IRELAND'S ADVANCED BROADBAND PERFORMANCE AND POLICY PRIORITIES

NOVEMBER 2011

Forfás

Table of Contents

Executive Summary

Advanced broadband services are crucial to achieve the productivity growth necessary to improve competitiveness, sustain high-level incomes and ensure Ireland captures new opportunities for entrepreneurship and jobs across all sectors. For a number of years Forfás has been concerned that Ireland lags other EU countries and those with which we compete for trade and investment in the provision of widely available competitively priced, advanced broadband services.

Forfás defines advanced broadband services as services offering download speeds of 100 Mbps or more, with significantly higher upload capability (including the widespread availability of symmetric services for enterprise) and low latency (speed of response of the system to the user). While the advanced broadband needs of ICT-intensive enterprises are generally well met in the large urban centres, businesses, particularly SMEs, outside the main urban centres have significantly less choice and less access to good quality services. The policy actions taken and investment made to date are necessary but are not sufficient to ensure the widespread availability of world class advanced broadband services within a timescale that will allow Ireland to catch up with competitor countries.

The optimal solution is that the telecommunications market players undertake the necessary investment within the context of a supportive policy and regulatory framework. In the event that the market does not deliver in a timely fashion, the State will need to intervene to ensure that Ireland has the advanced broadband services to allow the enterprise base to compete successfully in international markets. The Programme for Government proposes that '…NewERA will co-invest with the private sector and commercial semi state sector to provide next generation broadband to every home and business in the State'.

This paper provides an assessment of how Ireland is performing in meeting the needs of enterprise and what we need to do to deliver advanced broadband services.

Why are advanced broadband services important for enterprise?

Advanced broadband services are the enterprise development agencies' priority infrastructure requirement. Advanced broadband services are important for realising future growth potential in existing and emerging sectors, as they will:

- **Enable Ireland's existing and emerging sectors to exploit future growth opportunities:** A number of high-value industries already require download speeds of at least 100 Mbps and/or symmetrical services (same upload and download speed) and low latency for carrying out tasks that involve highly sophisticated design and graphics, time sensitive financial transactions and medical imagery. Advanced broadband services are important in emerging high value information-intensive industries such as digital media, cloud computing, e-games, healthcare and education.
- **Act as an attraction for foreign direct investment:** Advanced broadband services can provide a unique selling point for Ireland when competing against other locations for

investment. As there will be a growing emphasis on working from home in the future, particularly in the ICT intensive sectors Ireland targets for foreign direct investment, employee access from home to high quality broadband will be an important factor in future investment decisions by global companies. In addition, Ireland has potential to become an ideal test bed location for connected healthcare provided advanced broadband services are in place.

- **Stimulate the growth of small businesses:** The effective use of ICT allows SMEs to compete more vigorously in global markets, for example by reducing costs and improving the quality of services to their customer base. While large corporations tend to be concentrated in large urban centres, which are better served, SMEs tend to be more dispersed, often located in smaller centres that do not have access to advanced broadband services.
- **Capture productivity and innovation opportunities**: According to the European Commission, companies adopting broadband-based processes improve their employees' labour productivity on average by five per cent in the manufacturing sector and by 10 per cent in the services sector. In addition, a study by the European Commission suggests that broadband-related productivity has the potential to contribute 0.63 per cent to GDP in countries such as Ireland.
- **Support regional development:** The presence of advanced telecommunications infrastructure and services enables businesses to compete in national and international markets – particularly services based businesses. Restricted access to these infrastructures will limit the ability of Ireland's regions to capture the benefits set out above.
- **Improved delivery of essential services and public sector efficiency:** A study by the OECD concluded that on average, cost savings of between 0.5 per cent and 1.5 per cent per annum over a ten year period would be achieved as a result of investment in the broadband network platform in the areas of energy, transport, health and education. These savings would more than offset the cost of building a national fibre to the home network.

An absence of high quality infrastructure will limit Ireland's ability to achieve these benefits. However, as with other networked infrastructures, demand and the full benefits from their application will not emerge until the infrastructure is in place. While there is likely to be strong demand for advanced broadband services by enterprise in the short to medium term (Section 2), residential demand for advanced broadband services is likely to ramp up at a slower rate, at least in the short term.

How is Ireland performing in meeting the needs of enterprise?

The key findings of the benchmarking analysis (see Section 3 for details) are outlined below:

- There has been significant progress made in terms of the availability and take-up of basic broadband services by firms and households. At the end of Q2 2011, there were 1.63 million broadband subscriptions in Ireland;
- Despite recent progress, Ireland still lags the EU and OECD average with regard to total fixed broadband take-up (excluding mobile). According to European Commission

figures, at the end of 2010, fixed broadband penetration reached 23.3 per cent in Ireland, while the EU-27 average was 26.6 per cent of population. Ireland has one of the highest levels of mobile broadband subscription (47.1 per cent), and is above the EU-15 average (43.4 per cent) and the OECD average (41.6 per cent).

- In 2010, 87 per cent of enterprises and 58 per cent of households in Ireland had a broadband connection (Figure A1 in Appendix 1). Ireland's enterprise take-up rate is just below the EU-15 average of 89 per cent. Of the firms in Ireland with internet access, 94 per cent have a broadband connection – on par with the EU-15 average;
- The share of broadband lines in Ireland at 10 Mbps and above increased from 8.9 per cent at the end of 2009 to 13.4 per cent at the end of 2010; the EU average was 38.9 per cent of subscriptions at 10 Mbps and above in 2010, up from 23.4 per cent the previous year. In Denmark and Sweden, 47.6 per cent of connections were at speeds of 10 Mbps, in the UK, 44.8 per cent of connections were at or above 10 Mbps. In Belgium, at the end of 2010, 26 per cent of subscriptions were at 30 Mbps and above;
- In terms of the percentage of broadband subscribers migrating to fibre, Japan and South Korea lead the way. In Ireland, 0.5 per cent of fixed broadband connections are provided via fibre connections compared to 9.6 per cent of OECD-27 subscriptions.

Where does Ireland need to get to?

In August 2010, the EU adopted the Digital Agenda, which sets out a roadmap for developing a single digital market by 2020 to support sustainable long term economic growth and social progress. The biggest challenge to achieving this objective is ensuring advanced telecoms services are widely available across all member states. The EU has agreed three targets (see Section 4 for details) to deliver on the Digital Agenda objectives. Ireland has achieved the first target of universal access to basic broadband by 2013 ahead of schedule.

However, given that Ireland has a significantly lower share of high speed broadband lines than the EU average, at this point, we are concerned that Ireland, without further policy intervention, is not on the required trajectory to meet the EU's ambitious 2020 targets. These targets are that all citizens will have access to 30 Mbps broadband services and 50 per cent of European householders will be subscribing to services of 100 Mbps and above by 2020. The European Commission in their 2011 assessment of the Irish telecommunications market concluded that 'broadband speeds are relatively slow in Ireland compared to other member states.' We need to act now to ensure that Ireland can provide advanced broadband networks and services on a par with competitor countries and the actions required to achieve this are set out below.

To ensure enterprise growth is not constrained by a lack of access to advanced broadband services, advanced broadband infrastructure needs to be available in all the main towns. This would enable advanced broadband services to be delivered to a significant proportion of total enterprises and homes in Ireland within a short time period.

Forfás advanced broadband vision for Ireland

Within five years, Ireland will have an advanced broadband infrastructure comparable with our key competitors in all towns with a population greater than 1,500, delivering download speeds of at least 100 Mbps, with significantly higher upload speeds (including the widespread availability of symmetric services for enterprise) and low latency.

As enterprises generally tend to locate in urban centres, the Forfás advanced broadband vision focuses on delivering advanced broadband services to the main urban centres. However, to meet the EU Digital Agenda targets, Ireland will have to deliver 30 Mbps services everywhere by 2020, with 50 per cent of households subscribing to 100 Mbps or higher by 2020. The Forfás advanced broadband vision is an interim milestone to achieve the Digital Agenda 2020 targets and the targets proposed in the Programme for Government.

Various technologies are available to deliver advanced broadband services. At this time, on a purely technological level, it is widely accepted that fibre is the most future-proofed solution. However, several technologies can meet projected interim bandwidth needs (e.g. cable DOCSIS3, VDSL, wireless LTE (Long Term Evolution) and WiMAX) but there are limitations to the maximum amount of bandwidth they can supply (See Section 2). The State should be open to technologies, which demonstrate the ability to deliver on the advanced broadband vision. However, given Ireland's spatial patterns and low population density, wireless solutions will have a key role to play in reaching universal coverage, as it will not be economically feasible to deploy fixed advanced broadband infrastructure everywhere.

How do we get there?

Despite good progress in the provision of basic broadband services, Forfás is concerned that Ireland is performing poorly in the rollout and take-up of advanced broadband services. Given the weak telecommunications investment climate in Ireland, our dispersed population patterns and the recession, there is a strong risk, if appropriate action is not taken, that Ireland is likely to fall even further behind as other countries are moving ahead to deploy advanced telecoms networks.

The optimal solution is that telecommunications market players (public and private) undertake the necessary investment within the context of a supportive policy and regulatory framework with Government addressing areas of market failure. This paper sets out a range of actions that can support the development of a supportive policy and regulatory environment that will promote investment. In the event that the market does not deliver in a timely fashion, this paper also sets out the need for the State to intervene to ensure that Ireland has the advanced broadband services to allow the enterprise base to compete successfully in international markets.

Addressing barriers to investment

There are a number of actions that the State needs to progress immediately to support investment (whether private, commercial semi state and/or public) in advanced broadband

networks (see Section 5 for details). While these measures can improve Ireland's broadband performance, progress has been slow to date and while necessary, of themselves, they are not sufficient to lead to widespread advanced broadband services deployment.

Pro-investment regulation

We need to ensure the regulatory framework incentivises investment, promotes competition and reduces rollout costs (Section 5.1). The key actions required are to:

- Facilitate an appropriate return on investment for private operators to incentivise investment;
- Ensure wholesale access to a range of advanced products to promote competition at the retail level. ComReg has set out the principles that will apply to ensure wholesale access to next generation products and services, however, it is essential that specific obligations and remedies are put in place in a timely fashion to promote competition at the retail level. The recent publication of ComReg's preliminary next generation access consultation is therefore welcome; and
- Enable infrastructure sharing between telecommunication operators as a means to lowering rollout costs while maintaining competition at the service level.

Infrastructure planning

Planning policy has a key role to play in supporting the rollout of advanced broadband infrastructure by increasing certainty and reducing costs (Section 5.2). The planning measures that Ireland needs to progress include:

- Mainstreaming access to public ducting for fibre deployment and mandating the provision of ducting as part of all State infrastructure development programmes;
- Mandating the installation of open access ducting in all new developments (residential and commercial); and
- Reducing the costs of building access networks – e.g. harmonising local authority fee structures and processes.

Demand stimulation

Supply side measures alone will not be sufficient to capture the full benefits offered by advanced broadband services. The economic literature highlights that those countries/ companies who capture the productivity gains also need to invest in ICT, human capital and organisational change (Section 5.3). The State has a key role to play in stimulating demand for advanced telecoms services:

- The State sector should use its position as a leading purchaser of advanced broadband services to underpin demand aggregation strategies and support infrastructure investment;
- Ireland needs to make better use of ICT across government (e-government; e-health; e-education) to improve the efficiency and effectiveness of public services and make them easier to access for citizens and businesses;

- Irish businesses, particularly SMEs, are not exploiting the full benefits of greater ICT use. The development agencies, the city and county enterprise boards (CEBs), business representative bodies and the telecom providers have a key role to play in creating greater awareness among SMEs of the benefits of more efficient ICT use (e.g. increased productivity, reduced costs). In addition to awareness raising, we also need to enable companies to use ICT more effectively. This will require investment in skills development and organisational change; and
- We need to foster an e-payment friendly environment through the rebalancing of stamp duty on cheques in favour of debit and credit cards and ensure that all State bodies' transactions are payable via electronic funds transfer.

Role of the State in securing the required investment

The optimal solution to deliver advanced broadband services in Ireland is that the telecommunications market players undertake the necessary investment within the context of a supportive policy and regulatory framework. In the event that the market does not deliver in a timely fashion, the State will need to intervene to ensure that Ireland has the advanced broadband services to allow the enterprise base to compete successfully in international markets.

Forfás is concerned that Ireland, without further policy intervention, is not on the required trajectory to meet the EU's ambitious 2020 targets and the advanced broadband vision we have set out. To confirm the scale of the deficit, the State needs to:

- Quickly map existing telecommunications networks and concrete investment plans in order to identify deficits. As well as identifying areas that will not be served in the context of meeting the EU target of 100 per cent availability of 30 Mbps services by 2020, this exercise should also determine the quality of existing and planned services in the main urban centres (e.g. minimum upload and download speeds, latency, contention). In this regard, Forfás welcomes the establishment of the Next Generation Broadband Taskforce and its focus on identifying industry investment plans and barriers to investment. Consideration should be given to appointing an independent facilitator to work confidentially on a one-to-one basis with telecoms providers to finalise the mapping of existing and planned advanced broadband services as part of the gap analysis exercise.

To address broadband deficits, the Programme for Government proposes that: *'…NewERA will co-invest with the private sector and commercial semi state sector to provide next generation broadband to every home and business in the State*'. It is essential that the State advance on this proposal quickly. In particular, the State needs to:

- Having defined the deficits, design a mechanism, (e.g. competition/procurement process) for a collaborative approach with the industry players (private and/or commercial semi-state) to determine the level of market interest in addressing identified deficits. This process, mirroring earlier State interventions to support investment in international, regional, city and rural broadband networks, should be time-limited to demonstrate the State's seriousness in meeting its ambitious broadband goals;

- Make a firm commitment to providing or sourcing the funds required to support the achievement of the goals agreed in the EU Digital Agenda, and set objectives and targets to ensure the timely delivery of advanced broadband services. The level of funding required will depend on the extent of the advanced broadband deficits identified by the mapping exercise, the degree to which the market players can invest and how the deployment of advanced broadband infrastructure is phased; and
- If the market and the competition/procurement process is not successful in leveraging investment from the market players to support the State's broadband objectives and targets, progress with a State asset collaboration approach using the existing state telecommunications infrastructure, in consultation with the European Commission. In this context, Forfás has examined in detail how such a State asset collaboration model could deliver advanced broadband infrastructure to all towns with a population above 1,500 within five years. If the State has to invest or leverage funding from external sources, it will have to choose a technology. Our assessment looks at the cost of deploying open access fibre to the cabinet and home as fibre is regarded as the most future-proofed solution. The level of funding required will depend on the degree to which the market players can invest and how the deployment of advanced broadband infrastructure is phased.

  - The investment required to deploy fibre to the cabinet in those towns with a population greater than 1,500 is estimated to be €1.62 billion while rolling out fibre to all premises would cost an estimated €2.23 billion (Section 6.2).
  - Given the constraints on Exchequer funds and the challenges in raising private investment that currently exist, a phased build-out programme could be commenced in the immediate term as part of a concrete overall implementation plan to address identified deficits. For example:
    - Deploying fibre to the cabinet in all NSS centres (including Dublin) would cost approximately €780 million; while
    - Rolling out of advanced broadband services to all premises in the NSS centres would require an estimated investment of €1.24 billion (of which €800 million would be required to deploy fibre to all premises in Dublin).

1. Introduction

Advanced broadband services are crucial to achieve the productivity growth necessary to improve competitiveness, sustain high levels of income and ensure Ireland captures new opportunities for entrepreneurship and jobs across all sectors. For a number of years Forfás has been concerned that Ireland lags competitor countries in the provision of widely available competitively priced, advanced broadband services.

Forfás defines advanced broadband services as services offering download speeds of 100 Mbps or more, with significantly higher upload capability (including the widespread availability of symmetric services for enterprise) and low latency (see section 2 for more details). The advanced broadband needs of large corporate and ICT-intensive enterprises are generally well met in the large urban centres. This has been supported by investment (public and private) in international and regional connectivity. Enterprise Ireland and others have noted that SMEs outside the main urban centres have significantly less choice and less access to good quality services. The policy actions taken and investment made to date are necessary but are not sufficient to ensure the widespread availability of world class advanced broadband services within a timescale that will allow Ireland to catch up with competitor countries.

This paper's primary focus is to ensure that the advanced broadband current and future needs of the enterprise base are met. As enterprises generally tend to locate in urban centres, the Forfás advanced broadband vision focuses on delivering advanced broadband services to all towns with a population greater than 1,500. However, to meet the EU Digital Agenda targets, Ireland will have to deliver 30 Mbps services everywhere by 2020, with 50 per cent of households subscribing to 100 Mbps or higher by 2020. Various technologies (fixed and wireless) are available to deliver the advanced broadband infrastructure required to meet the EU targets.

The objectives of this paper are to highlight:

- Why advanced broadband services are important (section 2);
- What Ireland needs (section 2);
- How Ireland is performing in meeting the needs of enterprise (section 3);
- Where Ireland needs to get to (section 4); and
- How we get there (sections 5 and 6).

2. Why are advanced broadband services important?

The development agencies (Enterprise Ireland, IDA Ireland and Forfás) believe that the widespread availability of advanced broadband infrastructure and services is essential to realising future growth potential in existing and emerging sectors. It will also play a key role in supporting the growth of small business, capturing opportunities for productivity and innovation, supporting regional development, enabling greater public sector efficiency and marketing Ireland as a location for ICT-intensive FDI and R&D projects. In addition, it will signal to the international community that our commitment to the knowledge economy is a reality. In detail, advanced broadband services are important for a number of reasons:

Enable Ireland's existing and emerging sectors to exploit future growth opportunities:

- Broadband is essential to the delivery of many internationally traded services activities. The ESRI predicts that over 70 per cent of our exports will be traded services by 2025[1]. Data from TeleGeography shows that demand for international bandwidth grew seven-fold between 2006 and 2010[2].
- Advanced broadband services are important for realising future growth opportunities in high value information-intensive service industries such as digital media, cloud computing, e-games, healthcare and education. These services will be become more bandwidth hungry between now and 2020 with expected speeds of 100 Mbps and above required (see Figure 1).
- A number of high-value industries currently require download speeds of at least 100 Mbps and/or symmetrical services (same upload and download speed) and low latency – for example:
  - CAD for design, 3D graphics, construction, quantity surveying and engineering – symmetrical services will be important;
  - Scientific calculations for advanced research and centres of excellence;
  - Time-sensitive financial applications for banking, investment and insurance will require low latency;
  - Medical imagery for pharmaceutical and healthcare professionals – symmetrical services will be important (e.g. x-ray photographs);
  - File transfers in game and software development – symmetrical services will be important; and
  - Multiple secure e-commerce transactions for traders such as eBay, Amazon, Yahoo, Google – the availability of low latency services is key.

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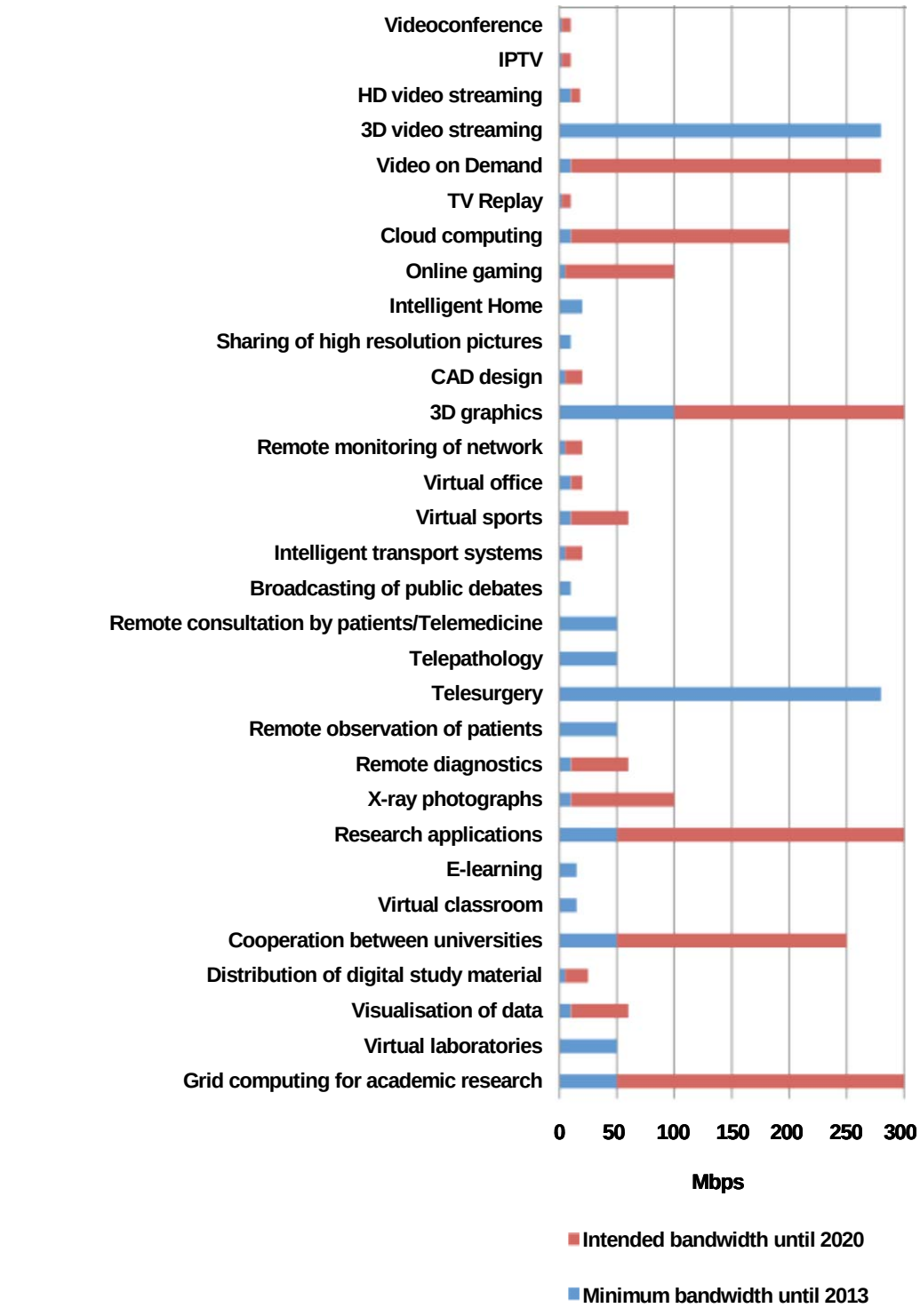
1 FitzGerald J. et al, ESRI, Medium Term Review, 2008 -2015, 2008.
2 http://www.telegeography.com/product-info/gb/index.php

Figure 1: Expected bandwidth requirements for different services



Source: Gartner,Vurderingaffremtidensbehov for bredbånd, IT & Telestyrelsen, 2009

Continued attraction of overseas FDI:

- Advanced broadband, which surpasses the services offered in competitor locations, would provide Ireland with a unique selling point to attract emerging bandwidth intensive sectors.
- A majority of new investments in Ireland are driven by ICT intensive firms in digital media, financial services, ICT, and R&D. An important part of the FDI value proposition will be in the ability of knowledge workers to work from home. There will be a growing emphasis on working from home in the future as globalisation continues and new types of industries evolve.
- The enabling of the development of test-bed facilities (for example, in the silver technology and connected health care sectors).

Growth of small businesses:

- The effective use of ICT allows SMEs to compete more vigorously in global markets, for example by reducing costs and improving the quality of services to their customer base. While large corporations tend to be concentrated in large urban centres, which are better served, SMEs tend to be more dispersed, often located in smaller centres that do not have access to advanced broadband services. As a result, they are constrained by the limited availability of advanced services to exploit future growth opportunities, particularly in the aforementioned data-intensive internationally traded services sectors. Approximately 70 per cent of all development agency-assisted firms are based outside Dublin city and county.

Capture productivity and innovation opportunities:

- There are significant challenges in quantifying the benefits of advanced broadband services, including measuring the benefits of advanced services over and above those of basic broadband and understanding the causation between the availability of advanced services and productivity/innovation opportunities. However, the consensus view from the OECD and the European Commission is that advanced broadband services can play a key role in supporting enterprise development and economic growth.
- According to the European Commission, companies adopting broadband-based processes improve their employees' labour productivity on average by five per cent in the manufacturing sector and by 10 per cent in the services sector[3]. For example, advances in cloud computing will see more enterprises using this and other remote web-hosted business applications to enhance productivity. However, the availability of advanced broadband will determine the robustness of these services.
- A 2008 European Commission study highlights how broadband fosters innovation and the development of service markets[4]. The impact of broadband on national economies

3 http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/broadband_impact_2008.pdf
4 The study categorises EU countries into four different groups. Ireland is ranked within the "quickly developing" group. Average broadband related GVA for this group is 0.63 per cent compared to an EU average of 0.71 per cent. The Impact of Broadband on Growth and Productivity, European Commissions, 2008. http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/broadband_impact_2008.pdf

depends on the level of broadband development (defined in terms of broadband infrastructure, readiness, and use). In the most advanced European countries, broadband-related gross value added growth reaches 0.89 per cent, whereas in the countries with less-developed broadband, this growth is limited to 0.47 per cent. The study ranks Ireland within a group of countries where broadband is 'quickly developing' and where broadband-related growth amounts to 0.63 per cent of GDP. Therefore, investment in high speed broadband has the potential to contribute a much needed increase in Irish GVA.

Support regional development:

- The presence of advanced telecommunications infrastructure and services enable businesses to compete in national and international markets – particularly services based businesses. Restricted access to these infrastructures will limit the ability of Ireland's regions to capture the benefits set out above.

Improved delivery of essential services and public sector efficiency:

- A study by the OECD focuses on the potential "spill-overs" of high bit rate infrastructures in four key sectors of the economy: energy, transport, healthcare and education[5]. The study concluded that on average, cost savings of between 0.5 per cent and 1.5 per cent per annum in each of the four sectors over a ten year period as a result of the investment in the broadband network platform could justify the cost of building a national fibre-to-the-home network.

What does Ireland need?

To ensure that Ireland remains competitive in meeting the needs of enterprise today as well as the needs of future enterprises and in order to drive new enterprise development, within five years, Ireland will have an advanced broadband infrastructure comparable with our key competitors in all towns with a population greater than 1,500 with the following features:

- High speed – at least 100 Mbps (download) of non-contested broadband with significantly higher upload capability (including the widespread availability of symmetric services for enterprise)[6]; and
- Low latency – the speed of response of the system to the user (e.g. video lag).

Various technologies are available to deliver advanced broadband. On a purely technological level, it is now widely accepted that fibre is the most future-proofed solution[7]. Several technologies can meet projected interim bandwidth needs (e.g. cable DOCSIS3, wireless LTE

5 OECD (2009) Network Developments in Support of Innovation and User Needs: Working Party on Communication Infrastructures and Services Policy.
6 The Innovation Taskforce, in their report to Government, recommended 1 Gbps be made available.
7 OECD (2008) Developments in Fibre Technology and Investments. European Commission (2008), The Impact of Broadband on Growth and Productivity.

(Long Term Evolution) and WiMAX) but there are limitations to the maximum amount of bandwidth they can supply[8]. Advances in copper technology such as ADSL+ and VDSL+ can deliver speeds of up to 100 Mbps, however it is very much dependent on the distance of the business/home from the cabinet and on upgrading the connections to the local cabinet with fibre. The telecommunications industry is also testing an array of technologies to enable operators to offer fibre to the home type speeds over their VDSL networks; the most promising technique is vectoring[9]. However, vectoring requires an operator to be in full control of the pair of lines; if another operator has unbundled one or more lines in that binder, vectoring the rest will not produce meaningful gains in speeds[10].

The potential to deliver more advanced speeds over cable is more limited than fibre-based solutions such as fibre to the home because bandwidth is shared among multiple users in a single cable and upstream bandwidth tends to be constrained. Notwithstanding the technical superiority of fibre, it is still relatively expensive to rollout in less densely populated areas. Therefore, telecommunications providers are likely to provide broadband services across a range of platforms in the coming years.

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8 LTE is the last step toward the 4th generation (4G) of radio technologies designed to increase the capacity and speed of mobile telephone networks.
9 Vectoring works on a single copper pair and is based on the concept of "noise cancellation", much like the headphones people use on planes to reduce or cancel background/engine noise when listening to music.
10 This presents a dilemma for policymakers. Regulators can still oblige incumbents to unbundle a standard fibre to the cabinet/VDSL network but such rules could discourage an incumbent from investing in vectoring, preventing consumers from accessing the higher speeds the technology promises. One option for regulators is to promote virtual unbundling, which offers alternative operators most of the features unbundling does, without the need to install their own equipment on the incumbent's network. The European Commission has accepted proposals by the UK and Austrian regulators to oblige their incumbents to offer virtual unbundling of their next generation access networks, but insist that they must impose full unbundling "*as soon as technically and economically possible*". Source: Box 2.1 of OECD, Next Generation Access Networks and Market Structure, June 2011.

3. How is Ireland performing in meeting the needs of enterprise?

This section examines how Ireland is performing in meeting the needs of enterprise relative to key competitor countries for trade and investment.

3.1 Recent developments in Ireland

Market investment in advanced telecommunications services in Ireland is relatively limited, with the exception of the cable network investment by UPC. Among the main developments in the past year are:

- UPC continues to upgrade its network as part of a €400 million investment that will be completed by the end of 2013. Its broadband product is available to over 40 per cent of Irish homes, most of whom can currently receive a 30 Mbps service[11]. UPC is in the process of rolling out 100 Mbps download services and 7 Mbps upload to these urban centres[12]. Fourteen per cent of total broadband subscriptions (including mobile) were via cable (22 per cent of fixed broadband) at the end of Q2 2011[13]. At the end of August 2011, almost all of UPC's 215,000 broadband customers were on speeds of 20 Mbps or higher[14];
- In September 2011, eircom announced phase 1 of its plan to rollout fibre based technologies to the cabinet and home, which will involve an initial investment of €100 million to deliver speeds of 40 Mbps and beyond to 100,000 premises by summer 2012[15]. Eircom is currently piloting fibre to the home to 8,000 homes and fibre to the cabinet to another 8,000 homes in Wexford town and Sandyford;
- Eircom's wholesale Ethernet services now cover over 90 per cent of businesses in Ireland and there have been significant price reductions recently (data on the availability and take-up of retail services is not available)[16]. BT has also commenced rollout of its next-generation network with the deployment of Etherflow fibre/radio access points across Ireland;
- The Metropolitan Area Networks (MAN) provider e-Net has agreed deals with service providers such as Imagine and Level 3 to provide enhanced regional broadband connectivity. As of September 2011, 49 of the 93 MANS are operational[17]; and
- The Minister for Communications has established a Next Generation Broadband Taskforce to progress the delivery of advanced broadband services[18]. The taskforce is focusing on identifying private and public investment plans, the removal of barriers to

11 UPC has upgraded its broadband network in the following urban centres – Dublin, Cork, Galway, Limerick, Waterford, Athlone, Balbriggan, Carlow, Celbridge, Clane, Clonmel, Kilcock, Kilkenny, Malahide, Maynooth, Naas, Navan, Newbridge, Portlaoise, Sallins, Sligo, Swords and Thurles.
12 The current upload speed on the 100 Mbps service is 7 Mbps.
13 ComReg, Quarterly Key Data Report, Q2 2011.
14 http://www.upc.ie/pdf/PR%20190711%20Broadband%20Press%20Release.pdf
15 http://pressroom.eircom.net/press_releases/article/eircom_Announces_Over_100M_Investment_in_Phase_1_of_Planned_Fibre_Rollout/
16 Ethernet is the most widely-installed local area network (LAN) technology.
17 Department of Communications, Energy and Natural Resources.
18 http://www.dcenr.gov.ie/Press+Releases/%e2%80%9cWe+want+tadbando+ensure+faster+broadband+everywhere+soon%e2%80%9d+%e2%80%93+Rabbitte.htm

investment and the establishment of appropriate targets and programmes to ensure Ireland delivers high speed broadband in line with its EU targets. The group is made up of the CEOs of the main telcoms companies in Ireland. Forfás is attending the taskforce meetings as an observer.

3.2 Broadband take-up

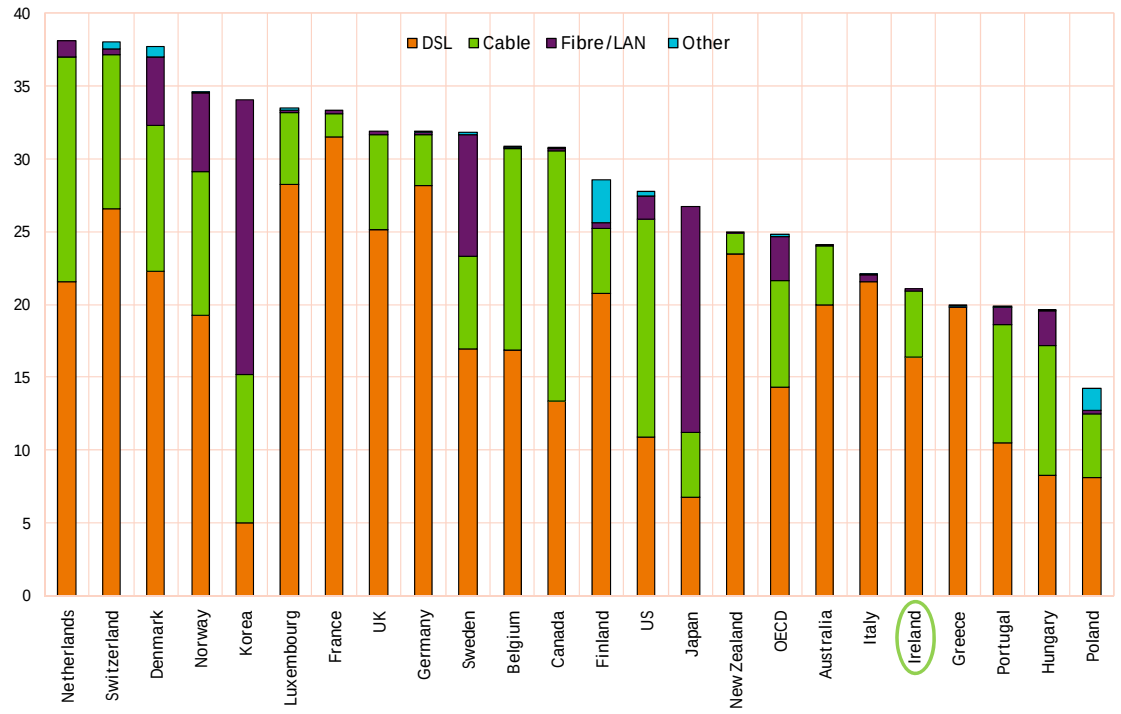
During 2010, significant progress was made with regard to the availability of current generation or basic broadband services and increased take up by firms and households. In Q2 2011, there were 1.662 million internet subscriptions in Ireland of which 1.628 million were broadband subscriptions. Broadband subscriptions accounted for 98 per cent of all internet subscriptions in Q2 2011.

In December 2010, 87 per cent of enterprises and 58 per cent of households in Ireland subscribed to broadband (Figure A1 in Appendix 1). Ireland's enterprise take-up rate is just below the EU-15 average of 89 per cent. Of the firms in Ireland with internet access, 94 per cent have a broadband connection – this is on par with the EU-15 average. Although Ireland's household penetration rate continues to increase (up from 54 per cent in 2009 to 58 per cent in 2010), Ireland remains significantly behind leading countries such as Sweden and Norway which have a penetration rate of 83 per cent.

Mobile subscriptions increased by 14.8 per cent in the year to the end of Q2 2011. Cable broadband has been growing quickly in recent years increasing by 355 per cent since the beginning of 2007 and by 32 per cent during the year to Q2 2011 (See Figure A2)[19].

19 ComReg, Quarterly Key Data Report, Q2 2011.

Figure 2: Fixed Broadband Subscribers per 100 Inhabitants by Technology, December 2010[20]



Source: OECD, Broadband Statistics

Despite these improvements, Ireland still lags the OECD average with regard broadband take-up. In December 2010, Ireland had 21.1 subscribers per 100 inhabitants compared to the OECD average of 27.3 (Figure 2). Leading countries such as the Netherlands and Switzerland (38.1) and Denmark (37.7) have significantly higher broadband penetration rates. Countries with larger household sizes are likely to have a lower population penetration rate. The average household in Ireland (3.0) is larger than the OECD average (2.7). The variance in average household size accounts for some of the differential between Ireland and the leading countries such as the Netherlands (2.6), Denmark (2.5) and Switzerland (2.6).

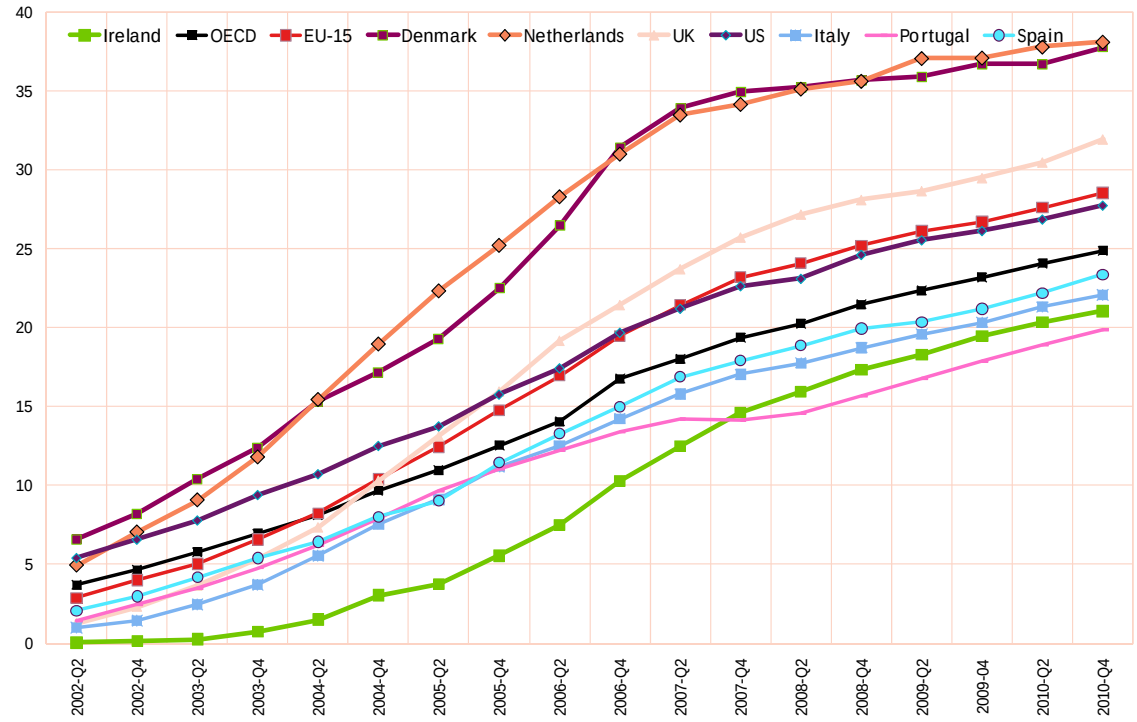
DSL (copper based) remains the primary platform for broadband access across the benchmarked countries. Fibre is the most popular platform in South Korea and Japan while cable is the preferred choice in the US, Canada and Hungary. In Ireland, 77.9 per cent of fixed broadband connections are via DSL and 21.5 per cent are via cable. The average percentage of fixed broadband connections provided by DSL in the OECD is 57.6 per cent while cable is accounts for 29.4 per cent (Figure A3 in Appendix 1).

Figure 2 looks at fixed broadband only and does not include mobile broadband take-up. Ireland has a relatively high rate of mobile broadband penetration. Of the benchmarked

20 Others includes BPL and leased lines. Mobile broadband data is not included in these figures.

group, Ireland has one of the highest levels of mobile broadband subscription (47.1 per cent), and is above the EU-15 average (43.4 per cent) and OECD average (41.6 per cent). Subscription to mobile broadband can be used as a substitute for fixed broadband and may be affecting Ireland's fixed broadband subscription performance. However, the US which has a higher rate of fixed broadband subscription (27.7 per cent) than Ireland (21.1 per cent), has a higher rate of mobile broadband subscription (53.5).

Figure 3: Fixed Broadband Subscribers per 100 inhabitants, Q2 2002 - Q4 2010[21]



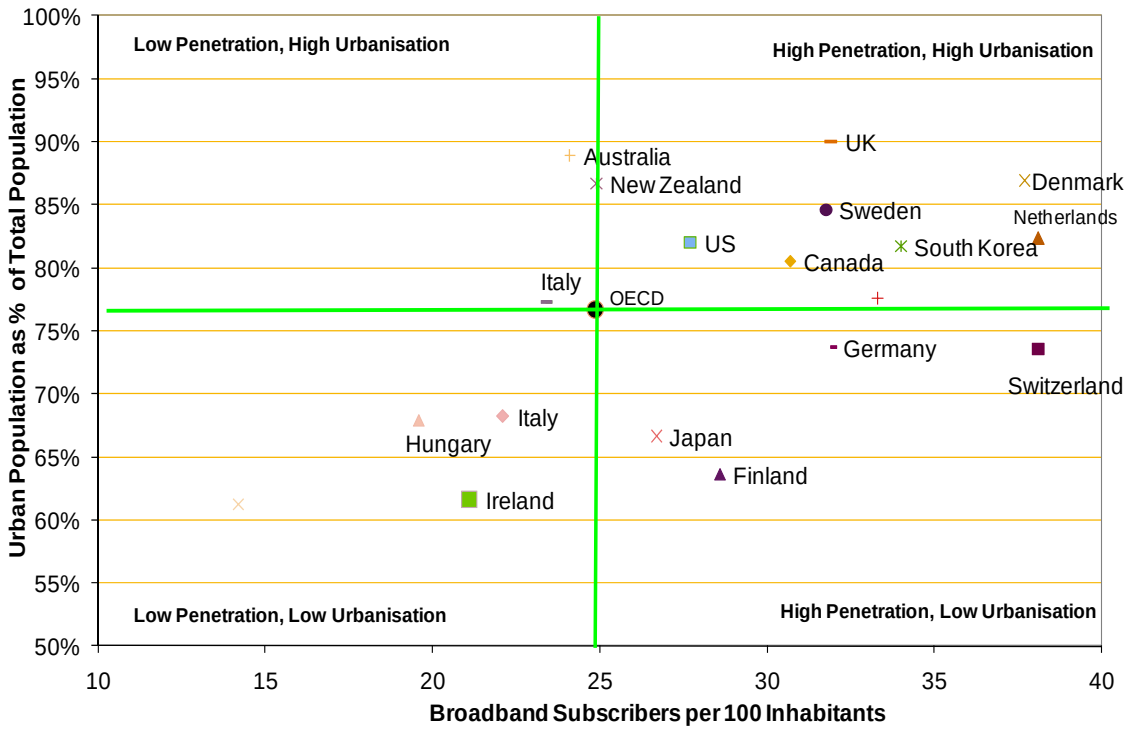
Source: OECD, Broadband Statistics

Looking at fixed broadband take-up rates over the period June 2002 to December 2010, Ireland's take up rate has increased steadily in recent years – however we continue to lag competitor countries (Figure 3). While the gap between Ireland's take-up rate and the OECD average has narrowed over the period, the gap with the EU-15 average has widened. By the end of 2010, the gap between Ireland and the OECD average had narrowed to 3.8 subscribers per 100 inhabitants while the gap between Ireland and the EU-15 was 7.5 per cent. Meanwhile, the UK which started from a relatively low penetration base in 2002, similar to that of Ireland, has progressed rapidly and is now seven subscribers per 100 inhabitants above the OECD average.

21 Mobile broadband subscription figures are not included.

The above chart does not include mobile broadband subscriptions and as noted above Ireland has a relatively high mobile broadband penetration.

Figure 4: Fixed Broadband Subscribers per 100 inhabitants December 2010 and Urban Population,[22]



Source: OECD, Broadband Statistics; World Bank, World Development Indicators

National broadband performance metrics reflect the different economic, geographic and demographic challenges that face individual countries. Urbanisation and population density are crucial determinants of the economic case for investing in broadband infrastructure. The case for investment in advanced broadband infrastructure is likely to be more attractive in countries with a high population density.

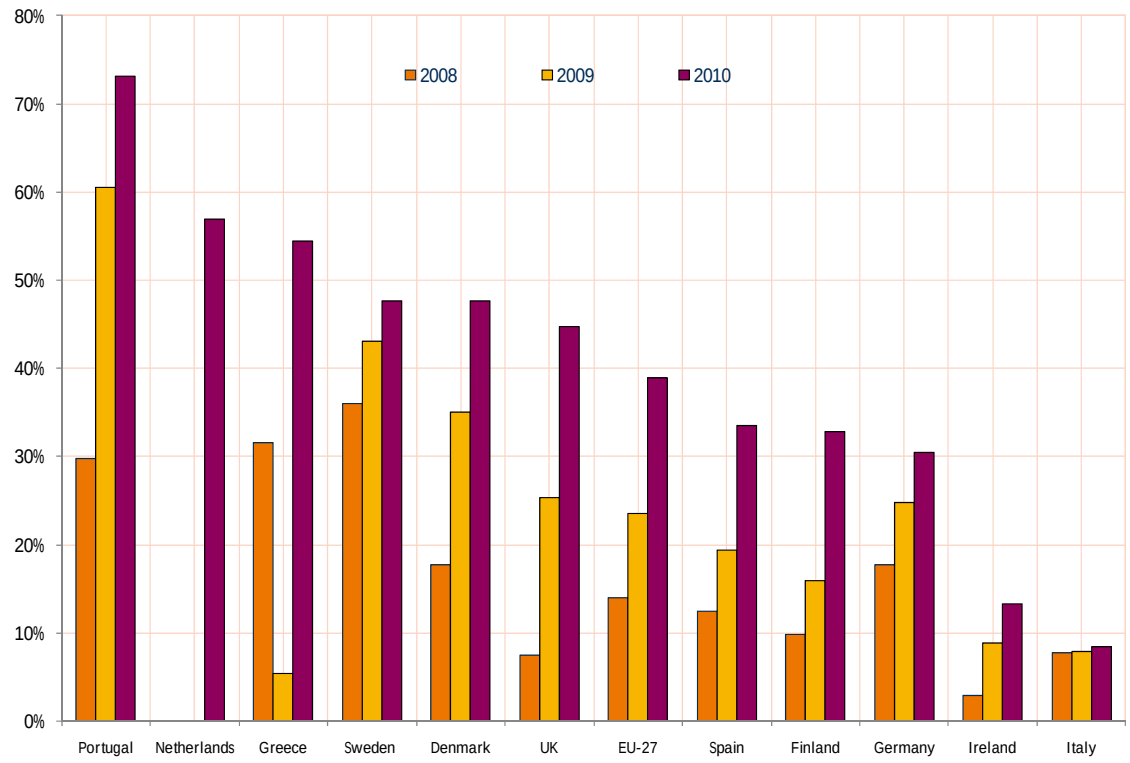
- Some of the best-performing countries such as Denmark, the Netherlands and South Korea have very high proportions of their populations living within urban areas (Figure 4). By contrast, Ireland has a relatively low proportion of people living in urban areas (62 per cent in 2009 compared to the OECD average of 77 per cent).
- In addition to having a relatively low urban population, the population density in Ireland is also low relative to other OECD countries; population density in Ireland is 64 inhabitants per square kilometre compared to 339 in Japan and 490 in South Korea where rollout of advanced infrastructure in significantly more advanced.

22 Mobile broadband connections are not included in this chart. Mobile connections tend to be higher in less densely populated countries. Data on urbanisation levels is for 2009.

3.3 Broadband speeds and costs

The availability of fast, competitively priced broadband services is vital for enterprise development. This section provides a comparison of the cost and speed of broadband services available to business customers.

Figure 5: Percentage of Fixed Broadband Lines with Speeds ≥10 Mbps, 2008- 2010[23]



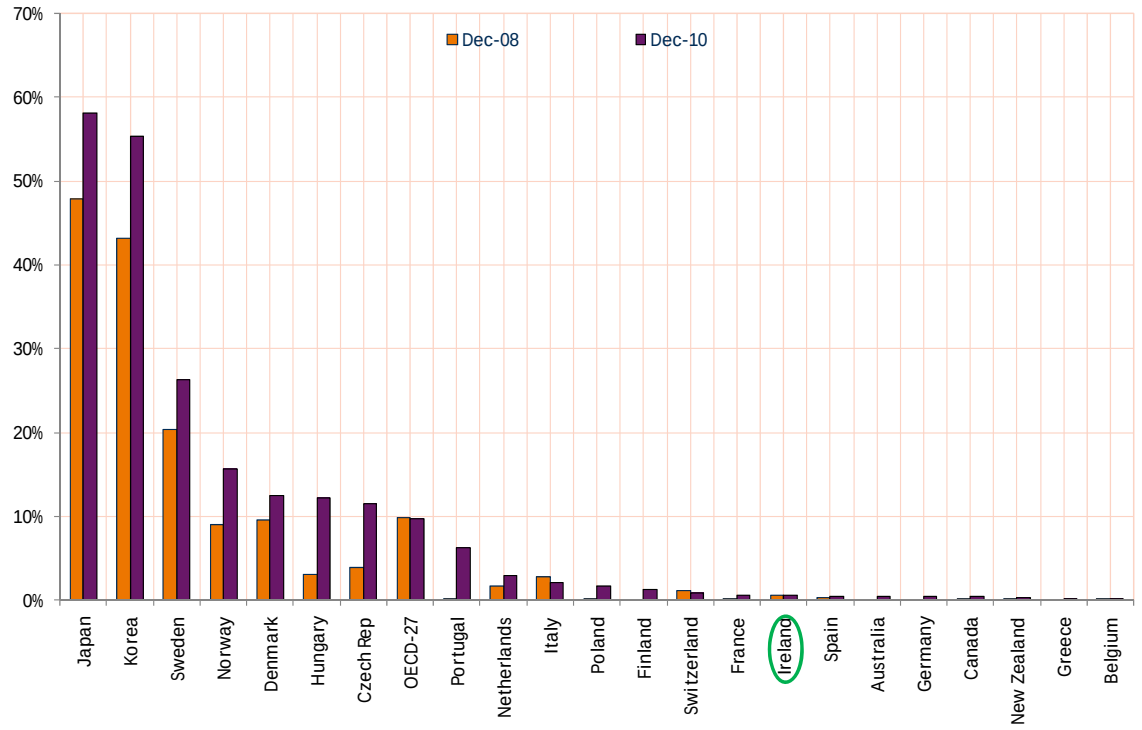
Source: European Commission Information Society: Digital Agenda Scoreboard, 2011

The European Commission in their 2011 assessment of the Irish telecommunications market concluded that '*…although increasing, broadband speeds are relatively slow in Ireland compared to other Member States.*' Across most EU countries, the majority of fixed broadband lines offer speeds of 2-10 Mbps. 70.5 per cent of fixed broadband lines in Ireland have speeds between 2 and 10 Mbps compared to an EU average of 47.8 per cent (Figure A4). In July 2010, the proportion of fixed broadband lines in Ireland with speeds at or above 10 Mbps was 10.8 per cent, a rapid increase on the 2008 performance (0.7 per cent) (Figure 5)[24]. By the end of 2010, this had risen to 13.4 per cent of fixed broadband subscriptions, below the EU average of 38.9 per cent[25]. Leading countries have a significantly higher proportion of fast speeds, 57 per cent of fixed connections have speeds at or above 10 Mbps in the Netherlands and 47.6 per cent in Sweden and Denmark. While a very high proportion of fixed broadband lines in Portugal (73.1 per cent) have speeds greater than 10 Mbps, it should be noted that the broadband penetration rate in Portugal (21.3 per cent) is low relative to the

23 Data for Netherlands is only available for 2010.
24 As UPC continued to upgrade its cable networks and rollout higher speeds during 2010, this may not be reflected in Figure 5 which is the state of play as of July 2010.
25 http://ec.europa.eu/information_society/digital-agenda/scoreboard/index_en.htm

OECD average (36 per cent).

Figure 6: Fibre Connections as a Percentage of Total Fixed Broadband Connections, 2008 and 2010

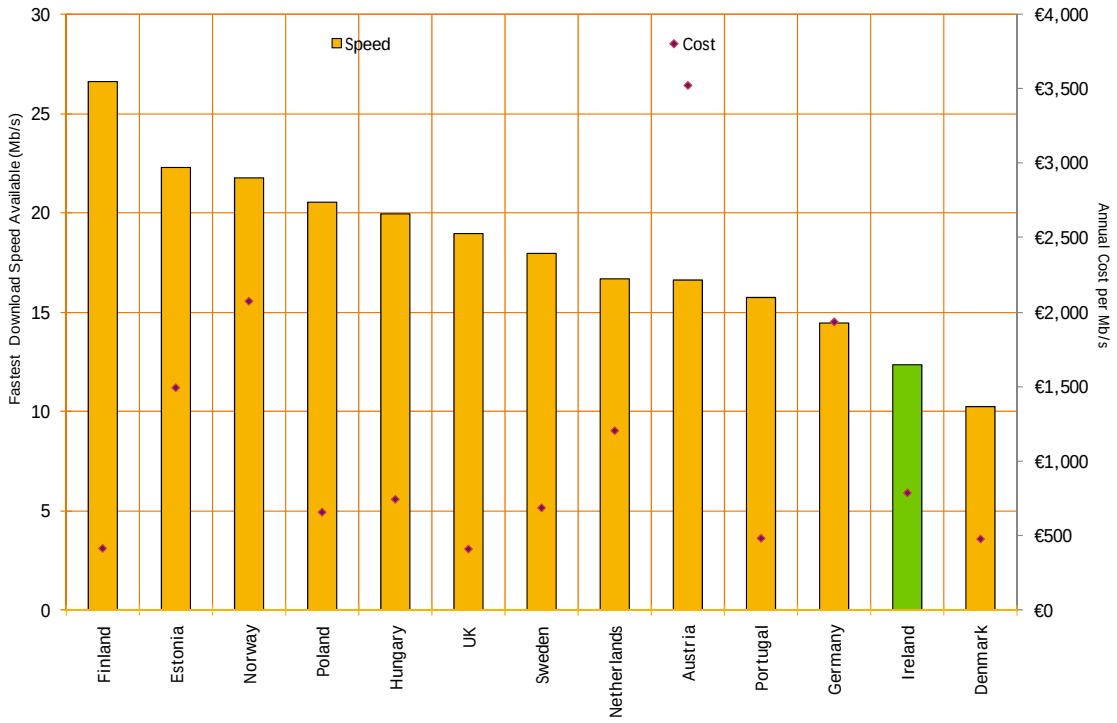


Source: OECD, Broadband Statistics

Fibre take-up as a percentage of total fixed broadband subscriptions is highest in Japan and South Korea (Figure 6). In Ireland, 0.6 per cent of fixed broadband connections are provided via fibre connections compared to 9.6 per cent of OECD-27 subscriptions[26]. There was no increase in the proportion of fibre subscriptions in Ireland between 2008 and 2010. This could be due to other fixed platforms (e.g. cable) increasing subscribers more quickly than fibre.

26 Fibre data is only available for the 27 OECD countries. Data is not available for Chile, Estonia, Israel, Mexico, Slovenia, the UK and the US.

Figure 7: Average Speed and Average Annual Cost of Business Broadband Service ex VAT, January 2011

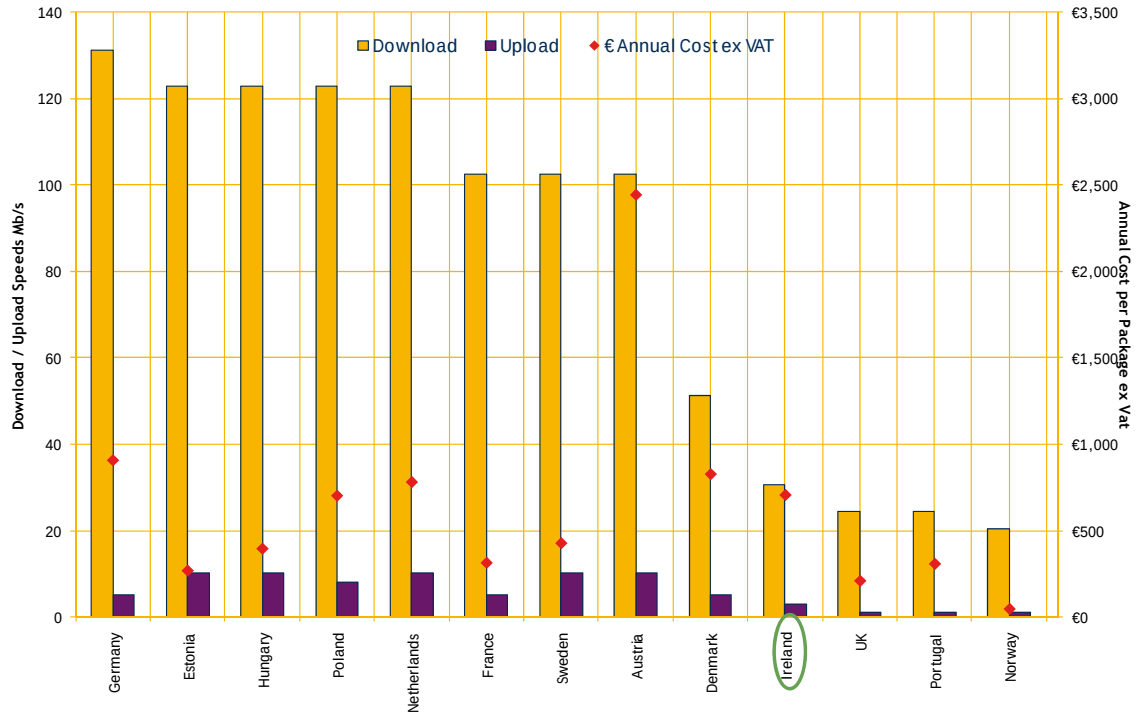


Source: Teligen, January 2011, Forfás calculations

Of the thirteen countries benchmarked (Figure 7), the average business package offered in Ireland is second slowest among the benchmarked group (12 Mbps)[27]. The average business broadband package in Ireland costs €785 (excluding VAT) per year, the fifth most expensive of the benchmark group.

27 For details of what is included in the Teligen dataset, see Appendix 1. The Irish operators covered by Teligen are Eircom, UPC, Vodafone, Digiweb and Imag!ne.

Figure 8: Fastest Business Connection and Annual Cost ex VAT, January 2011[28]



Source: Teligen, January 2011

Figure 8 shows the fastest download speed across all technology platforms available to businesses, the upload speed provided on this package and the annual cost of the fastest package. The fastest available speed is likely to be available in a limited number of areas in each country.

Of the thirteen countries benchmarked in January 2011, Ireland has the fourth slowest business broadband package available for both downloading (30 Mbps) and uploading data (3 Mbps). The fastest available business package (30 Mbps) in Ireland is provided by UPC and costs €706 ex VAT per year. Within the benchmarked group, the average annual cost of the fastest available business package is €641.

Looking at the incumbent telecom operator's fastest business speed (as it is likely to be the most widely available service in each country), Ireland has the third fastest of the benchmark group. Eircom offers a business service up to 24 Mbps, with an upload speed of 1 Mbps. However, as of January 2011 (when the Teligen data was compiled) the cost of the incumbent's fastest connection in Ireland (€1,440 per year, excluding VAT) compares poorly with competitor countries, including Finland (€737) and Portugal (€358) which offer similar

28 As the Teligen data is largely based on publicly available information on broadband services as of January 2011, UPC's 100 Mbps service is not included, as it was not listed among its service offerings on its website at the time. As of September 2011, UPC is offering business broadband services of 100 Mbps with a 7 Mbps upload speed for €1,200 per annum (ex VAT). We have not included this new, faster service in the chart, as the services offered in other countries may also have changed in the interim.

download and upload speeds (Figure A6). As of September 2011, the annual cost of the eircom 24 Mbps service was €1,032[29].

For ICT intensive sectors, advanced broadband services with very fast upload and download speeds are vital. Given the infrastructure investment required to deliver symmetrical broadband, these services are generally limited to areas of high population density. The highest symmetrical speed available in Ireland is a 12 Mbps service at a cost of €960 per year (excluding VAT). This is significantly slower than a number of other locations, which offer symmetrical services of 100 Mbps at a cost of between €606 (Portugal) and €3,436 (Hungary) per year (excluding VAT) (Figure A7).

29 In addition to the monthly fee of €65 for the 24 Mbps broadband service, customers also have to pay the monthly line rental of €20.96. Source: http://business.eircom.net/broadband/products/bb/20/

4. Where does Ireland need to get to?

In August 2010, the EU adopted the Digital Agenda which sets out a roadmap for developing a single digital market by 2020 to support sustainable long term economic growth and social progress[30]. The biggest challenge to achieving this objective is ensuring advanced telecoms services are widely available across all member states. To this end, the Europe 2020 Strategy set three targets for member states:

- **Access to basic broadband should be available to all citizens by 2013:** Ireland has made significant progress in ensuring near universal access to basic broadband. The recently completed National Broadband Scheme has supported the early achievement of this target.
- **Access to broadband with speeds of 30 Mbps or above should be available to all citizens by 2020**; and
- **50 per cent of European households should be subscribed to services of 100 Mbps or higher by 2020**.

Forfás is concerned that Ireland is not on the required trajectory, without further policy intervention, to meet the 2020 targets. While the take-up target for 2020 requires that 50 per cent of EU-27 households take-up high speed services and is not necessarily a target for individual member states, it is vital that Ireland aims to be among the leading countries. Ireland should pursue a strategy to ensure that at a minimum it reaches the 50 per cent target.

Failure to, at a minimum, achieve the EU 2020 targets will present a considerable risk to enterprise development in Ireland and the wider economy. Without rapid investment in advanced broadband services, Ireland will find it more difficult to attract foreign investment from data-intensive sectors and from global firms that want to support home working among their employees. In order for Irish enterprises to remain competitive, it will be important that they can trade efficiently in the global market place and achieve the productivity gains delivered by advanced broadband. In addition, given the challenging conditions currently facing the Irish economy, every effort should made to ensure Ireland exploits the public sector efficiencies and potential for economic growth, which are associated with advanced broadband infrastructures.

In terms of coverage, over 40 per cent of Irish homes have access to UPC's 30 Mbps services as of September 2011[31]. As mentioned in Section 3.1, eircom recently announced plans to deliver high speed services to 100,000 premises in the main urban centres by summer 2012. Wireless will have a role to play in achieving universal coverage of 30 Mbps by 2020.

30 http://ec.europa.eu/information_society/digital-agenda/index_en.htm
31 UPC is currently offering an upload speed of 3 Mbps on the 30 Mbps service and 7 Mbps on the 100 Mbps service.

The third EU 2020 target relates to broadband take-up. There is limited data available on the take-up of different speeds by household. However, according to ComReg, 14.2 per cent of total broadband subscriptions (including mobile) in Q2 2011 were to broadband services at or above 10 Mbps[32]. At the end of 2010, 13.4 per cent of fixed broadband subscriptions in Ireland were faster than 10 Mbps[33].

While, the advanced broadband needs of ICT-intensive enterprises are generally better met in the largest urban centres, many businesses, particularly SMEs, are located outside these centres and have restricted choice and limited access to good quality services. To ensure enterprise growth in these areas is not constrained by a lack of access to advanced broadband, Forfás proposes to focus the initial deployment of advanced broadband infrastructure in towns with populations greater than 1,500, which would enable coverage to be delivered to a significant proportion of enterprises and homes in Ireland within a relatively short time period. The Forfás advanced broadband vision, given its five year timeline, is less ambitious than the Digital Agenda 2020 targets and the broadband proposals outlined in the Programme for Government.

Forfás advanced broadband vision for Ireland

Within five years, Ireland will have an advanced broadband infrastructure comparable with our key competitors in all towns with a population greater than 1,500 (61 per cent of population), delivering download speeds of 100 Mbps or more, with significantly higher upload capability (including the widespread availability of symmetric services for enterprise) and low latency.

As enterprises generally tend to locate in urban centres, the Forfás advanced broadband vision focuses on delivering advanced broadband services to the main urban centres. However, to meet the EU Digital Agenda targets, Ireland will have to deliver 30 Mbps services everywhere by 2020, with 50 per cent of households subscribing to 100 Mbps or higher by 2020. A range of technologies, fixed and wireless are available to deliver on the EU targets.

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32 ComReg, Quarterly Key Data Report, Q2 2011
33 http://ec.europa.eu/information_society/digital-agenda/scoreboard/index_en.htm

5. How do we get there?

Despite good progress in the provision of basic broadband services, Forfás is concerned that Ireland is performing poorly in the rollout and take-up of advanced broadband services. Given the weak telecommunications investment climate in Ireland and the population profile, there is a strong risk that Ireland is likely to fall even further behind as other countries are moving ahead to deploy advanced telecoms networks.

From an enterprise and competitiveness perspective, there is an important commitment in the Programme for Government: *NewERA will co-invest with the private sector and commercial semi state sector to provide next generation broadband to every home and business in the State. This will be achieved by delivering fibre to the home or kerb for 90 per cent of homes and businesses in Ireland with the remaining 10 per cent provided with high speed mobile or satellite broadband*[34&35].

The optimal solution is that telecommunications market players undertake the necessary investment within the context of a supportive policy and regulatory framework. Given the scale of the investment required, it is accepted that there is likely to be market failure, particularly outside of the main urban centres. We need to act now to ensure that Ireland can provide advanced broadband networks and services on a par with competitor countries.

There are a number of actions that the State needs to progress immediately to support investment (whether private, commercial semi state and/or public) in advanced broadband networks. While these measures can improve Ireland's broadband performance, progress has been slow to date. In addition, although these measures are necessary to support investment in advanced broadband infrastructure and services, of themselves they are not sufficient to lead to widespread deployment.

5.1 Ensure a pro-investment regulatory framework

We need to ensure the regulatory framework incentivises investment, promotes competition and reduces rollout costs. In September 2010, the European Commission published its r*ecommendation on regulated access to Next Generation Access (NGA) Networks, which* seeks to ensure a consistent regulatory approach across member states to promote investment in advanced broadband infrastructure to meet the Digital Agenda targets[36]. Many EU member states have well developed regulatory frameworks in place to support the development of next generation access and can provide valuable insights on good practice in supporting

34 Government for National Recovery 2011 - 2016 Programme, March 2011.
35 Fibre-to-the home will deliver symmetrical speeds of at least 100 Mbps while fibre to the kerb has the potential to deliver speeds of up to 30 Mbps over different platforms such as cable, DSL and wireless.
36 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:251:0035:0048:EN:PDF As it is a recommendation and not a directive, the Commission document is non-binding but it should provide some increased certainty to infrastructure investors across the EU. It recognises that next generation access networks will be based on optical fibre. It is likely that some national regulators may decide to use these as guidelines rather than rules.

investment, competition and consumer interests in the move to higher speed services. The key regulatory actions required to support advanced broadband investment in Ireland are to:

- *Ensure regulatory certainty and an appropriate return on investment for private operators to incentivise investment:* Investment in advanced broadband networks is expensive and risky. Potential exists to increase allowable rates of return in order to spur additional investment where risks associated with advanced telecoms investment are clearly identified. In May 2011, ComReg issued a preliminary consultation paper to explore how the EU NGA guidelines should be applied to promote effective competition and efficient investment in Ireland. Among the issues discussed in the paper are the various mechanisms available (including a risk premium) to incentivise investment[37]. The impact of such measures on competitors and retail prices would also need to be assessed carefully;
- *Ensure wholesale access to a range of advanced products:* Following the 2010 market analysis by ComReg for wholesale access, eircom has SMP (significant market power) status for its copper and fibre access networks, which requires them to open these assets to others[38]. While ComReg has set out the principles that will apply to ensure wholesale access to next generation products and services, it is essential that specific obligations and remedies are put in place in a timely fashion to promote competition at the retail level[39]. As mentioned above, the publication of ComReg's preliminary NGA consultation is therefore welcome; and
- *Enable infrastructure sharing between telecommunication operators* as a means to lowering rollout costs while maintaining competition at the service level. Among the benefits of co-investment highlighted by the Commission in its 2010 recommendation on access to next generation access are that it can reduce both the costs and the risk incurred by an investor, thereby leading to more extensive deployment of fibre to the home. It also contended that networks based on multiple fibre lines are likely to lead to more timely and more intense competition in the retail market[40]. However, one of the challenges facing national regulators is to determine how to ensure co-financing operators can make a return on their investment while enabling new entrants access to the co-financed infrastructure.

5.2 Improve infrastructure planning

Planning policy has a key role to play in supporting the rollout of advanced broadband infrastructure by utilising existing infrastructure, mainstreaming the provision of ducting into State investment plans and lowering investment costs. Although the potential for these measures to support advanced broadband infrastructure rollout will be reduced given cuts in

37 http://www.comreg.ie/_fileupload/publications/ComReg1140.pdf
38The SMP status for eircom's fibre access network is to ensure that the deployment of next generation infrastructure on the incumbent's network does not lead to monopoly/bottleneck conditions over the access network.
39 For details on the principles to apply to ensure wholesale access, see ComReg, Market Review: Wholesale (Physical) Network Infrastructure Access (Document 10/39), May 2010.
40 Paragraphs 27 and 28 of the EC Recommendation on regulated access to next generation broadband.

Exchequer capital expenditure, Ireland has committed to capital investment of €16 billion between 2011 and 2014[41]. The planning measures that Ireland needs to progress include:

- *Mainstreaming access to public ducting and other infrastructure for fibre deployment:* Civil construction works typically represent up to 80 per cent of the total rollout costs of access networks. The mandatory provision of ducting as part of all State infrastructure development programmes, such as roads and rail, water network upgrades and sewage programmes, would support the development of an open access network. For example, in spite of the funding cuts, significant investment to upgrade the water networks in many urban centres is planned to reduce the current high levels of leakage. This provides an ideal opportunity to install ducting in these centres in a cost effective manner. Changes in the planning regulations should be introduced to compel the inclusion of ducting in all relevant public works.

  Local authorities can also promote the rollout of advanced broadband services by seeking to extend existing metropolitan area networks (MANs) to improve their reach. There is potential for the county/city executive (managers and directors of service) to take a more proactive and medium-term approach in their own infrastructure planning and to coordinate with the plans of other infrastructure providers such as telecommunications companies as they upgrade and maintain their networks in future. As previously recommended by Forfás, the MANs in Cork and Waterford should be extended to meet existing enterprise needs in key IDA industrial sites not currently connected to those MANs. Additional MANs should be built in a small number of outstanding National Spatial Strategy centres; namely Tuam, Castlebar, Ennis, Shannon, and Mallow;

- *Requiring the provision of ducting in new private developments (e.g. apartment blocks, offices)*: One of the actions identified in DCENR's 2009 policy paper to deliver next generation broadband is the requirement to have open access fibre connections installed for new residential buildings, where practicable[42]. DCENR recently published a consultation paper setting out non-mandatory recommendations for the provision of open access ducting in new residential developments[43]. Forfás is not convinced that a non-mandatory approach to the provision of ducting in new developments is sufficient to support national broadband policy objectives to deliver advanced broadband services at minimum cost to new homes. Forfás recommends that the installation of open access ducting in all new developments (residential and commercial) should be mandatory; and

- *Reducing the costs of building access networks:* The sharp downturn in the economy has lowered some rollout costs. The cost of civil engineering works in Ireland relative to the EU has fallen significantly during the recession[44]. However, administrative costs

41 Department of Finance, The National Recovery Plan 2011-2014, November 2010.
42 The paper states that it makes economic sense to wire a building for high speed technologies at new build stage rather than having to retro-fit, at greater expense. Source: DCENR, Next Generation Broadband – Gateway to a Knowledge Ireland, 2009.
43 DCENR, Consultation paper: Recommendations for Open Access Fibre Ducting and Interior Cabling for New Residential Buildings, March 2011.
44 In 2007, civil engineering construction prices fell from 22 per cent above the EU-27 average to seven per cent below it in 2009. Source: Eurostat, Investment Price Indices (statistics in focus 64/2010), 2010.

remain significant. Some costs are unavoidable – e.g. health and safety rules on guarding, lighting and signage in connection with civil works. There are a number of planning issues which should be reviewed with a view to minimising the cost of network rollout:

- Differences across local authorities in terms of charges and application processes for receiving permission to dig make it more expensive for operators to invest in upgrading their access networks. Local authority fee structures and processes should be harmonised to make construction of access networks easier and to reduce the cost and time for operators in dealing with the patchwork of local authorities individually;
- In addition to legal complexities, the bureaucratic obstacles and time involved in securing way leaves from different local authorities are an issue for operators. Steps need to be taken to minimise the administrative costs incurred by infrastructure providers by harmonising local authority fee structures and processes; and
- Existing planning rules do not facilitate the use of overhead networks - as opposed to underground ones. Only in rural areas or towns of less than 50 people is the provision of overhead networks generally allowed. This stems from individual decisions taken by local authorities, rather than national rules, but seems to be a nation-wide issue.

5.3 Promote demand stimulation

Supply side measures alone will not be sufficient to capture the full benefits offered by advanced telecoms services. The economic literature highlights that those countries/ companies who capture the productivity gains also need to invest in ICT, human capital and organisational change. The State has a key role to play in stimulating demand for advanced telecoms services:

- *The State sector should use its position as a leading purchaser of advanced broadband services to underpin demand aggregation strategies and support infrastructure investment*: Better use of ICT across government can radically improve the efficiency and effectiveness of public services and make them easier to access for citizens and businesses as well as offering significant cost savings. However, it will require the public sector to work in new ways, which will take time and resources to implement. Local government can also influence broadband deployment on a regional basis by aggregating its own demand for broadband services. In New Zealand, the government has established the *Common Framework for State Sector Broadband Aggregation* to provide a greater degree of alignment across the state sector when purchasing high speed broadband infrastructure[45].
- *The State can provide incentives for investment in ICT and skills development:* By creating conditions which encourage enterprises to invest in ICT, skills development

45 The New Zealand government has developed a National Broadband Map using Google Maps to provide broadband supply and demand information and tools to aid in demand aggregation and infrastructure planning. http://www.broadbandmap.govt.nz/map/

and organisational change in order to exploit the opportunities arising from advanced broadband services the State can help drive demand. Other countries are using various mechanisms to stimulate demand for advanced broadband services. For example, Sweden has introduced financial incentives and innovative financing schemes to promote take-up among end users[46]. Irish businesses, particularly SMEs, are not exploiting the full benefits of greater ICT use. The development agencies, the city and county enterprise boards (CEBs), business representative bodies and the telecom providers have a key role to play in creating greater awareness among SMEs of the benefits of more efficient ICT use (e.g. increased productivity, reduced costs). In addition to awareness raising, we also need to enable companies to use ICT more effectively. This will require investment in skills development and organisational change; and

- *Ireland needs to foster an e-payment friendly environment:* In particular, we need to rebalance stamp duty on cheques in favour of debit and credit cards and ensure that all State bodies' transactions are payable via electronic funds transfer. Although Ireland's use of electronic payments is rising, we still lag the EU average[47]. Ireland remains highly reliant on cash for payments; in 2009, the value of cash withdrawals at ATMs as a percentage of GDP was 15.9 per cent in Ireland compared to 9.9 per cent in the euro area-16[48]. Ireland, the UK and France are now the only significant users of cheques remaining in the EU but the number of cheques written in Ireland each year is declining; in 2010, the number of cheques was down 11 per cent on the previous year[49]. Annual savings of around €1 billion could be made if we switched from cash and cheques to electronic systems[50]. Greater efficiency in public service payments can also make an important contribution to the savings to be secured in the context of the current budgetary constraints[51].

46 A large proportion of the connection cost (around €1,800) is paid for by the end user. However, end users are provided with financing that allows such costs to be repaid over a period rather than as a one-off payment. Householders can also claim a tax refund of €530. This approach seems to have been successful, as over 83 per cent of homes are connected to the network and accessing services over it. Source: Analysys Mason, Final Report for the UK Broadband Stakeholder Group, 2008.
47 Irish Payment Service Organisation (IPSO) press release, August 2011.
48 NCC, Ireland's Competitiveness Scorecard 2011, July 2011.
49 IPSO, 2010 Annual Review, August 2011.
50 National Irish Bank, Target 2013: Modernising Payments in Ireland, September 2010.
51 Department of Finance, Circular 3/2009: Use of Electronic Payments by the Public Sector.

6. Role of the State in securing required investment

In many countries, the initial approach was for multiple network rollouts by the incumbent operators, alternative operators and often, as in Ireland, deployment involved public bodies[52]. The economics of rolling out networks is now necessitating increased coordination and collaboration in deployment and investment. A trend has emerged for increased commercial co-investment, public-private partnerships and efficiency enhancing policies and regulations (as outlined in section 5) that aim to reduce the build-out of duplicating networks.

The Programme for Government proposes that *'…NewERA co-invest with the private sector and commercial semi state sector to provide next generation broadband to every home and business in the State'*[53]. Collaborative models will be essential to delivering advanced broadband services in Ireland, whether through a strengthening of existing commercial arrangements and partnerships, strengthened collaborations or combining of existing activities of some operators. The experience of other countries is of such collaborative arrangements being developed for the provision of advanced infrastructures, so as to drive efficiencies in deployment, and for operators to compete vigorously in the provision of retail services.

6.1 What does the State need to do?

If the market does not deliver in a timely fashion, the State will need to intervene to ensure that Ireland has the advanced broadband services to allow the enterprise base to compete successfully in international markets. In developing a next generation broadband infrastructure, the key objectives for Ireland to meet current and future needs of the country and to catch-up with other EU member states should be:

- High speed – download speeds of at least 100 Mbps of non-contested broadband, with significantly higher upload speeds (including the widespread availability of symmetric services for enterprise);
- Low latency – the speed of response of the system to the user (e.g. video lag);
- Open access – choice of service providers and economies in investment; and
- Covering all towns above 1,500 population within five years.

Given the timescales involved in the planning, design and financing of the rollout of advanced broadband services, as a first step, the State needs to progress the development of an advanced broadband deployment plan quickly. In this regard, Forfás welcomes the establishment of the Next Generation Broadband Taskforce and its focus on identifying industry, private and public, investment plans. The work of the taskforce should be helpful in informing Government decisions on appropriate targets and programmes to ensure Ireland

52 The public bodies involved vary by location to include federal governments, municipal authorities, and commercial semi state firms.
53 IBEC's Telecommunications and Internet Federation (TIF) estimates that it will cost €2.5 billion to achieve 90 per cent coverage with a combination of fibre and wireless.

delivers advanced broadband services and is among the leaders in the EU. The mapping of existing telecommunications networks and committed investment plans to identify deficits is an essential first step in the process. As well as identifying areas that will not be served in the context of meeting the EU target of 100 per cent availability of 30 Mbps services by 2020, this exercise should also determine the quality of existing and planned services in the main urban centres (e.g. minimum upload and download speeds, latency, contention). In addition, it is critical that the work of the taskforce is time-bound and that decisions on what Ireland needs to do to achieve its digital potential and targets are taken quickly.

To facilitate the rapid deployment of advanced broadband services in all urban centres with a population greater than 1,500, the State needs to:

- Design a competition/process for a collaborative approach with the industry players (private and/or commercial semi-state) to determine the level of market interest in addressing the gaps. This competition/process, mirroring earlier State interventions to support investment in international, regional, city and rural broadband networks, should be time-limited to demonstrate the State's seriousness in meeting its ambitious broadband goals (see Textbox 1 for an overview of previous State interventions in the telecommunications market)[54]; and
- If the competition/process is not successful in leveraging investment from the market players to support the State's broadband objectives and targets, progress with a State asset collaboration approach using the existing state telecommunications infrastructure. In this context, Forfás has examined in detail how such a State asset collaboration could deliver advanced broadband services to all towns with a population above 1,500. It is critical that Government makes a firm commitment to support the achievement of the goals set out in the Programme for Government, and sets objectives and targets to ensure the timely delivery of advanced broadband services. The level of funding required will depend on the degree to which the market players can invest and how the deployment of advanced broadband infrastructure is phased.

This paper's primary focus is to ensure that the advanced broadband current and future needs of the enterprise base are met. Enterprises generally tend to locate in urban centres so the Forfás advanced broadband vision focuses on delivering advanced broadband services to all towns with a population greater than 1,500. However, to meet the EU Digital Agenda targets, Ireland will have to deliver 30 Mbps services everywhere by 2020, with 50 per cent of households subscribing to 100 Mbps or higher by 2020. Given Ireland's spatial patterns and low population density, wireless solutions will have a key role to play in reaching universal coverage as it will not be possible to deploy fixed advanced broadband infrastructure everywhere (e.g. fibre). The planned spectrum auctions in early 2012 will be key to ensuring that wireless can play a strong role in the delivery of high speed broadband services, particularly in rural areas.

54 See text box for details of previous State interventions.

Textbox 1: History of Previous State Funding Interventions in the Telecoms Market

Global Crossing International Connectivity[55]

Objective: To provide world class competitively priced international connectivity to Europe and to the US to facilitate the development of Ireland as a significant centre for e-business.

Cost to the State: €177 million.

Overview: Following a competitive process, a contract was signed with Global Crossing Limited in 1999 for a significant block of fibre-optic links to a number of European cities and New York[56]. To deliver the required capacity, Global Crossing constructed two submarine cables from Ireland to connect to its global network. It also constructed two international points of interconnectivity at City West and Kilcarbery in Park West, Dublin. The contract was renegotiated in 2002 to cover more than 50 cities internationally (including Asia) at no additional cost to the original contract.

Metropolitan Area Networks (MANS)

Objective: To accelerate the provision of, and access to, broadband services outside of Dublin.

Cost to the State: €85m for Phase I and €89m for Phase II. Eligible for grant aid of 40-50% from the EU (ERDF).

Overview: Fibre optic rings were constructed in 93 towns between 2003 and 2008 and are operated on an open access basis. Phase 1 of the MANS (27 towns) was completed in 2005 while Phase 2 was completed in 2008 and commenced operations in 2010. The MANs are managed, operated and maintained on DCENR's behalf by e-net. To date 49 of the MANs are operational. Where operational, they have delivered a wider range of offerings and higher speeds. A Value for Money and Policy Review of the MANs programme has recommended a more targeted approach to MANs investment and options for a further MANs programme are being considered in this context[57].

Group Broadband Scheme (GBS)

Objective: To use State funding to encourage internet service providers (ISPs) to provide access to broadband to communities of less than 1,500 people that were without broadband coverage.

Cost to the State/EU: A total of €25 million was allocated to the GBS from the NDP and European Regional Development Fund (ERDF) sources, but only €5.35 million was awarded[58].

Overview: The GBS was launched in March 2004, aimed at providing broadband access. The State would enter into partnerships with local communities (represented by voluntary groups) and internet service providers (ISPs) and would provide up to 55 per cent of the capital expenditure associated with the provision of the service. There were two calls for proposals and 133 schemes were approved. A third call was due to take place in December 2006, but this was cancelled in favour of a more direct method of provision, the National Broadband Strategy (NBS).

National Broadband Scheme (NBS)

Objective: To deliver broadband (min of 1 Mbps) to certain target areas in which broadband services were deemed to be insufficient.

Cost to the State/EU: The State and EU contributed €80m to the project, of which €72m has now been spent.

Overview: Following the conclusion of a competitive tendering process, the contract for the NBS was awarded to "3" (Hutchison Whampoa company) in December 2008. Under the contract, 3 is required to provide services to all premises in the NBS area who seek a service[59]. In order to facilitate competition, 3 is also required to provide open access to the NBS network. The rollout of the NBS advanced incrementally over a 22 month period and was completed in October 2010. In line with the NBS contract, broadband services are now available to all premises within each of the 1,028 designated NBS Electoral Divisions.

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55 More recently, Project Kelvin, which provides direct international connectivity between the north west/border regions and New York and Amsterdam was completed in 2010. It involved private investment of €40m and €30m of public funding (75 per cent from EU/Interreg and the rest from DCENR and the Department of Enterprise, Trade and Investment in Northern Ireland. http://www.dcenr.gov.ie/Press+Releases/2009/Major+milestone+reached+in+Ireland-US+Telecoms+Link.htm

56 DCENR had responsibility for the project, and it was managed through an inter-departmental /agency task force.

57 VFM review of MANS Phase 1: http://www.dcenr.gov.ie/NR/rdonlyres/D4A1A712-1DD1-467B-97C8-EB4C33016683/0/VFMPRofPhase1MetropolitanAreaNetworks.pdf

58 A VFM review of Group Broadband Scheme was undertaken: http://www.dcenr.gov.ie/NR/rdonlyres/C416A8E5-8B7F-49B1-8270-C19913D6A297/0/GroupBroadbandSchemeVFMPR.PDF

59 1,028 designated NBS Electoral Divisions were identified.

6.2 Cost of deploying advanced broadband infrastructure

Forfás has undertaken detailed analysis to estimate the cost of rolling out advanced broadband services in Ireland. The assumptions underpinning the costings summarised in Table 1 are set out in Appendix 3.

Internationally, the deployment of fibre optic networks to the cabinet and to homes and businesses is regarded as the ultimate technological next generation broadband solution[60]. Fibre investments, spurring competitive services with cable and other platforms, are already delivering higher speed services in most EU member states and to domestic customers in Singapore and Tokyo. While commercial operators may employ a range of technologies to meet commercial and technological needs, it would be most prudent if the State is investing that it invests in the most future proofed technology that can utilised by all communications services providers on an open access basis. Fibre is considered a one-off investment that can be exploited for the next 30-40 years.

Table 1 sets out, in each column, the estimated investments required for all towns with population greater than 1,500, for Dublin only, for the gateways and hubs, for all towns with MANs (excluding Dublin) and the investment required for all towns where UPC is not present with a cable network currently. Table 1 is based on the investment required for the rollout of point-to-point (P2P) networks. A comparison of P2P networks and passive optical networks (PON) is outlined in Appendix 3. The table provides also a breakdown of the investment required for provision of fibre to the cabinet/kerb and for the provision of fibre to all businesses/homes in the key centres. As noted above, the necessity for public intervention in terms of support will be determined by a competition or mechanism to test the level of market interest and how the deployment of advanced broadband infrastructure is phased.

60 The OECD and the European Commission see fibre as the most future proofed technology to deliver very fast broadband services in member countries. Sources: OECD, Developments in Fibre Technologies and Investment, 2008; European Commission, Recommendation on Next Generation Access (NGA), September 2010, (which sets out measures for national regulators to foster the deployment of next generation access networks based on optical fibre).

Table 1: Summary of the Estimated Costs of Deploying Advanced Broadband Services

Scheme	All towns with a population >1,500	Dublin	Gateways & Hubs (incl. Dublin)	All MAN towns (excludes Dublin)	All towns less Cable
% of total population	60.7	27.5	40.9	24.9	19.5
No. of residential connections	913,227	413,094	619,762	374,360	292,525
No. of business connections (at 13.7% of households)	125,197	56,632	84,965	51,322	40,103
Total connections (No.)	**1,038,424**	**469,726**	**704,727**	**425,682**	**332,628**
Cost of FTTC[61] (€ bn)	1.22	0.51	0.78	0.50	0.43
Additional cost of FTTH[62] (€ bn)	0.61	0.27	0.41	0.26	0.21
Cost of FTTH (€ bn)	*1.83*	*0.78*	*1.19*	*0.76*	*0.64*
Backbone access (€ bn)	0.40	0.02	0.05	0.24	0.35
Total Capex	**€2.23bn**	**€0.80bn**	**€1.24bn**	**€1.00bn**	**€0.99bn**

The advanced broadband vision outlined by Forfás in this report is to deploy advanced broadband services to all towns with a population greater than 1,500 within five years. However, given the constraints on Exchequer funds and the challenges in raising private investment that currently exist, a phased build-out programme may be required in the immediate term.

If the State is investing in advanced broadband services, it will have to choose a technology. As fibre is regarded as the most future-proofed solution, the Forfás costings look at the cost of deploying fibre to the cabinet and home. The investment required for rolling out fibre to all premises in those towns with a population greater than 1,500 is estimated to be €2.23

61 Cost of Running Fibre past the Building
62 Connecting Fibre from curb to building – assumes a loop of 25 metres

billion and for deploying fibre to the cabinet is €1.62 billion[63] (Table 1). The level of funding required to rollout fibre to the cabinet and/or to the premises will depend on the extent of the advanced broadband deficits identified by the mapping exercise. In addition, the estimated costs do not take account of the potential efficiencies and savings that would likely accrue in the current environment of significant spare capacity in the civil engineering and construction sectors and of the economies of scale achievable from a large scale deployment programme. Running cables overground on electricity or telecommunications poles is also likely to be significantly cheaper.

Given the constraints on Exchequer funds and the challenges in raising market investment that currently exist, as part of a concrete overall rollout plan, a phased build-out programme may be required in the immediate term - for example focusing in the first instance on identified deficits in the National Spatial Strategy (NSS) centres, where there is significant existing and potential demand (enterprise and residential) and the MAN towns where there is existing infrastructure that can be extended. The accelerated rollout of advanced broadband services to all premises in the NSS centres would require an estimated investment of €1.24 billion (of which €800 million would be required to deploy fibre all premises in Dublin). Deploying fibre to the cabinet in all NSS centres (including Dublin) would cost approximately €780 million.

6.3 Addressing the challenges to delivering advanced broadband services

There are two significant issues Government needs to overcome before progressing: financing and State aids.

6.3.1 Financing sources

Given the constraints on Exchequer funding, the State will need to consider other funding mechanisms, which could include:

- NewERA and coordinating infrastructure investment - the recently established NewERA will have responsibility for water, broadband and energy investment. Subject to the agreement of the Troika, it is proposed that NewERA will use proceeds from the sale of State assets and existing National Pension Reserve Fund resources to work with relevant government departments and the private sector to develop and implement proposals for commercial investment in line with Programme for Government commitments in energy, water and broadband[64]. NewERA will also identify possible synergies between the investment programmes of different State companies. This offers significant potential to exploit costs savings. For example, from coordinating water network investment and fibre deployment, as up to 80 per cent of the costs of telecoms infrastructure rollout are civil works. Some of the costs of deploying advanced broadband services could also be shared with the deployment of other State

63 This is the cost of backbone access (€0.4 billion) and the cost of FTTC (€1.22 billion)
64 http://www.taoiseach.gov.ie/eng/Government_Press_Office/Government_Press_Releases_20111/NewERA_and_the_Strategic_Investment_Fund_Establishment_and_Appointment.html

infrastructure such as the electricity transmission and distribution upgrade programme, smart electricity metering, water metering and smart transport;

- European Investment Bank (EIB) – the EIB has provided part funding (up to 50 per cent of the cost) to a number of high speed broadband public private partnership (PPP) projects in other countries. Average annual lending from the EIB for broadband projects averaged €1.1 billion over the past decade. However, EIB financing for broadband infrastructure projects has increased significantly during the global recession. In 2009, the EIB provided approximately €2.3 billion for broadband infrastructure projects across a range of technologies (e.g. fibre, wireless) and €2.5 billion in 2010[65]. These are to semi-state companies, governments and the private sector.
- Connecting Europe Facility (CEF) – in October 2011, the European Commission announced plans to fund a €50 billion investment to improve Europe's transport, energy and digital networks. It proposes a €9.2 billion fund to support investment in fast and very fast broadband networks and pan-European digital services between 2014 and 2020; at least €7 billion would be available for investment in high speed broadband infrastructure to meet the 2020 Digital Agenda targets. It is proposed that the CEF funding, which would include equity and debt instruments and grants, would leverage other private and public money, by giving infrastructure projects credibility and lowering their risk profiles. The Commission estimates that the broadband network infrastructure finance could stimulate investment worth more than €50 billion[66]; and
- Bond financing – funds could be raised directly in the capital markets from investors (e.g. investment funds, pension funds) who buy a bond bearing a fixed rate of interest. There continues to be a high level of financial market interest in telecommunications investments generally[67]. In the current context of Irish Government bond issuance, raising finance from financial markets might best be pursued by NewERA, together with relevant commercial semi-states that are pooling telecommunications infrastructures and the State owned MANs, raising the required finance for advanced broadband investment and asset development.

6.3.2 State aids

In 2009, the European Commission published guidelines for the assessment of State aid applications relating broadband deployment[68]. The primary objective of the broadband guidelines is to foster a wide and rapid rollout of broadband networks while at the same time preserving the market dynamics and competition in a sector that is fully liberalised. Since the introduction of the broadband guidelines in 2009, State aid for broadband in the EU has increased significantly. In 2010, there was a total of €1.8 billion in public funds invested; more than four times that in 2009.

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65 http://www.eib.org/

66 For more details see:
http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/11/709&format=HTML&aged=0&language=EN&guiLanguage=en

67 Vodafone has a notes issue programme up to 2032 for up to £12 billion (sterling).

68 European Commission, Communication on Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks (2009/C 235/04), September 2009.

The primary objective of State aid control is to ensure that government interventions do not distort competition and trade inside the EU. State aid is defined by the European Commission *as an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities. Therefore, subsidies granted to individuals or general measures open to all enterprises […] do not constitute State aid.*

Textbox 2: How other EU States are delivering advanced broadband services

France: The European Commission has specifically approved a plan for the nationwide rollout of fibre networks. There are four axes to the French strategy:

- *Call for interest from operators in areas not requiring public aid;*
- *Experimental deployments outside of densely populated areas, some of which were launched in 2010;*
- *Provision of public long term loans and official labelling to stimulate NGA investment in 'profitable' areas; and*
- *Subsidies for projects in remaining areas initiated by local authorities, typically in the form of public and private partnerships.*

To support NGA rollout, France has established a national credit programme of €2bn, of which €1bn is to support profitable areas and €750m to remaining areas and €250m for other solutions, such as satellite, cable etc. The French government estimates that to deploy fibre to 80 per cent of the population would cost an estimated €15bn, with €6bn of public funding required.

Sweden: Under the government's broadband strategy, market players are to ensure, in principle, the delivery of the national objectives for broadband rollout. This includes municipalities and other regional players that have been investing in networks over the last decade – indeed the share of publicly-owned fibre-base infrastructure is high and equivalent to that of the incumbent.

Portugal: In 2009, the government issued five tenders for NGA deployment in 139 municipalities in rural areas, to provide a minimum of 40 Mbps to 50 per cent of the population in the area and the total funding provided was €182m, of which €106m is from EU funds. Legislation with supporting measures including in-building infrastructure, non-discriminatory access to poles, ducts and other public infrastructures, tax measures and public tenders in underserved areas was also introduced. A review of these measures in February 2011 showed Government initiatives and regulatory measures were having an impact.

Estonia: Under a new strategy, EstWin, the government and telecommunications companies plan to invest €300m (€200m private, €100m public) to build a country-wide broadband network capable of delivering 100 Mbps to the majority of Estonian households and business by 2015. To deliver the network a new non-profit organisation was established in 2009 called the Estonian Broadband Development Foundation. It was approved under EU State Aid rules in 2010 and aid is to be provided in the form of grants.

The broadband guidelines outline the rules and conditions on how public funding could be provided to build broadband networks in line with the EU State aid rules:

- The guidelines allow for public funds to be channelled for the deployment of basic broadband networks as well as next generation access (NGA) networks to areas where market operators do not invest;
- The guidelines distinguish between competitive areas ("black" areas), where no State aid is necessary and unprofitable or underserved areas ("white" and "grey" areas) in which State aid may be justified, if certain conditions are met;
- This distinction is then adapted to the situation of NGA networks (whose deployment is still at an early stage) by requiring member states to take into account not only existing NGA infrastructures but also concrete investment plans by telecom operators to deploy such networks in the near future; and
- A number of safeguards (such as detailed mapping, open tender, open access obligation or technological neutrality and claw-back mechanisms) are laid down in the guidelines in order to promote competition and avoid the 'crowding out' of industry investment.
- In addition, the NGA network should provide universal connectivity to all users in a given area, residential and business users alike.

The Commission acknowledges that although investments in advanced broadband networks should primarily be driven by market operators, State aid can play a crucial role in extending broadband coverage in areas where market operators have no plans to invest. As mentioned above, there is precedence for State intervention to support advanced broadband deployment[69]. A number of other member states have agreed collaborative public-private support frameworks to deliver advanced broadband services in recent years (see Textbox 2). A recent OECD report also highlighted that in addition to privately driven investment, there are many publicly funded interventions in OECD countries, either underway or planned, to accelerate advanced broadband deployment[70]. Any proposal, which requires partial or full State intervention, will have to be discussed in detail with the Commission.

6.4 State asset collaboration approach

Forfás' preference is that the market players, public and private, invest in providing advanced broadband services (either on their own or as part of a collaborative arrangement) in those areas where gaps have been identified as part of the mapping process mentioned in section 6.1. However, if the industry does not invest, the State will need to take the lead to ensure the delivery of advanced broadband services itself. The vehicle or structures required to allow the State to undertake such a role are best decided when it is clear what the gaps are. It could be done under NewERA or managed by a new State entity with responsibility for broadband investment under the auspices of NewERA. While NewERA will operate initially on

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69 A list of Commission decisions on State aid to broadband are available at: http://ec.europa.eu/competition/sectors/telecommunications/broadband_decisions.pdf
70 OECD, Fibre Access: Network Developments in the OECD Area, June 2011 (see Table 3).

a non-statutory basis as a shareholder executive within the National Treasury Management Agency (NTMA), it is proposed that it will become a full holding company status, which could own the shares in commercial semi-states.

Existing State telecommunications assets that fall within the ambit of commercial semi-states and public authorities, including the MANs, could be combined under a common arrangement, managed by NewERA (a list of the existing State assets is available in Appendix 2)[71]. An alternative would be a shareholding model where the existing State assets would be valued and shareholdings distributed accordingly, providing negotiations for such an arrangement did not lead to significant delays in the rollout of advanced broadband services in Ireland.

Other countries have used variations on the NewERA model to accelerate the delivery of advanced broadband services. However, facilitating the rollout of the advanced broadband infrastructure on its own is not sufficient to allow businesses and households to exploit the full benefits. Demand stimulation measures will also be required to ensure the effective use of ICT (as outlined in Section 5.3). Measures to stimulate demand will be particularly important in the residential sector where early indications from other countries are that take-up is slow.

A number of examples of collaborative models involving the state are outlined below. In the Netherlands, which is already among the leaders in advanced broadband services, in 2010 the government's broadband taskforce recommended that progress be accelerated by organising and coordinating cooperation with municipal and regional authorities. This built on the initial joint venture of 2008, in which the incumbent participated with other operators and municipal authorities, to progress the rollout of advanced broadband services in Amsterdam, namely the Citynet project. In Amsterdam, BBNed manages the passive network and owns and operates the active layer of the network and provides wholesale services to third party operators and service providers. The Dutch regulator has also made a number of important competition enhancing decisions, including the decision to provide unbundled access to fibre in industrial parks in 2010.

In Estonia, under a new strategy, EstWin, the government and telecommunications companies plan to invest €300 million (€200 million of private investment and €100 million of public funds) to build a country-wide broadband network capable of delivering 100 Mbps to the majority of Estonian households and businesses by 2015. To deliver the network, a new non-profit organisation was established in 2009 called the Estonian Broadband Development Foundation. It was approved under EU State aid rules in 2010, and aid is to be provided in the form of grants.

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71 A number of maps depicting the supply of fibre by the State-owned companies have been prepared by the DCENR and are available on their website.
http://www.dcenr.gov.ie/Communications/Communications+Development/Next+Generation+Broadband/Next+Generation+broadband.htm.

In Denmark, fibre rollout was initially by the incumbent and by regional energy companies. Energy companies have continued to invest in fibre rollout, focusing on the delivery of 100 Mbps. In 2010, 15 of these electricity companies established a joint broadcast content provider, using their own fibre networks and those of the incumbent to deliver nationwide internet and TV content.

In the case of Singapore, following a government decision, in 2009 Nucleus Connect was incorporated as Singapore's official Next Generation Nationwide Broadband Network (Next Gen NBN) operating company. It is responsible for designing, building and operating the world's first open access ultra high speed fibre network, providing non-discriminatory wholesale access services to retail service providers. The fibre based network deployment had covered 60 per cent of all homes and buildings by end 2010 and is on track to achieve a target of 95 per cent nationwide coverage by 2012. Commercial services were launched on the network in August 2010, with service providers providing retail services ranging from 100 Mbps to 1 Gbps. On launch in August 2010, five alternative retail operators had agreements to interconnect and provide services over the NGNBN, including the two main incumbents SingTel and Starhub. The operators launched a range of new retail content and media services using the next generation network, with SingTel providing 200 Mbps service for €53 per month and another operator providing a 1 Gbps service for €224 per month. However, early indications are that take-up is slow.

6.4.1 Financial appraisal

Forfás has developed a financial model to assess the commercial viability of deploying advanced broadband services to all towns with a population greater than 1,500. As fibre is regarded as the most future-proofed solution for delivering advanced broadband services, the Forfás work looks at the cost of deploying fibre to the cabinet and home. Under the various assumptions set out in Appendix 3, the proposal breaks even at a take-up rate of 22.5 per cent in year 5, 50 per cent in year ten, and 70 per cent in year 30[72]. This means that at demand levels below 22.5 per cent in year 5, State funds would be required to finance the model as it would not be commercially viable.

Forfás has undertaken a sensitivity analysis for the proposal (based on the assumptions set out in Appendix 3) showing the impact of higher demand ramp-up by consumers on the business case and a break-even point as the lower bound. The demand ramp-up rate is presented as a percentage of population covered by the scheme rather than a percentage of total population.

72 For simplicity, the population has been kept constant at the 2006 Census results. However, this assumption is sufficient for this stage in project appraisal as this is a conservative approach and, therefore, underestimates the growth in demand and revenue.

Table 2: Results of Sensitivity Analysis[73]

All Towns with Population over 1,500	Financial Net Present Value - discounted to 2010, € million	Financial Internal Rate of Return, %
Base Case (25% demand in Y5)	16.6	11.5
Higher Demand Ramp-up (35% demand in Y5)	146.6	22.9
*Break-even point (***22.5% demand in Y5)**	0.0	10.0
Lower Demand Ramp-up **(15% demand in Y5)**	-48.4	Not calculable

While there is likely to be strong demand for advanced broadband services by enterprise in the short to medium term (section 2), residential demand for advanced broadband services is likely to ramp up at a slower rate, at least in the short term.

That said, demand for higher speeds (above 10 Mbps) is growing across Europe and other countries, where such services are being provided (Figure 5 in Section 3.3). However, the European Commission's recent report on telecom developments in Ireland concluded that *'…although increasing, broadband speeds are relatively slow in Ireland compared to other Member States[74].'* While recognising that trials for next generation networks are being undertaken by eircom in Ireland *'…the prospects for NGN remain uncertain'*[75]. This is in the context of other EU countries having plans and/or deploying advanced broadband networks. In assessing the likely demand for advanced services in Ireland, it is important to look at developments in other comparator countries to understand the potential demand. In a range of countries with high speed services as a result of fibre deployment, VDSL rollout and cable upgrades, the demand for higher speed services is increasing quickly. For example:

- Belgium as of January 2010, had 41 per cent of broadband lines with speeds of 10 Mbps and higher, while by January 2011, demand for high speeds ramped up again and 26 per cent of subscriptions were at 30 Mbps and above;
- In Denmark as of January 2010, 42.7 per cent of connections were at speeds of 10 Mbps or more, up from 35 per cent in January 2010 and eight per cent of connections were via fibre;
- Sweden had 47.6 per cent of broadband connections at or above 10 Mbps in January 2011, an increase from 43.1 per cent in January 2010, with the European Commission noting that *'…increased rollout of fibre networks was leading to faster broadband speeds…*' in Sweden. Fibre currently has a 24.4 per cent share of the fixed broadband market, moving ahead of cable which had a 20 per cent market share in January 2011;

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73 For details of the different demand scenarios and the assumptions underpinning the model, see Appendix 3.

74 European Commission, Report on telecom regulatory developments in Ireland, May 2011. http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/regulatory/ie_reg_dev_2011.pdf.pdf

75 It should be noted that the European Commission report was completed in early 2011 and does not take account of recent investments by UPC and the higher speeds now on offer.

- In Luxembourg, which wants to be the first 'fibred' country in the EU, take-up of services of 10 Mbps and above increased from 7.9 per cent in January 2010 to 27.4 per cent in January 2011, with the incumbent deploying fibre to homes. Luxembourg has an objective to have 100 Mbps available to 80 per cent of population by 2015;
- Latvia, where fibre now accounts for 17.7 per cent of broadband lines, take-up of services of 10 Mbps and above doubled for the second successive year, from 20.7 per cent in January 2010 to 41.3 per cent in January 2011;
- In Lithuania, fibre coverage has been expanded to more than half of the population. Fibre to the building/home currently accounts for 44.3 per cent of broadband lines, followed by 31 per cent for DSL and seven per cent for cable in Lithuania. Demand continues to grow with take-up of 10 Mbps and above services increasing from 26 per cent in 2009 to 41.9 per cent in 2010.

In the case of Ireland, the share of fixed broadband lines at 10 Mbps and above increased from 8.9 per cent in January 2010 to 13.4 per cent in January 2011; the EU average is 38.9 per cent of subscriptions are 10 Mbps and above in January 2011, up from 23.4 per cent in January 2010.

Innovation in services to use the available capacity is increasing also. The services range from IPTV to online gaming and now the advent of cloud computing. In the context of the anticipated rapid growth in demand and the need to ensure the required infrastructures are widely available, most EU countries have specific targets for the 2013 to 2015 timeframe to deliver high speed symmetric access in the 100 Mbps range, and for 1 Gbps access by 2020. Many of our competitor countries have mapped developments and have plans in place, together with initiatives to ensure pro-investment policy and regulatory environments and, in recognition of the technological and market risks, to provide support for collaborative public-private investments.

Among the countries with which we compete for foreign investment, in particular for internet content and games related businesses, such as Luxembourg and the Netherlands, the rollout of advanced services is progressing rapidly. Among newer competitors, such as Estonia, the government's strategy commits that all homes and offices will be connected on request to a network permitting connections of up to 100 Mbps. The Swedish government's broadband strategy commits to providing 100 Mbps access to 40 per cent and 90 per cent of households and business by 2015 and 2020 respectively. Outside of the EU, other small countries such as Singapore have set objectives to provide speeds of between 100 Mbps and 1 Gbps over fibre to 95 per cent of buildings and homes by 2012 and had achieved 60 per cent coverage by the end of 2010.

7. Conclusions

Advanced broadband services are crucial to achieve the productivity growth necessary to improve competitiveness and sustain high-level incomes and ensure Ireland captures new opportunities for entrepreneurship and jobs across all sectors. For a number of years Forfás has advocated the need to catch-up and close the gap in the provision of more widely available competitively priced, advanced broadband services with other EU countries and countries with which we compete for trade and investment.

While the advanced broadband needs of large corporate and ICT-intensive enterprises are generally well met in the large urban centres, businesses outside the main urban centres have significantly less choice and less access to good quality services. The policy actions taken and investment made to date are necessary but are not sufficient to ensure the widespread availability of world class advanced broadband services within a timescale that will allow Ireland to catch up with competitor countries.

The optimal solution is that the telecommunications market players undertake the necessary investment within the context of a supportive policy and regulatory framework. In the event that the market does not deliver in a timely fashion, the State will need to intervene to ensure that Ireland has the advanced broadband services to allow the enterprise base to compete successfully in international markets.

The Programme for Government proposes that '*…NewERA will co-invest with the private sector and commercial semi state sector to provide next generation broadband to every home and business in the State'.*

Once the advanced broadband deficits have been identified, it is essential that the State advances on this initiative quickly. In particular, the State needs to:

- Develop an implementation plan which would include quickly mapping existing telecommunications networks and concrete investment plans and identifying deficits; As well as identifying areas that will not be served in the context of meeting the EU target of 100 per cent availability of 30 Mbps services by 2020, this exercise should also determine the quality of existing and planned services in the main urban centres (e.g. minimum upload and download speeds, latency, contention). In this regard, Forfás welcomes the establishment of the Next Generation Broadband Taskforce and its focus on identifying industry investment plans and barriers to investment. Consideration should be given to appointing an independent facilitator to work confidentially on a one-to-one basis with telecoms providers to finalise the mapping of existing and planned advanced broadband services as part of the gap analysis exercise.

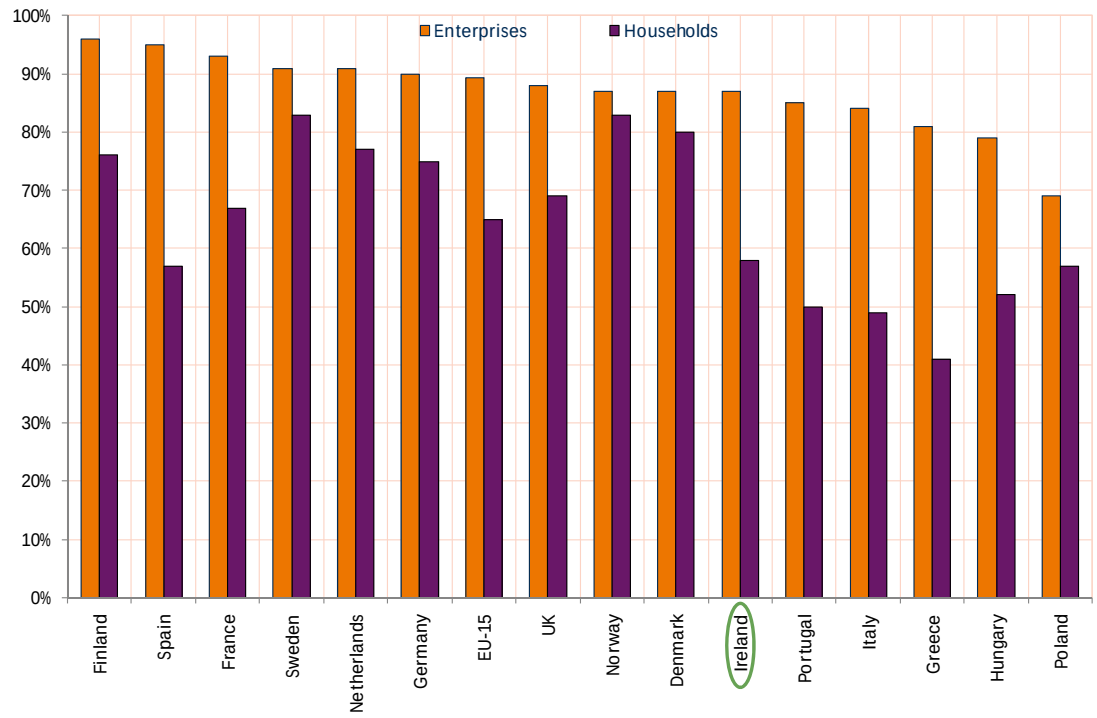
To address broadband deficits, the Programme for Government proposes that: '…NewERA will co-invest with the private sector and commercial semi state sector to provide next generation broadband to every home and business in the State'. It is essential that the State advances on this proposal quickly. In particular, the State needs to:

- Design a mechanism, (e.g. competition/procurement process) for a collaborative approach with the industry players (private and/or commercial semi-state) to determine the level of market interest in addressing identified deficits. This process, mirroring earlier State interventions to support investment in international, regional, city and rural broadband networks, should be time-limited to demonstrate the State's seriousness in meeting its ambitious broadband goals;
- Make a firm commitment to providing or sourcing the funds required to support the achievement of the goals agreed in the EU Digital Agenda, and set objectives and targets to ensure the timely delivery of advanced broadband services. The level of funding required will depend on the extent of the advanced broadband deficits identified by the mapping exercise, the degree to which the market players can invest and how the deployment of advanced broadband infrastructure is phased; and
- If the market and the competition/procurement process is not successful in leveraging investment from the market players to support the State's broadband objectives and targets, progress with a State asset collaboration approach using the existing state telecommunications infrastructure, in consultation with the European Commission. In this context, Forfás has examined in detail how such a State asset collaboration model could deliver advanced broadband infrastructure to all towns with a population above 1,500 within five years.

As enterprises generally tend to locate in urban centres, this paper has focused on delivering advanced broadband services to all towns with a population greater than 1,500, which is an interim milestone to achieve the Digital Agenda 2020 targets and the targets proposed in the Programme for Government. To meet the EU Digital Agenda targets, Ireland will have to deliver 30 Mbps services everywhere by 2020, with 50 per cent of households subscribing to 100 Mbps or higher by 2020. Given Ireland's spatial patterns and low population density, wireless solutions will have a key role to play in reaching universal coverage as it will not be possible to deploy fixed advanced broadband infrastructure everywhere (e.g. fibre).

Appendix 1: Supplementary benchmarking charts

Figure A1: Percentage of Households and Enterprises with Broadband (incl. mobile), 2010



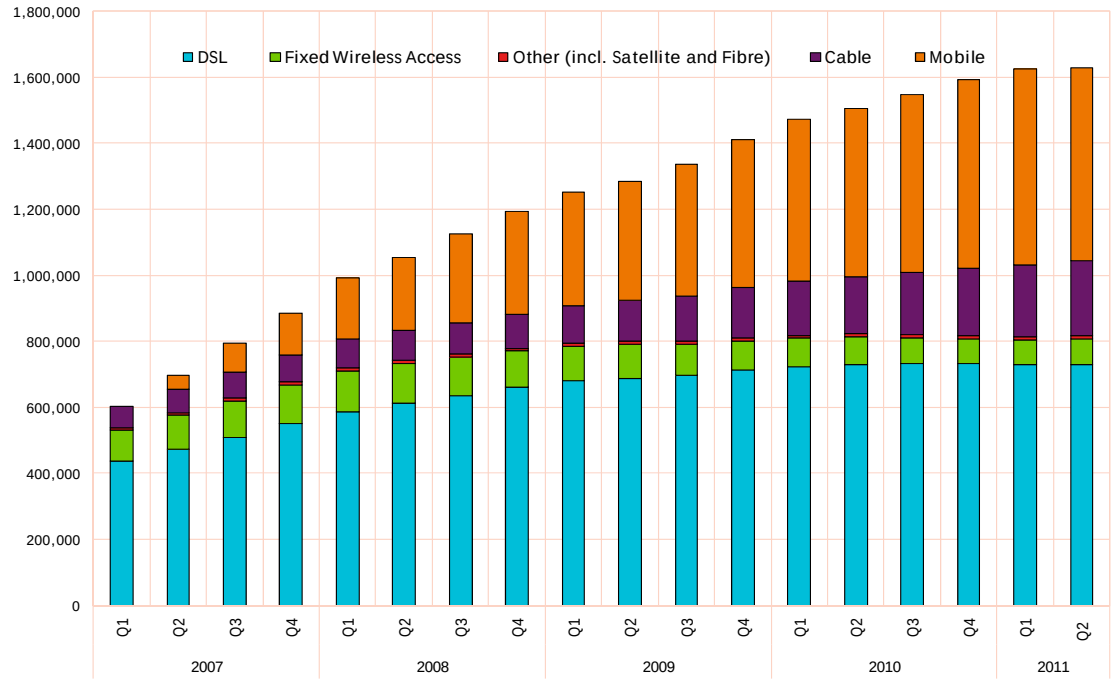
Source: Eurostat, Information Society Indicators

Figure A1 shows the percentage of households and enterprises with broadband connections and includes mobile broadband connections. Figure A1 highlights that:

- 87 percent of enterprises and 58 percent of households in Ireland have broadband.
- Ireland's enterprise take-up rate is two percent below the EU-15 average of 89 percent. Of the firms in Ireland with internet access, 94 percent have a broadband connection – this is on par with the EU-15 average[76].
- Ireland's household penetration rate increased by four percent to 58 per cent between 2009 and 2010, however, Ireland remains significantly behind leading countries such as Sweden and Norway which have a penetration rate of 83 percent.

76 According to the CSO, eight percent of enterprises in Ireland have no internet connection. Source: CSO, Information Society Enterprise Statistics, 2010.

Figure A2: Irish Broadband Subscriptions by Mode of Access, 2007 – 2011 Q2



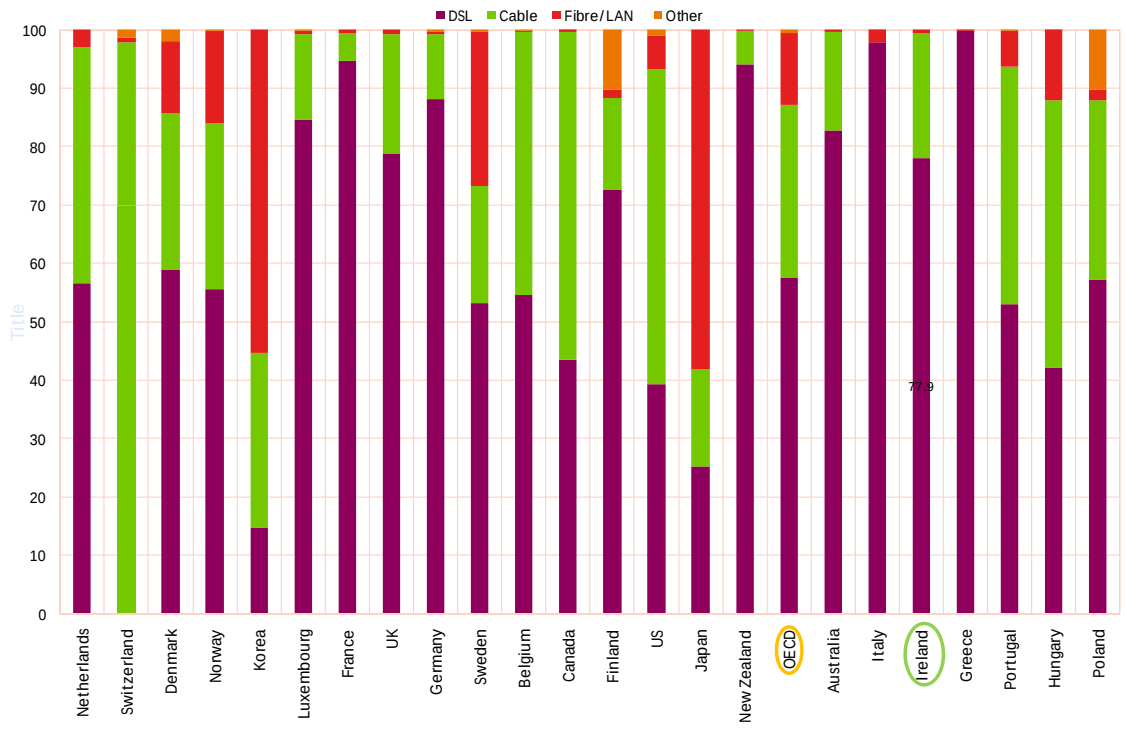
Source: ComReg, Quarterly Update, Q2 2011

Figure A2 highlights that:

- Total broadband subscriptions (including mobile broadband) in Ireland have grown rapidly in recent years, rising from just over 600,000 in Q1 2007 to 1.6 million in Q2 2011. When mobile broadband is excluded, the total number of broadband connections in Q2 2011 was just over one million.
- The choice of services for business and residential customers has also improved considerably. A wide range of broadband speeds are delivered over multiple platforms including fixed telephone line (DSL), cable, fibre, fixed wireless and mobile. Fixed line broadband connections make up 64 per cent of the broadband subscription market.
- Since the beginning of 2008, much of the growth has been driven by mobile broadband access, which increased until Q1 2011. Mobile subscriptions declined by 1.3 per cent between Q1 2011 and Q2 2011, but increased by 14.8 per cent in the year to Q2 2011. DSL connections account for 44.5 per cent of all broadband connections, fixed wireless access for 4.8 per cent and cable for 14 per cent. There are a very limited number of fibre and satellite connections (0.6 per cent).
- Cable broadband has been growing quickly in recent years increasing by 355 per cent since the beginning of 2007. UPC, the largest cable operator in Ireland, holds the second largest share of the fixed broadband market (21.7 per cent). The telecommunications incumbent, eircom has 46.4 per cent of the fixed broadband market[77].

77 ComReg, Quarterly Key Data Report, Q2 2011, September 2011.

Figure A3: Percentage of Fixed Broadband Subscriptions by Technology, June 2010[78]



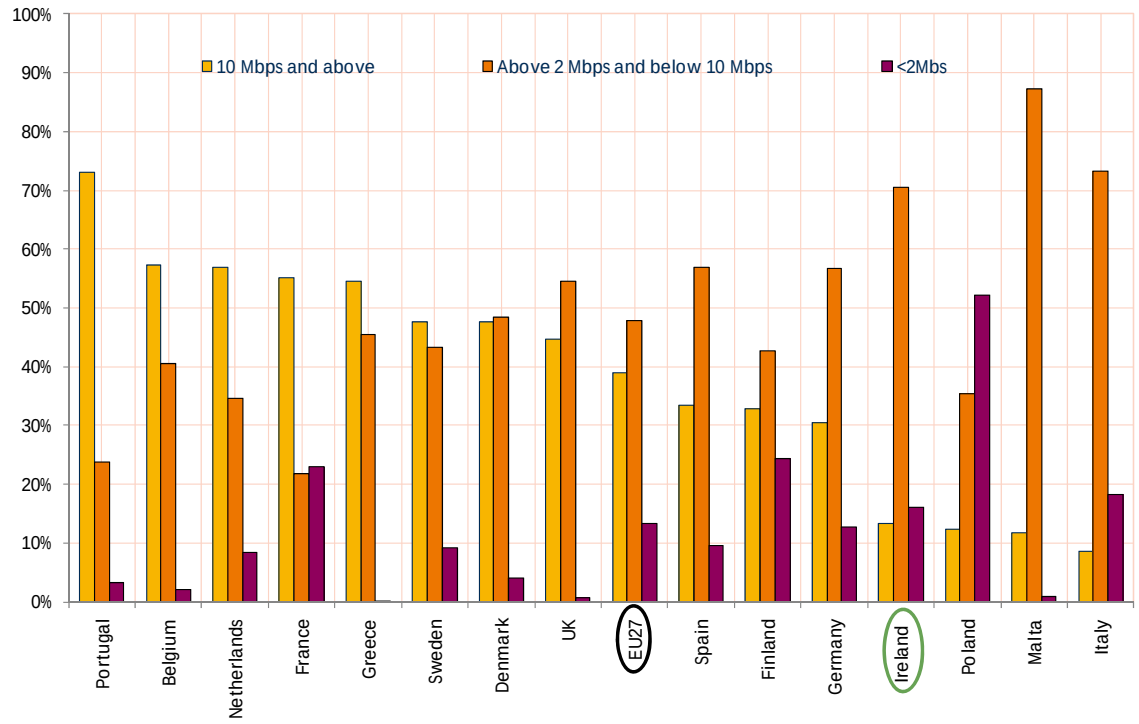
Source: OECD, Broadband Statistics

Figure A3 compares the market share of the various technologies used to deliver broadband in OECD countries.

- In Ireland 77.9 per cent of fixed broadband connections are via DSL and 21.5 per cent are via cable. The average percentage of fixed broadband connections provided by DSL in the OECD is 57.6 per cent while cable is accounts for 29.4 per cent.

78 Mobile broadband data is not included.

Figure A4: Fixed Broadband Lines by Speed, January 2011

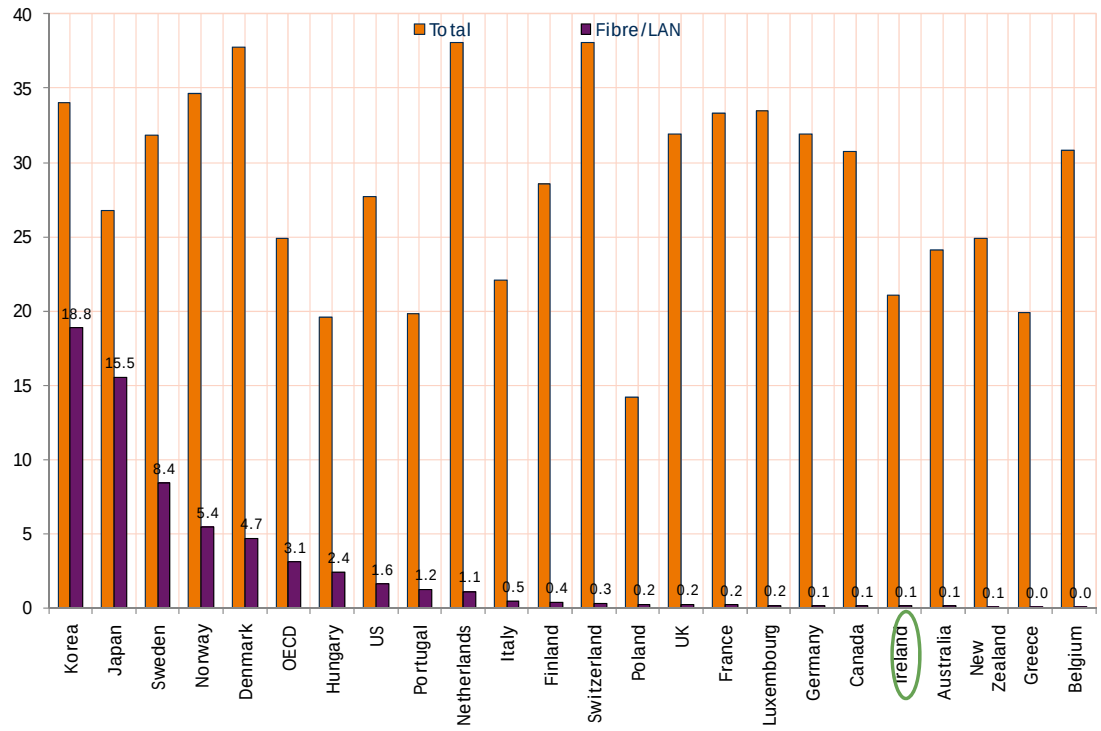


Source: European Commission Information Society: Digital Agenda Scoreboard, 2011

- Across most EU countries, the majority of fixed broadband lines offer speeds of 2-10 Mbps. 70.5 per cent of broadband lines in Ireland have speeds between 2 and 10 Mbps compared to an EU-27 average of 47.8 per cent.
- The proportion of fixed lines with speed capabilities in excess of 10 Mbps in Ireland increased from 8.9 per cent in January 2010 to 13.4 per cent in January 2011. This is likely to be largely due to investment in the cable network[79]. In the same period, the proportion of fixed broadband lines with speeds of greater than 10 Mbps increased significantly across the EU from 23.6 per cent to an average of 38.9 per cent.
- The proportion of Irish fixed broadband connections with speeds of less than 2 Mbps (16.2 per cent) is above the EU-27 average of 13.3 per cent.

79 In the twelve months to September 2010, UPC's capacity to provide two-services including internet and video services to homes expanded by 44 per cent, an increase of 8,500 homes. Liberty Global Third Quarter Results, 2010.

Figure A5: Total Broadband Subscriptions versus Fibre Subscriptions (per 100 inhabitants), June 2010



Source: OECD, Broadband Statistics

- Fibre take-up (as a percentage of total population) is highest in the Asian economies - 18.8 per cent in South Korea and 15.5 percent in Japan.
- Fibre take-up in Europe is slow, even in the leading countries; 8.4 per cent in Sweden, 5.4 per cent in Norway and 4.7 per cent in Denmark. The OECD average is 3.1 per cent. Just 0.1 per cent of the Irish population is subscribing to broadband via fibre.

Teligen Data

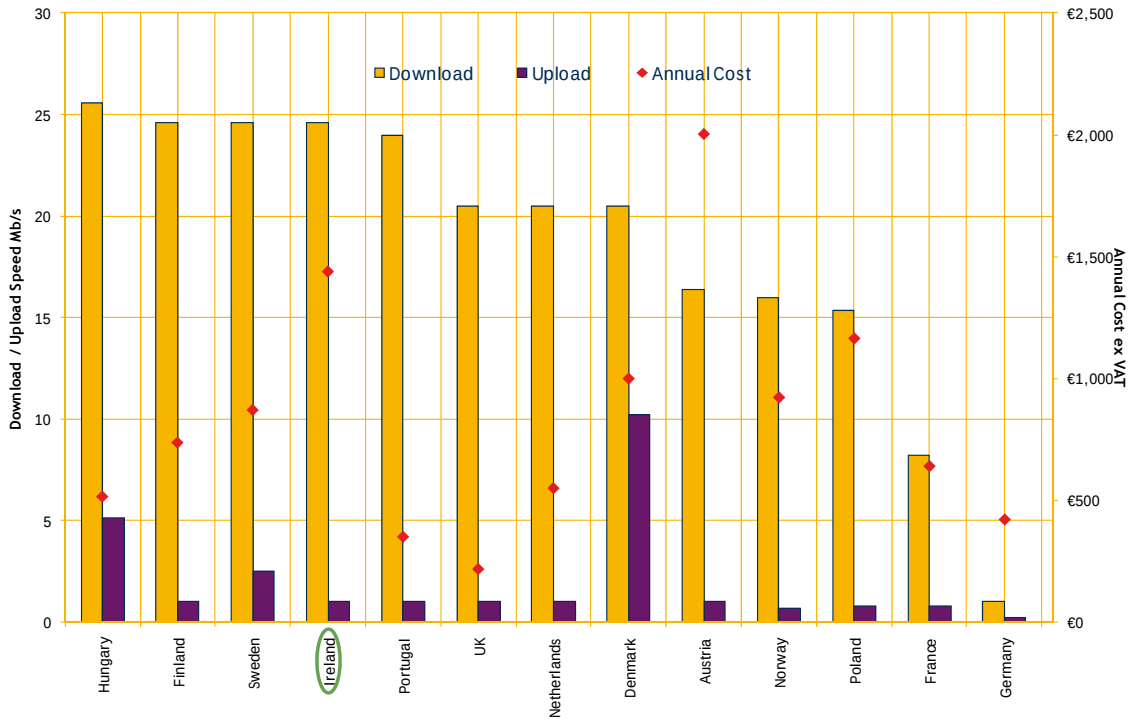
Forfás commissioned data from Teligen which provides details of the speeds and tariffs of broadband packages available to SMEs from the five leading operators in 14 different countries.

The data is collected using marketing materials available in the public domain, mainly websites. This database makes it possible to compare the range, speed and cost of broadband packages available to SMEs in different countries.

It is important to note that a number of limitations apply to this data;

- The data does not take into account the level of availability of the various packages offered. Some of the fastest packages available in each location are likely to be offered in a limited number of locations i.e. urban areas with high population density.
- The data was collected between December 2010 and January 2011. Any changes in the range of packages offered by operators since mid January 2011 will not be reflected in the data.
- As the data is collected largely from the websites of the five leading operators in each location, packages not advertised on their websites will not be captured.

Figure A6: Fastest DSL Connection Offered by the Incumbent and Annual Cost ex VAT[80]



Source: Teligen, January 2011

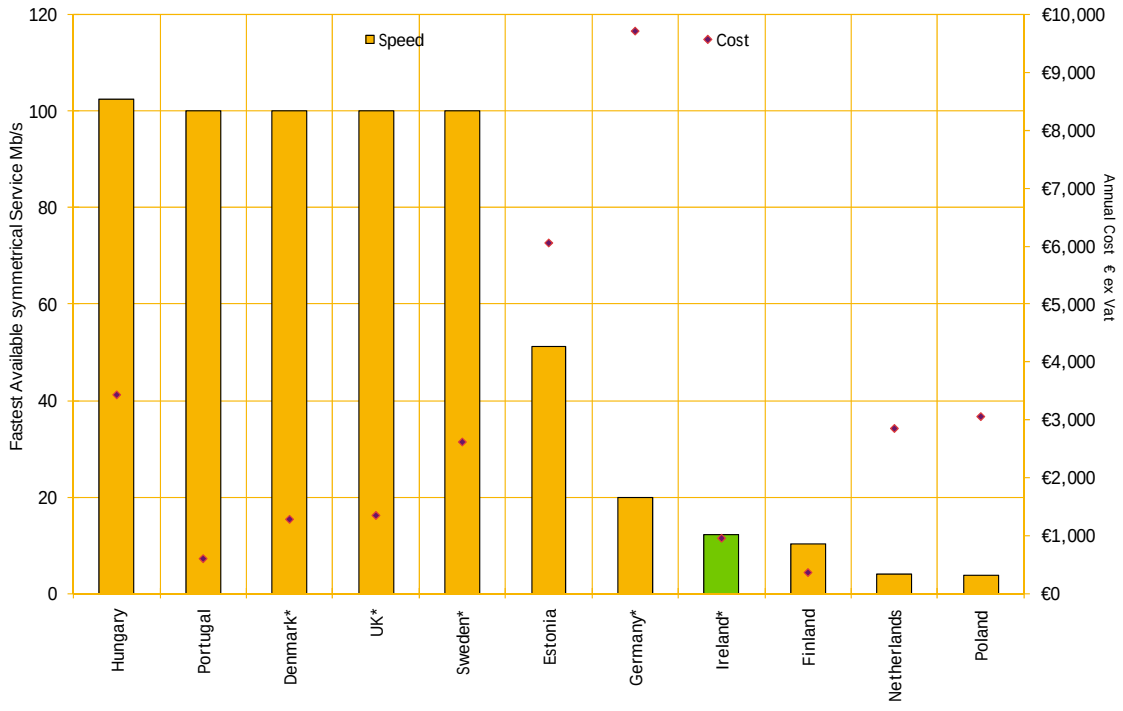
- Figure A6 shows the fastest asymmetrical business DSL connection offered by the incumbent operator, the upload speed provided with this package and the annual cost in euro (excluding VAT) of providing the service. The incumbent's fastest speed is included as it is likely to be the most widely available service.
- In Ireland, the incumbent operator, Eircom, offers a 24 Mbps service, the third fastest among the benchmarked group. The upload speed provided on this package is 1 Mbps.
- While there are significant differences in the fastest download speeds offered by incumbents, in general the upload speed offered on these packages is just 1 Mbps with the exception of Hungary (5 Mbps), Sweden (3 Mbps), Denmark (10 Mbps) and Austria (16 Mbps).
- The cost of the incumbent's fastest connection in Ireland is €1,440 per year (excluding VAT) and compares poorly with others in the group, including Finland (€737) and Portugal (€358) which offer similar download and upload speeds.

As of September 2011, the annual cost of the eircom 24 Mbps service was €1,032[81].

80 The Estonian incumbent offers a service which provides 100 Mb/s download and 50 Mb/s upload at an annual cost of €361 per year ex VAT.

81 In addition to the monthly fee of €65 for the 24 Mbps broadband service, customers also have to pay the monthly line rental of €20.96. Source: http://business.eircom.net/broadband/products/bb/20/

Figure A7: Fastest Symmetrical Service Available and Annual Cost ex VAT[82]



Source: Teligen, January 2011

Figure A7 shows the fastest download speed across all technology platforms available to businesses, the upload speed provided on this package and the annual cost per package. The fastest available speed is likely to be available in a limited number of areas in each country.

- Of the thirteen countries benchmarked, Ireland has the fourth slowest broadband package available for both downloading (30 Mbps) and uploading data (3 Mbps).
- The fastest available package in Ireland costs €706 ex VAT per year. Within the benchmarked group, the average annual cost of the fastest available package is €641.

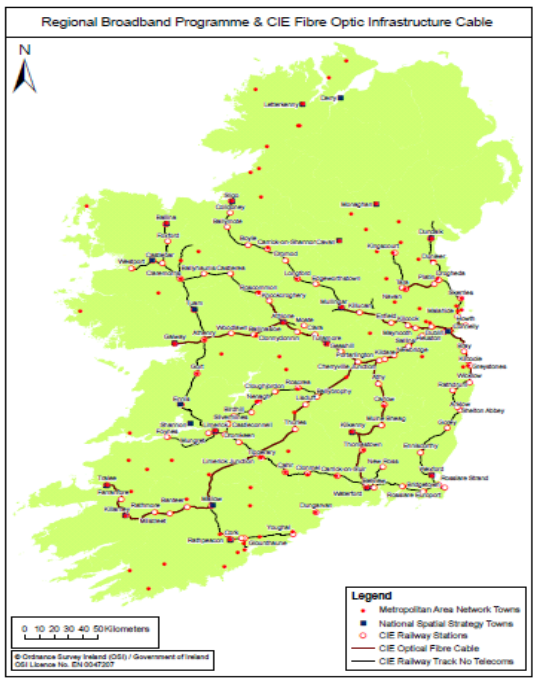
82 A symmetrical service of 400 Mb/s in available in Norway at a cost of €766 per year ex VAT and a symmetrical service of 100Mb/s is available in Austria at an annual cost of €2,661 per year ex Vat.

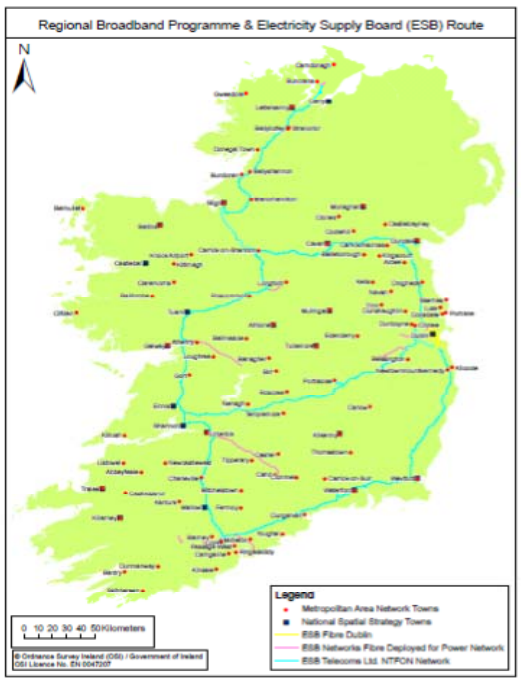
Appendix 2: Summary of State telecoms assets

This appendix provides an overview of the State telecommunications assets with fibre or ducting available to support NGN deployment

Metro-politan Area Network (MANs)	The Metropolitan Area Networks are fibre based rings, technology neutral, at the outskirts of a number of towns around the country. To date 27 MANs have been completed under Phase I of the Programme and 65 MANs have been completed under Phase II of the Programme, covering 93 towns. Listed below are the towns that are covered in phase 1 and phase 2 of the MANS. **Phase 1 MANs – 27 towns:** Athlone, Ballina, Carlow, Cavan, Carrick-on-Shannon, Carrickmacross, Clonmel, Cork, Drogheda, Dundalk, Dungarvan, Galway, Gweedore, Kilkenny, Kiltimagh, Kingscourt, Letterkenny, Limerick, Monaghan, Manorhamilton, Mullingar, Portlaoise, Roscommon, Sligo, Tullamore, Waterford, Wexford. **Phase 2 MANs – 66 towns:** Bantry, Blarney, Carrigaline-Ringaskiddy-Passage West, Charleville, Dunmanway, Fermoy, Kanturk, Kinsale, Midleton, Mitchelstown, Skibbereen, Youghal, Ballybofey-Stranorlar, Ballyshannon, Buncrana, Bundoran, Carndonagh, Donegal Town, Donabate/Portrane, Lusk, Skerries. Athenry, Ballinasloe, Clifden, Gort, Loughrea, Castleisland, Killarney, Listowel, Tralee, Longford, Ballinrobe, Claremorris, Knock Airport, Dunboyne/Clonee, Dunshaughlin, Kells, Navan, Trim, Edenderry, Ardee, Bailieborough, Castleblaney, Clones, Coothill, Cahir, Carrick-on-Suir, Cashel, Thomastown, Tipperary, Abbeyfeale, Banagher, Birr, Kilrush, Nenagh, Newcastlewest, Roscrea, Templemore, Blessington, Kilcoole / Newtownmountkennedy
ESB / Eirgrid / Networks	The backbone fibre assets are primarily those of ESB Telcom which has an aerial fibre network of 1,300 km, roughly shaped as a figure eight across the country with spurs to Sligo and Donegal.
CIE/ Iarnrod Eireann	A nationwide fibre network is laid alongside the rail tracks and is currently used exclusively by BT under contract. It covers all major towns along the rail route.
Aurora Telecom/ Bord Gáis Éireann	Aurora Telecom (a division of Bord Gáis) has a fibre optic network of over 140km in Dublin. It is also rolling out a high-speed fibre optic backbone network along the gas pipeline from Dublin to Cork via Galway. In the first phase, more than 300km of fibre optic cable has been inserted into ducting along the gas pipeline to the west. The second phase, currently under construction, involves the installation of fibre optic cable in existing duct network between Galway and Cork.
RTE	The vast majority of this network is wireless radio links with capacity used primarily by RTE. It does support some small local operators. It does not have any fibre deployment. Whether this network is useful for the NGN would need to be assessed. This network might be viewed as a State asset that could be shared, but it could equally well be viewed as a potential source of network traffic that might serve as an "anchor tenant" for a fibre-based NGN.
NRA	There is some ducting available along primarily the major motorways –M1, M7, M9, M6, and the M4. In some cases, ducts are placed under both verges and in other cases under one verge.

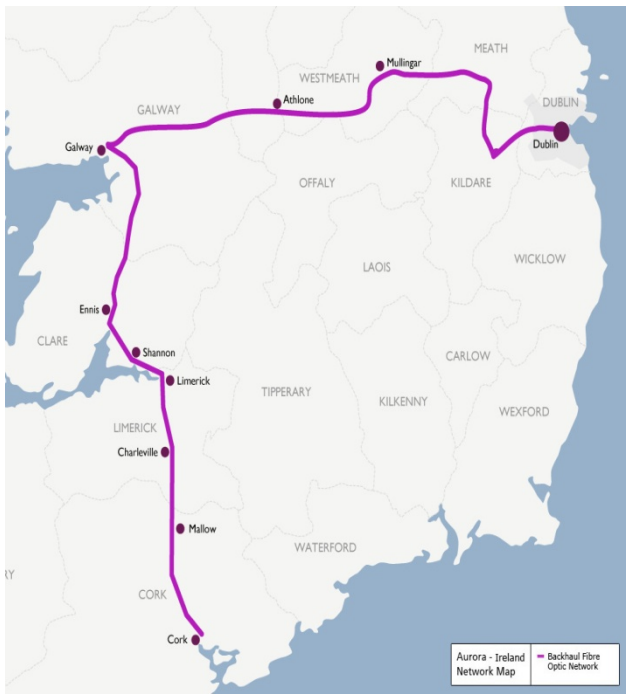
The following maps can be viewed in more detail on the DCENR website[83].





83 From the DCENR website as of November 2011- CIE network: http://www.dcenr.gov.ie/NR/rdonlyres/A5225D2C-D83D-481F-B821-D5C6E572BD21/0/CIE_Fibrenetwork.pdf ; ESB telecom network: http://www.dcenr.gov.ie/nr/rdonlyres/e23b93f3-b66d-4a85-a5f8-dfbe73bb8613/0/esbnetworkmap.pdf; NRA network: http://www.dcenr.gov.ie/NR/rdonlyres/1783EF91-0836-4C5F-BA94-E57F6FEB40DA/0/NRAnetworkmap.pdf; RTÉ network: http://www.dcenr.gov.ie/NR/rdonlyres/0ADA5EE3-17B9-498A-AFFF-5EE9E4881677/0/RTEnetworkmap.pdf

A map of the Aurora Telecom network is provided below[84].



84 From the Aurora Telecom website (Nov 2011) http://www.auroratelecom.ie/service-level.htm.

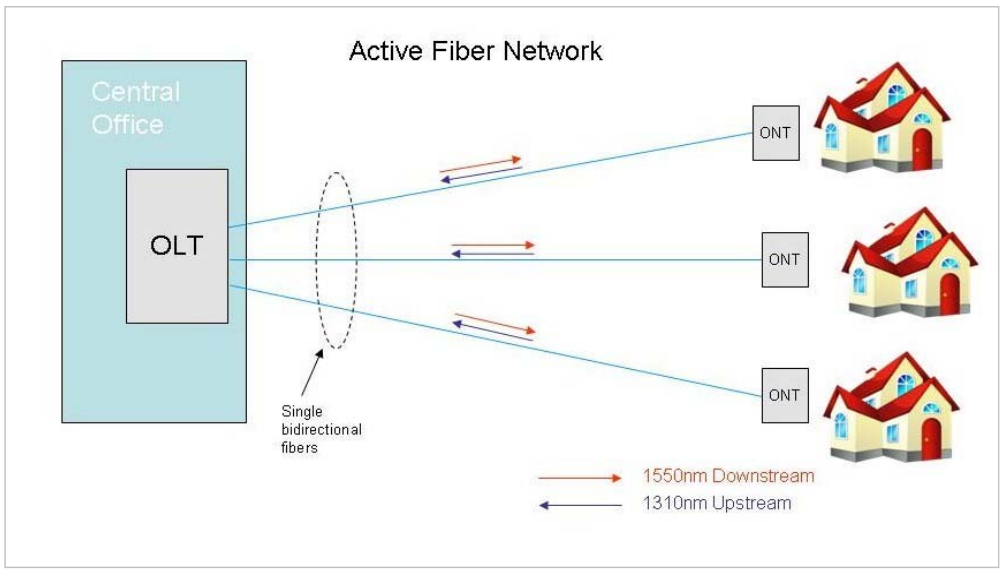
Appendix 3: Details of the proposal for fibre deployment

As mentioned in the main report, the Forfás work looks at the cost of deploying fibre to the cabinet and home because fibre is regarded as the most future-proofed solution. In deploying fibre to the home, there are two main architectures, which can be considered. These are point-to-point (P2P) and Passive Optical Networks (PON). P2P networks are felt by most experts to be more future proofed than PON networks, and better suited to unbundled wholesale provision; however, they are also more expensive than PON networks[85]. Careful consideration needs to be given to the best solution in an Irish context, taking into account the significant challenges we face such as our small and dispersed population. The investment requirements set out in this paper have been developed for the rollout of point-to-point (P2P) networks. A comparison of P2P networks and passive optical networks (PON) is outlined below.

P2P networks

In a P2P architecture there is a dedicated fibre (or fibre pair) from each business or home back to a fibre patch panel in the local exchange or network node (Figure A9). Network operators or service providers could then install their own equipment in the exchange and connect to the dedicated fibre(s) to deliver services to their customer. This is comparable to an unbundled local loop in the conventional copper network case.

Figure A9: Schematic representation of P2P access network



85 There is general consensus that P2P networks are more expensive than PON, but there is some disagreement as to the degree to which P2P costs exceed those of PON. See, for instance, Dieter Elixmann, Dragan Ilic, Dr. Karl-Heinz Neumann, and Dr. Thomas Plückebaum, "The Economics of Next Generation Access", 10 September 2008, at http://www.ectaportal.com/en/upload/ECTA%20NGA_masterfile_2008_09_15_V1.zip.

The advantages of this architecture over the PON architecture is that it facilitates competitive access, provides a dedicated fibre path for each user and so is future proofed and not capacity constrained, and it allows the network operators and service providers leasing the fibre to choose which architecture they wish to implement, either P2P or PON.

The disadvantage of this architecture is that it is more costly to deploy than the PON equivalent. It requires more duct space and more equipment at the exchange or node.

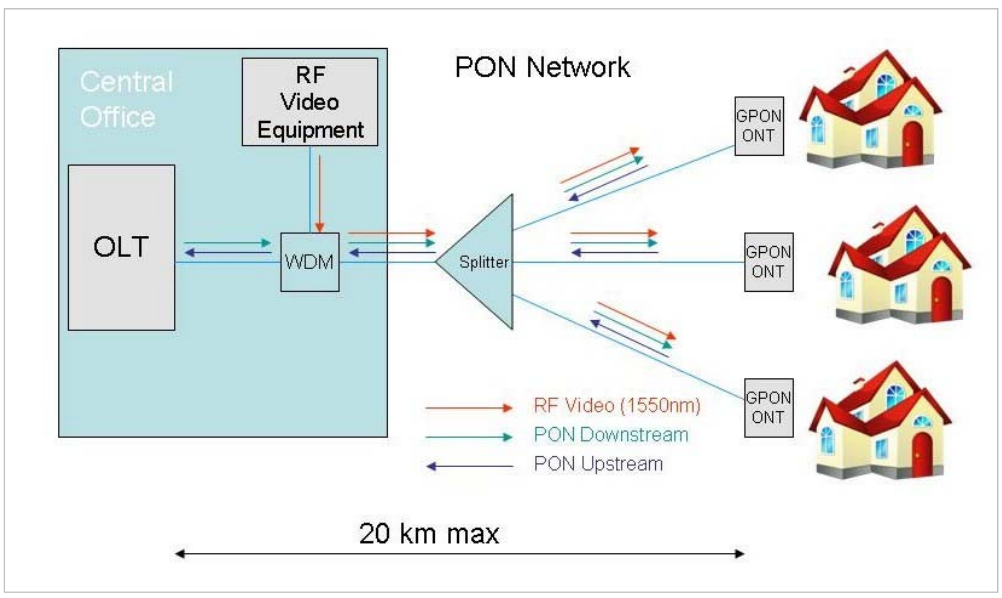
Passive Optical Networks (PON)

In the PON architecture, a single fibre (or fibre pair) is used to carry services to/for several (typically 32 or 64) houses to a point where the services are split using a passive optical splitter and delivered over dedicated fibres from that point (Figure A10). These aggregation points may be in street cabinets or in splice boxes in the cable ducts.

The advantage of this architecture over P2P is cost and space saving. Fewer fibres are required to be terminated in the local exchange for a given number of customers, less space and fewer Optical Terminal units are required.

The disadvantages, being a shared medium along part of the route, are individual customer access and bandwidth limitations (although the bandwidth issue may be solved when WDM PON becomes economical). Access to an individual customer at passive infrastructure level is practically impossible and so this architecture does not support the open access model in the passive infrastructure model.

Figure A10: Schematic representation of PON access network



NGN Financial Appraisal

In developing a cost model for the deployment of fibre-to-the-home, Forfás has estimated that the cost of fibre deployment to the premises in all towns with a population greater than 1,500 at €2.23 billion. These calculations are based on a budgetary estimate, which may need to be refined but is not an unreasonable starting point for analysis. This proposal does not assess the cost of deploying advanced broadband services to the remainder of the population. For the proposal to deliver fibre to all premises in towns with a population greater than 1,500 to break even, a take-up rate of 22.5 per cent would be required in year 5, 50 per cent in year ten, and 70 per cent in year 30. A summary of the financial model is presented below. This proposal was internationally peer-reviewed and validated for approach and assumptions made[86].

Scheme Choice

The following tables show the assumptions and results for the financial appraisal of fibre deployment in all towns with a population of over 1,500.

Scheme Coverage

Based on the census of 2006, Table A1 shows the coverage of the deployment scenarios, in terms of percentage of population, the number of household connections (including apartments), and the number of business connections.

Table A1: Scheme Summary

Scheme Option	Percentage of Population (2006)	No. of Residential Connections[87]	No. of Business Connections (at 13.7% of households)
All towns over 1,500 and MAN towns with a population < 1,500	60.7	913,227	125,197

The fibre connections are set at 100 per cent of all homes in towns analysed and for apartments a 25 per cent coverage was assumed i.e. an average of four homes per building. Fibre to the business premise is set at 13.71 per cent of residential connections with the total active enterprises in the State estimated using CSO Business Demography data, 2010. For all MAN towns it is assumed that 15 per cent of all residential properties and 70 per cent of all business premises were passed by a MAN, hence there is no requirement for kerb access.

86 Peer reviewed by international telecommunications consultants, WIK-Consult GmbH.
87 Includes apartments.

Capital Expenditure

The capital expenditure is summarised in Table A2 below and is based in the costings of the deployment of Phase 1 of the MANs (2003 figures), which was reduced by 25 per cent to reflect the reduction in construction costs and economies of scale, and also reflects the costs of connection to the nearest State asset and the additional points-of-presence (POPs) required[88].

Table A2: Summary of Capital Expenditure

	Total Capex, €	Total capex per connection, €
Access – providing the local network and connecting to each building	1,831,516,881	1,764
Core – connecting towns to the national backbone	400,363,462	386
Total Capital Expenditure	**2,231,800,343**	**2,149**

The unit costs shown above are within the range of costs for deploying fibre reported in other countries and cities: in the Netherlands the cost was estimated at €1,739 per household; San Francisco the estimate ranged from €1,801-€2,199; and in Germany for 100 per cent coverage the cost was estimated at €2,900 per connection.

In Ireland, cost estimates for connections from existing MANs to buildings range from €2,000 to €14,000, with an approximate average cost of €7,500. However, these estimates are for one-off connections and do not reflect the huge economies of scale that will arise from full deployment in the proposed towns. The 2010 Telecommunications and Internet Federation report gives a weighted (rural and urban) average of €1,875 per home passed to deploy fibre[89].

Lifecycle Expenditure

Operating Costs

An operating cost of two per cent of capital expenditure was assumed, which implies an annual cost of €44.6 million for operations. This figure covers day-to-day maintenance, control room operations costs and the administrative costs of running NewERA/NGNCO.

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88 It is assumed that at least one POP will be required for each town under the scheme i.e. 173 POPs
89 TIF, Building a Next Generation Access Network for Ireland, 2010.

Renewal Costs

An OECD report gives a per connection cost of €767 in 2006 for the active network[90]. However, this figure has been halved to take account of the scaling effects and the reductions in the cost of equipment since then and into the future. It has been assumed that the active network will need complete replacement every seven years. Smoothing has been assumed so that one seventh of renewal costs occur in each year of operation starting from year 7.

Once-off terminal equipment connection costs

The cost of terminal equipment for every dwelling and business premises is included in the lifecycle expenditure as it is assumed that this expenditure will occur only once each subscription to the infrastructure occurs. The assumptions on demand ramp-up are given below. The terminal equipment costs were estimated at €100 per connection.

Appraisal assumptions

The assumptions used in the financial appraisal are shown in Table A3. Under various assumptions New ERA/NGNCO is profitable based on a take-up rate of 25 per cent in year five, 50 per cent in year 10, and reaching 70 per cent in year 30. For the proposal to break even a take-up rate of 22.5 per cent would be required in year 5, 50 per cent in year ten, and 70 per cent in year 30.

90 OECD, Developments in Fibre Technologies and Investment, April 2008. http://www.oecd.org/dataoecd/49/8/40390735.pdf The model is available on http://ngn.arcadis.nl

Table A3: Assumptions

Parameter	Base Case		
Per annum Lifecycle (Operating and Maintenance/Renewals) Costs (Percentage of Capital Expenditure)	2%		
Inflation rate (CPI)[91]	2%		
Financial Discount Rate	10%		
Interest Rate on Project Financing	10%		
Demand Ramp-up	Years	% Households	% Firms
	0	0	0
	5	25	50
	10	50	75
	20	65	95
	30	70	100
Household Monthly Charge for NGNCO	€20		
Household Once-off Connection Fee	€80		
Firm Monthly Charge	€30		
Firm Once-off Connection Fee	€80		
Appraisal Period	30 Years		

In addition, it was assumed that the capital expenditure was in 2010 prices, with full operations commencing in 2013.

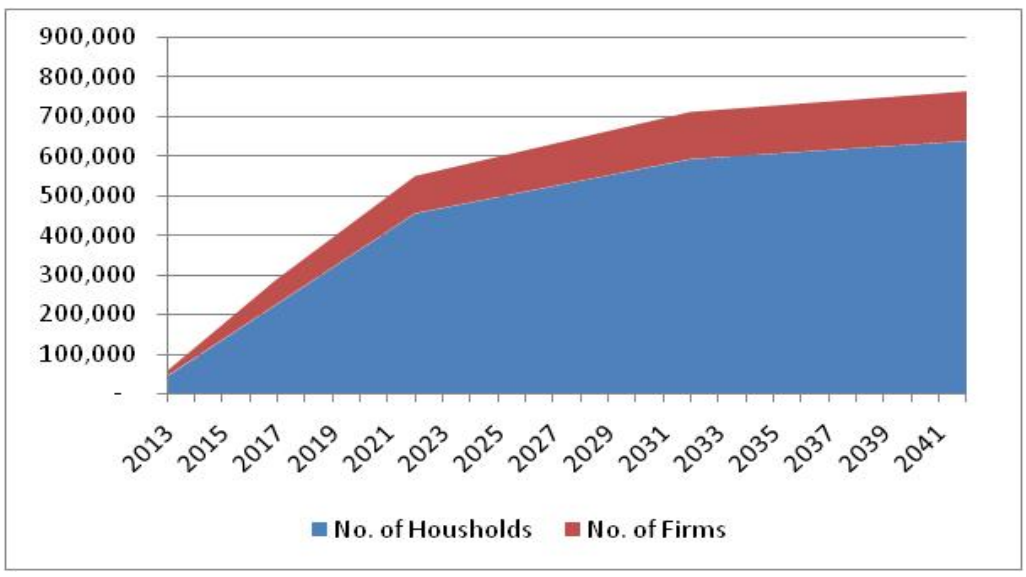
Demand and Revenue

The assumptions for the growth of demand are shown in Table A3 above, and linear interpolation has been applied for the intervening years. The demand ramp-up is shown in Figure A11 below. Per annum revenues were calculated by applying the customer fees and once-off connection fees in each year.

91 Department of Finance (April 2010) Project Discount and Inflation Rates

Note that, for simplicity, the population has been kept constant at the 2006 Census results. However, this assumption is sufficient for this stage in project appraisal as this is a conservative approach and, therefore, underestimates the growth in demand and revenue.

Figure A11: Demand Ramp-up over thirty years



Project Financing

In the base case, the capital costs were repaid in equal annual instalments at an interest rate of ten per cent over the lifetime of the project (30 years). This is a very simple approach, and a more complex funding model would be used in raising the project finance thereby reducing the cost of finance.

Financial Appraisal Methodology

All costs and revenues were assumed to be in 2010 prices. These constant prices were then grown at two per cent annually to give the nominal prices in each year of the appraisal. Two percent inflation is recommended by the Department of Finance in their circular of April 2010 (Project Discount and Inflation Rates).

In line with standard appraisal methodology, all costs and revenues were discounted[92] A discount year of 2010 was chosen. In order to appraise the project discounting is necessary as cash flows occur in multiple periods. Therefore, nominal (or current) cash flows in each year must be discounted to a present value (here, 2010).

Two decision criteria are used below:

- financial net present value = present value of revenues minus the present value of costs
- financial internal rate of return = the financial discount rate that would result in a net present value of zero

92 In line with discounted cash flow analysis methodology, the interest costs have not been included in the calculation of the internal rate of return and the net present value, since they are already reflected in the discount rate.

Financial Appraisal Results

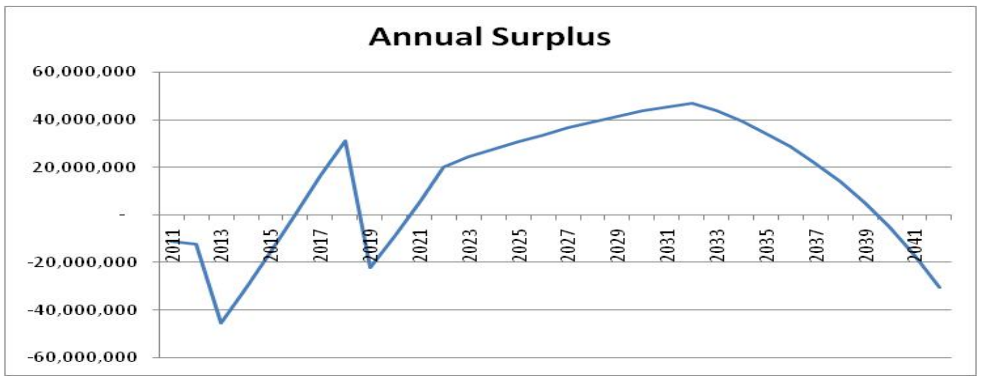
Table A4 below shows the results of the financial appraisal for the scheme using the base case assumptions.

Table A4: Results of Financial Appraisal – Base Case Scenario

	All Towns with population over 1500
Financial Net Present Value - Discounted to 2010, € million	16.6
Financial Internal Rate of Return (percent)	11.5

As shown in the chart below, in year 4 of operations, 2016, nominal revenues cover nominal costs. There is a dip in 2019 when renewal work on the active layer commences. Due to the amortisation schedule it drops into a deficit position in 2040.

Figure A12: Annual Surplus/Deficit



Sensitivity Analysis

Table A5 below shows the sensitivity analysis for the scheme showing the impact of higher demand ramp-up by consumers on the business case and a break-even point as the lower bound. Note: the demand ramp-up rate is presented as a percentage of population covered by the scheme rather than a percentage of total population.

Table A5: Different Demand Scenarios

Higher Demand Scenario	
Year	**Demand Ramp-up**
Year 0	0%
Year 5	35%
Year 10	55%
Year 20	70%
Year 30	80%

Break-even Demand Scenario (Lower Demand, year 5)	
Year	**Demand Ramp-up**
Year 0	0%
Year 5	22.45%
Year 10	50%
Year 20	65%
Year 30	70%

Lower Demand Scenario (15 % Year 5)	
Year	**Demand Ramp-up**
Year 0	0%
Year 5	15%
Year 10	50%
Year 20	65%
Year 30	70%

Lower Demand Scenario (over lifetime)	
Year	**Demand Ramp-up**
Year 0	0%
Year 5	15%
Year 10	37.5%
Year 20	48.75%
Year 30	52.5%

Appendix 4 - Recent Forfás Publications

Intelligent Infrastructure: Delivering the Competitiveness Benefits and Enterprise Opportunities Forfás	October 2011
The Games Sector in Ireland: An Action Plan for Growth Forfás	October 2011
Ireland's Competitiveness Scorecard National Competitiveness Council	September 2011
Research and Development Funding and Performance in the State Sector 2009 – 2010 Forfás	August 2011
Monitoring Ireland's Skills Supply 2011 - Trends in Education and Training Outputs Expert Group on Future Skills Needs	August 2011
Developing a Green Enterprise **Forfás**	July 2011
National Skills Bulletin 2011 **Expert Group on Future Skills Needs**	July 2011
Forfás Annual Report 2010 **Forfás**	June 2011
Costs of Doing Business in Ireland 2011 **National Competitiveness Council**	June 2011
Annual Employment Survey 2010 **Forfás**	May 2011
Response from Ireland to the European Commission Green Paper: Framework for Research and Innovation Funding **Advisory Science Council, Forfás, DJEI**	May 2011
The Expert Group on Future Skills Needs Statement of Activity 2010 **EGFSN**	May 2011
Business Expenditure on R&D 2009/2010 **Forfás, CSO**	April 2011
Developing Recognition of Prior Learning **EGFSN**	April 2011

Vacancy Overview 2010 **EGFSN**	March 2011
Statement on Competitiveness Priorities **NCC**	March 2011
Analysis of Ireland's Innovation Performance **Forfás**	March 2011
Progress Report on the implementation of the recommendations of the report of the High Level Group on Green Enterprise **Forfás, DETI**	March 2011
Staying the Course **Advisory Council for Science, Technology and Innovation**	January 2011
Research strengths in Ireland: a bibliometric study of the public research base - Extension Report: Public Research Organisations **Forfás, HEA**	December 2010
The Higher Education R&D Survey 2008 **Forfás**	December 2010
Profile of Public Research Activity in Ireland, 1998-2006 **Forfás, HEA**	December 2010
Research and Development Activity of Irish Based Enterprise **Forfás, HEA**	December 2010
Research and Development Activity of Irish Based Enterprise - Vol 2: Data **Forfás, HEA**	December 2010
Ireland's Priorities in FP8 **Forfás**	December 2010
Annual Competitiveness Report 2010 Volume 2: Ireland's Competitiveness Challenge **National Competitiveness Council**	November 2010
Future Skills Needs of Enterprise within the Green Economy in Ireland **EGFSN**	November 2010
An Enterprise Perspective on the Universal Social Contribution **Forfás**	November 2010

Appendix 5 - Forfás Board Members

Eoin O'Driscoll
Chairman, Forfás
Chairman, Southwestern

Martin Shanahan
Chief Executive, Forfás

Simon Barry
Chief Economist ROI, Ulster Bank Capital Markets

Bob Brannock
President, European Operations, Genworth Financial

Timothy Dullea
Former Chief Executive Officer,
Tipperary Co-op

Sean Gorman
Secretary General, Department of Enterprise, Jobs and Innovation

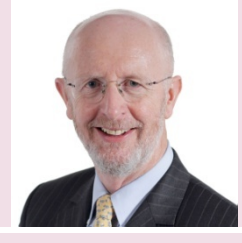
Miriam Magner Flynn
Managing Director, Career Decisions

William O'Brien
Chief Executive, Wm O'Brien Plant Hire Ltd

Barry O'Leary
Chief Executive Officer, IDA Ireland

Paul O'Toole
Director General,
FÁS

Frank Ryan
Chief Executive Officer, Enterprise Ireland



Dr Don Thornhill
Business Adviser and Company Director

Michael O'Leary
Secretary to the Board

Notes