and Communications would be pleased to receive a consolidated submission on behalf of this portfolio in relation to the Inquiry into the Role and Potential of the National Broadband Network.

I note that submissions were to be sent by email before 25 February 2011 but that the Committee kindly granted this portfolio an extension to file by 25 March 2011.

Enclosed please find the portfolio's submission to this Inquiry. The Department looks forward to elaborating on the matters outlined in the submission at a future hearing, if the Committee so wishes.

Yours sincerely

A handwritten signature in black ink, appearing to be 'Peter Harris'.

Peter Harris
24 March 2011



Australian Government

**Department of Broadband,
Communications and the Digital Economy**

Submission to the House Standing Committee on Infrastructure and Communications

The Role and Potential of the National Broadband Network

23 March 2011

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1. Executive Summary

The Australian telecommunications market is going through a period of transition as the National Broadband Network is rolled out.

The National Broadband Network (NBN) will dramatically improve the speed, quality and reliability of broadband services available to all Australians. The NBN is also fundamentally changing the telecommunications industry structure in Australia, providing the basis for a dynamic competitive market for the supply of services that use high-speed broadband.

Providing all Australians with access to world class high-speed broadband in turn creates opportunities for business, for government and for consumers themselves to use the NBN to expand business opportunities, improve and extend the reach of service delivery, help address significant public policy challenges, and get easier and more convenient access to a greater range of services.

A ubiquitous, high-speed, reliable broadband network like the NBN responds to continuing rapid increases in online data consumption and production practices. Based upon experience with current broadband technologies, international examples and considerable domestic and international research, effective use of the NBN has the potential to:

- assist in overcoming the challenges posed by the physical distances people have to travel in regional Australia;
- contribute to an improvement in Australia's productivity by giving businesses new ways of conducting business and accessing markets;
- allow for better and more efficient use of infrastructure by enabling greater opportunities for tele-working and video conferencing, thereby reducing pressure on transport infrastructure;
- support the growth of the growing "sensor revolution" that allows households and businesses to manage energy consumption;
- support alternative healthcare models which allow patients and the elderly to stay longer at home and reduce pressure on health care budgets associated with an aging population;
- support enhanced access to education and skills development opportunities; and
- allow governments to enhance service delivery models providing more convenient and more efficient services to clients.

The 2010 declaration by the Broadband Commission for Digital Development recognised:

"Equitable and affordable universal access to broadband networks and broadband enabled applications are the key for the delivery of online public

goods and services, the sharing of scientific information, the strengthening of social cohesion and the promotion of cultural diversity".¹

The Organisation for Economic Cooperation and Development (OECD) considers that high-speed communications networks will support innovation throughout the economy in much the same way as electricity and transport networks were platforms that spurred innovation.² While this submission aims to set out the potential benefits of the NBN in line with the Inquiry terms of reference, the Department notes the NBN's broader role in developing the digital economy. The Department is working with other agencies and industry bodies to realise the benefits from advances in communications technologies and online content capability generally, with implementation of the NBN representing a significant Government commitment to achieving a step-change for Australia's future technology landscape.

1.1 Characteristics of the NBN

Five characteristics define the NBN and how it represents a major change in the nature, capability and reach of high-speed broadband services in Australia today:

- greater data capacity for homes and businesses to use higher bandwidth applications than is currently the case;
- it supports high-speed download and upload speeds. There is a range of applications and services, such as high-definition video conferencing, sharing and collaborating on very large files which require high-speed upload capability which is not available to many people using current broadband technologies;
- improved stability and reliability of services and scope for future upgrades. Compared to the ageing copper network infrastructure, the NBN will be more reliable thereby giving households, businesses, and service providers greater confidence to use the network for services and applications which demand a high quality of service;
- ubiquitous coverage providing a platform for high-speed broadband applications development; and
- uniform national wholesale pricing which will allow Retail Service Providers using the NBN to provide all communities in Australia with access to affordable high-speed broadband.

A network with these characteristics accessible to households and businesses throughout Australia provides a platform on which new services and applications, that require these features, can be developed or can be deployed on a wider scale.

¹ Broadband Commission, "A 2010 Declaration of Broadband Inclusion for All", A 2010 Leadership Imperative: the Future Built on Broadband: A Report by the Broadband Commission, 2010, <http://www.broadbandcommission.org/report1.pdf>

² OECD Working Party on Communications Infrastructure and Services Policy, *Network Developments in Support of Innovation and User Needs*, December 2009, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2009\)2/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2009)2/FINAL&docLanguage=En)

A network with these characteristics is also needed to meet the rapidly growing total data consumption of Australians. In June 2010, Australians downloaded 155,503 terabytes of information.³ This compares to the 55,434 terabytes downloaded in the 2008 June quarter, close to tripling, within a period of just two years. The majority of data continues to be downloaded via fixed-line broadband services (91 per cent of data downloads) despite rapid increase in the number of mobile wireless connections. It is estimated that there were 5 exabytes of data online in 2002, which has risen to 281 exabytes in 2009 – a growth rate of 56 times over seven years.⁴ Google and HP executives predict that more data will be created over the next four years, than in the history of the planet.⁵

1.2 Delivery of government services and programs

Australians have shown a preference to use an e-Government channel to access government services and those who contact government via the internet have the highest levels of satisfaction at 91 per cent.⁶

While there has been significant progress towards online service delivery in Australia, it remains the case that there are many transactions that still require the client to visit a government office. For the elderly, the disabled, families with young children and those living in regional and remote Australia, the need to travel to a shopfront can be difficult and inconvenient.

Using the characteristics of the NBN, there is the potential to make service delivery more efficient and more convenient by:

- increasing the range of government services that can be fully completed online;
- enabling clients to use video-conferencing, rather than visiting a shopfront, where interaction with a customer service representative is required; and
- allowing specialist services to be delivered remotely thus reducing the need for either or both the client and the specialist officer to travel.

In addition, the use of high-speed broadband will support cloud computing, which is expected to play a significant role in the future. This will deliver significant savings for existing business models supported by existing information and communications technologies (ICTs) and enable new capabilities for business and government.

³ Australian Bureau of Statistics, 8153.0 - Internet Activity, Australia, Jun 2010; Jun 2009; Jun 2008, www.abs.gov.au/ausstats/abs@.nsf/mf/8153.0/

⁴ Marissa Mayer, *Innovation at Google: the physics of data* (presentation), 2009, www.slideshare.net/PARCIInc/innovation-at-google-the-physics-of-data.

⁵ Richard MacManus, ReadWriteWeb, *The coming data explosion*, 2010. www.readriteweb.com/archives/the_coming_data_explosion.php

⁶ Department of Finance and Deregulation – Australian Government Information Management Office, *Interacting with Government: Australians' use and satisfaction with e-government services*, December 2009, <http://www.finance.gov.au/publications/interacting-with-government-2009/docs/interacting-with-government-2009.pdf>

1.3 Health

An ageing population, increasing rates of chronic disease and a shortage of health and care professionals is expected to put significant pressure on Australia's health care systems and budgets in coming years. The percentage of the Australian population over the age of 65 is predicted to grow from 13.5 per cent in 2010 to 22.6 per cent in 2050. Over the same period real health spending on those aged over 65 is expected to increase seven fold. Against this background there is a need to find new ways of delivering health care services efficiently and effectively, that also meet patient expectations.

The NBN provides an opportunity to develop new services and models of care. Pervasive high-speed broadband is a key enabler for the widespread use of high quality video consultations. In combination with work underway to provide Medicare Benefits Schedule rebates for telehealth services, this can support telehealth to become a mainstream complementary option for health service delivery in Australia.

By making reliable, high capacity broadband services available to the home, the NBN can also support new in-home models of care. This can enable services that are especially well suited to addressing the needs of the frail and elderly, those with complex or chronic disease, and those living in regional and rural areas. High-speed broadband enabled in-home services can also support older Australians to stay in their home for longer, and provide greater support for carers.

Significant financial benefits are estimated to accrue from greater use of tele-health and e-health services with Access Economics estimating the benefits of wide-scale tele-health implementation as being between \$2 billion and \$4 billion per year.⁷

1.4 Education and skills

Australia has been facing significant skills shortages in some sectors for sometime and the ageing population is going to exacerbate this problem. A KPMG-Econtech paper suggests that Australia could face chronic shortages of tradespeople and of building and engineering professionals.⁸ More directly, with respect to education, there continues to be a shortage of specialist teachers for some subject areas as well as a general shortage of teachers for rural and regional schools.

The Vocational Education and Training (VET) sector faces a challenge in the future with 66.9 per cent of teaching staff over the age of 45. It is the VET sector which is going to have to play a leading role if Australia is to address shortages of tradespeople.

There is the potential to address some of these challenges, both the shortage of teachers and the need for a more skilled Australian workforce by using the ubiquitous, high-speed capability of the NBN. According to a 2010 survey 60 per cent of employers expect their organisations to increase their use of e-learning in the next two years. By

⁷ Access Economics, *Financial and externality impacts of high-speed broadband for telehealth*, May 2010, http://www.dbcde.gov.au/digital_economy/benefits_of_digital_economy_from_nbn

⁸ KPMG/Econ Tech, *Clarius Skills Index: December Quarter*, January 2010, http://www.clarius.com.au/PDF/Clarius%20Skills%20Index_December%202009%20Quarter.pdf

contrast, only 5.3 per cent of recognised training delivery in the VET sector took place via online or off campus methods in 2006.

By extending high-speed broadband to all Australian premises, the NBN will provide a platform that can support the greater integration of technology into learning. Learning environments can be extended across all sectors, in particular, into the home. Possible benefits include:

- improved access to high quality vocational and adult education and training services for students at home and in the workplace, leading to increased take-up of relevant skills development programs;
- increased productivity through the creation of ‘virtual classrooms’, where students in a range of locations can receive tuition and where attendance at traditional classes may be unviable;
- job seekers can more readily access appropriate training and professional development to get back into the workforce faster;
- ongoing and flexible learning opportunities that fit around work and family commitments;
- increased participation by mature-age workers, migrants and itinerant workers through online retraining opportunities; and
- improved usage of existing teaching resources which will help to address teacher shortages.

Based on international experience, the increased use of online learning enabled by high-speed broadband can increase the reach of education services, the availability of open education resources, and an improvement in education outcomes. For example:

- Carnegie Mellon University’s Open Learning model has shown that online learning can substantially reduce the time required to learn a subject (50 per cent of the time required using more traditional methods) while greatly increasing course completion rates (99 per cent compared to 41 per cent for more traditional methods);⁹
- high school students attending Florida Virtual Schools outscored the states standardised assessment average by more than 15 percentage points in grades 6 through 10;¹⁰ and
- a study conducted in the European Union found that broadband access in classrooms results in significant improvements in pupils’ performance in national tests taken at age 16.¹¹

⁹ D. Carter, *Program goes beyond open course model*, [ecampusnews.com](http://www.ecampusnews.com), 16 September 2009
<http://www.ecampusnews.com/top-news/program-goes-beyond-open-course-model/>

¹⁰ Federal Communications Commission, *National Broadband plan: Connecting America*, Broadband.gov, 16 March 2010, <http://www.broadband.gov/plan/11-education>

¹¹ European Schoolnet, *The ICT Impact Report A review of studies of ICT impact on schools in Europe*, December 2006, http://ec.europa.eu/education/pdf/doc254_en.pdf

1.5 Australia's built and natural resources and environmental sustainability

Australia has the highest greenhouse gas emissions, per capita, of any OECD country. Within Australia's urban environment the energy and transport sectors are the two highest contributors to greenhouse gas emissions. Australia also has a growing and highly urbanised population leading to increased congestion.

The OECD has recognised that use of innovative ICT applications enables sustainable production and consumption across the economy and has the potential to improve environmental performance across entire systems and industry sectors.

Applications that use the NBN could assist in lowering per capita greenhouse gas emissions, better managing energy consumption and making more efficient use of infrastructure. It has been suggested that smarter use of ICT-enabled systems could reduce Australia's carbon emissions by 116.6 million tonnes annually.¹²

Smart meters can be used by households and by energy companies to better understand and actively manage energy consumption. While smart meters themselves do not require high-bandwidth, they do represent part of the overall growing data consumption requirements of increasingly connected and online households. As households add more smart systems to their houses, such as heating and cooling systems, data consumption increases further. Ideally these smart systems need to be always on meaning that households need sufficient and reliable bandwidth to be able to support multiple applications running simultaneously.

The capacity of the NBN to support high-definition video services and simultaneous use of applications can support increased teleworking.¹³ By reducing the need for people to commute to the office each day, teleworking can contribute to a reduction in greenhouse gas emissions and also reduce congestion problems on transport infrastructure. It is estimated that a 10 per cent increase in Australian employees that telework 50 per cent of the time would save an estimated 120 million litres of fuel, avoiding 320,000 tonnes of CO₂ (equivalent to \$6 million worth of emissions), and would reduce traffic at peak periods by 5 per cent, resulting in a reduction of \$470 million in congestion costs.¹⁴

1.6 Regional economic growth and employment opportunities

Telecommunications services and infrastructure in regional and remote Australia has, traditionally not matched that available in major metropolitan areas. This issue will to a significant degree be largely addressed by the reliable, high-speed, affordable broadband services that will become available in regional and remote Australia through the NBN.

¹² *Reducing Greenhouse Gases Through Intense Use of Information and Communication Technology*, International Data Corporation, 2009,

<http://download.intel.com/pressroom/archive/reference/IDCW31R.pdf>

¹³ Teleworking refers to work undertaken outside of the office, usually at home.

¹⁴ *The Impacts of Teleworking Under the NBN*, Access Economics, 2010,

http://www.dbcde.gov.au/data/assets/pdf_file/0018/130158/ImpactsofteleworkingundertheNBN.pdf

The distances and dispersed population that makes up regional and remote Australia makes the provision of most government services challenging.

The NBN offers the prospect of connecting regional and remote Australia to both the rest of Australia and to the world. In doing so it opens up opportunities to respond to some of the challenges facing parts of regional Australia such as:

- slowing economic growth;
- declining populations and skill shortages; and
- inconvenient access to government services including health and education services.

By taking advantage of the characteristics of the NBN it becomes possible to deliver a range of government services online, into people's homes rather than requiring them to travel to a government office. Education opportunities can expand if high-speed broadband is used to offer virtual, interactive learning with teachers and students located throughout Australia. Tele-health services that use the NBN could remove the need for patients to travel long distances to access medical services.

For regional businesses the NBN provides a platform which could be used to further expand access to national or international markets. For consumers, the NBN gives them better access to shops and services that would otherwise only be accessible in major capital cities. Access Economics has noted that regional households in particular stand to benefit from the removal of geographical barriers that e-commerce brings.¹⁵

1.7 Business efficiencies, revenues and exports

Australia's productivity performance has slowed averaging only 1.4 per cent in the past decade. This compares with 2.1 per cent in the 1990s.¹⁶ An aging population will reduce the relative size of Australia's working age population. This increases the importance of productivity growth as a key driver of Australia's future living standards. Growth in productivity is recognised as the main source of improvements in living standards in the long run.¹⁷

Investments in Australia's digital infrastructure can contribute to higher productivity, economic growth and improved living standards. International evidence suggests a positive correlation between broadband penetration rates and labour productivity. For OECD countries, a 1 per cent increase in broadband penetration rates in 2009 resulted in an increase in labour productivity growth by 0.02 percentage points.¹⁸

¹⁵ Access Economics, *Household E-Commerce Activity and Trends in Australia*, page 3, November 2010 <http://www.accesseconomics.com.au/publicationsreports/getreport.php?report=254&id=323>

¹⁶ Treasury, *The 2010 Intergenerational Report*, 1 February 2010, www.treasury.gov.au/igr/igr2010/report/html/03_Chapter_2_Growing_the_economy.asp

¹⁷ Treasury, *Estimating Trends in Australia's Productivity*, 2 February 2009, www.treasury.gov.au/contentitem.asp?NavId=049&ContentID=1466

¹⁸ OECD data, *Broadband penetration and labor productivity growth - Some preliminary findings*, 2010 (referenced in the *Broadband: A Platform for Progress, A contribution to the Broadband Commission* <http://www.broadbandcommission.org/report1/report2.pdf>)

In the current competitive environment, businesses must take full advantage of the opportunities that online business presents to them in order to maximise their chances of success. There is evidence to suggest that Australia lags international counterparts in terms of the percentage of businesses online. OECD comparative data from 2008 indicates that 40 per cent of Australian businesses had a website compared to around 70 per cent in leading digital economies.¹⁹ Uptake of e-commerce in Australia was around 10 per cent compared to 22 per cent in leading digital economies.²⁰ Use of tele-working also lags behind leading digital economies.

Ubiquitous availability of high-speed broadband provides an opportunity for Australian businesses to more effectively compete in the global digital economy. By increased use of online opportunities, businesses in Australia could benefit, in ways identified by the OECD, through:²¹

- reductions in inventory costs by adopting ‘just in time’ delivery;
- expansion into a global marketplace; and
- reduced distribution costs.

In addition to the opportunities identified by the OECD, businesses in Australia using the NBN should be able to more easily take advantage of cloud based services to more efficiently run and manage their business and get access to a wider pool of skills by allowing staff to telework. The Managing Director, Dragan Dimitrovici, of the high performance computing specialist company, Xenon, has said that: “*cloud without NBN is pretty much a non-event.*”²²

The Australian Bureau of Statistics (ABS) has recently noted that innovation is necessary for business survival in export markets.²³ While the global nature of the digital economy means a greater variety of Australian businesses are trade exposed, the use of the NBN as an enabler of business innovation may assist businesses to adapt and prosper in the global marketplace.

1.8 Innovation and research and development

An environment encouraging innovation, supported by high quality research and a skilled and flexible workforce, will support productivity growth in Australia. The NBN

¹⁹ OECD, *The Future of the Internet Economy: Statistical Profile*, June 2008, www.oecd.org/dataoecd/44/56/40827598.pdf. Noting that over three years this has not increased significantly – the most recent ABS data from 2008-09 indicates that 41.5 per cent of Australian businesses have a web presence.(refer: ABS, 8166.0 - *Summary of IT Use and Innovation in Australian Business*, 2008-09, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8166.0>)

²⁰ *Ibid*

²¹ OECD, *The Economic and Social Impact of Electronic Commerce: Preliminary Findings and Research Agenda*, page iii 1999, www.dbcde.gov.au/_data/assets/pdf_file/0018/130158/ImpactsofteleworkingundertheNBN.pdf

²² ZDNet, *Cloud without NBN a ‘non-event’: Xenon*, Suzanne Tindal, 19 March 2011, <http://www.zdnet.com.au/cloud-without-nbn-a-non-event-xenon-339311380.htm>

²³ Todhunter, Jessica and Abello, Ruel, *Business Innovation and the Use of Information and Communications Technology*, March 2011, pages 3-7. <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1351.0.55.033Mar%202011?OpenDocument>

itself has the potential to be a platform for innovation, with new services and applications expected to emerge.

The OECD has identified that high-speed communication networks will support innovation throughout the economy in much the same way as electricity and transportation networks were platforms that spurred innovation in the previous century.²⁴ The ABS has found a positive connection between the intensity of a firm's use of ICT and the extent to which the firm is innovative.²⁵

Even at the early stages of the rollout of the NBN there are already significant investments being made by organisations such as Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO),²⁶ National ICT Australia (NICTA) – Australia's ICT Research Centre of Excellence²⁷ – and the Institute for a Broadband Enabled Society (IBES)²⁸ to explore innovative new ideas that will take advantage of the NBN in the medium term. For example, CSIRO, in partnership with the NSW Government and NICTA has launched the Australian Centre for Broadband Innovation (ACBI).

Through ACBI the partners will be trialling new services and applications, which require the NBN, with a particular focus on regional service delivery. CSIRO notes that, as with the internet, the precise transformative impact of the NBN is to an extent unknown. Activities such as those being undertaken through ACBI will evaluate NBN applications to establish value propositions, business cases and business models for using the NBN.

1.9 Community and social impact

There are two dimensions to the relationship between the use of the NBN and the development of communities and social inclusion:

- as broadband becomes more embedded in people's everyday life, those who do not have access to broadband and the online tools that it gives access to, risk getting left behind; and

²⁴ OECD, *Network Developments in Support of Innovation and User Needs*, 9 December 2009, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2009\)2/FIN&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2009)2/FIN&docLanguage=En)

²⁵ Australian Bureau of Statistics, *Business Innovation and the use of Information and Communications Technology*, March 2011, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1351.0.55.033Main+Features1Mar%202011?OpenDocument>

²⁶ The CSIRO is Australia's national science agency and one of the largest and most diverse research agencies in the world. The agency conducts large-scale, long-term, multidisciplinary science to address Australia's major national challenges and opportunities. <http://www.csiro.au/>

²⁷ NICTA is an independent company involved in research, commercialisation and research training and is the largest organisation in Australia dedicated to ICT research. NICTA's research addresses national issues such as security, transport, the environment, broadband, water management and health, including medical implants such as the bionic eye. <http://www.nicta.com.au/>

²⁸ The IBES at the University of Melbourne is an interdisciplinary research institute dedicated to innovations in products, services and end-user experiences that maximise the benefits of new broadband technologies. <http://www.broadband.unimelb.edu.au/main.php?id=1>

- the use of online tools, facilitated by the NBN, can contribute to building social inclusion by helping to address some areas of disadvantage.

As more and more services are being delivered via the internet, something that is likely to accelerate with the NBN, it is important that all Australians have access to the broadband infrastructure and digital media literacy skills they need for access to online information, communications applications and services. Digital exclusion, referring to those people who do not currently have access to broadband, can be particularly concerning if it overlaps with and exacerbates characteristics of social exclusion.

A range of indicators suggest a correlation between digital use divides and social exclusion. Around 26 per cent of Australians 14 years or over did not use the internet in 2008-09.²⁹ However this figure is much higher for:

- retired persons – thirty-seven per cent of persons aged 55-64 did not use the internet in 2008-09, compared with 69 per cent of persons aged 65 or over;
- low income earners – 34 per cent of persons earning less than \$40,000 per year did not use the internet in 2008-09;
- people with a disability – for example, only 28 per cent of people with disability requiring assistance with core activities have a broadband connection;
- Aboriginal and Torres Strait Islander Australians; and
- those living in remote areas – 34 per cent of people living in remote areas do not have a broadband connection.³⁰

The Australian Government is committed through its Social Inclusion Agenda to “a vision of a socially inclusive society” in which “all Australians feel valued and have the opportunity to participate fully in the life of our society.”³¹ Achieving this vision means that all Australians need to have the resources, opportunities and capability to:

- learn, by participating in education and training;
- work, by participating in employment or voluntary work, including family and carer responsibilities;
- engage, by connecting with people, using local services and participating in local civic, cultural and recreational activities; and
- have a voice, in influencing decisions that affect them.

By using the capabilities of the NBN it will be possible to help respond to some of these requirements for a socially inclusive society. By enabling the delivery of services online, use of the NBN can help overcome barriers such as distance or physical disability, that make travel difficult. This allows people to get easier access to education services, it means people are able to telework and it lets people get better access to specialist government services more conveniently.

²⁹ Australian Bureau of Statistics, Household Use of Information Technology Australia, 2008-2009, 16 December 2009, table 3.8 page 36, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8146.0>

³⁰ *Ibid*

³¹ Commonwealth Government, *Overview of the Social Inclusion Agenda*, socialinclusion.gov.au, last accessed 17 March 2011, www.socialinclusion.gov.au/SIAGENDA/Pages/Overview.aspx

There is also evidence to suggest that access to broadband can deliver consumer welfare benefits and contribute to improved employment outcomes.

1.10 Optimal capacity and technological requirements

The characteristics of the NBN will support a large range of online applications and services. In particular, applications that require symmetrical bandwidth, such as video conferencing will be well-supported.

The proposed characteristics of the NBN also represents a step-change improvement over the most popular fixed broadband technology in Australia – asymmetrical digital subscriber line (ADSL) because the transmission signal within optical fibre does not degrade as rapidly with distance. On existing ADSL technology, the Department calculates that if all nine million Australian premises connected, only 22 per cent could be guaranteed to receive at least 12Mbps downstream / 1Mbps upstream. A further 30 per cent of premises may be able to receive 12Mbps in the best case scenario but are more likely to receive something less.

In addition, while wireless broadband technology is also becoming increasingly popular in Australia, as noted in the Implementation Study:

*“Mobile broadband growth does not directly substitute fixed-line services; they are complementary in many cases, and address different user bases.”*³²

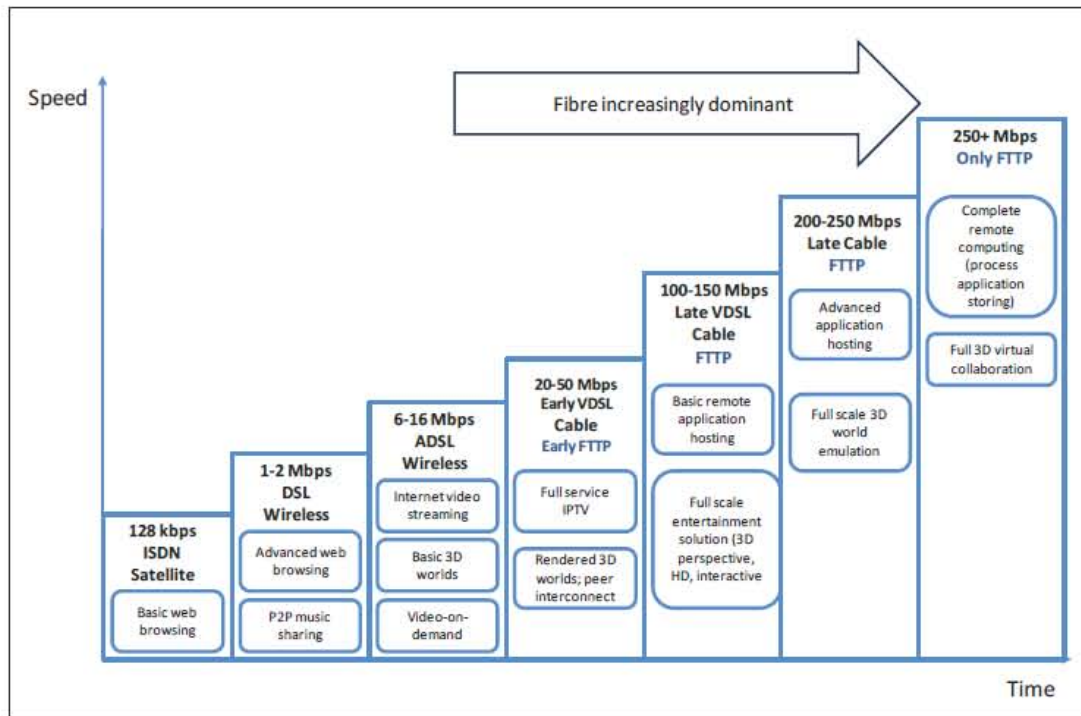
The following chart³³ shows the evolution of various broadband technologies and their respective bandwidth capacities. Once bandwidth requirements move beyond 20-30Mbps, existing technologies such as ADSL and wireless 3G technologies are insufficient. While HFC cable can support data speed beyond 100Mbps, the cable footprint in Australia is limited to approximately 2.6 million households³⁴, and like wireless technology, HFC is a shared technology and performance degrades when users share the available bandwidth in their area.

³² National Broadband Network Implementation Study, prepared by McKinsey & Company and KPMG, 6 May 2010
http://www.dbcde.gov.au/broadband/national_broadband_network/national_broadband_network_implementation_study

³³ NBN Co Corporate Plan 20 December 2010 p 39: www.nbnco.com.au/wps/wcm/connect/main/site-base/main-areas/publications-and-announcements/latest-announcements/nbn-co-corporate-plan-released

³⁴ According to the ACMA, *ACMA Communications report 2009–10*, p. 23, 9 December 2010, http://www.acma.gov.au/webwr/assets/main/lib311995/2009-10_comms_report-complete.pdf

Bandwidth and Delivery Technologies



Source: NBN Co Corporate Plan 2011- 2013 (17 December 2010)

2. Key Characteristics of the National Broadband Network and Increases in Data Usage

The NBN will consist of a mix of technologies; fibre-to-the-premises (FTTP), wireless and satellite, with the majority of premises having access to fibre.

2.1 High-speed broadband

Broadband services delivered over copper infrastructure can generally deliver speeds suitable for a majority of today's internet applications to a portion of Australia's households and businesses. However, the rate at which demand for bandwidth is growing and will continue to grow it is likely to be difficult for Australia to become a leading global digital economy without a ubiquitous, reliable, high-speed broadband network.

Australia's geography means that investment in telecommunications infrastructure outside the major metropolitan centres has lagged that of the cities. These same geographic features mean that it is people outside the major centres who stand to benefit substantially from technology that can help overcome the challenges of distance. Based upon recent experience, including the first NBN Request for Tender process, it is apparent that the market is not prepared to make the necessary investment that will provide a ubiquitous high-speed and high capacity broadband platform throughout the country that can serve as a stimulus for investment and innovation in services and applications.

New services that can only work on the NBN platform are likely to emerge once the rollout has progressed sufficiently. For early users of the NBN, it is likely to be the ability to use multiple known online applications simultaneously that will be most attractive feature. Experience with other technologies suggests that it is only when a critical mass of users, or potential users is reached, that new high-speed/high capacity services will be deployed or developed.

NBN Co's strategy is based on the expectation that as higher bandwidth becomes available, applications that take advantage of that bandwidth will be developed.

In its Corporate Plan, NBN Co forecasts that:

- in the near term (1-5 years), applications such as Internet Protocol Television (IPTV) and Video-on-Demand (VoD) are expected to grow in Australia, as they have in many other markets, which will only be possible on networks that offer sustained speeds of 10-20Mbps;
- in the medium term (5-10 years), applications such as remote hosting and 3D imaging that are already in development are expected to become mainstream, pushing bandwidth demands up towards 100Mbps; and
- in the long-term (10+ years) there are already products in development – such as Ultra High-definition video (4320p) – that are expected to require speeds of 250+Mbps.³⁵

³⁵ NBN Co. Ltd. *Corporate Plan 2011 – 2013*, 15 December 2010, <http://www.nbnco.com.au/wps/wcm/connect/eea11780451bd3618ebfef15331e6bbb/101215+NBN+Co+3+Year+GBE+Corporate+Plan+Final.pdf?MOD=AJPERES>

2.2 Other key characteristics

The NBN will provide more than just its headline download speed, for example, other key characteristics are:

- **Greater data capacity for each home and business:** The NBN's capacity will enable households to simultaneously use a wider range of high bandwidth online applications without a deterioration in service quality. It also means that small and medium sized businesses, particularly those in regional Australia, will be able to access increasingly sophisticated business applications and greater data storage capacity 'in the cloud' that in the past have only been available to larger companies.
- **Supports high-speed download and upload services:** The NBN will provide homes and businesses with the capacity to support both high download and upload speeds, which are essential for applications such as high-definition videoconferencing and are not available on current broadband networks in Australia.
- **Stability/reliability of service and capacity for future upgrades:** Some applications, particularly health applications, rely on assured levels of stability/reliability of connection to a minimum level of internet speed and capacity. It is for these reasons that many of these applications are currently only used between larger hospitals that already have access to high-speed broadband. The NBN has the potential to extend a wider range of online health applications to the home and the local GP surgery environment.
- **Ubiquitous coverage:** The NBN will be available to 100 per cent of Australian premises, with the fibre to the home component available to up to 93 per cent of premises. This provides a sufficiently large customer base using a single platform to justify development and deployment of advanced services and also maximises the potential network benefits for all customers. In Australia today there is a multiplicity of fixed broadband networks such as cable modem systems, ADSL, ADSL2+ and fixed wireless each offering quite different characteristics.
- **Uniform national wholesale pricing:** The NBN will offer services at a uniform national wholesale price, which will give every community in regional Australia the opportunity to get fairer access to affordable high-speed broadband. Retail pricing levels will be a matter for Retail Service Providers that utilise the network and it is anticipated the level and range of retail prices will be comparable to existing prices in the market today, while providing a significantly better service.

2.3 Increasing data downloads

The rollout of a high-speed broadband network across Australia responds to evidence that shows that Australians are:

- engaging online more often;
- connecting to the internet in growing numbers;

- increasingly opting for a broadband connection; and
- consuming an increasing amount of data online.

In 2007, it was estimated that YouTube, a site that went public only in December 2005 and is among the 10 most popular sites in Australia, consumed more data than the entire internet did in 2000.³⁶

At the end of June 2010, there were 9.6 million active internet subscribers in Australia.³⁷ Nearly 92 per cent of internet connections are now broadband and 71 per cent of access connections offer a download speed of 1.5Mbps or greater.³⁸

When Australians get connected to the internet, they increase their online activity over time, as they find more and more uses for their connection. From June 2005 to June 2010, there was a 100 per cent increase in the number of Australians considered 'heavy users' of the internet (that is, the number of Australians who spent 15 or more hours online each week).³⁹

In June 2010, Australians downloaded 155,503 terabytes of information.⁴⁰ This is a significant increase compared with the 55,434 terabytes downloaded in the 2008 June quarter, close to tripling. The majority of data is downloaded via fixed-line broadband services (91 per cent of data downloads).

³⁶ David Smith, Guardian.co.uk, *Video boom threatens to gridlock the internet*, 6 April 2008,

<http://www.guardian.co.uk/technology/2008/apr/06/internet.digitalmedia>

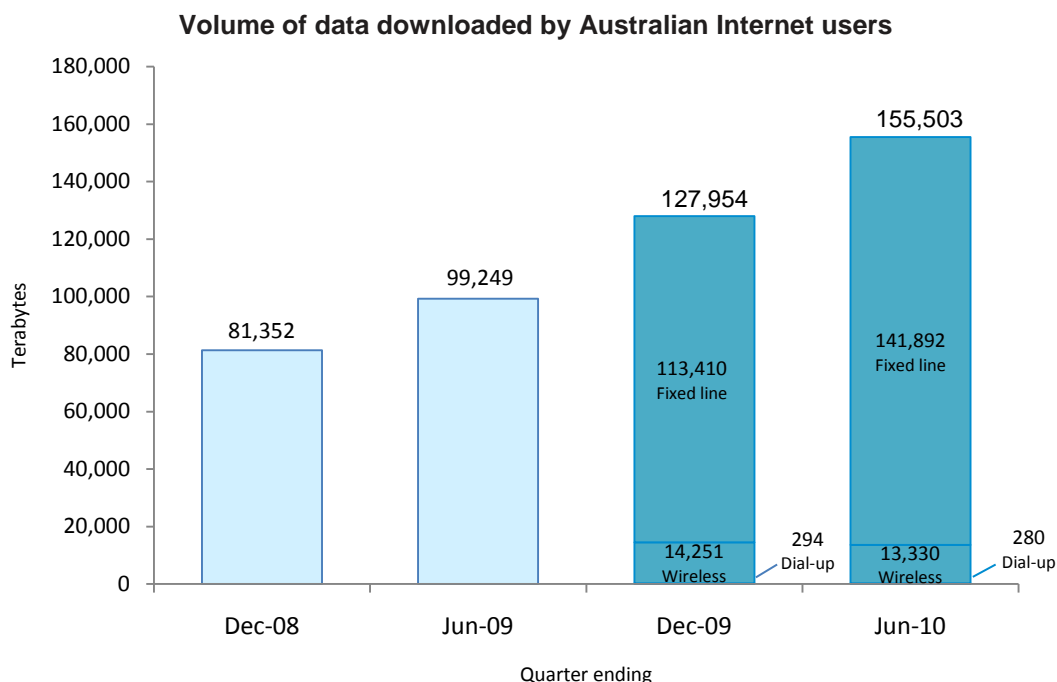
³⁷ Australian Bureau of Statistics, *Internet Activity, Australia, Jun 2010*; last accessed 16 March 2011, 20 September 2010, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8153.0/>

³⁸ *Ibid*

³⁹ Australian Media and Communications Authority, *Australia in the digital economy, Report 1*, page 13, March 2009,

http://www.acma.gov.au/webwr/aba/about/recruitment/trust_and_confidence_aust_in_digital_economy.pdf

⁴⁰ Australian Bureau of Statistics, *Internet Activity, Australia, Jun 2010*; last accessed 16 March 2011, 20 September 2010, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8153.0/>



Source: Data: ABS, 8153.0 Internet Activity, Australia, June 2010 &
Graph: Australian Communications and Media Authority, Communications Report 2009-10

Based on existing trends, it is likely that the online experience will become increasingly integrated into everyday life, at home and at work, and that the online experience will become richer and more data intensive.

Mr Jeffrey Cole, Director of the Annenberg School at the University of Southern California, explained in an address to the *Realising Our Broadband Future Forum* held in December 2009 that “[t]he broadband internet is not just a faster internet. It is a whole new world.” According to Mr. Cole, while initially it is the always-on nature that is the most potent, once people start using broadband, the speed becomes key.⁴¹

Mr Cole’s research has reviewed the early changes in households that came about because of broadband. In the early days of dial up in the household, people aggregated their tasks of what they needed online beforehand so that they could do them all at once when they dialled in; in total they might spend 20-30 minutes at a time on the internet. With the introduction of broadband, people go online 30 to 50 times a day for two to three minutes at a time.

According to Mr Cole, this more frequent access to broadband during the day meant that the internet moved from the office into the family room or the lounge room or kitchen and became even more integrated into our daily lives.

As broadband internet becomes more integrated in daily Australian life, the future trends are likely to be an exponential increase in data demands. It is estimated that there were five exabytes of data online in 2002, which had risen to 281 exabytes in 2009 -- a growth rate of 56 times over seven years.⁴² Google and HP executives predict that more

⁴¹ Jeffrey Cole, *Presentation to the Realising Our Broadband Future Forum*, 10 December 2010, <http://webcast.viostream.com/?viocast=2230&auth=ac7aa355-0853-4b29-be91-793af259c03d>

⁴² Marissa Mayer, *Innovation at Google: the physics of data* (presentation), 2009, www.slideshare.net/PARCIInc/innovation-at-google-the-physics-of-data.

data will be created over the next four years, than in the history of the planet.⁴³ Cisco predicts that global online traffic will grow at a compound annual growth rate of 34 per cent from 2009 to 2014 and that the average monthly traffic in 2014 will be equivalent to 32 million people streaming Avatar in 3D, continuously for an entire month.⁴⁴

Extensive availability of high-speed broadband via the NBN will itself be a catalyst for innovation and the development of new applications that rely on higher speeds, capacity and reliability.

The roll-out of the NBN responds to the growing trend for online applications to be more bandwidth intensive, which increasingly incorporate video and interactive, real-time communications, for example, Voice-Over-IP. According to Cisco, voice and video communications is already six times higher than data communications traffic (emails and instant messaging).⁴⁵

⁴³ Richard MacManus, Readwriteweb.com, *The coming data explosion*, 31 May 2010, http://www.readwriteweb.com/archives/the_coming_data_explosion.php

⁴⁴ Cisco Systems, *Hyperconnectivity and the Approaching Zettabyte Era*, 2 June 2010 www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/VNI_Hyperconnectivity_WP.html

⁴⁵ Cisco Systems, *Cisco Visual Networking Index: usage study*, Cisco.com, 25 October 2010, http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/Cisco_VNI_Usage_WP.html

3. Delivery of Government Services and Programs

For government services and programs, ubiquitous, high-speed broadband will make better use of the development of growing numbers of online government services and programs because of the confidence that services can be accessed by all Australian households and businesses. This can reduce costs and increase efficiencies, and has the potential to occur at all levels of government. In time, the roll-out of high-speed broadband can enable faster, cheaper and more ubiquitous delivery of many government services and programs. It can also facilitate much easier direct contact between government agencies and clients including the routine use of video links, regardless of where a person may live in Australia.

3.1 Online government service delivery

Given a choice, most Australians already prefer to use an e-Government channel to access a government service. For example, in 2009 four in five (78 per cent) people said they would prefer to use the internet (45 per cent) telephone (32 per cent) or mobile phone (1 per cent) to contact government.⁴⁶

The Department of Finance and Deregulation's *Interacting with Government 2009* report indicates that those who contacted government by internet have the highest level of satisfaction (91 per cent).⁴⁷

The United Nations Broadband Commission for Digital Development makes the case that:

*“moving government services online offers the prospect of revitalising public administration and improving the speed, efficiency and effectiveness of service delivery. It can also transform the way citizens relate to their governments and policy makers by making the work of politicians and public servants more public and transparent. Governments increasingly have to respond to growing expectations for communication with tech-savvy citizens.”*⁴⁸

Denmark is considered by the OECD to be among the best in Europe in terms of the sophistication in e-government services with 84 per cent of the 20 basic public services for citizens online.⁴⁹ This is supported by Denmark's performance as a leader in terms of broadband penetration and frequent internet users.⁵⁰

⁴⁶ Department of Finance and Deregulation – Australian Government Information Management Office, *Interacting with Government: Australians' use and satisfaction with e-government services*, December 2009, <http://www.finance.gov.au/publications/interacting-with-government-2009/docs/interacting-with-government-2009.pdf>

⁴⁷ *Ibid*

⁴⁸ Broadband Commission, “A 2010 Declaration of Broadband Inclusion for All”, *A 2010 Leadership Imperative: the Future Built on Broadband: A Report by the Broadband Commission*, 2010, www.broadbandcommission.org/report1.pdf

⁴⁹ OECD e-Government Studies, *Denmark – Efficient E-Government for Smarter Public Service Delivery* (Preliminary Copy), 3 June 2010, www.oecd.org/dataoecd/43/55/45382552.pdf

⁵⁰ *Ibid*

Increased online delivery of government services and programs can increase internal efficiencies and reduce costs of delivering government services and programs. A recent report by PriceWaterhouseCoopers for the UK Government found that face to face transactions cost £10.53, the cost of a telephone engagement was £3.39 and by mail was £12.10 compared with the cost of an online transaction at just £0.08.⁵¹

The US Government noted in its *National Broadband Plan* in March 2010:

"Smarter use of broadband can facilitate vast change in government. Like private companies, government can make its services available 24 hours a day, seven days a week, 365 days a year. Broadband-enabled online services can create paths across government's bureaucratic silos so that someone wanting to access unemployment benefits can deal with the local government and the federal government at the same time. Broadband holds the potential to move all government forms online, eliminating paperwork. Broadband allows for online tutorials for simple government services, which can help free government employees to focus on the most complicated cases. And broadband can increase efficiency by increasing the speed and depth of cooperation across departments and across different levels of government."⁵²

However, it is important to acknowledge that use of high-speed broadband provided by the NBN will not by itself guarantee the realisation of these benefits. Government will still have a role to play in terms of ensuring that there is a coordinated approach to policy development across agencies. In addition, government agencies need to understand the potential and capability of the high-speed broadband provided by the NBN by ensuring the right conditions are in place at a whole of government level, to assist the broader transformational change process.

3.2 Real-time, interactive government service delivery

There has been significant progress in Australia to expand delivery of government services and programs online. However, it continues to be the case that fully completing many transactions with government, even where they are commenced online, still requires the client to visit a government office. For example, currently around 62 per cent (69.5 million) of Centrelink transactions are made onsite which involves people presenting at a Centrelink office. This is inconvenient and costly for clients, noting that four out of five clients of government services have indicated a preference for not having to visit a government office to obtain a government service. It also means Centrelink must maintain much larger client waiting areas and transaction counters.

The availability of ubiquitous, reliable, high-quality and high-speed broadband will enable several changes that can help reduce the need for people to physically attend government offices to transact business. For example:

- high quality video conferencing between people at home with a government service officer; and

⁵¹ PricewaterhouseCoopers, *The Economic Case for Digital Inclusion*, October 2009, www.parliamentandinternet.org.uk/uploads/Final_report.pdf

⁵² Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010 www.broadband.gov/plan

- during such video-conferences the capacity for participants to simultaneously view data rich files or applications (for example, a patent application).

Video and technologies require high-bandwidth because they are highly subject to jitter and latency. High-quality video conferencing can provide real-time customer service that is as good as in-person meetings. The availability of a ubiquitous, reliable, high-speed broadband network can reduce the need to travel, allow government employees to collaborate more efficiently and give citizens greater convenience to engage with government at a time and place of their choosing. It can also reduce government costs.

Case Study – High-Definition Video Conferencing in Denmark

In one example, the municipality of Guldborgsund in Denmark installed a high-definition video-conferencing screen in the local library to allow local residents to sit and talk to a council employee in another town. The local council advised that, where previously many staff were needed in several locations, the work could now be carried out more effectively. The council was able to better utilise its resources in the sense that a smaller number of employees from the local authority can serve the same number of citizens.⁵³

At present it is very unusual in Australia for a government agency to enable clients to access it using video conferencing capacity. The NBN can help make high definition video conferencing a more feasible option for government service delivery. DBCDE is consulting with agencies at Commonwealth, State and Territory, and local levels to gauge interest in trialling this.

3.3 Government operations and cloud-based services

The combination of high-speed broadband and emerging cloud computing services offers a range of opportunities for improved government services to be delivered more cheaply and effectively to a much wider range of the population. One study estimates that an agency that migrates its infrastructure to a public or private cloud can achieve savings of 50 to 70 per cent.⁵⁴ The Managing Director, Dragan Dimitrovici, of the high performance computing specialist company, Xenon, has said that: “*cloud without NBN is pretty much a non-event.*”⁵⁵

Access to high-speed broadband supports high-speed uploads and downloads, which provides governments (as well as consumers and businesses) with the opportunity to take advantage of cloud based services. This in turn will enable them to access common service platforms at a fraction of the cost of developing these platforms themselves. This could enhance the quality, timeliness and variety of local government services,

⁵³ Cisco,vimeo.com, *Digital Citizen Services 2010*, September 2010, <http://www.vimeo.com/15018086>

⁵⁴ Booz Allen, Morton & Alford, *The Economics of Cloud Computing*, 6 October 2009, www.boozallen.com/media/file/Economics-of-Cloud-Computing.pdf

⁵⁵ ZDNet, *Cloud without NBN a ‘non-event’: Xenon*, Suzanne Tindal, 19 March 2011, <http://www.zdnet.com.au/cloud-without-nbn-a-non-event-xenon-339311380.htm>

particularly in regional Australia. At the local government level, many offices do not have and are unlikely to get high-speed connections without the NBN.

Increasingly, state and territory governments around Australia are becoming aware of the potential benefits of cloud services and are considering the use of these services to provide a wider range of citizen-facing services while reducing the cost of developing these services. In addition, a number of state governments are considering the use of cloud services to better cope with the abrupt peaks in demand for computing and communications services which arise during emergencies for police and emergency services organisations. The roll out of the NBN could mean that such cloud based solutions will become increasingly common.

In a similar fashion, the development of common, cloud-based solutions that are facilitated by the NBN could dramatically enhance the quality, timeliness and variety of local government services, particularly in regional Australia. Many of Australia's local governments lack the resource base to develop sophisticated online service offerings for their ratepayers if these offerings had to be developed individually by each council. But the promise of cloud computing, coupled with high-speed broadband, is that all Australia's regional and remote local governments may be able to access leading edge online services for their ratepayers. This would reduce costs and enhance economic opportunities in many parts of regional Australia.

4. Achieving Health Outcomes

Increasing pressures on Australia's health system due to factors such as an ageing population, increased rates of chronic disease and dementia, and health workforce challenges mean it is critical to consider opportunities to deliver high quality services more effectively and efficiently.

The NBN will provide a platform enabling homes, doctors' surgeries, pharmacies, clinics, hospitals, aged care facilities and allied health professionals to connect to affordable, reliable, high-speed and high-capacity broadband. This represents a major opportunity to improve the way healthcare is delivered in Australia.

4.1 Challenges facing Australia's health sector

Health expenditure as a proportion of gross domestic product (GDP) has increased from 6.3 per cent in 1981–82 to 9.0 per cent in 2008–09.⁵⁶ Australian Government health spending is projected to grow from 4.0 per cent of GDP in 2009–10 to 7.1 per cent of GDP in 2049–50.⁵⁷ The ageing of the Australian population is expected to be a major contributor to this increase – through higher health costs for the elderly, particularly as a result of increased rates of chronic disease and dementia. Demographic changes in the health care workforce will also increase capacity constraints.

Increasing health requirements of an ageing population

At 30 June 2010, the number of Australians aged 65 and older was estimated at 3 million (13.5 per cent of the population). By June 2050, around 22.6 per cent of the population is projected to be aged 65 and over. The proportion of the population aged 85 and over is projected to increase most rapidly, rising from 1.8 per cent in 2010 to 5 per cent in 2050.⁵⁸

As people over the age of 65 have greater health requirements, population ageing will place increasing demands on our health and aged care systems and upward pressure on government spending. Australian Government spending on aged care is projected to increase as a proportion of GDP from 0.8 per cent in 2009–10 to around 1.8 per cent in 2049–50. From 2009–10 to 2049–50, real health spending on those aged over 65 years is expected to increase around seven-fold. Over the same period, real health spending on those over 85 years is expected to increase around twelve-fold.⁵⁹

Australian Government funding for residential care subsidies and supplements, paid to residential care providers, was \$7.097 billion in 2009–10, compared with \$6.474 billion in 2008–09 – an increase of 9.6 per cent.⁶⁰ In 2009–10, there were 182,936 operational

⁵⁶ Australian Institute of Health and Welfare, *Health expenditure Australia 2008-09, December 2010* <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442472701&libID=6442472682>

⁵⁷ Treasury, *The 2010 Intergenerational Report*, 1 February 2010,

http://www.treasury.gov.au/igr/igr2010/report/html/03_Chapter_2_Growing_the_economy.asp

⁵⁸ *Ibid*

⁵⁹ *Ibid*

⁶⁰ Department of Health and Ageing, *Report on the Operation of the Aged Care Act 1997, 1 July 2009 to 30 June 2010*, 24 November 2010,

<http://www.health.gov.au/internet/main/publishing.nsf/Content/ageing-reports-acarep-2010.htm>

residential care places (an increase of 3.8 per cent over the previous year), and a total of 214,418 people received permanent residential care over the course of the year.⁶¹ The average completed length of stay for permanent residential aged care residents in 2008-09 was two years and 10 months.⁶²

The Productivity Commission has projected that, assuming no change in current policy settings, by 2046-47, the Australian Government will be providing subsidies for 567,000 persons aged 65 years or older in residential aged care. This is estimated to require a 1.53 per cent share of GDP.⁶³

Increased rates of chronic disease

Over the last century, chronic disease has become more prominent than infectious disease as a cause of death and disability, and this trend is likely to continue. Chronic disease is strongly correlated with age, and older people make up the bulk of people with chronic disease.

Already, more than 50 per cent of GP consultations are for people with a chronic condition such as heart disease, mental disorders and diabetes. Expenditure on chronic disease in Australia accounts for nearly 70 per cent of total health expenditure on disease.⁶⁴ In addition, Australia has a higher rate of hospital admissions related to these chronic conditions than its peer countries, which suggests a need to emphasise preventative management of these conditions in the home and in primary care.

Pressures on the health workforce

The health sector's workforce is ageing rapidly. There is concern that the rate of workforce replacement is not keeping up with the increased demand for health-care services. The number of workers in the health and community sector aged over 45 years is predicted to increase by 5.5 per cent by 2014 and many workers can be expected to retire over the next ten years.⁶⁵ One-third of medical specialists and primary care practitioners were aged 55 years and over in 2007.⁶⁶

Industry and governments recognise that Australia faces a significant shortfall in appropriately skilled aged care workers, and that this is likely to increase in the future. In late 2007, it was estimated that there were 262,000 people working in the aged care sector, including 175,000 providing services in residential aged care facilities. In a submission to the Productivity Commission, the Department of Health and Ageing stated:

⁶¹ *Ibid*

⁶² Australian Institute of Health and Welfare, *Residential aged care in Australia 2008-09*, 9 December 2010, <http://www.aihw.gov.au/publications/index.cfm/title/11628>

⁶³ Productivity Commission, *Caring for older Australians Draft Report*, 21 January 2011, <http://www.pc.gov.au/projects/inquiry/aged-care/draft>

⁶⁴ National Health and Hospitals Reform Commission, *A Healthier Future For All Australians, Final Report*, June 2009 <http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/nhhrc-report>

⁶⁵ *Ibid*

⁶⁶ Australian Institute of Health and Welfare, *Australia's Health 2010*, p. 452, 23 June 2010, www.aihw.gov.au/publications/aus/ah10/ah10.pdf

“Assuming that the ratio of aged care workers to the size of the population aged 70 or over remains constant, then by 2050 a total of 827,100 will be engaged in the provision of aged care ... Based on the projected workforce participation rates from the Intergenerational Report 2010, this will account for about 4.9 per cent of all employees in Australia.”

This indicates that under current policy arrangements, the aged care workforce would need to increase by between two and three times as a direct result of Australia’s ageing population.⁶⁷

A further workforce challenge is that the current distribution of the health workforce across Australia does not match the population distribution. General practitioners, medical specialists, dentists and physiotherapists are particularly poorly distributed in regional and remote Australia, resulting in difficulty meeting current, let alone future, health care needs.⁶⁸ For example, only 10.6 per cent of cardiologists and 12.5 per cent of radiologists are based outside major cities,⁶⁹ however around 31 per cent of Australia’s population reside in such areas.⁷⁰

4.2 Opportunities presented by the NBN

In light of the challenges to Australia’s health system, there is a need for new services and models of care that provide more efficient and effective ways of using available health resources to continue to provide Australians with high quality health services into the future.

The NBN presents a major opportunity to help address this challenge. In a report examining telemedicine opportunities in the context of the NBN, NICTA stated that:

“There is no doubt that health care systems will undergo fundamental transformations over the next several decades. Pervasive broadband access has the potential to be a genuinely ‘disruptive technology.’”⁷¹

There are five key characteristics distinguishing the NBN from existing networks that will support the enhancement of a range of existing health services, as well as the delivery of new services not previously possible or viable:

- *greater data capacity* – enabling the use of broadband for a range of simultaneous high bandwidth applications;

⁶⁷ Productivity Commission, *Caring for older Australians Draft Report*, 21 January 2011,

<http://www.pc.gov.au/projects/inquiry/aged-care/draft>

⁶⁸ National Health and Hospitals Reform Commission, *A Healthier Future For All Australians, Final Report*, June 2009 <http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/nhhrc-report>

⁶⁹ Australian Institute of Health and Welfare, *Health and community services labour force 2006, Appendix 5, Part 4*, 6 March 2009,

http://www.aihw.gov.au/publications/index.cfm/title/10677#detailed_tables

⁷⁰ Australian Bureau of Statistics, *Regional Population Growth, Australia, 2008-09*, 30 March 2010, <http://www.abs.gov.au/Ausstats/abs@.nsf/mf/3218.0>

⁷¹ NICTA, *Telemedicine in the context of the National Broadband Network*, June 2010 http://www.dbcde.gov.au/digital_economy/benefits_of_digital_economy_from_nbn

- *higher speed download and upload services* – supporting high-speed data transfer in both directions, essential for applications such as the rapid transfer of data intensive high definition 3D images and video;
- *high levels of network stability and reliability* – ensuring robust and reliable capability required to support health applications and services which have a very low tolerance for risk of downtime or degraded quality, in addition to enabling new services that had not been considered previously given network reliability challenges;
- *Ubiquitous coverage* – meaning broadband-enabled health services can be accessed by all Australians, and that healthcare professionals can adopt a new telehealth-enabled model of care knowing they can rely on all of their patients, not just some of them, having access to suitable broadband services; and
- *uniform national wholesale pricing* – helping to make high-speed broadband more affordable for all Australians.

These characteristics of the NBN will enable it to assist in improving health service delivery, delivering care to the home, enabling innovation in healthcare, facilitating widespread adoption of electronic records and reducing funding pressures on the health system.

4.3 Health service delivery

Greater use of video-consultations

Pervasive high-speed broadband is a key enabler for the widespread use of high quality video consultations. In combination with work underway to provide Medicare Benefits Schedule rebates for telehealth services⁷², this can support telehealth to become a mainstream complementary option for health service delivery in Australia.

For Australians living in regional, rural or remote communities, accessing certain health services, particularly specialist medical care, can involve a need to travel considerable distances, incurring significant cost in time and expense for families. Even in urban Australia, the level of road congestion can result in lengthy travel times to see health and other service providers. The NBN will enable a greater range and quantity of services (such as remote consultations supported by high-quality videoconferencing and supporting tools) to reduce the need to travel, and help to provide more timely diagnosis and treatment for patients.

Such services are useful in a range of contexts where consultations do not require physical examination, but rather involve the sharing of information. For example, parents and a child with developmental issues living in rural Western Australia may have an initial video-consultation with a paediatrician based in Perth to provide a

⁷² Department of Health and Ageing, *A discussion paper on connecting health services with the future*, November 2010, [http://www.health.gov.au/internet/mbsonline/publishing.nsf/Content/256BA3C38B7EEA22CA2577EA006F7C42/\\$File/Telehealth%20discussion%20paper.pdf](http://www.health.gov.au/internet/mbsonline/publishing.nsf/Content/256BA3C38B7EEA22CA2577EA006F7C42/$File/Telehealth%20discussion%20paper.pdf)

preliminary diagnosis and determine whether the long journey for further treatment is required.

Video-consultations and related services are currently used to some extent in a number of hospitals around Australia (see case study below). The NBN can allow such services to be delivered with higher quality and reliability on a more systemic basis in many more locations and sites across Australia, for example to local GP clinics, non-hospital based specialists, allied health professionals, and to the home. This will provide opportunities to modify or enhance existing services to take advantage of the ability to include real-time video interactions. For example, the Australian Government committed to providing \$50 million to extend the after-hours GP helpline to include capability for video-conferencing from July 2012.⁷³

Case study – Virtual Trauma and Critical Care Unit (ViTCCU) - Victoria⁷⁴

The Victorian Virtual Trauma and Critical Care Unit (ViTCCU) is an innovative project that was supported by the Australian Government through the Clever Networks Program. It has demonstrated the capability of high-speed broadband to improve critical and emergency care in regional communities. The ubiquitous coverage of the NBN, along with its high-capacity bandwidth will make it possible for services such as these to be delivered in hospitals across regional Australia.

ViTCCU provides support for regional doctors in smaller towns, dealing with trauma or specialist cases, by linking them (via video conferencing supported by high-speed broadband) with trauma and critical care specialists at major Melbourne hospitals. This allows quicker decisions on the right treatment for the patient, and also helps to determine if they can stay in their local hospital or need to be sent on to a larger hospital.

The service went live in December 2008. The project resulted in a reduction in social and economic costs of critical care through the provision of comprehensive virtual specialist services to target hospitals. This enabled more patients from rural and remote locations to remain in their local communities close to their family and support networks. It also reduced the transport, accommodation and other costs of family and friends visiting patients in metropolitan hospitals.

Through this project, GPs, health clinicians and other support health workers gained increased training and skills in telehealth. Training packages were developed to train health professionals and support workers in the use of IT systems to enhance patient care. The ongoing training included developing skills in diagnostic capabilities and stabilisation of trauma and acute care patients as a direct result of ongoing exchanges between provider and receiver hospitals.

After less than 18 months in operation, there had been 88 consultations for critically ill and/or trauma patients from four rural hospitals (more than one per week), and almost

⁷³ Julia Gillard & Nicola Roxon, *Connecting health services to the future*, 16 August 2010, <http://www.alp.org.au/federal-government/news/connecting-health-services-to-the-future/>

⁷⁴ Loddon Mallee Rural Health Alliance, Project Brief, last accessed 7 March 2011, <http://vitccu.lmha.com.au/> and final project report provided to DBCDE

900 specialist video conferencing sessions held over the network. About 40 per cent of rural and regional Victoria was enabled to participate in the ViTCCU to leverage the specialist services offered by provider hospitals so as to improve healthcare services.

Increased support and training for rural health professionals

The NBN also offers a range of opportunities to enhance support services for GPs and other health professionals. This could include content rich online real-time interactive continuing professional development courses (including, for example, 3D virtual environments), or mentoring by senior practitioners facilitated through videoconference. Such support can improve the skills and capabilities of health professionals, but without having to waste time in traffic or long distance travel.

By providing support and reducing professional isolation, these services can also encourage health professionals to consider or continue in rural practice. This provides a valuable complement to other initiatives to attract and retain rural health professionals, such as financial incentives.

4.4 Care to the home

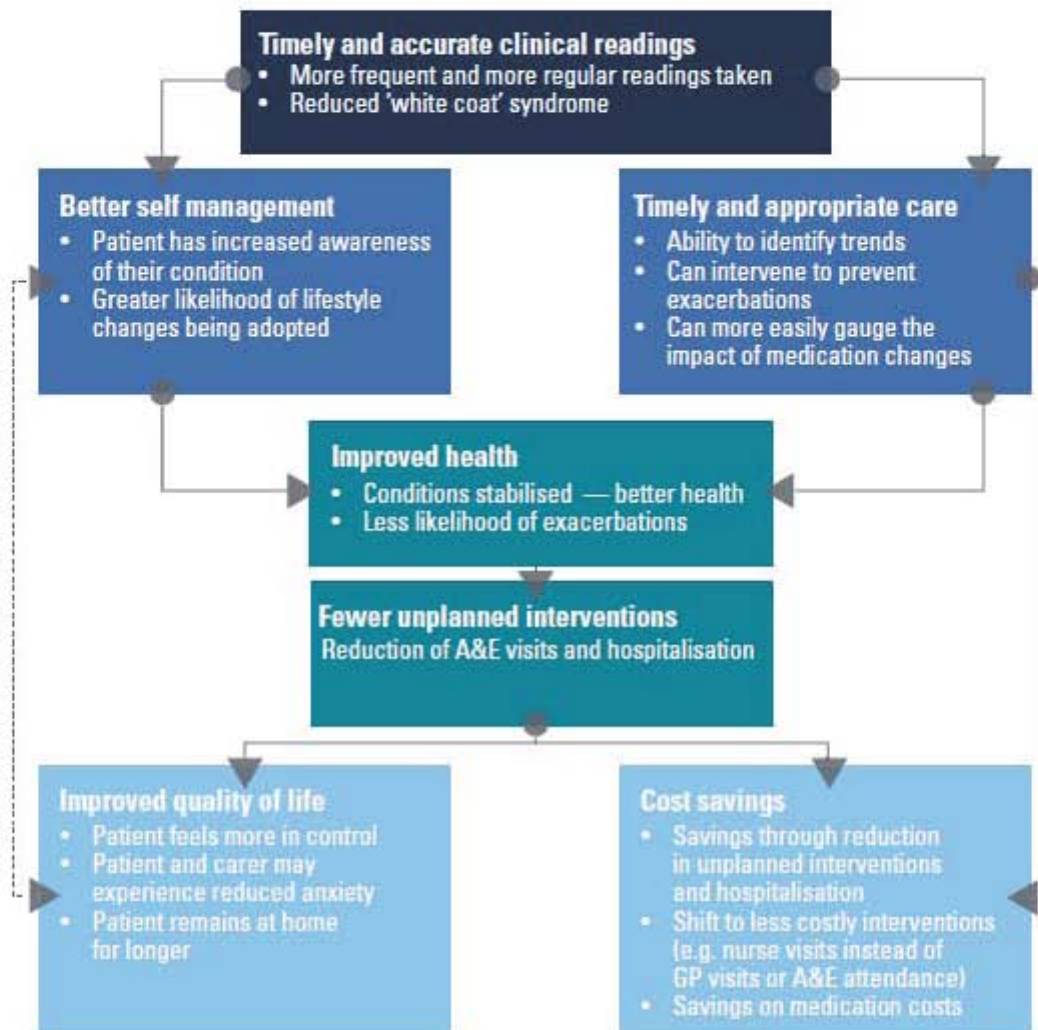
By making reliable, high capacity broadband services available to the home, the NBN can support new in-home models of care. This can enable services that are especially well suited to addressing the needs of certain groups within society, particularly the frail and elderly, those with complex or chronic disease, and those living in regional and rural areas. NBN enhanced in-home services can also support older Australians to stay in their home for longer, and provide greater support for carers.

Better managing chronic conditions

In-home tele-monitoring and support can help those with chronic conditions to be better monitored on an ongoing basis. This might include daily measurement of key health indicators (for example, blood glucose readings, blood pressure), automatically provided to the GP or a nurse coordinator, and complemented by video visits. Such a model generates a range of benefits not only to the patient's health and wellbeing, but also to the health system, through delivering more timely and appropriate care before any deterioration that may require hospitalisation or emergency attention. Key outcomes and benefits of this approach are outlined in the following diagram.⁷⁵

⁷⁵ KPMG, *Switch On! The case for telehealth*, June 2010, http://www.kpmg.co.uk/pubs/200343_Healthcare_web_accessible_v2.pdf

Use of technology to monitor people's health remotely



Source: KPMG Healthcare Report (2010) *Switch On! The Case for Telehealth*

The NBN provides an opportunity to develop models of care that enhance remote monitoring with face-to-face videoconference interventions, increasing the effectiveness of this in-home care and improving cost savings.

Improved coordination and timely and appropriate management of chronic conditions represents a key opportunity to limit increasing costs relating to the increased prevalence of chronic conditions as the population ages.

Supporting older Australians to remain in their own homes for longer

Delivering health services to the home can be particularly beneficial in better managing the health and wellbeing of older Australians, and supporting them to remain in their own homes for longer. Understandably, older Australians prefer to remain in their own homes and live independently for as long as possible, maintaining connections to their communities, family and friends, with the comfort and security of familiar surroundings. This preference has been noted by the Productivity Commission,⁷⁶ and found in research conducted by the University of South Australia.⁷⁷

High-speed broadband offers potential for a range of health services and support for older Australians such as post-operative care, in-home monitoring for a chronic condition or sensors to issue alerts in the event of a fall or prolonged inactivity. The NBN provides such services with additional reach by ensuring homes have access to a fast connection and making such connections cheaper to access. For those applications that require a high level of reliability, the NBN provides a high quality of service, broadening the types of applications that can be developed and increasing ease of use for older Australians.

For example, Brownsell et al.⁷⁸ report that telehealth could be used to assist, prevent or minimise the impact of two thirds of the top three dozen causes of residential aged care entry in the UK, and three quarters of the top dozen reasons for admission.

In-home health monitoring and care is also a more cost-effective use of health resources than residential aged care. For example, the US Veterans' Health Administration's care coordination and home telehealth program is significantly less expensive per patient than long-term institutional care.⁷⁹

Case study – Care Coordination / Home Telehealth – United States Veterans' Health Administration⁸⁰

The US Veterans Health Administration (VHA) is a large integrated healthcare system, delivering healthcare services to some 5.6 million veteran patients annually. In 2011, the number of veteran patients aged 85 or more treated by VHA is expected to be triple the number in 2000.

Between July 2003 and December 2007, VHA introduced a national home telehealth program – Care Coordination/Home Telehealth (CCHT). Its purpose is to coordinate the

⁷⁶ Productivity Commission, *Caring for Older Australians Draft Report*, January 2011, p.

51 www.pc.gov.au/data/assets/pdf_file/0011/104879/aged-care-draft.pdf

⁷⁷ Alpana Sivam & Sadasivam Karuppannan, University of South Australia, *Ageing and its implications for housing and urban development: South Australia*, November 2007,

<http://www.fbe.unsw.edu.au/cityfutures/SOAC/aginganditsimplications.pdf>

⁷⁸ Brownsell et al. (2007), *The role of telecare in supporting the needs of the elderly*, Journal of Telemedicine and Telecare, 13(6), pp. 293 – 297, <http://jtt.rsmjournals.com/cgi/content/abstract/13/6/293>

⁷⁹ Darkins et al., *Care Coordination/Home Telehealth: the systematic implementation of health informatics, home telehealth and disease management to support the care of veteran patients with chronic conditions*, Telemedicine and e-Health, Vol. 14, No. 10, December 2008, pp. 1118-1126, <http://www.liebertonline.com/doi/abs/10.1089/tmj.2008.0021>

⁸⁰ *Ibid*

care of veteran patients and avoid their unnecessary admission to long-term institutional care. CCHT is now a routine service offered to veterans with chronic conditions in their homes as they age.

Within the CCHT model, care is actively coordinated by a dedicated team of care coordinators, who assess patients, select the appropriate home telehealth technology and vital signs or parameters to be monitored, provide the required training to patients and carers, review telehealth monitoring data, and provide active case management, including daily assessment and communication with the patient's doctor as required.

Analysis of data from a cohort of 17,025 CCHT patients show a 25 per cent reduction in numbers of bed days of care, a 19 per cent reduction in numbers of hospital admissions, and a satisfaction score rating of 86 per cent. The annual cost of CCHT per patient (\$1,600) also compares very favourably with traditional home-care services (\$13,121) and nursing home care rates (average \$77,745). CCHT is therefore a cost-effective complement to VHA's other services for older veterans.

Greater support for carers

Enhanced in-home services could also be designed to provide additional support, resources and assistance for carers. Increased access to video-consultations and rich content training can help ensure carers are better supported, thereby improving their skills and confidence.

For example, a report on the incidence and prevalence of dementia noted that it was important to improve the consistency and coverage of dementia skills training for carers, promoting a pervasive understanding of quality person-centred dementia care through knowledge transfer and monitoring outcomes.⁸¹

There are currently around 245,000 people with dementia in Australia. By mid-century, it is estimated there will be over 1.13 million Australians with dementia. Dementia is the leading single cause of disability in Australians aged 65 years or older, and is responsible for one year in every six years of disability burden for this group.⁸²

Comprehensive, rich online training content and environments and ongoing real-time interactive support for carers of people with dementia could assist not only in providing best practice care for those with dementia living in the community, but also in reducing uncertainty and pressure on the more than 100,000 carers.

4.5 Innovation in health services

In addition to enhancing existing services, the NBN will enable the health sector, in partnership with the technology industry, to explore and deliver new and innovative

⁸¹ Access Economics, *Keeping dementia front of mind: incidence and prevalence 2009-2050*, August 2009,

<http://www.accesseconomics.com.au/publicationsreports/showreport.php?id=214&searchfor=2009&searchby=year>

⁸² *Ibid*

health and care services for Australians. As NICTA stated in its report on telemedicine in the context of the NBN:

*“Australia has the opportunity to use the NBN as a catalyst to jump-start it into a leading position in telehealth care as an integral part of future healthcare.”*⁸³

NICTA also noted that the NBN could play a catalyst role in developing new supply/value chains, gaining quality and cost benefits in health systems and addressing usability issues through more effective access and competition.

Large technology companies⁸⁴ and other Australian businesses⁸⁵ are already exploring innovative health care products and services that will take advantage of the ubiquitous high-speed broadband that NBN will deliver. They are also increasingly recognising the advantages of combining this high-speed connectivity with cloud based services.

Research and academic organisations are also pursuing opportunities to use the NBN to enhance health and wellbeing. For example, the CSIRO notes that building on CSIRO technologies, the NBN will make it possible to deliver improved home-based care systems, an intelligent portal for medical imaging and improved access to medical data.⁸⁶

The IBES, part of the University of Melbourne, also has a range of projects underway, including homes for the elderly, haptic tele-rehabilitation, and real-time tele-dentistry.⁸⁷

An NBN-enabled Australia can provide a useful ‘test-bed’ for new models of care enabled by ubiquitous high-speed broadband not only to traditional medical sites, but also to the home, giving Australia a unique opportunity to lead the development of new and innovative services in this field.

4.6 Electronic health records

By providing a high capacity, ubiquitous and reliable network, the NBN will enable the benefits of system-wide electronic health records to be fully realised, building on the Australian Government’s provision of a personally-controlled electronic health records (PCEHR) for every Australian who chooses to have one from 2012–13.⁸⁸ Doctors and specialist medical practitioners in various health settings and locations across Australia will be able to have fast and reliable access to patient health records, including data intensive, high resolution medical images and videos. In addition, patients will have

⁸³ NICTA, *Telemedicine in the context of the National Broadband Network*, June 2010, http://www.dbcde.gov.au/digital_economy/benefits_of_digital_economy_from_nbn

⁸⁴ Press Release, The Honourable Stephen Conroy, *Intel and Government share digital economy vision*, 1 October 2010, http://www.minister.dbcde.gov.au/media/media_releases/2010/077

⁸⁵ For example, TeleMedCare (www.telemedcare.com.au) and Precedence Health Care (<http://precedencehealthcare.com/>)

⁸⁶ CSIRO, *e-Health innovation*, 16 September 2009, <http://www.csiro.au/files/files/ps6z.pdf>

⁸⁷ Institute for a Broadband Enabled Society, *Health and Wellbeing Research*, last accessed 7 March 2011, <http://www.broadband.unimelb.edu.au/main.php?id=140>

⁸⁸ Department of Health and Ageing, *Personally Controlled Electronic Health Records for all Australians*, 11 May 2010 <http://www.health.gov.au/internet/budget/publishing.nsf/Content/budget2010-hmedia09.htm>

high-quality access to their online health record.

The widespread use of electronic health records in the Australian health system can deliver a range of benefits for individuals and health professionals, including:

- providing relevant and required information to health professionals when they need it, enabling more coordinated care, faster diagnosis, more appropriate treatment, and reduced medication errors;
- strengthened privacy and information security supported by individual control of access to the record, and the ability to track who has viewed the record; and
- improved health literacy, patient self-management and preventative care by enhancing the tools available to individuals for tracking, monitoring and managing their own health.

The use of electronic health records is particularly valuable for Australians with chronic conditions (for example, diabetes, chronic obstructive pulmonary disease, cystic fibrosis), who are often high users of health services, and require ongoing integrated care from a range of health professionals. Similarly, older Australians who often have a complex mix of medical needs, and may at times have difficulty remembering details of their health history. Ensuring all relevant information is able to be provided to key health personnel can support swifter and more effective diagnosis and treatment, informed by knowledge of existing medications and past health events.

4.7 Funding pressures on the health system

Estimating the financial benefits of incorporating telehealth and e-health into the health system is a complex task. There are a number of reports estimating the financial benefits of systemic adoption, including:

- Access Economics estimated that the ongoing benefits to Australia from wide scale implementation of telehealth (not including impacts arising from electronic health records) would be in the order of \$2 billion to \$4 billion per year;⁸⁹
- Booz & Co estimated that a shift to e-health would generate a net benefit between \$7.5 billion and \$8.7 billion to the Australian economy over the first 10 years;⁹⁰ and
- Booz & Co estimated that a rollout and adoption of core e-health capabilities in Australia are expected to be worth an estimated \$7.6 billion annually by 2020, with the primary benefits stemming from reduced errors, enhanced adherence to best practice, and enhanced workforce productivity.⁹¹

⁸⁹ Access Economics, *Financial and externality impacts of high-speed broadband for telehealth*, May 2010, http://www.dbcde.gov.au/digital_economy/benefits_of_digital_economy_from_nbn

⁹⁰ Booz & Co, *E-health: enabler for Australia's health reform*, prepared for the National Health and Hospitals Reform Commission, November 2008 www.racgp.org.au/Content/NavigationMenu/ClinicalResources/ehealth/Resources/Booz_eHealth_Report.pdf

⁹¹ Booz & Co, *Optimising E-Health Value*, May 2010 www.booz.com/media/file/Optimising_e-Health_Value.pdf

4.8 Turning opportunity into reality

The Department commissioned a report from NICTA on *Telemedicine in the context of the National Broadband Network*. The report stated that the NBN was expected to play a key role in overcoming barriers to the wider deployment of telemedicine. This included a critical role in overcoming the pervasive access barrier, and in allowing the trials needed for innovation capture that can identify a pathway for the deployment of innovative trial results into sustainable programs.⁹²

Given that NBN first release sites are already under construction, with services to commence later in 2011, the Department has been working with the Department of Health and Ageing (DoHA) and the Department of Veterans Affairs (DVA) to examine opportunities to trial new services that could be implemented nationally, as the NBN is deployed across Australia.

Supporting older Australians with chronic conditions in their homes, through in-home monitoring and video consultations is a particular priority, in light of growing pressures on the health system as discussed earlier.

In December 2010, the Australian Government announced an offer of funding to the NSW Government to deliver a trial of in-home telehealth services for older Australians with chronic disease living in the NBN early release sites of Armidale and Kiama.

The purpose of the trial is to gather vital information needed to determine how best to enable wider adoption of telehealth in Australia to realise its full potential to provide better and more efficient healthcare.

The trial is intended to contribute to a wider adoption of telehealth in the health system. A comprehensive independent evaluation will be undertaken to identify the impacts, outcomes and key lessons from the trial.

The Department, together with the DoHA and the National E-Health Transition Authority, is working closely with the New South Wales Government, the medical profession and other key stakeholders to design and implement the trial.

The Department, DoHA and DVA are continuing to consult with relevant stakeholders on other possible trials of telehealth.

⁹² NICTA, *Telemedicine in the context of the National Broadband Network*, June 2010
http://www.dbcde.gov.au/digital_economy/benefits_of_digital_economy_from_nbn

5. Achieving Education and Skills Outcomes

Australia is, and has for some time been, facing significant skills shortages in many sectors.

The Council of Australian Governments (COAG) recognises that Australia requires people with high quality skills to maintain its long term economic and social prosperity. COAG has set qualifications targets to reduce gaps in skill levels and substantially deepen Australia's skills base.⁹³ Skills Australia has also outlined the need to increase tertiary sector enrolments (which include Vocational Education and Training (VET)) by at least 3 per cent a year over the next 15 years.⁹⁴ The availability of ubiquitous, high-speed broadband has the potential to significantly extend the reach, availability and quality of education services, particularly in regional areas, to help meet these needs. In addition, the greater data capacity of the NBN (both download and upload) can enable more intensive and immersive online interactions, resulting in higher quality outcomes for students.

5.1 Challenges facing skills development in Australia

Skills shortages

The Skill Shortages, Australia June 2010 report comments that over the nine months to June 2010 there were strong signs of a recovery in demand for skills following the global recession and shortages became more widespread. In the case of the trades groups, shortages were evident in the automotive, construction and food sectors.⁹⁵

A number of employer organisations have argued that there is an emerging shortage of skilled tradespeople in Australia. The Housing Industry Association Trades Report (October 2010) identified a shortage of skilled tradespeople in nine of the thirteen skilled trades, including carpentry, electrical and plumbing.⁹⁶

A research paper by KPMG-Econtech revealed a trend towards chronic skills shortages. The paper observes that this shortage is growing most quickly in tradespeople as well as building and engineering professionals.⁹⁷

Australia's ageing workforce will exacerbate skill shortages, with potentially large workforce replacement issues meaning Australia needs to significantly increase its current rate of employment participation. In addition, to meet the changing needs of

⁹³ Council of Australian Governments' Meeting 29 November 2008, Attachment B

http://www.coag.gov.au/coag_meeting_outcomes/2008-11-29/attachments.cfm#attachmentb

⁹⁴ Skills Australia, *Creating a future direction for Australian vocational education and training*, October 2010, <http://www.skillsaustralia.gov.au/VETdiscussionpaper.shtml>

⁹⁵ DEEWR, *Skill Shortages, Australia June 2010*, June 2010,

<http://www.deewr.gov.au/Employment/LMI/SkillShortages/Pages/Publications.aspx>

⁹⁶ HIA, Housing Industry Association-Austral Bricks Trades Report, October 2010,

<http://hia.com.au/hia/news/article/mr/national/ec/skilled%20trade%20shortages%20highlight%20need%20for%20policy%20action%20says%20hia.aspx>

⁹⁷ KPMG/Econ Tech, *Clarius Skills Index: December Quarter*, January 2010,

http://www.clarius.com.au/PDF/Clarius%20Skills%20Index_December%202009%20Quarter.pdf

both industry and individual learners, the education sector must become increasingly flexible, innovative and responsive to a rapidly changing technological environment. While 60 per cent of employers expect that their organisation's use of e-learning will increase in the next two years (2010 Employer E-learning Benchmarking Survey)⁹⁸, only 5.3 per cent of recognised delivery in the public VET system in 2006 took place via online or other off campus modes.⁹⁹

Teaching shortages

The Report on the *Labour Market for Vocational Education Teachers* concluded that there is a shortage of vocational education teachers in Australia because of the difficulty that government and non-government VET employers are facing in recruiting VET teachers (75 per cent of survey respondents had experienced difficulty).¹⁰⁰

The Skills Australia Report, *Creating a Future Direction for Australian Vocational Education*, states that the VET workforce is ageing with many practitioners needing to be replaced due to retirements, or supplemented with additional staff due to scaling down to part-time work. This is especially evident with TAFE staff where 66.9 per cent of the workforce was aged 45 years or more in 2005. The report concludes that the future capacity of the sector is compromised without sufficient qualified and experienced staff.¹⁰¹

A number of national reports over the past decade have found there are ongoing school teacher shortages in certain subject areas, such as secondary mathematics and science, as well as for schools in rural and remote areas. The most recent national data on school teacher vacancies found that:¹⁰²

- there were teacher shortages at the national level in specialist areas, such as (Languages other than English) LOTE and Special Needs in primary schools, and mathematics, science and LOTE in secondary schools;
- a higher proportion of primary and secondary school principals in provincial and remote areas reported major or moderate difficulties in filling staff vacancies compared to those in metropolitan areas;
- a similar trend in relation to retaining staff, but noting that attracting suitable staff to schools in non-metropolitan areas was more difficult than retaining them once they have arrived; and
- in response to staffing shortages, school principals find it necessary to use teachers to teach classes outside their field of expertise or to reduce curriculum areas offered to students.

⁹⁸ DEEWR, *2010 Employer E-learning Benchmarking survey*, June 2010

http://www.flexiblelearning.net.au/files/2010_Employer_E-learning_Benchmarking_Survey_Final.pdf

⁹⁹ Knight, Brian and Mlotkowski, Peter (2009), *An overview of vocational education and training in Australia and its links to the labour market*, Adelaide NCVER, p.34

¹⁰⁰ CEDA, *Labour Market for Vocational Education Teachers*, 5 August 2010,

<http://inventingthefuture.ceda.com.au/UserDir/Documents/Skills%20Shortage%20-%20Vocational%20Education%20Teachers.pdf>

¹⁰¹ Skills Australia, *Creating a future direction for Australian vocational education and training*, October 2010, <http://www.skillsaustralia.gov.au/VETdiscussionpaper.shtml>

¹⁰² Department of Education, Employment and Workplace Relations, *Staff in Australian Schools 2007*, January 2008, <http://www.deewr.gov.au/Schooling/Documents/SiASSurveyDataReport2007.pdf>

Additionally, the most recent *OECD Teaching and Learning International Survey (TALIS)* on professional development found that:¹⁰³

- all TALIS countries reported unmet demand for professional development but this varied considerably across countries;
- about 55 per cent of Australian teachers wanted more professional development than they have received; and
- Australian teachers had one of the highest participation rates in professional development but one of the lowest levels of intensity (for example, average number of days undertaken for professional development).

Case study – Circular Christian School uses NBN to improve learning¹⁰⁴

In August 2010, Circular Head Christian School became the first Australian school to be connected to the NBN.

Based in Smithton, north-western Tasmania, the school of 385 children from kindergarten to year 12 had built a strong reputation for the quality of its Vocational Education Training (VET) stream as well as standard academic subjects. In recent years though, Circular Head had found it increasingly difficult to attract and retain the number and breadth of teachers required to deliver VET subjects.

When the NBN arrived, Patrick Bakes, Principal of the Circular Head Christian School immediately identified the opportunity to overcome that challenge. Face-to-face teaching could be supplemented with high-definition video conferencing and access to subject matter experts and teachers in other states and territories across Australia.

“Our little school might not have been able to deliver all the subjects our year 11 and 12 students wanted onsite, but we could link to another school that would effectively let us into their classroom,” Patrick said.

Before Circular Head was connected to the NBN, Patrick says staff viewed the internet as a research tool only – an extension of traditional encyclopedias as opposed to an intrinsic part of the classroom.

“On our previous internet connection, students would have to sit and wait for ages for content to download. Because the online experience was so frustrating, teachers were often reluctant to use the internet in the classroom.”

The benefits of being connected to the NBN are reverberating through the school and teachers are being encouraged to actively explore new ways to use internet-based learning in the classroom.

¹⁰³ OECD, *Creating effective teaching and learning environments*, 2009, <http://www.oecd.org/dataoecd/17/51/43023606.pdf>

¹⁰⁴ NBN Co case study: *Education – teacher retention*: <http://www.nbnco.com.au/wps/wcm/connect/main/site-base/main-areas/publications-and-announcements/research/>

“We are finding that students are engaged, they can move from one task to another much more quickly, they can access a range of media when they are researching, they can get onto the latest maps, instead of having to use an atlas which is five years old,” Patrick said.

“It’s exciting that the NBN is fast – yes. But most important to us is that it has enabled us to offer our students access to the kind of technology and subjects that their metropolitan classmates can access without question.”

5.2 Opportunities presented by the NBN

The NBN’s ability to support the provision of high quality, real-time and interactive training in widely dispersed locations can enable students, who previously did not have practical access to educational institutions, to do so. It can also provide flexibility and increased richness of interaction for an even greater number of students who will be able to complete requirements more quickly and effectively. The high-speed, ubiquitous broadband and expanded two-way capacity offered by the NBN will provide a platform that can support the delivery of new and enhanced forms of collaborative and interactive learning.

Using the NBN to extend the reach and depth of education and training provision could improve access to professional development and re-training for people already in the workforce and potentially contribute to addressing the shortage of specialist teachers.

The NBN provides an opportunity to build on what is already being achieved in the Digital Education Revolution (DER) which aims to bring about meaningful change to teaching and learning in Australian schools to prepare students for further education, training and to live and work in a digital world. The DER is helping to upgrade connectivity and ICT equipment for schools, the ICT proficiency of teachers, and the availability of digital educational tools and resources.

By extending high-speed broadband to all Australian premises, the NBN will provide a platform that can support the greater integration of technology into learning, across all sectors, and the extension of learning environments, in particular, to the home.

Possible benefits include:

- improved access to high quality vocational and adult education and training services for students at home and in the workplace, leading to increased take-up of relevant skills development programs;
- increased productivity through the creation of ‘virtual classrooms’, where students in a range of locations can receive tuition and where attendance at traditional classes may be unviable;
- job seekers can more readily access appropriate training and professional development to get back into the workforce faster;

- ongoing and flexible learning opportunities that fit around work and family commitments;
- increased participation by mature-age workers, migrants and itinerant workers through online retraining opportunities; and
- improved usage of existing teaching resources which may help to address teacher shortages.

5.3 Education outcomes

Based on international experience, the increased use of online learning enabled by high-speed broadband has the potential to increase the reach of education services, the availability of open education resources, and an improvement in education outcomes. For example:

- Carnegie Mellon University's Open Learning model has shown that online learning can substantially reduce the time required to learn a subject (50 per cent of the time required using more traditional methods) while greatly increasing course completion rates (99 per cent compared to 41 per cent for more traditional methods);¹⁰⁵
- high school students attending Florida Virtual Schools outscored the states standardised assessment average by more than 15 percentage points in grades 6 through 10;¹⁰⁶ and
- a study conducted the European Union found that broadband access in classrooms results in significant improvements in pupils' performance in national tests taken at age 16.¹⁰⁷

5.4 Reach and availability

The NBN's ubiquitous nature can extend the reach and availability of education services, particularly in regional areas. Several initiatives are underway to achieve this, including:

- under the Digital Regions Initiative, 270 schools (State, Catholic and Independent) in Tasmania will progressively be linked via the NBN to allow any student, teacher or parent across the participating schools to have access to a wide range of teaching, collaborative and learning resources. The project will benefit up to 80,000 students and 12,000 teachers across Tasmania; and
- with funding from the Digital Regions Initiative, up to 425 sites in South Australia will be linked to deliver broadband-enabled e-learning for 17,000 volunteers and fire fighters.

¹⁰⁵ D. Carter, *Program goes beyond open course model*, [ecampusnews.com](http://www.ecampusnews.com/top-news/program-goes-beyond-open-course-model/), 16 September 2009

¹⁰⁶ Federal Communications Commission, *National Broadband plan: Connecting America*, Broadband.gov, 16 March 2010, <http://www.broadband.gov/plan/11-education>

¹⁰⁷ European Commission, *The ICT Impact Report A review of studies of ICT impact on schools in Europe*, December 2006, http://ec.europa.eu/education/pdf/doc254_en.pdf

5.5 Teaching resources

Availability of ubiquitous and reliable broadband may accelerate the take-up of online learning opportunities, and improve the quality with which those opportunities can be delivered. By making the experience of online learning as seamless as possible, the NBN can increase the rate at which technologies are adopted and thus the rate at which productivity improvements can be realised.

A study by the National Center for Academic Transformation in the United States followed 30 two to four year colleges over five years as they implemented online learning programs. These colleges showed savings of between 20 to 71 per cent in their cost of serving students. This represents either money that could be diverted to other teaching goals or an increase in productivity that could be used to teach more students with the same set of resources. These improvements were achieved while at the same time improving teaching quality and outcomes.

5.6 Immersive online education

The greater data capacity of the NBN (both download and upload) will allow for more intensive and immersive online education. For example, the University of Melbourne (through its IBES and supported by Ericsson) is trialling the delivery of 3D learning applications (linked with haptic feedback systems in some circumstances) over a prototype 'Uni TV' system. Areas being trialled include surgical training, engineering and molecular chemistry.¹⁰⁸

5.7 Online educational resources

There are significant global trends towards the publication and use of online educational resources and towards greater inclusion of richer content such as videos. Examples include the growth of Opencourseware which refers to the free and open digital publication of high quality university-level educational materials¹⁰⁹, the Australia online repository for educators -- edna.edu.au¹¹⁰, the Australian Flexible Learning Network,¹¹¹ YouTube EDU¹¹² and Apple iTunes U.¹¹³ Numerous Australian educational institutions are participating in YouTube EDU and Apple iTunes U including, for example, the University of New South Wales¹¹⁴ and the University of Tasmania.¹¹⁵

The availability of ubiquitous, reliable, high-speed broadband is likely to accelerate the trend towards richer online educational resources which can, in turn, lead to improved educational outcomes. A US meta-analysis of 51 studies into online learning platforms found that students who took all or part of their class online performed better, on

¹⁰⁸ IBES media release, *Delivering 3D education through high-speed broadband*, 10 December 2010 http://www.broadband.unimelb.edu.au/main.php?pg=news&news_id=549&s=67

¹⁰⁹ For example, see the Opencourseware Consortium: www.ocwconsortium.org/

¹¹⁰ www.edna.edu.au/edna/go/pid/1

¹¹¹ www.flexiblelearning.net.au/

¹¹² www.youtube.com/education?b=400

¹¹³ www.apple.com/education/itunes-u/

¹¹⁴ www.unsw.edu.au/news/pad/articles/2008/jun/iTunesU.html

¹¹⁵ www.teaching-learning.utas.edu.au/elearning/itunes-u

average, than those taking the same course through traditional face-to-face instruction.¹¹⁶ Online engagement can also increase student and teacher efficiency, for example, in producing and editing documents.¹¹⁷

Access to research, cultural and educational public resources (for example, from educational and research institutions, public service broadcasters, public libraries, museums and cultural centres) is important in order to support educational development. Historical, educational and cultural heritage records are increasingly being digitised, and relevant institutions are increasingly servicing their clients through online portals. Significant scope remains for improving access through further digitisation efforts. The NBN's capabilities can support innovation to increase the number, type and quality of services that knowledge-keeping institutions such as these are able to offer.

For example, the National Library of Australia's *Trove*¹¹⁸ service currently allows users to search for content across eight different digital platforms including newspapers, photos, music, archived websites, books, journals and more. The Australian Literature Gateway (AustLit),¹¹⁹ a collaborative effort involving several Australian universities and educational institutions, provides online access to digitised Australian literature and makes this service available to educational institutions (including schools) on a subscription basis. High-speed broadband will support these or similar services incorporating more interactive and high-bandwidth applications, such as the ability to easily access and search high-definition video archives. The availability of high-speed broadband in the home through the NBN provides the potential to extend access to online resources from the school, or learning institution, to the student at home.

5.8 Specialist online training and instruction

The capability to both receive and send high quality video provides scope for improved educational services. High upload/download speeds allows for online course attendance and high-definition virtual classes participation.¹²⁰

Online classes for specialist subjects, such as languages, are excellent examples of the kinds teaching that can benefit from high-speed internet connections. Australian students – even in regional areas – will be able to study almost anything.

¹¹⁶ U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*, Washington, D.C., 2010.

www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

¹¹⁷ PricewaterhouseCoopers, *Champion for Digital Inclusion: The economic case for digital inclusion*, pages 22-23, October 2009, http://raceonline2012.org/sites/default/files/resources/pwc_report.pdf

¹¹⁸ <http://trove.nla.gov.au>

¹¹⁹ The Australian Literature Gateway (AustLit): <http://www.austlit.edu.au/about>

¹²⁰ OECD, *Network developments in support of innovation and user needs*, 2009, table 2, page 35. http://www.oecd.org/document/58/0,3746,en_2649_34225_44245946_1_1_1_1,00&en-USS_01DBC.html

Case Study – Australian National University’s (ANU) School of Music¹²¹

The Australian National University’s (ANU) School of Music recently opened a new state-of-the art music videoconference facility in 2011, using systems specially designed for the audio requirements of music transmission. The new facilities will provide the means to connect students, teachers and artists around the world through individual high level coaching, master classes, academic seminars, music education programs, professional development, and virtual artist residences.

The ANU School of Music is confident that with increased high-speed broadband, it will be able to reach out to local, regional and remote communities and enable Australians to engage with the broader international music scene.

Shared online learning spaces could be used more widely by course participants (and their parents/guardians) to encourage collaboration, facilitate communications between teachers and students, disseminate course and curriculum materials, and access feedback such as test results and achievement against desired learning outcomes. A European Commission study of the impact of ICT in schools found that broadband is a major factor in increasing collaboration between teachers and that embedded, reliable and high-capacity broadband in the classroom increases the quality and quantity of educational activities that can be undertaken.¹²²

The study found that teachers benefit from broadband in several ways:¹²³

- new ways of communicating between staff, staff and pupils, sharing of expertise and knowledge within and between schools, and communicating between the home and the community (currently limited, but a growing feature of the schools surveyed);
- better and faster access to a rich source of learning resources allows teachers to gain confidence and learn about the possibilities they offer;
- access to lesson ideas and materials aids teachers in their planning, which reduces time spent on initial preparation whilst increasing time available for developing and sharing ideas with colleagues; and
- the ability to tailor learning packages to individual pupils by provision of various learning tasks.

The use of high-speed broadband provided by the NBN can support the development of high-quality immersive online-learning environments, such as simulations, and interactive software that allows for constant two-way feedback can significantly enhance the learning experience and improves potential for tailoring instruction and tutoring to individual students.

¹²¹ ANU School of Music Videoconferencing, <http://music.anu.edu.au/vc>

¹²² European Schoolnet, *The ICT Impact Report A review of studies of ICT impact on schools in Europe*, December, page 27, 2006, http://ec.europa.eu/education/pdf/doc254_en.pdf

¹²³ *Ibid*, page 38

Public libraries, institutions offering online learning and community-focused education groups such as the *School of the Air* and home-schooled Australians could particularly benefit from the introduction of fast, reliable internet access. As the OECD has recognised, fast broadband access:

*“opens up access to online learning materials for unfamiliar subjects and provides access to a community of other parents choosing a home schooling approach for education.”*¹²⁴

5.9 Digital literacy driving improved educational outcomes

A study by the Information Technology and Innovation Foundation suggests that digital literacy skills enhance a child’s educational performance. The study found that home internet connections improve a child’s performance on standardised reading tests and improve the chances that a child would remain in school.¹²⁵ The ubiquity of the NBN can help to drive greater digital literacy among Australian school children, which would, in turn, deliver improved educational attainment.

Another US analysis noted that children with internet access have been found to have higher standardized test scores, graduation rates, and earning potential.¹²⁶ In these studies, the benefits were found to extend beyond those provided by family income, parental education, the parent’s occupation/s and other factors.

In the UK, a 2009 PricewaterhouseCoopers study estimated that getting every citizen online would deliver an aggregated benefit for the UK of £10.5 billion in lifetime earnings as a result of improved educational attainment. This represents over 47 per cent of the estimated total economic benefits expected from getting everyone in the UK online (£22 billion).¹²⁷

Case Study – Cairns School of Distance Education¹²⁸

This government run school is one of seven schools of distance education run by Education Queensland to service the educational needs of remote and rural students from prep to year 12. The school is co-educational and provides students with an individualised curriculum through a close working relationship with teachers, students and home tutors.

¹²⁴ OECD, *Network developments in support of innovation and user needs*, 2009, page 33.

http://www.oecd.org/document/58/0,3746,en_2649_34225_44245946_1_1_1_1,00&&en-USS_01DBC.html

¹²⁵ Atkinson, Robert D and Daniel D Castro, *Digital Quality of Life: Understanding the Personal and Social Benefits of the Information Technology Revolution*, Information Technology and Innovation Foundation, 2008, page 22 <http://archive.itif.org/index.php?id=179>

¹²⁶ Digital Impact Group and EConsult Corporation, *The Economic Impact of Digital Exclusion*, EConsult Corporation, 2010, page 18 <http://www.digitalimpactgroup.org/costofexclusion.pdf>

¹²⁷ PricewaterhouseCoopers, *Champion for Digital Inclusion*, October 2009

http://raceonline2012.org/sites/default/files/resources/pwc_report.pdf

¹²⁸ Queensland Department of Education and Training, *Cairns School of Distance Education*, last accessed 16 March 2011, <http://cairnssde.eq.edu.au>

The use of digital technologies in this school is critical to everyday communication between teachers and students and between fellow students. As one teacher commented:

“Whether it be on a yacht sailing in the Mediterranean Sea or whether it be in a mining town on an isolated cattle property, on a fishing boat in the gulf, they are dependent on the ICT to give them the opportunity to interact with each other.”

Technology is used by the Cairns School of Distance Education to mediate the face to face relationships that are taken for granted in many other schools. Students are sending emails, ‘skyping’ and video conferencing from a young age as a way of communicating with their teachers and fellow students.¹²⁹

5.10 Turning opportunity into reality

To exploit the full potential of the NBN for education and skills outcomes, particularly in regional areas, it is important that innovative service delivery applications are developed and introduced in a systematic way.

To assist with this process the Government has previously funded the development of innovative broadband services and applications, supporting a number of education related projects which benefited more than 1,330 schools and education institutions in regional, rural and remote Australia.

The Digital Regions Initiative builds on this to co-fund innovative digital technology/enablement projects with state, territory and local governments. This program has already funded a major education related project in Tasmania described earlier in this section.

Innovative online education services continue to be explored to:

- take advantage of ubiquitous, reliable, affordable, high-speed broadband particularly to the home in the early NBN rollout areas;
- deliver measurable improvements in national education and training outcomes, reduced pressure on education and training budgets and increased skills levels in the community; and
- support education and training providers, and relevant industry and user groups.

Potential areas in which such services may develop include:

- *delivering enhanced university, TAFE and high school courses online* –through a media-rich interactive learning environment, allowing students to access an extensive range of courses from home. This would help meet emerging skills and vocational teaching shortages, strengthen Australia’s skills base, and improve workforce productivity;

¹²⁹ The Centre for Educational Multimedia, *Exemplar Schools report Exemplar Schools: Using Innovative Learning Technologies*, 2008

http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/Documents/exemplar_schools_report_pdf.pdf

- *online professional development* – professional associations (for example, architecture, engineering or accountancy) could provide online interactive and collaborative professional development courses and training able to be accessed by members from home or the workplace;
- *virtual classes for gifted and talented students* – enhancing the learning outcomes of gifted students by delivering access to highly skilled maths, science or language teachers in specialised interactive virtual classes at home;
- *home tutors online* – enabling commercial tutoring providers to deliver live tutoring online to students at home. Students would be able to access tutoring support for a broad range of subjects that might not otherwise be readily available through traditional face-to-face tutoring services. Providers would also be able to deliver tutoring services more efficiently; and
- *virtual museum tours* – using the NBN to deliver real-time interactive virtual museum tours for students to complement educational courses (for example, science and engineering students in regional areas undertaking a virtual tour of a museum).

6. Management of Australia's built and natural resources and environmental sustainability

The roll-out of high-speed broadband under the NBN can support Australia to make more efficient use of infrastructure, transport, water management and energy, and reduce environmental impacts. The NBN is a potential catalyst for the deployment and widespread use of smart technology in Australia which can assist to better manage Australia's built and natural resources and embed environmentally sustainable practices. This view is supported by Australia's key industry bodies in the ICT sector such as the Australian Information Industry Association (AIIA), which has identified the NBN as the key technological infrastructure required to enable the widespread adoption of smart technology.¹³⁰

International organisations such as the OECD have noted that innovative ICT applications enable sustainable production and consumption across the entire economy and have the potential to improve environmental performance across entire systems and industry sectors, including construction, transport and energy.¹³¹ High-speed broadband platforms such as the NBN have the potential to enable the widespread adoption of innovative ICT applications.

In addition to environmental benefits, one industry report has estimated that the adoption of smart technology in energy, water, health and transport, and the rollout of high-speed broadband could add more than 70,000 jobs to the Australian economy and 1.5 per cent to the level of Australia's gross domestic product within a few years.¹³²

The efficiency gains and environmental benefits from greater use of smart technology applications in energy management, infrastructure, transport and water management, are already evident and continuing to emerge.

6.1 Challenges in environment and infrastructure management

Australia has one of the fastest rates of population growth in the developed world. In the 12 months ended 30 September 2009¹³³ Australia's population grew by 2.1 per cent, which is more than double the OECD average growth rate of 0.8 per cent¹³⁴. Australia's strong population growth continued at 1.7 per cent for the 12 months ending 30 June 2010.¹³⁵

¹³⁰ Australian Information Industry Association, *ICT's Role in the Low Carbon Economy*, September 2010, <http://www.aiaa.com.au/news/59462/AIIA-Media-Releases-AIIA-technology-to-play-a-key-role-in-low-carbon-e.htm>

¹³¹ OECD, *Greener and Smarter: ICTs, the environment and climate change*, 2010, <http://www.oecd.org/dataoecd/27/12/45983022.pdf>

¹³² Access Economics, *The economic benefits of intelligent technologies*, May 2009 <http://www.accesseconomics.com.au/publicationsreports/getreport.php?report=201&id=257>

¹³³ Australian Bureau of Statistics, *Australian Demographic Statistics, Sep 2009*, December 2010 <http://www.abs.gov.au/Ausstats/abs@.nsf/mf/3101.0>

¹³⁴ OECD, OECD Factbook 2009: Economic, Environmental and Social Statistics <http://titania.sourceoecd.org/v1=5725981/cl=16/nw=1/rpsv/factbook2009/01/01/01/01-01-01-g2.htm>

¹³⁵ Australian Bureau of Statistics, *Australian Demographic Statistics, June 2010*, September 2009 <http://www.abs.gov.au/Ausstats/abs@.nsf/mf/3101.0>

Furthermore, Australia is one of the world's more urbanised nations, with more than three quarters of the population living in 17 major cities of 100,000 people or more, and the majority of urban dwellers living in one of the five mainland state capitals. Projections of Australia's population to be 35 million by the middle of the 20th century – with the majority of people living in the major capital cities – creates various policy challenges for governments at all levels.¹³⁶

Changing climate and impact on energy and water use

The Australian Government understands that a changing climate is altering the natural environment and having a significant impact on the way we live. The effect of climate change presents a key challenge that requires new and innovative ways to make more efficient use of energy in order to help reduce Australia's current and projected levels of greenhouse gas emissions.

The production and consumption of energy in Australia contributes significantly to pressures on the environment. Gross electricity generation is projected to grow by nearly 50 per cent from 247 terawatt hours in 2007-08 to 366 terawatt hours in 2029-30.¹³⁷

Coal power plants are responsible for almost 40 per cent of electricity production worldwide, making electricity generation responsible for a significant share of carbon emissions. In addition to sourcing cleaner, alternative forms of energy, managing consumers' energy use more efficiently can have a significant impact upon levels of use.¹³⁸

The changing climate and increasing competition for fresh water is also threatening the economic viability of many agricultural regions in Australia and around the world. Demands on water include human consumption, crop irrigation and ensuring environmental sustainability.

The policy challenge for government is to better balance the water needs of urban and rural communities, farmers and the environment. Ensuring the long-term availability of this resource will require using water wisely, securing supplies, supporting healthy rivers and wetlands, and acting on climate change.

Infrastructure and transport

Australia's population growth, combined with higher levels of urban density, is increasing the strain on existing infrastructure, exacerbating transport congestion problems, and increasing energy and water use.

¹³⁶ Infrastructure Australia, Major Cities Unit *State of Australian Cities 2010*, 6 March 2010, http://www.infrastructureaustralia.gov.au/files/MCU_SOAC.pdf

¹³⁷ Australian Information Industry Association, *ICT's Role in the Low Carbon Economy*, 2010, <http://www.aiia.com.au/news/59462/AIIA-Media-Releases-AIIA-technology-to-play-a-key-role-in-low-carbon-e.htm>

¹³⁸ OECD, *OECD Information Technology Outlook 2010*, 2010, http://www.oecd.org/document/20/0,3746,en_2649_33757_41892820_1_1_1_1,00.html

Investment in infrastructure not only has the capacity to stimulate the productivity of the economy, now and into the future, but also the potential to reduce Australia's environmental impact.

Infrastructure Australia has identified nine key infrastructure challenges facing Australia in its *National Infrastructure Priorities* report.¹³⁹ The report notes the importance and need for the better use of existing infrastructure. This includes changes in the operation, pricing or use of existing infrastructure to solve problems without the need for investment in additional capacity. Smart technology incorporated into the existing built environment transforms it into 'smart infrastructure' and provides it with a potentially longer life.

The growth and impact of transport on Australia's built and natural environment will continue as the population increases. Greenhouse gas emissions from transport activities are a large contributor to Australia's overall emissions output, and have negative effects on people's health and the environment.

Increased population, urban density and transport use also leads to congestion, particularly in Australia's major capital cities. The Bureau of Infrastructure, Transport and Regional Economics (BITRE) (formerly the Bureau of Transport and Regional Economics (BTRE)) estimated that in 2005 the social costs of congestion across Australia's capital cities equalled about \$9.4 billion. This figure is based on costs associated with people's loss of private time, loss of business time, extra vehicle operation and extra air pollution. The BITRE estimates these costs will double during the 15 years between 2005 and 2020 to \$20.4 billion.¹⁴⁰

6.2 Role of the NBN

Certain applications that are used to make more efficient use of infrastructure, water management and energy require high-speed broadband for both download and upload services. For example, mapping applications that use high resolution images require high-speed download and upload service to work effectively. High-definition video conferencing to reduce the need to travel also requires high-speed broadband.

Other examples of smart technology such as smart meters, for example, may not, in and of themselves, require the high-speed broadband offered by the NBN. However, the increased uptake of smart technologies throughout our society will lead to larger amounts of data generated and transmitted, which, taken cumulatively, will require ubiquitous, reliable, high-speed broadband.

Google and HP executives predict that more data will be created in the next four years than in the history of the planet and one of three key causes for this is the 'sensor revolution'.¹⁴¹ They predict that there will be millions of sensors working in real time,

¹³⁹ Infrastructure Australia, *National Infrastructure Priorities*, May 2009,

http://www.infrastructureaustralia.gov.au/files/National_Infrastructure_Priorities.pdf

¹⁴⁰ Bureau of Transport and Regional Economics. *Estimating urban traffic and congestion cost trends for Australian cities (Working Paper No 71)*, 2007, www.btre.gov.au/publications/56/Files/wp71.pdf

¹⁴¹ Richard MacManus, Readwriteweb.com, *The coming data explosion*, 31 May 2010, http://www.readwriteweb.com/archives/the_coming_data_explosion.php

with data sampled every second. There may be many different applications for this data, including retail, defence, traffic, seismic, oil, wildlife, weather and climate modelling.

As more and more devices become ‘smart’ and internet-connected, bandwidth requirements will intensify for many Australian households and businesses. The NBN will provide greater data capacity for each home and business therefore enabling the greater adoption of smart technology in the home and office. In one home, in addition to the computer, video-phone, gaming console and digital video recorder connected to the internet, there may be the electricity meter, the home heating and cooling system and the security system also connected to the internet.

With a ubiquitous coverage of broadband, smart technology and intelligent networks are expected to become more commonplace and innovative; data-intensive applications will continue to emerge. As the United States Department of Energy explained with respect to one example of smart technology, the smart grid: “*think of the Smart Grid as the internet brought to our electric system.*”¹⁴² Similar to the innovative applications that the internet has spawned, the same could be expected to arise in relation to smart networks.

6.3 Energy

The use of smart technology by Australian households and businesses to track, better understand and manage energy and resource consumption may contribute to more cost reflective energy pricing, improving energy efficiency and thereby result in reduction of greenhouse gas emissions.

Studies have shown that the smarter use of ICT-enabled systems in Australia could reduce this country’s carbon emissions by 116.6 million tonnes annually, primarily through efficiencies made in power generation and distribution, intelligent building design and improved transportation networks.¹⁴³

Smart technology applications incorporate the use of sensors, meters, digital devices and analytic tools to automate, monitor and control the two-way flow of energy from power plant to plug. Smart grids are an example of this, combining advanced communication, sensing and metering infrastructure with existing energy networks. This enables a combination of applications that can deliver a more efficient, robust and consumer-friendly electricity network.

¹⁴² The U.S. Department of Energy, *The Smart Grid: an Introduction*,

[http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages\(1\).pdf](http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf)

¹⁴³ International Data Corporation, *Reducing Greenhouse Gases Through Intense Use of Information and Communication Technology*, 2009,

<http://download.intel.com/pressroom/archive/reference/IDCWP31R.pdf>

Case Study – Smart Grid, Smart City

The Australian Government has committed up to \$100 million to develop the *Smart Grid, Smart City* demonstration project in partnership with the energy sector.¹⁴⁴ The initiative will gather robust information about the costs and benefits of smart grids to inform the business case for future deployment of smart grid technologies and applications and decisions by government, electricity providers, technology suppliers and consumers across Australia.

The project will roll out Australia's first commercial-scale smart grid in the Newcastle area, and will demonstrate an electricity system of the future — one that uses information and communications to improve the efficiency of power production, delivery and use. The proposed NBN synergy projects under the *Smart Grid, Smart City* project are:

- **Project 1 – Smart Home Digital Gateway.** This project involves the design of a 'smart meter base' that could be used to consolidate an optical network termination unit and smart meter on to the same footprint, allowing use of NBN services for smart metering with minimal overhead.
- **Project 2 – NBN Support for Smart Grid.** This project involves a physical trial of NBN services used by EnergyAustralia meters for the delivery of both smart grid and smart metering applications. Subject to NBN Co's endorsement and support, the trial would cover approximately 3000 homes/endpoints. It would concern developing NBN Co's service offerings relevant to an energy utility, associated business models and technical synergies.
- **Project 3 – Broadband over WiMAX.** This project involves delivery of broadband (internet) services over the utility's WiMAX network in the Scone region of NSW. Covering thousands of residents, the project will investigate whether NBN-like services can be supported over a utility's infrastructure in a rural context.

Australia is not the only country preparing for smart grids. Smart grids are being developed around the world because of their potential economic benefits. For example, the United States Government announced its intention to invest \$3.4 billion to spur the transition to smart grids.¹⁴⁵ According to McKinsey & Company, successful deployment of smart grid technologies could yield savings of \$130 billion annually by 2020 in the US alone.¹⁴⁶

Smart technology also enables households and individual consumers to actively manage their energy use. Broadband networks that allow greater upload speeds can enable

¹⁴⁴ Department of Resources Energy and Tourism, ret.gov.au, last accessed 8 March 2011, <http://www.ret.gov.au/energy/energy%20programs/smartgrid/pages/default.aspx>

¹⁴⁵ The U.S. Department of Energy, energy.gov, President Obama Announces \$3.4 Billion Investment to Spur Transition to Smart Energy Grid, 27 October 2009, <http://www.energy.gov/8216.htm>

¹⁴⁶ McKinsey & Company, McKinsey on Smart Grid, 2010 http://www.mckinsey.com/client-service/electricpowernaturalgas/downloads/MoSG_Full_Book_Smart_Grid_VF.pdf

homes to interact with energy systems through smart meters to manage overall consumption and spread the energy demand more evenly across time thereby reducing peak energy consumption and generation requirements.

Households and offices can also apply smart technology applications to monitor heating, lighting and ventilation, automatically switch off electronic devices and manage security and access systems. Sensors and sensor networks used in smart building systems can contribute significantly to energy reduction. ICT company Siemens has estimated energy savings of 30 per cent in buildings with smart ICT systems, because of more precise climate, air quality and occupancy sensors.¹⁴⁷

6.4 Travel and transport

Smart technology has the potential to reduce the need to travel and to increase transport efficiency in a number of ways. There are opportunities to directly connect infrastructure, including roads and rail, to digital networks. There are also opportunities to use digital technologies to reduce or manage the demand for infrastructure thus reducing or slowing the speed of new investment.

The United Kingdom's Sustainable Development Commission (SDC) conducted a study into how ICT can promote sustainable mobility. In its report to the UK Government, SDC made a number of recommendations in relation to ICT's potential to: reduce the need for travel, influence commuter travel mode choice, change driver and vehicle behaviour, increase vehicle loading and improve the efficiency of transport networks.¹⁴⁸

Increased adoption of teleworking can reduce the need for people to travel. Teleworking refers to work undertaken outside of the office, usually at home. This removes the need for employees to regularly commute to the workplace, thereby reducing transport congestion and greenhouse gas emissions.

By reducing the need for people to commute to the office at the same time each day, teleworking can also reduce traffic congestion, leading to reduced impact on our natural and built environment. It is estimated that a 10 per cent increase in Australian employees that telework 50 per cent of the time would save an estimated 120 million litres of fuel, avoiding 320,000 tonnes of CO₂ (equivalent to \$6 million worth of emissions), and would reduce traffic at peak periods by 5 per cent, resulting in a reduction of \$470 million in congestion costs. These outcomes would have a flow-on benefit of reducing strain on infrastructure.¹⁴⁹

All Australian organisations – whether commercially, charitably or community minded – stand to benefit from the increase in teleworking which is possible in an NBN-enabled digital economy. A recent survey of Australian businesses revealed that 20 per cent

¹⁴⁷ OECD, *OECD Information Technology Outlook 2010*, 2010,

http://www.oecd.org/document/20/0,3746,en_2649_33757_41892820_1_1_1_1,00.html

¹⁴⁸ Sustainable Development Commission, *Smarter Moves: how information communications technology can promote sustainable mobility*, 2010, <http://www.sd-commission.org.uk/publications.php?id=1050>

¹⁴⁹ Access Economics, *Impacts of teleworking under the NBN*, July 2010,

http://www.dbcde.gov.au/data/assets/pdf_file/0018/130158/ImpactsofteleworkingundertheNBN.pdf

believed the NBN would change their employment model by facilitating increased flexibility in the location of staff and expanding the supply of skilled labour.¹⁵⁰

Through the use of high-speed broadband provided by the NBN, employees at home will be able to choose to access services and applications such as graphic design applications and other business tools that require high bandwidth for both downlink and uplink connections.

The increased use of high quality, high-definition video conferencing can also reduce the need to travel for meetings as collaboration can occur online. The use of the NBN supports these types of work practices and allows people to communicate as effectively and efficiently as face-to-face communications. This can be important for numerous government services and activities.

The Australian Government and State and Territory governments, for example, have used high-definition telepresence technology for numerous COAG meetings. The National Telepresence System has been operational since July 2010. Benefits from the use of the system for the period from October 2010 to January 2011 include estimated savings of \$3 million and reduced greenhouse gas emissions attributed to the Australian Government of an estimated 490 tonnes.

Case Study – Australian Government Use of National Telepresence System

In 2009, the Federal Department of Finance and Deregulation installed the National TelePresence System (NTS) using Cisco's TelePresence technology. The National TelePresence System delivers a high-quality, secure, 'immersive' video conferencing capability for Commonwealth, State and Territory governments over an existing high-speed, secure Australian Government communications network.¹⁵¹

The National TelePresence System involves 30 operational sites around Australia, including the Commonwealth Parliament Office, Australian Parliament House, Department of Finance and Department of Prime Minister and Cabinet in Canberra, as well as state and territory governments. The system is designed to reduce the number of, and need for, face-to-face meetings – such as the COAG and Ministerial Council meetings – thereby improving productivity and reducing travel costs and associated carbon emissions.¹⁵²

Benefits have been tracked progressively since October 2009 when only a small number of sites were commissioned. To the end of January 2011:

- 344 official meetings held out of a total 1162 bookings (including cancellations, reschedules and maintenance bookings);
- estimated savings of \$3.009 million in travel related expenses such as airline,

¹⁵⁰ Access Economics, *Australian Business Expectations for the National Broadband Network*, 16 November 2010,

<http://www.macquarietelecom.com/reports/Business%20expectations%20for%20the%20NBN.pdf>

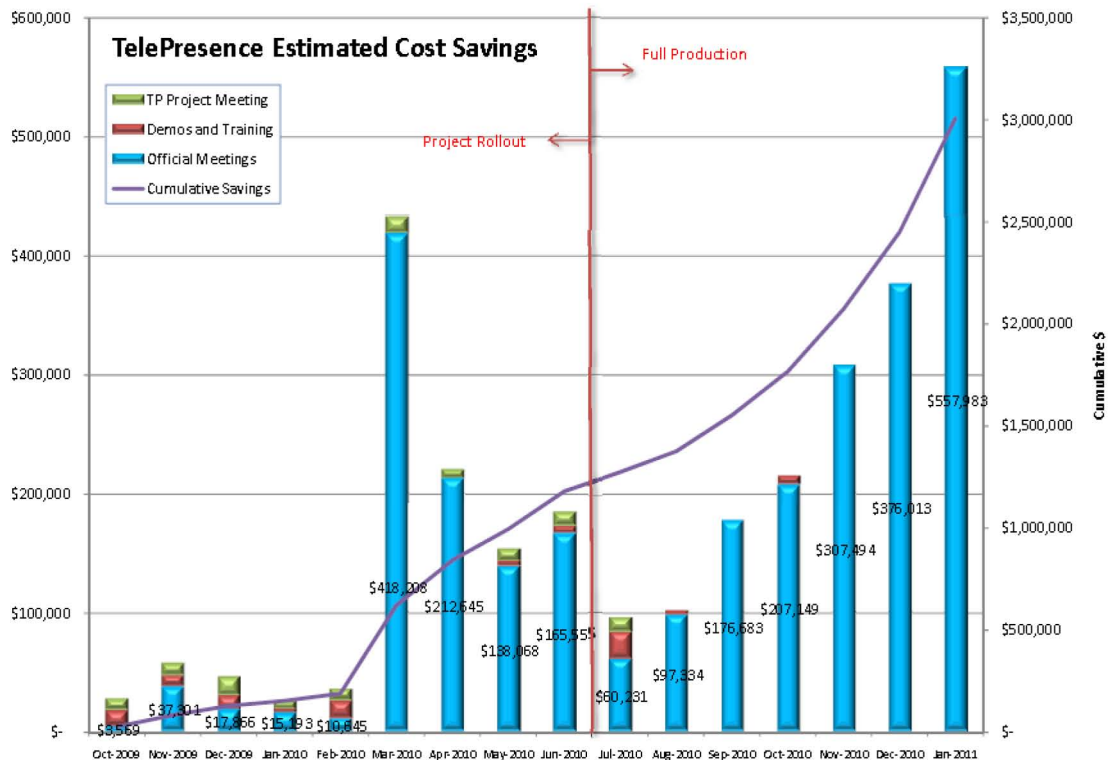
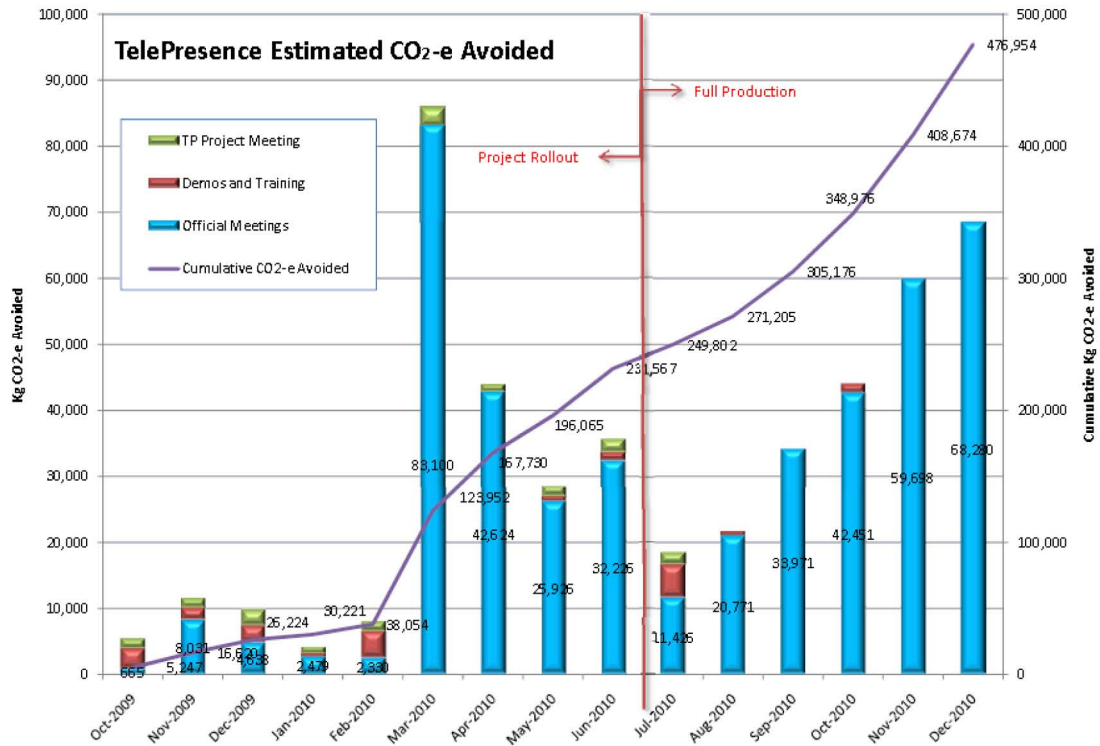
¹⁵¹ Department of Finance and Deregulation, 2009-10 Annual Report, 2010,

<http://www.finance.gov.au/publications/annual-reports/annualreport09-10/report-on-performance/information-and-communication-tech.html>

¹⁵² *Ibid*

- taxi and accommodation costs, and staff time lost due to travel; and
- use of TelePresence has reduced greenhouse gas emissions attributed to the Australian Government by an estimated 490 tonnes.

See tables below. Benefits are calculated at the end of each calendar month.



Source: AGIMO, Department of Finance and Deregulation

The NBN platform could drive increased use of high quality, high-definition video conferencing, allowing people to communicate effectively online and reducing the need to travel for face-to-face meetings. One winemaker in South Australia, when asked about the potential impact of the internet and broadband for his business, explained how he has been using Skype to make video calls to hold virtual wine tastings with trade media and overseas buyers. He indicated that the NBN will provide a broadband service that can help to make his international business even more efficient and professional:

“When I do my ‘webinars’ with groups overseas, it will be just like I’m in the room with them - they’ll be tasting the wine and I’ll be giving running commentary,” Mr Osborn said.

“With the wireless broadband we have at the moment, the video is a bit jerky and the resolution isn’t very good.

*“It’s a bit unprofessional when you’re dealing with countries like the US that have very fast broadband and can get a very clear picture.”*¹⁵³

In addition to reducing the need to travel, traffic congestion can also be improved by greater efficiency in transport. Use of smart technologies and sensor networks can improve freight and passenger transport and the overall efficiency of transport infrastructure such as road and rail networks. Energy and cost savings can also be made in the freight transport and logistics sector. Sensor technology, for example, can be applied to better track goods and vehicles, leading to greater operational efficiencies for businesses in this industry.¹⁵⁴

The rollout of high-speed broadband under the NBN increases the potential to apply advances in information technology to address transport bottlenecks and urban traffic congestion. For example, smart technologies or Intelligent Transport Systems (ITS) can be applied to traffic control systems to establish an understanding of how traffic is flowing over a wide area network of traffic. Such use of ITS delivers environmental benefits including reduced local pollution from vehicles delayed in traffic and minimised fuel waste.

Case Study – traffic management

The Australian Government’s investment in the Kwinana Freeway in Perth, Western Australia will help install advanced technologies like variable speed limits and lane management systems. When the project is complete, road users will get real time traffic information, freight vehicles will get priority access when needed, and all will benefit from a safer road and more integrated road and transport systems.¹⁵⁵

¹⁵³ Sarah Garvis, *High-speed broadband a barrel of success*, Southern Cross messenger, 25 January 2011, <http://southern-times-messenger.whereilive.com.au/news/story/rollout-the-barrel/>

¹⁵⁴ OECD, *OECD Information Technology Outlook 2010*, 2010, http://www.oecd.org/document/20/0,3746,en_2649_33757_41892820_1_1_1_1,00.html

¹⁵⁵ The Hon Anthony Albanese MP, *Australian Government Smart Infrastructure Awards*, 12 March 2010 http://www.minister.infrastructure.gov.au/aa/releases/2010/march/aa108_2010.htm

NICTA is also trialling a traffic management system at a major road intersection on the Princes Highway south of Wollongong, New South Wales. The system is predicted to improve the flow of vehicles through the intersection in peak periods by 5 per cent. In addition to the reduced pollution from fuel waste this delivers, improved traffic flow means that drivers will avoid longer traffic delays.¹⁵⁶

6.5 Water

Smart technology can be used to help industries that use irrigation like agriculture and horticulture better manage and more efficiently use water – a vital natural resource both sectors rely upon heavily.

Better management and more efficient use of natural resources can be gained from the use of smart technology. Increased connectivity and use of broadband will increase the potential for the widespread use of sensor networks to more closely monitor water resources throughout agricultural districts particularly in regional and rural areas which currently do not enjoy reliable access to broadband.

Sensors can contribute to improved water management. The NBN will provide a platform that can support a broad take-up of technologies such as smart meters in the home, which will enable better management of Australia's water use for increased efficiency.

¹⁵⁶ NICTA, *Smart Transport and Roads*, last accessed 8 March 2010, http://www.nicta.com.au/research/research_themes/embedded_systems/smart_transport_and_roads

7. Regional economic growth and employment opportunities

Australia is a vast country, characterised by large distances between regional areas and urban centres, low population density and difficult terrain. People living in regional Australia (outside major metropolitan cities) represent approximately 32 per cent of the Australian population. Regional Australia is very diverse, with different regions having different economies and therefore different growth trajectories and economic development priorities. However, many parts of regional Australia have experienced similar economic challenges such as:

- slowing economic growth, unemployment and de-population in some areas and strong economic, employment and population growth in other areas;
- skill shortages and reduced access to services;
- structural adjustment in some agricultural industries as well as other industries in heavily agriculture dependent regions; and
- inadequate investment in infrastructure including, telecommunications infrastructure, which has in turn affected the level of competition that has developed in many regional telecommunications markets, resulting in high costs of services.

While responding to regional Australia's economic challenges will of course require a range of measures from governments and the private and not for profit sectors, the NBN will provide a platform that can act as an enabler for a wider range of economic and employment opportunities for regional Australia into the future.

7.1 The role of the NBN

The NBN creates a platform which can be used to deliver economic benefits to regional areas through increased productivity, greater employment opportunities and better access to information and services. Communities could have faster access to goods and services as well as the opportunity to globally showcase local businesses and attractions.

The NBN provides the opportunity for communities in regional Australia to get fairer access to affordable high-speed broadband. This is expected to provide an additional impetus to the economic growth and development of communities and regions as a whole, because it will overcome the long-standing communications cost disadvantages which regional areas have confronted for years. At the same time, it will also open up access to exciting new communications products and services to those which are becoming available in metropolitan centres.

The prioritisation of regional areas for the roll out of the NBN will see regional Australia get access to better broadband sooner. Greater data capacity provided by the NBN will enable households and businesses to simultaneously use a wider range of high bandwidth online applications without deterioration in service quality, providing opportunities for regional Australia to fully participate in the digital economy through the delivery of key services such as health, education and emergency services.

In the UK, the Rural Commission has noted the positive impact of broadband on rural communities. Specifically:

- businesses owners have relocated from urban areas to enjoy a better quality of life;
- home-working and online services have slowed down out-migration and attracted in-migration;
- businesses can now tap into worldwide markets; and
- the retention of rural services.¹⁵⁷

In addition to providing the necessary infrastructure, realising the economic growth and employment benefits of the NBN for regional Australia will require Australians living and working in regional areas to have the necessary digital skills and confidence to take advantage of online opportunities.

The Australian Government's Regional Broadband Coordinators work with regional, rural and remote communities in priority backbone blackspot regions to assist them to take full advantage of the opportunities of broadband. Regional Broadband Coordinators complement the NBN Regional Backbone Blackspots Program, which is a first stage of the NBN rollout on the mainland. Coordinators raise awareness of broadband and promote broadband take-up and use. They work to improve community understanding of the opportunities of broadband and engagement in the digital economy. Coordinators work closely with key community organisations in their coverage areas—in particular, local councils, Regional Development Australia offices, state and territory governments, local chambers of commerce and community groups.

7.2 Economic benefits

The use of the NBN can contribute to improvements in regional Australia's long-term economic competitiveness through the creation of employment opportunities and will support regional, rural and remote Australian communities by providing greater opportunities to participate in the digital economy. Economic modelling shows that regional areas stand to benefit more than metropolitan areas from increased internet connectivity. On average, a 10 per cent increase in connectivity raised regional output by 0.53 per cent compared with only a 0.38 per cent increase in metropolitan areas.¹⁵⁸

A 2008 report by Systems Knowledge Concepts explored the benefits of increased broadband adoption in the Yorke Peninsula in South Australia.¹⁵⁹ The report found that both businesses and consumers generate surpluses as a result of broadband adoption:

¹⁵⁷ Commission for Rural Communities, *Mind the gap: Digital England – a rural perspective* in Williams, Tim, *Connecting Communities: The Impact of broadband on communities in the UK and its implications for Australia*, commissioned by Huawei Technologies, February 2011, page 32.

http://www.huawei.com.au/connectingcommunities/docs/Huawei_CC_WhitePaper.pdf

¹⁵⁸ The Allen Consulting Group, *Quantifying the economic gains of getting more Australian households online*, pages 36 – 38, November 2010.

¹⁵⁹ Systems Knowledge Concepts (Molloy, S. Burgan, B. and Rao, S.) *Creating new markets: broadband adoption and economic benefits on the Yorke Peninsula*, 2008, page 52, <http://www.acma.gov.au/webwr/assets/main/lib310554/ypbb2%20final%2020080813.pdf>

*“primary, or direct benefits (consumer and producer surpluses), which flow to household and business broadband users, and secondary (indirect or multiplier) benefits, which accrue to all residents and occur via an increase in the general level of economic activity due to increased broadband use.”*¹⁶⁰

Direct and indirect benefits to the state from the increased broadband use in the Yorke Peninsula were estimated to a total present value of \$25.5 million, compared with total program implementation costs of less than \$3 million.

7.3 Employment and business opportunities

Evidence indicates that broadband availability can improve regional employment opportunities. One US report found that counties that had broadband access for longer enjoyed higher employment growth and greater nonfarm private earnings than counties with little or no broadband access.¹⁶¹ The use of ubiquitous and reliable high-speed broadband may open up the opportunities for these benefits to be realised by Australian regional communities, encouraging increased workforce participation.

In the UK, broadband availability is credited with regenerating the town of Cornwall. After a long history of mass emigration for over a hundred and fifty years, its population has increased by 6.5 per cent since 2001, faster than the UK average. As one industry report notes:

*“investment in broadband, is seen by political, community and business leaders as a vital part of this process of economic and social recovery.”*¹⁶²

The roll-out of broadband across Cornwall also enabled increased flexible working among businesses and research suggests a positive impact of broadband on company productivity and employee flexibility – and in the marketing of Cornwall. Program Manager for Superfast Cornwall has said that *“Now, we can confidently say that small businesses will be able to operate while enjoying the quality of life that Cornwall has to offer.”*¹⁶³

There are also examples of access to quality broadband benefiting Australian businesses. One local insurance broker and financial services company on the Yorke Peninsula – John Webb & Associates¹⁶⁴ – estimated that switching to broadband caused a 10 per cent increase in productivity for the business because the faster internet speeds allowed it to complete transactions online quicker. In addition, as a result of expanding its use of web-based technology and publishing a website to connect with clients

¹⁶⁰ *Ibid.* p.9.

¹⁶¹ Stenberg et al, *Broadband Internet’s Value for Rural America*, August 2009, p23.

<http://www.ers.usda.gov/publications/err78/>

¹⁶² Williams, Tim, *Connecting Communities: The Impact of broadband on communities in the UK and its implications for Australia*, February 2011, page 33.

http://www.huawei.com.au/connectingcommunities/docs/Huawei_CC_WhitePaper.pdf

¹⁶³ *Ibid*, page 34.

¹⁶⁴ Systems Knowledge Concepts, *Creating new markets: broadband adoption and economic benefits on the Yorke Peninsula*, June 2008, page 52.

<http://acma.gov.au/webwr/assets/main/lib310554/ypbb2%20final%2020080813.pdf>

virtually, John Webb & Associates has moved from being a local supplier of financial and insurance services to writing insurance policies for customers all over Australia.

Robbie Sefton, the Director of Communications and Marketing firm Sefton and Associates, has explained that the services offered by the NBN will give her business more reach and access. Sefton and Associates moved from Sydney to Tamworth almost a decade ago. Ms Sefton explains:

"It will give us probably more reach and more access. Our business is based as you said in Tamworth but we've got team members right across Australia, mainly in rural and regional Australia.

Our clients are all based in Sydney, Canberra and Melbourne, so they're mainly metro-based, large corporate and government organisations that need to reach rural and regional Australia with their messages, products or services.

So our job is to communicate them to our rural audiences. One of the challenges we find is that yes you can get access to the Internet probably in most places in Australia but speed is the most important thing.

And so for us, it's actually being able to have faster speed to actually get those products or services - particularly training, that kind of thing, web-based training or even communication tools - out to areas who may have farmers in them or even just rural and regional communities....

...there is no reason why you can't run any business that's in the city in the bush these days, particularly with the Internet....

...So it's not just about businesses moving from the city into the bush, it's actually enabling country businesses - be they farms or be they small business - in towns or regional centres to actually expand their business opportunity.

And it gives particularly farmers' wives or and farmers the opportunity to have another business on top of their existing business."¹⁶⁵

7.4 Access to information and services

The NBN will provide a platform that can also support improved access to information and services for regional communities, ranging from retail goods through to education opportunities.

As Access Economics have noted:

"Regional households in particular stand to benefit from the removal of geographical barriers that ecommerce brings as the range of physical retail

¹⁶⁵ B Glanville, Regional business hails broadband plan, 8 September 2010, www.abc.net.au/lateline/business/items/201009/s3006648.htm

outlets and associated consumer choice in regional areas tend to be more limited."¹⁶⁶

The ubiquitous, always-on broadband made available via the NBN may also mean that farmers are better able to access market information and new research and development outcomes. It can also facilitate greater ecommerce in regional areas, which in turn would drive efficiencies and open up direct sales channels, particularly in horticulture and niche products.¹⁶⁷

Reliable, ubiquitous, high-speed broadband can deliver cost savings and improved social well-being to Australians living in regional, rural and remote areas by increasing their ability to engage in ecommerce and use applications such as voice-over-the-internet-protocol (VOIP) services (such as Skype). One study that examined the impact of the rollout of broadband on the Yorke Peninsula in South Australia found that

*"[O]f the 37 per cent of premises that adopted broadband, some 30 per cent used VOIP because a relatively high proportion of their calls are non-local. VOIP helped rural users significantly cut their telephone bills and reduced the effects of isolation."*¹⁶⁸

And in the UK, access to fast broadband, in remote areas in particular, enabled civic participation and engagement with service providers by those who previously may not have been able to engage because of distance, cost and competing pressures for time.¹⁶⁹ There is also evidence in the United States that internet use bolsters community vitality in rural areas through the promotion civic engagement and community participation.¹⁷⁰

The ubiquitous access to high-speed broadband made possible by the NBN may open up new and improved educational opportunities for people living in regional, rural and remote Australia. Over the last several years, the number of post-secondary qualifications available to be studied online through Australian and overseas universities, technical and further education institutes and private training organisations has grown rapidly. As discussed in greater detail in section 5.3 (Education outcomes), the services provided by the NBN will make it easier for people in regional areas to exercise choice in the educational market, reduce barriers to online education and enable more immersive online learning experiences, such as increased use of video conferencing and high definition video.

¹⁶⁶ Access Economics, *Household E-Commerce Activity and Trends in Australia*, page 3, November 2010 <http://www.accesseconomics.com.au/publicationsreports/getreport.php?report=254&id=323>

¹⁶⁷ Ibid; see also, *Unlocking the Promise of ICTs for Transforming Agriculture in Africa*, Towela Nyirenda-Jere, Technical Centre for Agricultural and Rural Cooperation, 2010. <http://knowledge.cta.int/en/Dossiers/S-T-Issues-in-Perspective/ICTs-for-Transforming-Agriculture-in-Africa/Unlocking-the-Promise-of-ICTs-for-Transforming-Agriculture-in-Africa>.

¹⁶⁸ Systems Knowledge Concepts, *Creating new markets: broadband adoption and economic benefits on the Yorke Peninsula*, June 2008, page 52.

<http://acma.gov.au/webwr/assets/main/lib310554/ypbb2%20final%2020080813.pdf>

¹⁶⁹ Williams, Tim, *Connecting Communities: The Impact of broadband on communities in the UK and its implications for Australia*, February 2011, page 35.

http://www.huawei.com.au/connectingcommunities/docs/Huawei_CC_WhitePaper.pdf

¹⁷⁰ Stenberg et al, *Broadband Internet's Value for Rural America*, August 2009, p23. <http://www.ers.usda.gov/publications/err78/>

Case study – NBN enables efficiency and new business for Midway Point sign-writer¹⁷¹

In Midway Point, just outside Hobart, sign-writer David Jones faced the same challenge typical of his and other design industries: time lost trying to transfer large photo and image files over slow internet connections.

In the past, David had large files couriered to him on disk or sent in the mail because his connection was too slow. After connecting to the National Broadband Network (NBN) in November 2010, David can now download the larger files in seconds. He describes the change as going from “*walking around in sandshoes to driving a Ferrari.*”

With the faster speed, David has been able to take on new business interstate and sees the potential to improve the way he works with customers overseas now that he has the ability to send and receive large image files almost instantly.

“In the past some customers have thought it’s too hard to physically send me their artwork files, so they chose somewhere closer,” David said. “Whereas now, over the NBN, location is no longer a problem – there are no obstacles at all.

“I can download most of the files clients send me in seconds and it doesn’t matter how close or far away the customer is. The possibilities are endless.”

Before connecting to the NBN, there were many things David just couldn’t do from his home workshop.

His connection was not fast enough to effectively download artwork larger than five megabytes which meant he had to travel to Hobart 15 times per month to physically collect photos from a graphic designer, or pay to have a disk sent in the mail.

“Before the NBN, I had ADSL broadband set up with kilobits of download speed rather than megabytes” David said. “If someone sent me a three or four megabyte file it would take half an hour to download. I couldn’t download photos from websites and buy them because my connection just wasn’t fast enough.”

David’s business has benefitted from his connection to the NBN. The time saved in the transfer of files has meant that everything he does can move much faster and he can deliver his signs to customers in almost half the time it took before.

“The first thing I did was download a 17 megabyte file from a graphic artist that took just eight seconds. Before the NBN, I would either have sent it over on a DVD, or let the download max out my connection. The difference is just astonishing,” David said.

“If an overseas customer suddenly wants something, I can just draw it up and email it over straight away even if it’s a large file,” he says. “It’s just easy to do with that kind of speed and capacity over the NBN.”

¹⁷¹ NBN Co case study: *Small business – remote working*:

<http://www.nbnco.com.au/wps/wcm/connect/main/site-base/main-areas/publications-and-announcements/research/>

8. Business efficiencies, revenues and exports

On the internet, Australians and international consumers can compare products, services and prices with the click of a mouse or an "Alt-Tab" to another browser window. Businesses are increasingly "competing with everyone from everywhere for everything", highlighting the need for Australian businesses to be globally competitive.¹⁷² As a seemingly ever increasing range of goods and services are available online, more and more industries are becoming exposed to international competition.

Availability of reliable, high-speed broadband will be increasingly important in order to enhance Australian firms' international competitiveness. Constraints on Australian premises accessing high-speed broadband services currently limit local consumer demand for online services and create disincentives for Australian businesses to develop online offerings that require high-speed broadband. The ubiquity of the NBN will allow more households and businesses to connect and generate "network effect" benefits. One study of the US experience showed that as the number of people using a broadband network grows, it increases in total factor the productivity that can be expected, which in turn generates positive and enduring benefits for the overall economy.¹⁷³ Given that many international companies are well-placed to innovate and meet local and global demand of this nature, Australian businesses will lose out and may not remain viable if they are not able to leverage high-speed broadband in how they conduct their business.

In the current competitive environment, businesses must take full advantage of the opportunities that online business presents to them in order to maximise their chances of success. The 2008 OECD Statistical Profile on the Future of the Internet Economy indicated that the number of Australian businesses that had a website is around 40 per cent¹⁷⁴ (compared to around 70 per cent in leading digital economies¹⁷⁵) and the revenue from e-commerce was around 10 per cent (compared with around 22 per cent in leading digital economies). The most recent ABS data from 2008-09 shows this has improved only slightly with only 41.5 per cent of Australian businesses have a web presence.¹⁷⁶

In addition, the potentially productivity-enhancing benefits of teleworking are not currently able to be fully realised by most small and medium sized businesses given the low bandwidth and variable reliability of many home internet connections. The OECD reports that as of June 2010, Australia ranked 18th amongst member states for fixed (wired) broadband penetration rates.¹⁷⁷

¹⁷² Sirkin, H, Hemerling, JW, Bhattacharya. *Globality: Competing with Everyone from Everywhere for Everything*. New York: Business Plus, 2008

¹⁷³ Robert D. Atkinson, Daniel Castro and Stephen J. Ezell, The Information Technology & Innovation Foundation, *The Digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America*, January 2009, <http://www.usinnovation.org/files/ITIFDigitalRoadtoRecovery10709.pdf>

¹⁷⁴ Australian Bureau of Statistics, *Business Use of IT, 2007-08*, 20 October 2009, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8129.0>

¹⁷⁵ OECD, *The Future of the Internet Economy: Statistical Profile*, June 2008, www.oecd.org/dataoecd/44/56/40827598.pdf.

¹⁷⁶ ABS, 8166.0 - *Summary of IT Use and Innovation in Australian Business*, 2008-09, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8166.0>

¹⁷⁷ OECD, Broadband Portal, <http://www.oecd.org/dataoecd/22/12/39574779.xls>

The Australian Bureau of Statistics' Research Paper – “Business Innovation and the Use of Information and Communications Technology” (March 2011) has demonstrated that there is a strong relationship between the intensity of information and communications technologies use and innovative activity in businesses. Innovations can include product, process, organisational and market innovation. Based on firm level data for 6,442 businesses tracked over time, the ABS concludes that:

*“businesses which use sophisticated types of ICT are significantly more likely to undertake innovation of all types. In addition, these businesses are likely to undertake more types of innovation, more novel innovations and are more likely to develop their innovations in-house.”*¹⁷⁸

Current internet speeds experienced by some Australian internet users can make for frustrating online experiences, leading to the abandonment of purchases or the limitation of other online activities. Evidence suggests that 23 per cent of dissatisfied and 18 per cent of dissuaded online purchasers cited lack of speed as a factor in their dissatisfaction or failure to complete a transaction.¹⁷⁹ To the extent that this is caused by poor or slow internet connection speeds, the services offered by the NBN have the potential to reduce this cause for dissatisfaction and facilitate increased customer satisfaction through a richer online customer experience.

Australia is also lagging international counterparts in the growing area of online retail activity. While reports suggest that Australian households are increasingly engaging in online retail activity, it appears that Australia still lags behind the UK and the US. It also appears to be the case online purchasing by Australian consumers from overseas based retailers is growing faster than purchasing from domestic retailers.

Access Economics states that:

*“the rollout of the NBN is likely to act as a catalyst for online retailing, for both sellers and consumers, as a substantial proportion of the population gains access to reliable high-speed internet.”*¹⁸⁰

8.1 The role of the NBN

While many large businesses already have access to high-speed broadband services, the NBN will make them accessible for smaller businesses and businesses outside major metropolitan areas. The features of the NBN that offer opportunities to businesses are:

- the widespread coverage of a single, uniform technology platform;

¹⁷⁸ Australian Bureau of Statistics, *Business Innovation and the use of Information and Communications Technology*, March 2011, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1351.0.55.033Main+Features1Mar%202011?OpenDocument>

¹⁷⁹ Access Economics, *Australian Business Expectations for the National Broadband Network*, 16 November 2010, <http://www.macquarietelecom.com/reports/Business%20expectations%20for%20the%20NBN.pdf>

¹⁸⁰ Access Economics, *Household E-Commerce Activity and Trends in Australia*, page 3, November 2010 <http://www.accesseconomics.com.au/publicationsreports/getreport.php?report=254&id=323>

- the capacity of the network to support high-speed uploads as well as downloads; and
- affordability of services.

The ubiquity of the NBN and its bandwidth advantages over the broadband services most businesses currently use can particularly benefit small to medium enterprises (SMEs) by improving business efficiency and opening up new revenue and export opportunities. The NBN can enable Australian businesses, including SMEs and those in regional Australia, to:

- achieve efficiency improvements, for example, through increased capacity to use cloud computing;
- access a bigger market, either nationally or overseas; and
- improve customer service.

The NBN will assist in improving the stability and reliability of internet services. This will, in turn, enable greater uptake of efficiency-enhancing internet services internally by businesses than has previously been possible. Greater internal use of online tools, such as high definition video conferencing and cloud computing, can increase productivity and reduce costs. These applications are highly conducive to the greater adoption of teleworking.

In order to ensure Australian businesses are well placed to realise the opportunities that the NBN will provide, business owners and employees will need to have the necessary digital business and technology skills. The Australian Government has undertaken a number of initiatives to support Australian businesses develop their digital skills and confidence so that they will be better positioned to take advantage of the NBN. These include:

- *Small Business Online*¹⁸¹ – A program providing grants totalling \$14 million to 47 eligible organisations to build the capacity of Australian small businesses. Funding recipients help small businesses get online through providing training seminars and support on a range of online business topics.
- *Digitalbusiness.gov.au*¹⁸² – A website that provides information and advice to assist small and medium businesses and not-for-profit organisations to establish or enhance their online presence and to get the most out of online communications and productivity tools.
- *Online Retail Forum* – The Australian Government held an Online Retail Forum in Sydney on 18 February 2011 to support Australian retailers and businesses in the retail supply chain explore how to take advantage of online business opportunities. Over 100 participants attended and over 2,300 viewers watched the live webcast of the event. A replay and transcript of the webcast is available on the forum's landing page.¹⁸³

¹⁸¹ Small Business Online

<http://www.ausindustry.gov.au/smallbusiness/smallbusinessonline/pages/smallbusinessonline.aspx>

¹⁸² Digitalbusiness.gov.au <http://www.digitalbusiness.gov.au/>

¹⁸³ Online Retail Forum, 18 February 2011, <http://www.dbcde.gov.au/onlineretail>

8.2 Larger customer base and increased revenues and exports

Access to and use of ubiquitous, high-speed broadband can assist in making it easier for consumers and businesses to engage online, which can lead to an expanded customer base, and, as a consequence, increased revenues and exports for Australia. Using the NBN and the services and applications that it will be able to support, businesses can level the playing field, giving Australians greater confidence and ability to connect and engage in a high-speed enabled world. This can help position Australia as a leader in broadband access and speeds, driving local demand and consequently local supply for online services, leading to greater export opportunities, as foreign customers are able to easily experience competitive Australian offerings.

As the ABS indicates, innovation is necessary for business survival in export markets and the intensity of ICT use plays an important role as an enabler of business innovation. This is because it enables closer communication and collaboration between businesses and other organisations and also provides a platform from which businesses can build innovations and achieve significant efficiency gains.¹⁸⁴

The potential for online engagement by Australian businesses to lead to an expanded customer base and increased revenues and exports can be demonstrated by examples of how businesses have embraced previous internet enabled business innovation. Carol Hunt, co-owner of Aquatic Blue Charters, a Gold Coast tourism and whale watching business, has said of having an online presence:

*“The digital economy has enhanced our business by increasing our turnover due to an easy accessible line of communication between ourselves and our clients, and has expanded our business locally, nationally and internationally.”*¹⁸⁵

Online engagement between business and their customers through an e-commerce enabled website opens up trading hours to 24/7 without additional effort on the part of the business and its employees, and opens up its customer base beyond the local area to include, potentially, the whole world.

As one participant in the Australian Government’s Small Business Online program, Don Titterton of Valiant Drycleaners in Albany, West Australia has explained - it is possible for a dry cleaner to gain business from 100 kilometres away simply because people were using a search engine to find a local drycleaner. Don said “[n]o matter how small [a business is], they need to be online because that is the modern way of reaching your customers.”¹⁸⁶

The potential for greater online engagement by Australian businesses to grow export revenues is illustrated by the example of Shoes of Prey, a custom, designer shoe online retailer who, within a year after starting their business, in 2010 made 40 per cent of its

¹⁸⁴ Todhunter, Jessica and Abello, Ruel, *Business Innovation and the Use of Information and Communications Technology*, March 2011, pages 3-7.

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1351.0.55.033Mar%202011?OpenDocument>

¹⁸⁵ Department of Broadband, Communications and the Digital Economy, 2010 *Digital Economy case study questionnaire*.

¹⁸⁶ Don Titterton, Small Business Online transcript, Ausindustry.gov.au,

<http://www.ausindustry.gov.au/SmallBusiness/SmallBusinessOnline/Documents/ValiantDrycleaners.pdf>

sales to overseas customers.¹⁸⁷ Another example is Firemint, a company that started as a boutique game developer and developed two original iPhone games – Flight Control and Real Racing – which sold more than one million copies in the first three months. Customers for the games were based in the US, Europe, Japan and Canada.¹⁸⁸

8.3 Increased productivity and efficiencies

Reliable access to ubiquitous high-speed broadband will give Australian businesses greater confidence to innovate with new technologies, and with new ways of working and with new product and service offerings. There is evidence that many Australian businesses recognise the potential that an NBN-enabled digital economy offers. In a 2010 Macquarie Telecom survey, over half of the businesses surveyed said that the NBN would definitely or was likely to enable them to do business differently through:

- enhanced online capabilities (55 per cent);
- new product and service offerings (50 per cent); and
- more diverse ways of communicating with consumers and suppliers (67 per cent).¹⁸⁹

The use of high-speed broadband can also contribute to improved internal business productivity by promoting the use of bandwidth intensive applications that allow employees to engage in remote collaboration and/or simultaneously undertake data intensive online activities. Businesses will be able to use higher bandwidth online applications or more applications at the same time, without experiencing deterioration in service quality. The high-speed nature of the NBN will allow businesses to more frequently use higher-resolution images and videos in their websites and other marketing materials, with the confidence that consumers can readily access them.

In addition, the OECD estimates that participating in e-commerce as a sales channel with consumers can deliver a productivity improvement of one half to two-thirds of a percentage point. The OECD specified the following causes of efficiency gains from e-commerce for the sale of goods:¹⁹⁰

- a reduction in inventory costs due to the adoption of ‘just in time’ delivery and the ability to improve forecasting;
- expanded opening hours to 24/7, unrestricted to physical shop hours and open to a global marketplace; and

¹⁸⁷ Fox, Michael, *Submission to the RBA’s Strategic Review of Innovation in Australia’s payment System*, 22Michaels.com, 16 October 2010, <http://www.22michaels.com/2010/10/submission-to-rbas-strategic-review-of.html>

¹⁸⁸ Australian Trade Commission, *Case Study – Firemint (VIC)* Australian Export Awards, last accessed 15 March 2011, <http://www.exportawards.gov.au/Resources/Case-Studies/Firemint/default.aspx>

¹⁸⁹ Access Economics, 2010. *Australian Business Expectations for the National Broadband Network*, <http://www.macquarietelecom.com/reports/Business%20expectations%20for%20the%20NBN.pdf>

¹⁹⁰ OECD, *The Economic and Social Impact of Electronic Commerce: Preliminary Findings and Research Agenda*, page iii 1999, www.dbcde.gov.au/data/assets/pdf_file/0018/130158/ImpactsofteleworkingundertheNBN.pdf

- reduced distribution costs and need for physical office/retail space estimated by the OECD to be as much as 50 to 90 per cent for some businesses compared with traditional bricks and mortar systems.

Cloud computing

The NBN will provide a platform that can support businesses to more effectively utilise cloud computing,¹⁹¹ bringing with it access to new services and opportunities to improve and better manage costs. The emergence of cloud computing services has the potential to reduce technology costs for businesses. For SMEs in particular, cloud computing offers the ability to reduce upfront costs associated with establishment and maintenance of technology systems, as well as avoiding the need to own, secure, and service data storage capacity. The reduced barriers to entry that cloud computing make possible will help facilitate entrepreneurship and business model innovation. As a Microsoft representative has stated:

*“the latest advancements in cloud computing will lead to a decreased cost of entry for a typical small or medium business.”*¹⁹²

Teleworking

The greater availability of ubiquitous, reliable, high-speed broadband will also allow Australian organisations to increase their adoption of teleworking, which will also contribute to increased productivity. In 2010 Macquarie Telecom conducted a survey of 540 businesses and over half of the businesses surveyed said they expected the NBN would lead to changed employment models, especially an increase in telecommuting (20 per cent).¹⁹³

As discussed earlier in section 6.4 (Travel and transport), teleworking refers to work conducted outside of the office, often at home. The NBN will provide a platform that can support new and more flexible working arrangements for Australian businesses and their employees, as well as independent contractors. Many current home internet connections lack the speed and reliability required for networked communications tools that make teleworking seamless and highly effective. These tools include desktop virtualisation (whereby a desktop environment on a client computer is provided via a network connection with a host server), VoIP, remote collaboration and video conferencing. In addition to greater use of these tools for home-based teleworking, the NBN rollout will also support the development of innovative shared spaces for co-working or events.

¹⁹¹ “Cloud computing is an ICT sourcing and delivery model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” Australian Government Information Management Office, *Cloud Computing Strategic Direction Paper*, 2011, http://www.finance.gov.au/e-government/strategy-and-governance/docs/draft_cloud_computing_strategy.pdf

¹⁹² Orlando Ayala, *Leaders talk: technology that improves efficiency and effectiveness*, 17 August 2010, <http://www.asiafuturesmag.com/FutureSite/Default.aspx>

¹⁹³ Access Economics, *Australian Business Expectations for the National Broadband Network*, 2010, <http://www.macquarietelecom.com/reports/Business%20expectations%20for%20the%20NBN.pdf>

The Access Economics report, *Impacts of Teleworking under the NBN* (July 2010)¹⁹⁴ analyses the impacts of teleworking within in the context of the NBN. The report identifies the benefits to businesses from teleworking to be improved productivity, better workforce retention and participation and reduced office costs. The total annual gains from 10 per cent of Australian employees teleworking 50 per cent of the time would be in the order of \$1.4 to \$1.8 billion per year.

The NBN may also lead to an expansion of the type of industries in which teleworking can be commonplace. Where bandwidth restrictions presently may limit teleworking to information and services industries, the availability of ubiquitous, high-speed broadband opens up the ability for remote working and collaboration to a greater range of industries that focus on graphics, videos and other bandwidth intensive uses. For example, the digital video effects studio Animal Logic that made the award-winning *Happy Feet* movie has said:

“With the rollout of high-speed broadband as part of the National Broadband Network, the ability to improve content production quality will only increase. Bandwidth requirements always grow to fill the available capacity. It can also give the company greater flexibility in how it manages its production facilities.

*With high-speed broadband, Animal Logic's work could, for example, be carried out seamlessly by pods working in different locations. It makes sense for Animal Logic to maintain its base in Fox Studios because it is convenient for the director and others shooting a movie nearby to quickly drop by and see how the visual effects are developing. However, allowing people to work in other locations around Sydney can increase the talent pool because it gives people greater choices in terms of cost of living, and travel time. Locating teams away from the inner-city of Sydney can also reduce business costs.*¹⁹⁵

¹⁹⁴ Access Economics *Impacts of Teleworking under the NBN*, 2010,

<http://www.accesseconomics.com.au/publicationsreports/getreport.php?report=240&id=310>

¹⁹⁵ Department of Broadband, Communications and the Digital Economy, *Animal Logic: from a start in advertising to an Oscar*, DBCDE.gov.au, May 2009,

http://www.dbcde.gov.au/digital_economy/future_directions_of_the_digital_economy/australias_digital_economy_future_directions/final_report/appendix_case_studies/animal_logic_from_a_start_in_advertising_to_an_oscar

9. Research and Development and Related Innovation Investments

Australia's ability to generate strong productivity gains will occur as a result of encouraging competition and related reforms, carrying out significant national research that generates innovation, and successfully adopting and adapting innovative ideas that are created internationally. The Intergeneration Report has pointed to some of the challenges facing Australia including slowing productivity. The report has stated that:

*“Australia’s recent productivity performance has slowed, averaging only 1.4 per cent over the past decade compared with 2.1 per cent in the 1990s.”*¹⁹⁶

The Australian Government has promoted the benefits of innovation and research as a driver of sustainable productivity growth and social wellbeing. The Government recognises that Australia's innovative capacity *"has been uneven, and we have failed to keep pace with the rest of the world"*.¹⁹⁷ To address this, the Government has announced its Innovation Agenda in the *Powering Ideas* report. That report also noted that the investment in the NBN will support the overall Innovation Agenda.¹⁹⁸

This view is shared by industry – the Australian Industry Group (AIG) recently stated that current evidence suggests that "Australia's innovation capacity is not yet embedded throughout the economy as a whole". It identified that:

*"Ubiquitous open-access connectivity will provide real benefits in the short and medium term, as supply chain interactions are optimised and new business-to-business and consumer markets become accessible. In the longer term, ubiquitous connectivity makes radical business model innovation possible for Australian businesses, through the creation of services and delivery models that do not yet exist."*¹⁹⁹

Australia's innovative capacity will not only be strengthened by investment in research and development. It will also be strengthened by innovation at the firm level. As the ABS has recognised:

“Innovation, as defined in the Oslo Manual (OECD, 2005, p. 46) encompasses more than just the strict research and development (R&D) activities which lead to the implementation of new goods and services. It also includes the application of new ideas to marketing and delivery activities, as well as the organisation of management structures. Many of these activities cannot be captured fully when

¹⁹⁶ The Treasury, *Australia to 2050: Future Challenges*, page 11, 1 February 2010, http://www.treasury.gov.au/igr/igr2010/Overview/pdf/IGR_2010_Overview.pdf

¹⁹⁷ Department of Innovation, Industry, Science and Research, *Powering Ideas: An Innovation Agenda for the 21st Century*, 2009, page.2.

<http://www.innovation.gov.au/Innovation/Policy/Documents/PoweringIdeas.pdf>

¹⁹⁸ Ibid

¹⁹⁹ The Innovation Review Steering Group, *Innovation: New Thinking New Directions*, 2010 page 8 http://www.aigroup.com.au/portal/binary/com.epicentric.contentmanagement.servlet.ContentDeliveryServlet/LIVE_CONTENT/Publications/Reports/2010/9256_innovation_review_report_web.pdf

*using traditional measures of innovative activity, such as R&D expenditure or patent data.*²⁰⁰

The presence of a reliable, high capacity communications network that is ubiquitous across Australia will support firm-level innovation. As the OECD has recognised, communications networks like the NBN are similar to roads, water, rail, and electricity networks:

*“Each of these networks has played an important role in supporting innovation and growth partially by transporting necessary elements of production from one location to another. This “transporter” role is one key underpinning of a network’s impact on innovation and economic growth.*²⁰¹

The OECD identifies that high-speed communication networks will support innovation throughout the economy in much the same way as electricity and transportation networks were platforms that spurred innovation in the previous century.²⁰²

In its submission to the Senate Select Committee on the NBN (July 2009), NICTA notes that:

*“...the importance of scalable infrastructure cannot be over estimated. Technology is constantly changing and improving. While many technological advances are underpinned by use-inspiration and based on needs and applications that can be foreseen, once these advances have been made leading edge users find new ways to use the technology and create yet more demands for technology improvements”*²⁰³

To achieve improved productivity growth in the future, the Intergeneration Report says this will require a continual process of reform and that the Government’s policy agenda supports productivity growth, for example through investment in social and economic infrastructure, including the NBN.²⁰⁴

The ABS has recently found a strong positive relationship between innovation and intensity of ICT usage by firm.²⁰⁵ It has also noted that innovation is particularly

²⁰⁰ Australian Bureau of Statistics, *Business Innovation and the Use of Information and Communications Technology*, 3 March 2011, page 3,

www.abs.gov.au/ausstats/abs@.nsf/mf/1351.0.55.033?OpenDocument

²⁰¹ OECD, *Network Developments in Support of Innovation and User Needs*, December 2009, page 7,

[http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp\(2009\)2/final](http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp(2009)2/final).

²⁰² OECD, *Network Developments in Support of Innovation and User Needs*, December 2009.

[http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp\(2009\)2/final](http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp(2009)2/final).

²⁰³ NICTA, *Submission to Senate Select Committee on the National Broadband Network*, 3 July 2009, page 2,

http://www.aph.gov.au/senate/committee/broadband_ctte/submissions_from_april_2009/sublist.htm

²⁰⁴ The Australian Government Treasury, *The 2010 Intergenerational Report*,

<http://www.treasury.gov.au/igr/igr2010/>

²⁰⁵ Australian Bureau of Statistics, *Business Innovation and the use of Information and Communications Technology*, March 2011,

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1351.0.55.033Main+Features1Mar%202011?OpenDocument>

important to firms that are trade exposed. In the global digital economy firms and sectors that have previously been largely immune from global competition are finding themselves exposed to new competitors. And, in reverse, Australian firms are getting access to new global markets.

9.1 Role of the NBN

The Australian Government's investment in the NBN can yield significant multiplier effects throughout the economy, stimulating employment, innovation, efficiency and productivity. By enabling innovation and making new services available, the use of the NBN can help revitalise economic and community development in metropolitan, regional and remote communities alike. The internet provides a natural platform for innovative ways to bring new and old products and services to market, connect with potential partners, streamline processes involved with sharing knowledge and deliver factors of production to where they are needed.

The use of the NBN is likely to provide greater opportunities for Australians to engage more in research based innovative activities. Innovation will increasingly play a key part in driving Australia's economic growth and productivity. There are several characteristics of the NBN that assist to drive research based innovation in Australia:

- the NBN capacity to support both high-speed download and upload services can enable increased collaborative research, not only within Australia, but also internationally. These activities will facilitate knowledge transfer and support innovation;
- the ubiquitous coverage of the NBN and use of broadband can help to lower barriers to entry for businesses applying innovative models, and lower the cost of innovation, marketing and selling products and services;
- widespread availability and use of broadband by households and businesses can also help to increase the size of potential markets for Australian businesses domestically as well as internationally thereby stimulating increased innovation activity; and
- high stability and reliable connectivity under the NBN will provide the platform for research and innovation in many sectors of the economy. For example, using broadband will enable supply chain interactions to be optimised for business-to-business and for consumer markets as more households become accessible.

The use of the NBN can also open up avenues for collaborative research between research and academic institutions. Research will spur innovation, in particular, into the unknown and currently unquantifiable benefits of broadband. Services that develop from the NBN will be investigated and tested through research undertakings. For example, research looking at optimising the use of fibre optic infrastructure and related technologies, to the application services that run on top of the infrastructure will be key to the development of the NBN in terms of enticing new user demand and interest.

9.2 Investment in research and development

The roll out of the NBN may attract international and domestic companies to invest in

research and development that promotes and expands Australia's innovative capacity. Vint Cerf, currently Vice President and Chief Internet Evangelist at Google and popularly recognised as one of the "fathers of the internet", in an address to the *Realising Our Broadband Future* forum in December 2009 likened the decision to build the NBN to the architecture of the Sydney Opera House, which has become an icon of Australia; similarly, the NBN, Mr Cerf predicted would become an icon of similar status to the technology community.²⁰⁶

The rollout of the NBN will not be complete for a number of years. For many potential users the benefits or value of the NBN is in the network effect. For example it is only when a critical mass of customers or clients is able to access the NBN that some firms will start to explore its potential. However the work of organisations such as CSIRO, NICTA and IBES make an important contribution to identifying and proving the ideas that innovative firms will capitalise on in the medium terms as the NBN rollout gets more extensive.

The CSIRO is undertaking research into new technologies with the objective of improving services efficiency, offering an alternative for the wireless elements of the NBN package and to develop applications which utilise the NBN infrastructure.

On 7 December 2010, CSIRO launched the ACBI in partnership with the NSW Government and NICTA. This activity will develop and trial new applications and services for the NBN with a particular focus on regional service delivery. CSIRO notes that, as with the internet, the transformative impact of the NBN is to an extent unknown. Activities such as ACBI will be lighthouse activities to evaluate broadband applications (those that cannot be run on current broadband networks) to establish value propositions, business cases and business models for the NBN.

ACBI is establishing full emulation of an Access Seeker network using designs provided by the NBN Co. This network connects the Parkbridge estate in western Sydney and by April 2011 will connect the regional town of Armidale in NSW. This extensive network will allow real world development, testing and evaluation of broadband applications.

CSIRO is also developing applications for the Health, Media/Entertainment, Infrastructure and eGovernment sectors. At this stage initial technology developments and trials will be in the following areas:

- *health* – a CSIRO Remote Immersive Diagnostic Examination System (RIDES) will be installed and applications in nursing training investigated;
- *media/entertainment* – NICTA has developed a Social TV system that allows time shifting of content, media streaming and sharing of user generated content. This platform can be extended with CSIRO gesture recognition and cloud computing interfaces;

²⁰⁶ Swan, Georgina, *Broadband future: Father of the Internet praises NBN*, Computer World, 10 December, 2009, http://www.computerworld.com.au/article/329413/broadband_future_father_internet_praises_nbn/

- *infrastructure* – CSIRO is already participating in a number of smart grid activities where intelligence is being incorporated into the power network to integrate renewable energy sources, distributed generation, energy storage and introduce demand side management to shift peak loads on the network. The NBN network is ideal for the sensing and control needed for smart grid and discussions regarding trials are proceeding; and
- *eGovernment* – working with the University of New England ACBI will look at tele presence platforms (derived from the RIDES intellectual property mentioned above) and the use of cloud computing infrastructure to reduce cost and increase efficiency in IT infrastructure. The cloud work will enable storage, computing and other services on demand.

NICTA is also conducting significant research, for example, NICTA is helping to build a sustainable Australian ICT sector by:

- making fundamental advances in ICT that can underpin the development of globally competitive products, processes and services;
- building innovative ICT companies; and
- contributing skills and outcomes that are changing the profile of our ICT industry.

The IBES's research projects are investigating such diverse themes including:

- education and learning;
- health and wellbeing;
- network deployment and economics;
- service and business transformation; and
- social infrastructure and communities.

IBES incorporates a test-bed laboratory that allows industry to configure, test, optimise and showcase its broadband-enabled applications and services. The laboratory consists of end user, access, aggregation and transport technology components donated largely from industry, including a selection of passive optical network (PON) systems, wireless routers, IPTV set top boxes, video on demand media servers, a radio frequency overlay system, and load and impairment generators.

After one year of operation, IBES has committed \$1.3 million to support its research activities across the five research themes. A total of 40 research projects have been established through two rounds of seed funding. In addition, IBES has provided five PhD top-up scholarships to postgraduate students with research aligned with IBES research themes.²⁰⁷

Respondents to the AIG's large-scale innovation survey across more than 300 small, medium and large Australian businesses in the manufacturing, construction and services

²⁰⁷ *About IBES*, IBES website, last accessed 15 March 2011, www.broadband.unimelb.edu.au/main.php?id=108

sectors identified the opportunity to ‘leverage the Australian broadband opportunity’ as a key opportunity. One industry report notes that:

*“One trend likely to continue into the future is the adoption by consumers and businesses of faster broadband connections, especially as more content and services, such as voice over IP and streaming video, are delivered over Internet connections instead of traditional cable or phone services. Already countries with next-generation broadband networks such as Korea and Japan have seen the emergence of high-definition video applications that demand very high bandwidth.”*²⁰⁸

9.3 Firm-based innovation

A market enabled with ubiquitous broadband infrastructure can engage more fully in innovative activities and play its part more fully as a driving force in Australia’s economic development. Numerous examples demonstrate the wide range of economic sectors that are able to springboard innovations off broadband infrastructure, including intelligent traffic systems that incorporate weather conditions.²⁰⁹

The OECD has stated that:

*“Innovation, which involves the introduction of a new or significantly improved product, process or method, will increasingly be needed to drive growth and employment and improve living standards. This is true as well for emerging economies that look to innovation as a way to enhance competitiveness, diversify their economy and move towards more high value added activities.”*²¹⁰

A research paper recently released by the ABS shows a strong link between business use of ICT and innovative activity. According to the report, *“...businesses which use ICT more intensely are more likely to innovate and furthermore, develop more types of innovation and also more novel innovations.”*²¹¹ In addition, the report states that ICT’s provide innovation through more effective linkages, *“...between business, their suppliers, customers and competitors and collaborative partners...by enabling closer communication and collaboration, ICT assists businesses to be more responsive to innovation opportunities and provides significant efficiency gains.”*²¹²

²⁰⁸ Grimes, A., Ren, C. and Stevens, P. (October, 2009). *The Need for Speed: Impacts of Internet Connectivity on Firm Productivity*. Motu Working Paper 09-15; Motu Economic and Public Policy Research (page 61)

²⁰⁹ OECD, *Network Developments in Support of Innovation and User Needs*, 2009, page 27, [http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp\(2009\)2/final](http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp(2009)2/final).

²¹⁰ OECD, *The OECD Innovation Strategy: Getting a Head Start on Tomorrow*, 2010, page.9, www.oecd.org/document/15/0,3746,en_2649_34273_45154895_1_1_1_1,00.html#summary

²¹¹ Australian Bureau of Statistics, *Business Innovation and the Use of Information and Communications Technology*, 3 March 2011, p.3, www.abs.gov.au/ausstats/abs@.nsf/mf/1351.0.55.033?OpenDocument

²¹² *Ibid*

Evidence from the European Union suggests that firms consider that the Internet enabled them to introduce new products or process technologies and, moreover, that these internet-enabled innovations boosted firm sales and employment.²¹³

In addition to product and service innovation, the ubiquity of the NBN can increase the size of the potential market for Australia businesses, which in turn may lead to innovative capacity. The transporter role of the network increases the potential size of the market.²¹⁴ Larger markets mean lower production costs due to the economies of scale and higher potential returns for entrepreneurs.²¹⁵ Previously, firms that developed new products or services had to launch wide-reaching marketing campaigns in order to make consumers aware of them and to get existing retailers to stock the new product. Firms using the internet have an easier time introducing new products and services.²¹⁶

²¹³ Robert D. Atkinson, Stephen J. Ezell, Scott M. Andes, Daniel D. Castro, and Richard Bennett, *The Internet Economy 25 Years After .Com – Transforming Commerce & Life*, March 2010, www.itif.org/files/2010-25-years.pdf

²¹⁴ OECD, *Network Developments in Support of Innovation and User Needs*, 2009, p.8. [http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp\(2009\)2/final](http://www.oecd.org/officialdocuments/displaydocument/?doclanguage=en&cote=dsti/iccp/cisp(2009)2/final)

²¹⁵ *Ibid.*

²¹⁶ EurActiv.com, *Information technology and innovation for SMEs*, 23 March 2009, <http://www.euractiv.com/en/innovation/information-technology-innovation-smes/article-180285>

10. Facilitating Community and Social Impact

The OECD recognises that a 'digital-use divide' can emerge based on inequalities of internet use and socioeconomic factors:

“As broadband use increases in frequency, variety and diversity among frequent users[,] two other effects are likely to increase the advantages of broadband use for frequent and diversified users. The costs of undertaking transactions via the Internet are likely to be lower than off-line costs and to decline further, and there is likely to be a rapid expansion of diversified and accessible content available. Both of these effects are likely to increase the importance and impacts of the digital use divide linked with broadband use.”²¹⁷

Digital exclusion can be particularly concerning if it overlaps with and exacerbates characteristics of social exclusion. The Australian Government is committed through its Social Inclusion Agenda to “a vision of a socially inclusive society” in which “all Australians feel valued and have the opportunity to participate fully in the life of our society.”²¹⁸ The Social Inclusion Agenda outlines that achieving this vision means that all Australians will have the resources, opportunities and capability to:

- learn, by participating in education and training;
- work, by participating in employment or voluntary work, including family and carer responsibilities;
- engage, by connecting with people, using local services and participating in local civic, cultural and recreational activities; and
- have a voice, in influencing decisions that affect them.

As more and more services are being delivered via the internet and new online communications tools are becoming increasingly popular amongst many Australians, it is important that all Australians have access to the broadband infrastructure and digital media literacy skills they need for access to online information, communications applications and services.

A range of indicators suggest correlations between digital use divides and social exclusion. Around 26 per cent of Australians 14 years or over did not use the internet in 2008-09.²¹⁹ This figure is much higher for retired persons, low income earners, people with a disability, Aboriginal and Torres Strait Islander Australians and those living in remote areas.²²⁰

Thirty-seven per cent of persons aged 55-64 did not use the internet in 2008-09, compared with 69 per cent of persons aged 65 or over. Similarly, 34 per cent of persons

²¹⁷ OECD, *OECD Information Technology Outlook 2008*, page. 212, 2008, http://eskills.eun.org/c/document_library/get_file?p_1_id=10713&folderId=10545&name=DLFE-1635.pdf

²¹⁸ Commonwealth of Australia, *Overview of the Social Inclusion Agenda* Social Inclusion.gov.au last accessed 15 March 2011, www.socialinclusion.gov.au/SIAGENDA/Pages/Overview.aspx

²¹⁹ Australian Bureau of Statistics, *2008-09 Household Use of IT*, table 3.8 page 36, 16 December 2009, [www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/9B44779BD8AF6A9CCA25768D0021EEC3/\\$File/81460_2008-09.pdf](http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/9B44779BD8AF6A9CCA25768D0021EEC3/$File/81460_2008-09.pdf)

²²⁰ *Ibid*

earning less than \$40,000 per year did not use the internet in 2008-09 and nor did 34 per cent of people living in remote areas.²²¹ People with a profound or severe disability requiring assistance with core activities have significantly lower usage of the internet and broadband than other Australians. For example, only 28 per cent of people with disability requiring assistance with core activities have a broadband connection, in comparison to 48 per cent of people who do not need assistance with core activities.²²²

10.1 The role of the NBN

Ubiquitous, reliable, high-speed broadband can contribute towards achieving greater social inclusion, deliver consumer welfare and social benefits, and lead to enhanced employment outcomes. Research suggests that exclusion from networks that reach almost all people has the potential to negatively affect those excluded.²²³ The NBN's ubiquitous nature means that all Australian premises will be able to more readily access the internet if they so choose.

Studies have suggested that all internet users have hard limits on their patience for sites to load, with two seconds the threshold of an average shopper's expectations for page loading. Forty per cent of users will abandon a site if they do not receive a response within three seconds.²²⁴ The services provided via the NBN will assist in addressing this barrier so that Australian households are able to access online material quickly. This will particularly be important as an increasing amount of online material is video.

Realising the potential community and social benefits of the NBN also require Australians from diverse backgrounds (particularly those from disadvantaged groups) to acquire the digital media literacy skills to confidently engage and participate online. Australian Government departments and agencies currently offer a range of digital skills and online safety and security services to improve Australians' digital confidence. These initiatives include the Digital Education Revolution, the Australian Government's Cybersafety Plan, online content regulation, the Indigenous Communications Program, Regional Broadband Coordinators, Broadband for Seniors, Staysmartonline.gov.au, Scamwatch.gov.au, digitalbusiness.gov.au, and the cybersafety help button. The Department of Broadband, Communications and the Digital Economy is currently exploring further ways to help support Australians to develop the digital skills and confidence they need to safely and securely take full advantage of the community and social benefits of the NBN.

10.2 Digital and social inclusion

The NBN can encourage more Australians to become digitally engaged and that Australian society is more socially inclusive by making high-speed broadband available

²²¹ *Ibid*

²²² Australian Bureau of Statistics, *Patterns of internet access in Australia*, 2006, page 54, Figure 29 <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/8146.0.55.001Main+Features12006>

²²³ Tongia, R and EJ Wilson III, *The Dark Side of Metcalfe's Law: Multiple and Growing Costs of Network Exclusion*, page 1, 2010, www.cstep.in/docs/Network%20Exclusion%209-22-09.pdf.

²²⁴ Selvidge, P.R., Chaparro, B. & Bender, G. (2000) 'The world wide wait: Effects of delays on user performance', *Proceedings of the IEA 2000/HFES Congress in Slater, Jim, Jan-Ingvar Lindström and Gunela Astbrink, Broadband Solutions for Consumers with Disabilities*, ACCAN, 2010, page 5.

to all Australian premises. The availability of ubiquitous, reliable, high-speed broadband will offer a greater number of Australians similar resources, opportunities and capability to better engage by connecting with people and using their local community's resources.

The services offered by the NBN can support greater use of high-definition video conferencing, delivering a range of social inclusion benefits. For example, it has been recognised that the immediacy of response provided by videoconferencing would provide those with intellectual impairments with a greater sense of connection with the person they are speaking with.²²⁵ Where an impairment is such that a person would benefit from multisensory communication (such as visual, automatic captioning and audio), the NBN would also offer users sufficient capacity to use such a service. Research from overseas suggests that the improved speed and services available through the NBN could be invaluable to Australians with disabilities and carers.²²⁶

10.3 Consumer welfare benefits

High-speed broadband lowers the cost of searching for and finding information, primarily in terms of the user's time, and may also provide users with access to lower priced services.²²⁷

Specifically, the benefits to the consumer of digital engagement may include:

- enhanced communication through email, instant messaging, VoIP and other services;
- time saving activities including telecommuting, online shopping, remote work and study opportunities, information gathering and accessing services;
- price/product discovery;
- education and knowledge;
- access to new online services such as social networking, media/entertainment and professional services;
- substitution of physical services to services delivered electronically; and
- engagement in the online community.²²⁸

Allen Consulting has stated that: *"Households benefit from access to new online services and information and from the connection to the social community."*²²⁹

Allen Consulting estimates that if the number of Australian households connected to the internet increased by 10 per cent, this would provide gains to households of \$2.4 billion

²²⁵ Slater, Jim, Jan-Ingvar Lindström and Gunela Astbrink, *Broadband Solutions for Consumers with Disabilities*, page 14, 2010, www.accan.org.au/uploads/Broadband%20Solutions%20ED.pdf.

²²⁶ PricewaterhouseCoopers, *Champion for Digital Inclusion*, October 2009, http://raceonline2012.org/sites/default/files/resources/pwc_report.pdf

²²⁷ OECD, *Broadband and the Economy: Ministerial Background Report*, 2008, page 43.

²²⁸ The Allen Consulting Group, *Quantifying the economic gains of getting more Australian households online*, Table 6.1. November 2010

²²⁹ The Allen Consulting Group, *Quantifying the economic gains of getting more Australian households online*, page 39. November 2010

in terms of consumer surplus. In addition to benefits to households, achieving, for example, a 10 per cent point increase in Australians connected to the internet is estimated to lead to an increase of 0.44 per cent to national GDP.²³⁰ There are also indirect benefits to other sectors as a result of increased household connectivity:

- for businesses – the reduction in the costs of customer acquisition and client servicing;
- for government – improved public sector efficiencies and the returns from greater economic activity; and
- for community organisations – increased engagement/participation with community groups.

A UK report provided a different insight into the benefit digital engagement delivers to households, quantifying that UK households that are offline were missing out on an estimated savings of £560 per year from shopping and paying bills online.²³¹

10.4 Flexible working arrangements

The more flexible work practices that the NBN can support, via greater teleworking (discussed in sections 6.4 (Travel and transport) and 8.3 (Increased productivity and efficiencies) will also benefit Australian households. The saved commute time can be spent on other activities such as additional work tasks, time with family and friends or sports and community groups. An Access Economics report into teleworking in the context of an NBN identifies several benefits both for individuals and the community:

- personal savings on travel in time and money;
- greater choice in place of residence;
- greater access to family;
- reduced impact on road and public transport infrastructure; and
- potential for greater involvement in local community by the teleworker.²³²

For small business owners, evidence suggests that high-speed broadband will lead to improvements in daily life, with one survey noting a better work-life balance in 82 per cent of small businesses who moved to broadband connections when compared to dial-up connections.²³³ This is largely due to the reduced time needed to perform essential tasks.

²³⁰ The Allen Consulting Group, *Quantifying the economic gains of getting more Australian households online*, page 39. November 2010

²³¹ PriceWaterhouseCoopers, *Champion for Digital Inclusion*, page 2, October 2009, http://raceonline2012.org/sites/default/files/resources/pwc_report.pdf.

²³² Access Economics, *Impacts of Teleworking under the NBN*, July 2010, http://www.dbcde.gov.au/_data/assets/pdf_file/0018/130158/ImpactsofteleworkingundertheNBN.pdf

²³³ BT Business, *State of the Small Business Nation*, 2007 in D'Costa, Valerie and Tim Kelly, "Broadband as a platform for economic, social and cultural development: Lessons from Asia", *Joint OECD-World Bank Conference on 'Innovation and Sustainable Growth in a Globalized World'* (conference paper), 2008, page 12.

10.5 Enhanced employment outcomes

By extending ubiquitous, high-speed broadband to all Australian premises, the services offered by the NBN can offer Australian families and communities an increased opportunity to enjoy benefits such as improved access to business and job opportunities, health, education and government services. The ability for people to connect and share common interests will become easier through the rollout of high-speed broadband to all Australian homes, businesses and community centres.

A report²³⁴ commissioned by the UK Government estimated that unemployed people who get online could increase their chances of getting employment with an estimated lifetime benefit of over £12,000 for every person moved into employment. The report calculated that this would have positive ramifications for the entire economy. If 3.5 per cent of the digitally excluded found a job by getting online, it estimated that this would deliver a net economic benefit of £560 million.

Digital literacy and good ICT skills can also increase earning capacity for those who are in employment; people with good ICT skills earn between 3 per cent and 10 per cent more than people without such skills.²³⁵

²³⁴ PriceWaterhouseCoopers, *Champion for Digital Inclusion*, page 2, October 2009
http://raceonline2012.org/sites/default/files/resources/pwc_report.pdf.

²³⁵ *Ibid*

11. Optimal Capacity and Technological Requirements of a Network to Deliver these Outcomes

As noted previously the NBN will deliver:

- greater data capacity for homes and businesses;
- stability, reliability and quality of service (QoS); and
- ubiquitous coverage raising both the maximum peak speeds on wireless (12Mbps downstream/1Mbps upstream) and maximum peak speeds on FTTP (1Gbps down/400Mbps up) for all Australians.²³⁶

11.1 Bandwidth capacity

The bandwidth capacity of a network link is the metaphorical size of the pipe (size of the frequency band) through which data can be transmitted. Data speed is the rate at which data travels between two points within the pipe and is usually measured in bits per second (Bps). The data carrying capacity of a network link is relevant both in the downstream channel and the upstream channel and this is particularly important when delivering applications requiring two-way communications such as voice and video communications. High-definition video conferencing, for example, requires at least 6-8Mbps of bandwidth both in the downstream channel and the upstream channel to function optimally.²³⁷

Broadband technologies which are ‘asymmetric’, such as asymmetric digital subscriber line (ADSL) have a bandwidth capacity downstream which is greater than its upstream capacity. The optical fibre technology proposed by NBN Co²³⁸ is also asymmetric but not nearly to the same degree. The theoretical upstream capacity of ADSL, for example, is 1Mbps compared with NBN Co’s top level fibre service which will be able to deliver up to 400Mbps upstream.

11.2 NBN Co service offerings

Table 1 (below) shows the NBN Co service parameters that will be offered to Retail Service Providers (RSPs).²³⁹ The peak information rate (PIR)²⁴⁰ is the theoretical maximum speed an end user may achieve. It shows the entry level service is 12Mbps/1Mbps and the top level service at 1Gbps/400Mbps.

Table 2 (below) shows the quality of service levels the NBN Co will offer for fibre-connected premises. Certain applications require a committed information rate (CIR) in

²³⁶ These are the peak network speeds the technology will offer, it is yet unclear what speeds retail service providers will offer their customers.

²³⁷ Assuming full 1080i quality using MPEG-4 compression technology. Using MPEG-2 compression technology will require 13-14Mbps.

²³⁸ GPON – gigabit passive optical network

²³⁹ NBN Co Corporate Plan, 2011 – 2013, 17 December 2010

<http://www.nbnco.com.au/wps/wcm/connect/eea11780451bd3618ebfef15331e6bbb/101215+NBN+Co+3+Year+GBE+Corporate+Plan+Final.pdf?MOD=AJPERES> p94

²⁴⁰ The theoretical speed that an End-User could receive if there were no other End-Users using the infrastructure at the same time. PIR is limited by the speed of the physical port of connection.

order to function optimally, such as voice and video communications. A committed information rate is a guaranteed amount of bandwidth that is made available to an end user. The NBN Co will offer a number of traffic classes to RSPs in order for them to guarantee the quality of service of their applications and services to the end user.

Peak information rates (PIR) and Traffic Classes available on NBN Co's fibre products

Table 1.

Downstream (PIR Mbps)	Upstream (PIR Mbps)
12	1
25	5
25	10
50	20
100	40
250	100
500	200
1,000	400

Table 2.

Traffic Class	Symmetrical CIR (Mbps)
1	Initial 150Kbps, then 0.5, 1, 2 and 5Mbps
2	Starting at 5Mbps, then 10, 20 30 and 40 Mbps
3	Starting at 10Mbps, then 20, 40 and 100 Mbps
4	See PIR table to the left

Source: NBN Co (17 Dec 2010) Corporate Plan 2011- 2013

In delivering the outcomes stated in this paper, a variety of potential applications and services will require both bandwidth capacity and quality of service guarantees. It is important to also note that some applications will require symmetrical bandwidth capacity, for example 5Mbps downstream and 5Mbps upstream, such as certain video conferencing applications. The table below lists a selection of potential applications and services and their bandwidth and QoS requirements. These technological parameters are indicative only and will depend on the specific implementation and service requirements.

Current 3G users in Australia are typically receiving data speeds in the range of 550kbps - 8Mbps downstream²⁴¹ and less than 500kbps upstream, which is insufficient to support HD video conferencing.

Telstra recently announced²⁴² its intention to upgrade certain parts of its 3G network to the next evolution in wireless technology, LTE (long term evolution). Peak cell speeds for LTE can reach over 100Mbps but as with all wireless technologies the realistic end users speeds vary depending on number of users in a cell, distance from the base station etc.

The following chart²⁴³ shows the evolution of various broadband technologies and their respective bandwidth capacities. Once bandwidth requirements move beyond 20-30Mbps, existing technologies such as ADSL and wireless 3G technologies are insufficient. While HFC cable can support data speed beyond 100Mbps, the cable

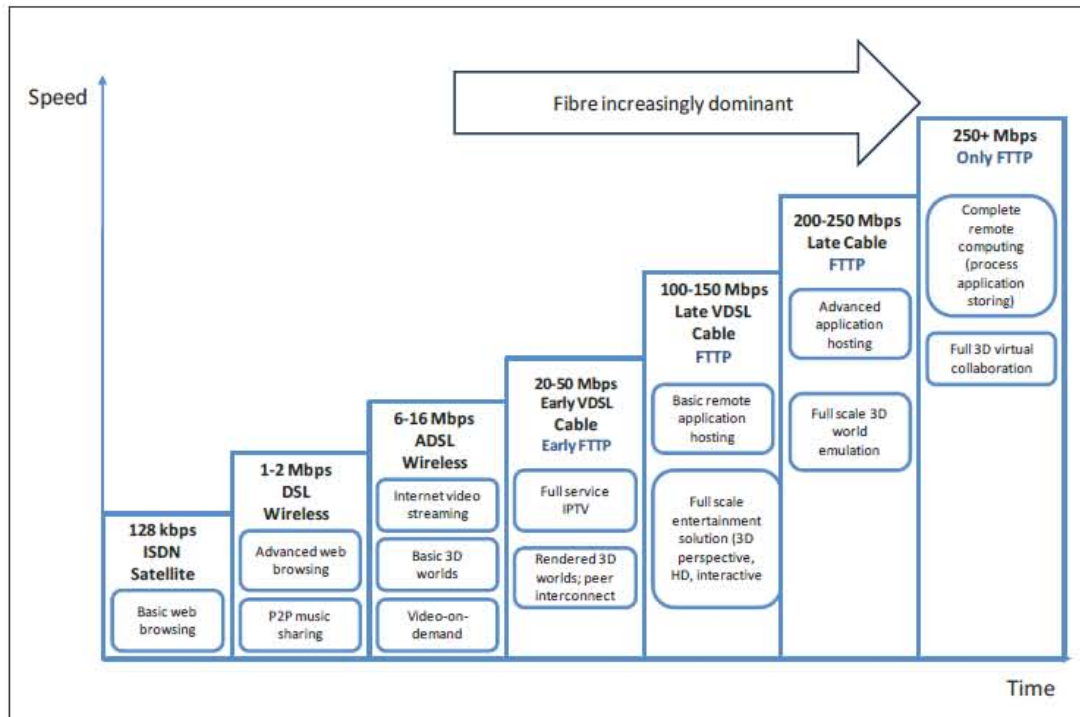
²⁴¹ Bigpond Mobile Broadband Terms and Conditions <http://www.telstra.com.au/customer-terms/download/document/bp-part-d.pdf>

²⁴² <http://www.telstra.com.au/abouttelstra/media-centre/announcements/telstra-to-launch-4g-mobile-broadband-network-by-end-2011.xml>

²⁴³ NBN Co Corporate Plan 20 December 2010 p 39: www.nbnco.com.au/wps/wcm/connect/main/site-base/main-areas/publications-and-announcements/latest-announcements/nbn-co-corporate-plan-released

footprint in Australia is limited to approximately 2.6 million households²⁴⁴, and like wireless technology, HFC is a shared technology and performance degrades when users share the available bandwidth in their area.

Bandwidth and Delivery Technologies



Source: NBN Co Corporate Plan 2011- 2013 (17 December 2010)

²⁴⁴ According to the ACMA, *ACMA Communications report 2009–10*, p. 23, 9 December 2010, http://www.acma.gov.au/webwr/_assets/main/lib311995/2009-10_comms_report-complete.pdf

**Optimal bandwidth capacity and technological requirements
of select broadband applications**

Outcomes	Potential Applications and Services	Optimal capacity and technological requirements²⁴⁵
Boosting productivity	• Teleworking	• 1-100Mbps symmetrical, QoS traffic class 3
	• HD video language interpreting	• 6-20Mbps symmetrical, QoS traffic class 2
	• Business communications & file transfer	• 1-100Mbps symmetrical, QoS traffic class 3
	• Cloud computing	• 20 – 100Mbps symmetrical
	• Research & Development	• 10-1000Mbps symmetrical
Improving health outcomes	• HD video consultations	• 6-20Mbps symmetrical, QoS traffic class 2
	• In-home health monitoring	• 1-20Mbps symmetrical, QoS traffic class 1-3
	• 3D image transfer	• 25-100Mbps
	• Electronic health record transfers	• 1-100Mbps
Improving education outcomes	• Online teaching resources	• 1-100Mbps
	• Multi-student online training	• 10 – 40Mbps, QoS traffic class 2
Environmental sustainability	• Fibre-to-the-Premises	• Less energy requirements than fibre-to-the-node, ADSL or wireless networks ²⁴⁶
	• Smart grids/home/appliances	• 0.2-10 Mbps symmetrical depending on how many devices and appliances connected
	• Video conferencing reducing travel	• 1-20 Mbps, QoS traffic class 2
	• Smart agriculture	• 1-100Mbps, QoS traffic class 1-3
Regional development & social inclusion	• Voice and video communications	• 1-40Mbps, QoS traffic class 1-2
	• Teleworking	• 1-100Mbps, QoS traffic class 3
	• Access to online employment opportunities	• 1-10Mbps

Source: Technology Advisory Unit, Department of Broadband, Communications & the Digital Economy (February 2011)

²⁴⁵ These estimates are based on the assumption that basic broadband internet activity requires 1Mbps, basic video conferencing requires at least 384Kbps in both directions, HD video conferencing requires 6-8Mbps symmetrical and applications such as quality voice and video communications require specific quality of service requirements. Simultaneous use of multiple applications will require more bandwidth as will multiple users of the same application. The Quality of Service traffic classes correspond to the NBN Co traffic classes as outlined in their Corporate Plan, 2011-2013, p93

<http://www.nbnco.com.au/wps/wcm/connect/eea11780451bd3618ebfef15331e6bbb/101215+NBN+Co+3+Year+GBE+Corporate+Plan+Final.pdf?MOD=AJPERES>

²⁴⁶ Rod, Tucker, Institute for a Broadband Enabled Society,

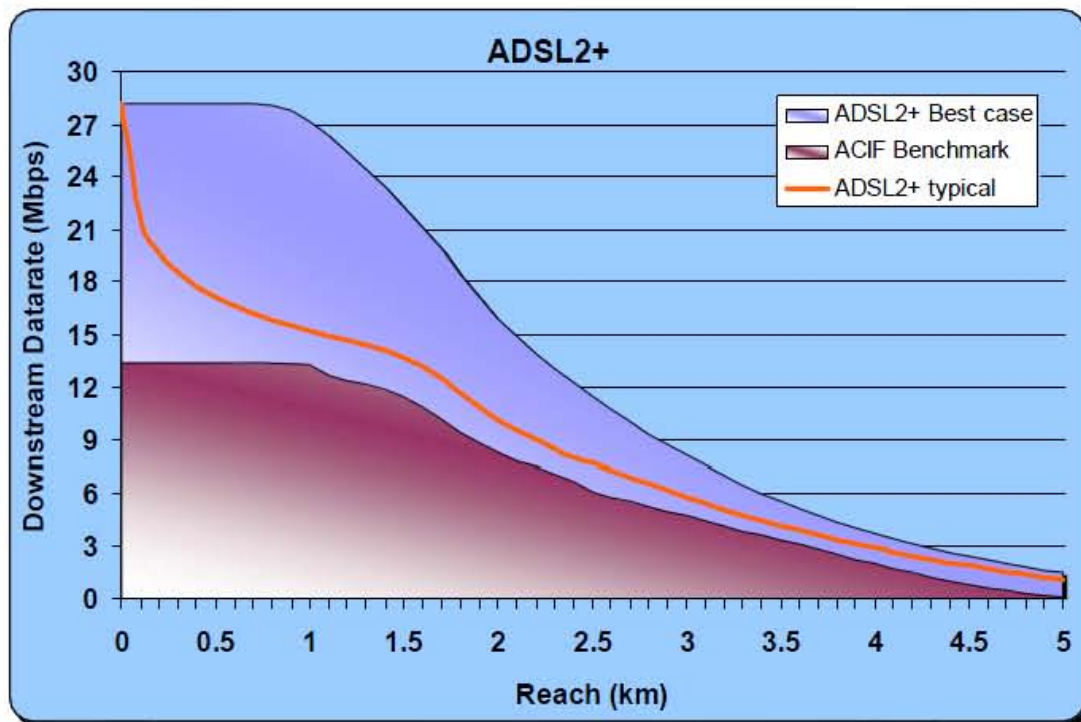
http://people.eng.unimelb.edu.au/rtucker/talks/files/Tucker_Broadband.pdf

11.3 Comparing broadband technologies

Currently, the most popular fixed broadband technology in Australia is ADSL technology.²⁴⁷ The fastest variant of this, ADSL2+, has a nominal peak download speed of 24Mbps and upload speed of 1Mbps. On average, however, speeds delivered to the end user are considerably below this and is largely dependent on how far the end user is from the telephone exchange.

The following chart shows the ADSL2+ best case scenario and typical speeds achievable. Departmental modelling indicates there are approximately nine million premises in Australia that could theoretically receive ADSL2+ if all those within a 4.5 km radius of an ADSL2+ enabled exchange were connected. This equates to 72 per cent of all Australian premises²⁴⁸ compared to the 93 per cent that NBN Co propose to deliver fibre to speeds up to 1000Mbps downstream and 400Mbps upstream.

Maximum, minimum (benchmark) and typical speeds achieved by ADSL2+ by distance



Source: Layer 10 consulting, 26 July 2006²⁴⁹

The key distinction between DSL technologies and the fibre technology proposed by NBN Co is that the transmission signal within optical fibre does not degrade as rapidly with distance as DSL technology. The following chart²⁵⁰ shows the performance

²⁴⁷ According to ABS, 'Internet Activity', Australia, Jun 2010, catalogue 8153.0,

<http://abs.gov.au/ausstats/abs@.nsf/mf/8153.0/#>

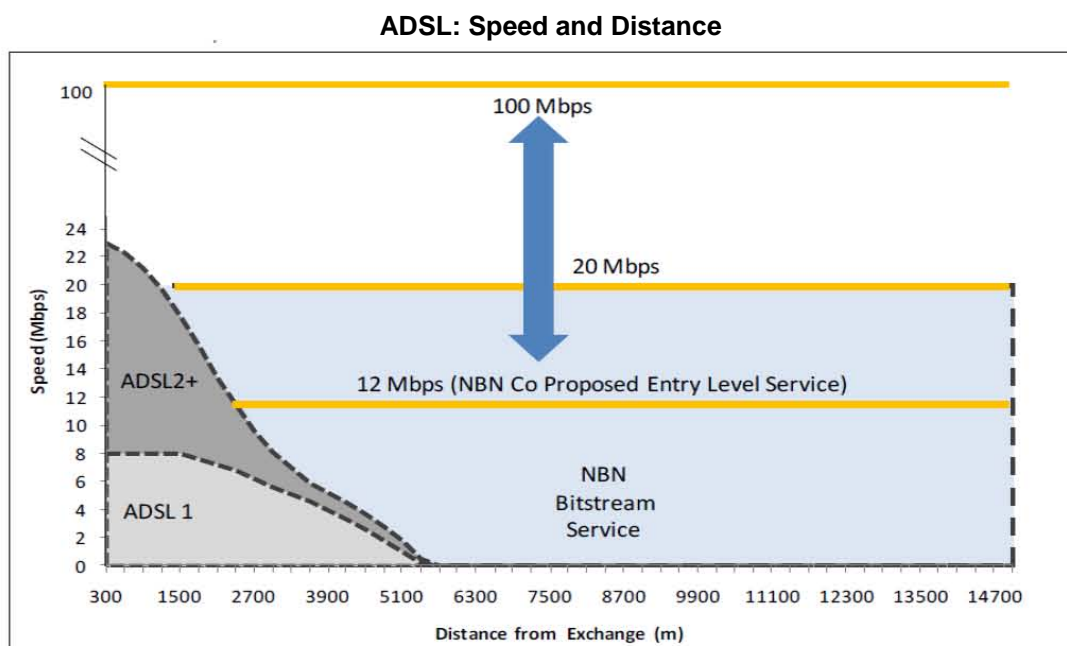
²⁴⁸ According to DBCDE internal modelling

²⁴⁹ Local Loop Spectrum Management Report prepared for The Commerce Commission of New Zealand by Layer10 Consulting, 26 July 2006

²⁵⁰ NBN co corporate plan 2011 – 2013, p40

<http://www.nbnco.com.au/wps/wcm/connect/eea11780451bd3618ebfef15331e6bbb/101215+NBN+Co+3+Year+GBE+Corporate+Plan+Final.pdf?MOD=AJPERES>

degradation (Mbps) between ADSL technologies compared to the proposed NBN Co offerings. It shows that the coverage capabilities with optical fibre are superior to existing ADSL technology without a performance reduction. Furthermore, the proposed NBN Co satellite and wireless solution which will deliver a minimum of 12Mbps downstream and 1Mbps upstream will be superior, in a raw data speed terms, to a significant proportion of all ADSL2+ customers who are beyond 2 km from an exchange.²⁵¹



Source: NBN Co Corporate Plan 2011- 2013 (17 December 2010)

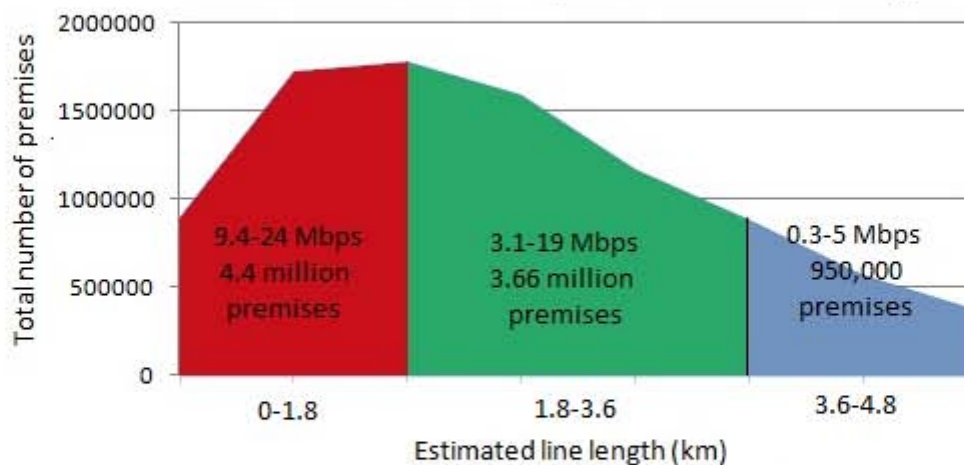
11.4 Speed impact of distance from ADSL2+ enabled exchanges

The graph below shows the estimated distribution of Australian premises against length of phone lines, and the range of download speeds they could access if all ADSL exchanges were upgraded to ADSL2+.

Departmental modelling indicates that if all Australian premises within a 4.5 km radius of an ADSL2+ enabled exchange connected, only 22 per cent could be guaranteed to receive at least 12Mbps downstream and 1Mbps upstream. A further 38 per cent of premises may be able to receive 12Mbps in the best case scenario but are more likely to receive something less.

²⁵¹ Another measure of network performance, latency, however is inferior in wireless and particularly satellite technology compared with ADSL.

Distribution of Australian premises within 4.5km of an ADSL2+ enabled exchange



Source: Department of Broadband, Communications and the Digital Economy, modelling, 2010

Often wireless technologies are touted as a viable alternative to optical fibre technologies and there is no question that wireless broadband technologies and devices are becoming increasingly popular in Australia, particularly mobile devices that take advantage of the 3G network.

As noted in the Implementation Study: “*Mobile broadband growth does not directly substitute fixed-line services; they are complementary in many cases, and address different user bases.*”²⁵²

In addition, it is clear that despite significant increases in numbers of wireless broadband subscribers due to the advent of smartphones and pads/tablets, the fixed line network still handles the bulk (91%) of data flows and data use continues to grow exponentially (see 1.1 and 2.3).

11.5 Application requirements

A co-dependent relationship exists between the availability/ubiquity of affordable high-speed internet and the development of new, rich applications which require large bandwidths. Generally speaking, development of high bandwidth, rich applications follow when broadband reaches an adequate level of penetration to sustain a business case for that application.

Certain applications, such as voice, video and video conferencing, require an optimal amount of bandwidth to function adequately. Two-way high definition (HD) video, for example requires at least 6-8Mbps, in both the downstream and upstream directions. Many other internet applications are not per se, bandwidth dependent, but the user experience is enhanced with greater bandwidth.

Some applications are ‘bandwidth critical’, meaning that if they don’t have enough bandwidth they won’t work properly. Bandwidth critical applications include

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‘streaming’ applications like internet radio and video, and real-time applications like internet telephony and online collaboration. Other applications such as web browsing, email and downloading files will still work even on slow connections; however they are quicker and more convenient with greater bandwidth. The table below illustrates different types of applications and their relationships to bandwidth.

Bandwidth Requirements of Select Applications

Broadband Application	Examples	Bandwidth Critical	Implications
Bandwidth critical applications	<ul style="list-style-type: none"> • Voice (symmetry req.) • Streaming video • Video conferencing (symmetry req.) • Cloud computing • Online games 	Yes	Not enough bandwidth = Interrupted service
Non-real time applications (low capacity)	<ul style="list-style-type: none"> • Browsing • Checking emails 	No	Not enough bandwidth = poor user experience
Non-real time applications (high capacity)	<ul style="list-style-type: none"> • Downloading movies • Downloading large files 	Sometimes	Not enough bandwidth = poor user experience

Source: Technology Advisory Unit, Department of Broadband, Communications & the Digital Economy (February 2011)

11.6 Download times

End-users will be less willing to engage in online activities and applications if it takes too long for them to download or function properly. The following chart illustrates the approximate download time for a variety of internet applications at various data speed rates.

Download times of select Internet Applications by Data Speeds

Download type	56 kb/s (dial-up)	256 kb/s	2 Mb/s	10 Mb/s	50 Mb/s	100 Mb/s
Google home page (160 KB)	25 sec.	5 sec.	<1 sec.	<1 sec.	<1 sec.	<1 sec.
Sydney Morning Herald web page (1618 KB)²⁵³	5 min.	1 min.	7 sec.	1.5 sec.	<1 sec.	<1 sec.
5 MB music track	13 min.	3 min.	21 sec.	<1 sec.	<1 sec.	<1 sec.
20 MB video clip	52 min.	11 min.	1 min.	17 sec.	3 sec.	1 sec.
CD, or low quality movie (700 MB)	30 hrs.	7 hrs.	50 min.	10 min.	2 min.	1 min.
DVD, or high quality movie (4GB)	1 week	1.5 days	4.5 hrs.	1 hr.	12 min.	6 min.

*Notes: Calculated using a 10% overhead
Source: Numion.com (February 2011)²⁵⁴*

²⁵³ SMH Website accessed on 11 January 2011, www.smh.com.au

²⁵⁴ <http://www.numion.com/calculators/Time.html>

11.7 Bandwidth requirements for video

Video communications will be an important driver of bandwidth usage in the years ahead, particularly high definition video. The following chart²⁵⁵ shows the bandwidth requirements for a variety of picture formats using two common video compression technologies (MPEG-2) and MPEG-4. A high-definition video conference requires a minimum of 6Mbps-8Mbps of symmetrical bandwidth for optimal performance.

Bandwidth Requirements of Standard Definition, High Definition and 3D TV by Picture Format and Compression Technology

	Picture Format	MPEG-2	MPEG-4
Standard Definition (SD)	576i	3 – 7 Mbps	1.5 – 3.5 Mbps
High Definition	1080i	13 – 14 Mbps	6.5 – 8 Mbps
	720p	10 – 12 Mbps	5 – 6 Mbps
	576p	8 – 10 Mbps	4 – 5 Mbps
3D Television	1080i	N/A	14.5 Mbps (will decrease)

Source: Information adapted from Australian Competition & Consumer Commission submission into the uptake of digital TV (2006)

High bandwidth connections enable 'triple-play' services – internet, telephony and multi-channel TV - via the one connection. The following table²⁵⁶ shows some different user scenarios and the bandwidth requirements of each. If an operator used MPEG-4 video compression technology and offered two standard DTV channels and one HD channel along with telephony and a 5Mbps internet service, the bandwidth requirement would be over 16Mbps.

²⁵⁵ Information adapted from ACCC submission to the Inquiry into the uptake of digital television in Australia, <http://www.aph.gov.au/house/committee/cita/digitaltv/subs/sub65attachc.pdf>

²⁵⁶ Cited in the international Cablemakers federation (ICF) http://www.icf.at/en/6000/how_much_bandwidth.html#559

Bandwidth Requirements of Triple-Play Services

Video Services With MPEG-2 Compression			
	Mbps		Mbps
Internet (average user)	5	Internet (high user)	10
Telephony	0,1	Telephony	0,1
2 SDTV Channels	6	2 SDTV Channels	6
1 HDTV Channel	16	2 HDTV Channels	32
Total	27,1	Total	48,1

Video Services With MPEG-4 Compression			
	Mbps		Mbps
Internet (average user)	5	Internet (high user)	10
Telephony	0,1	Telephony	0,1
2 SDTV Channels	3	2 SDTV Channels	3
1 HDTV Channel	8	2 HDTV Channels	16
Total	16,1	Total	29,1

Source: ITU as cited in the International Cable makers Federation (ICF)

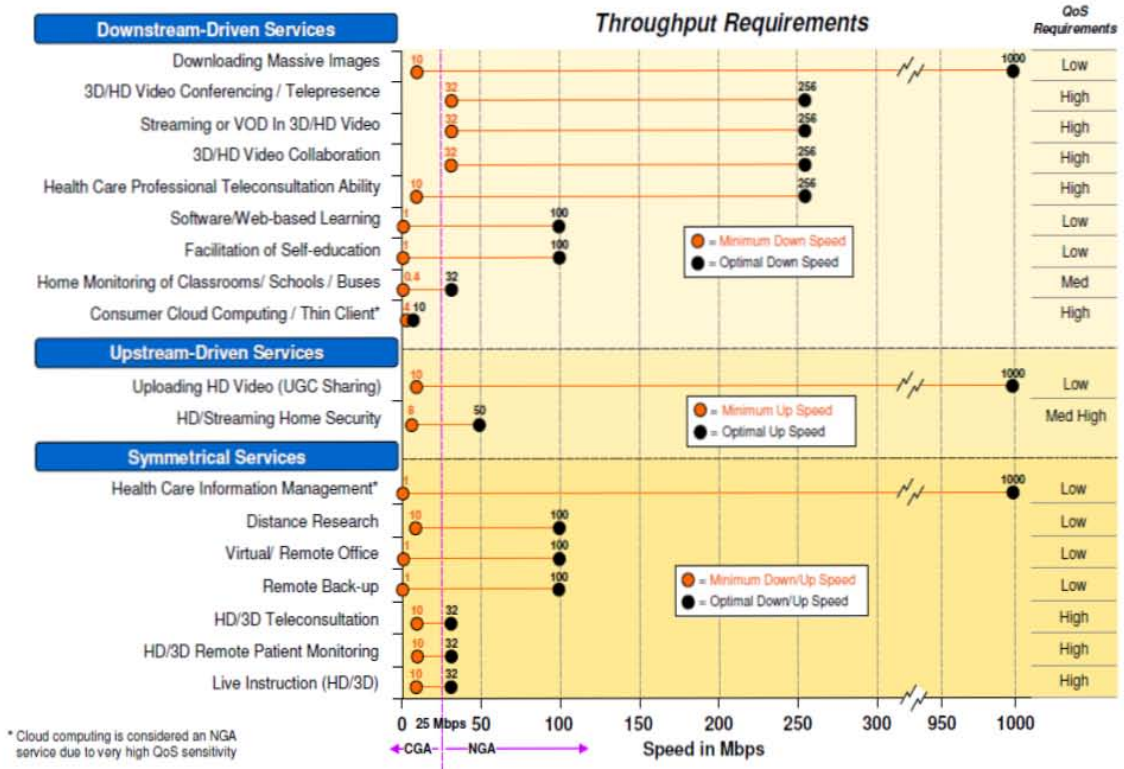
11.8 Next generation applications

In a study conducted by CSMG Consulting for the Fibre-to-the-Home council, a variety of next generation applications (NGAs) were identified that required at least 25Mbps of throughput²⁵⁷ and/or a high quality of service.²⁵⁸ These are some of the applications and services which are around the corner and beyond the current generation of applications (CGA) but will be potentially available under an NBN scenario.

²⁵⁷ Data throughput is often used interchangeably with bandwidth but throughput is the average rate of data that successfully gets delivered over a channel.

²⁵⁸ CSMG, *National Broadband Plan Policy Evaluation*, November 2009
http://s.ftthcouncil.org/files/csmg_nbp_policy_evaluation_study_2nov09_final.pdf

Throughput and quality of service requirements of select Next Generation Applications



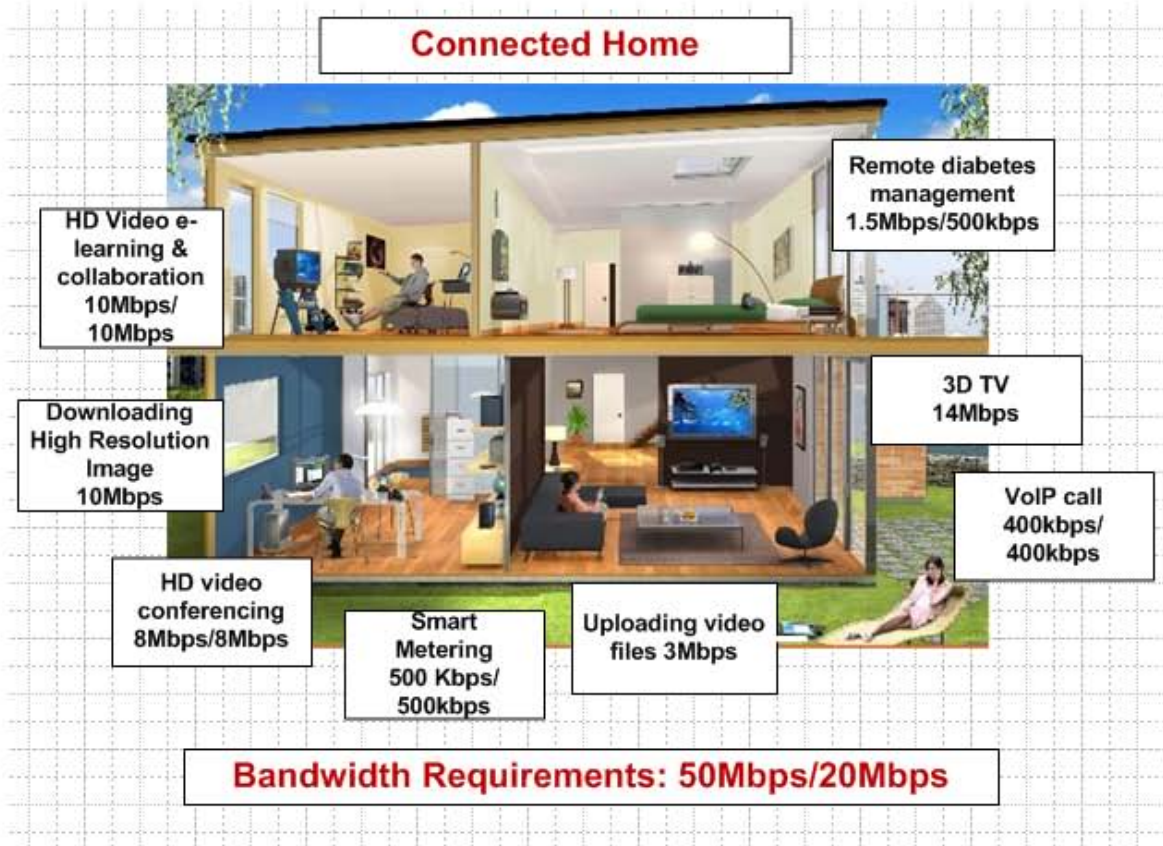
Source: CSMG Consulting for the Fibre-to-the-home council (2009)

11.9 The connected home

While individual applications require a certain amount of bandwidth, when simultaneous users are utilising the one internet connection, bandwidth requirements are cumulative. This can be thought of in the same way as peak-hour electricity usage when a variety of appliances are simultaneously drawing electricity as they need it.

The following scenario shows a variety of simultaneous applications being utilised at once in a household equating to a cumulative bandwidth requirement of approximately 50Mbps downstream and 20Mbps upstream.

Connected Home



Source: Technology Advisory Unit, Department of Broadband, Communications & the Digital Economy (February 2011)