creating **a fibre nation**

fine gael

Creating a Fibre Nation

January 2008

Policy Statement by:

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CREATING A FIBRE NATION
EXECUTIVE SUMMARY

Objective:

- To encourage, support and drive next generation broadband roll-out across the country;
- To maximise the potential from existing infrastructure, with appropriate regulation and a frontloading of State investment under the NDP;
- To combine public and private sector effort to deliver high-speed broadband access as an immediate priority for government.

Government actions needed:

1. Mandate the Department of Communications to undertake a comprehensive audit of all ducting under both public and private ownership throughout the country. Based on this audit, a detailed plan of where ducting, especially between the exchange and the cabinet but also at backhaul level, is most needed.
2. Enter negotiations with all private owners of ducting for the purposes of securing open access to infrastructure, in an effort to try to create a web of open-access ducting throughout the country.
3. Tender for private sector interest in managing all State-owned ducting and coordinate with the regulator on the opening of access to privately-owned ducting. The contract will also provide for the management of roll-out of new ducting where appropriate. Funding for this will be provided from the ICT budget within the NDP.

4. The State should support high-speed wireless connectivity to areas too remote to justify ducting and fibre connections.

5. Revise the terms of the contracts for provision of broadband to extremely remote areas under the National Broadband Scheme, to require that this connectivity be of a high-bandwidth.

6. Pass legislation to require ducting to be installed to the home in all new housing and apartment developments under new building standards regulations.

7. Pass legislation to require ducting to be laid as part of all new road developments and maintenance.

8. Ensure that all infrastructure relating to roll-out of next generation access – at all parts of the network – be subject to fast-track planning rules.

9. Invite tenders for provision of wholesale high-bandwidth access to state bodies throughout the country, such as schools, third-level institutions, hospitals and departmental buildings.

10. The connection of Next Generation Access to all schools and educational institutions needs immediate priority in government planning.

I. Introduction

Despite a steady increase in the numbers of people subscribing to a basic broadband service in recent years, Ireland is still a long way behind our competitors in terms of broadband connectivity. Ireland has become uncompetitive as a destination for business investment and growth, as a result our inability to roll out an ambitious program of even basic broadband.

Due to a lack of planning and investment from Government we have remained far behind our European neighbours and are below the OECD average for per capita broadband penetration. Now is the time to dramatically increase the urgency and priority of broadband rollout within Government policy and to set ambitious targets in terms of penetration and availability.

Broadband should not be seen as a luxury in the home or a convenience issue for doing business, it is now an essential tool for basic modern communication and needs to become treated as the fourth utility for every building and every citizen, just as essential as connection to water, electricity, and telephone networks.

The Government's National Broadband Scheme, which will start to come on stream in mid-2008, aims to provide basic broadband access for the 10-15% of the population living in remote areas. As a result, first-generation broadband availability should be at 100% within a few years at most. However this is not solving our competitiveness problem.

As Ireland rolls out first generation broadband availability to the remainder of the country, the rest of the developed world is moving on to make higher-bandwidth and faster broadband (known as Next Generation Access) available. This problem is now a crisis: Ireland is 33rd out of 35 OECD countries for average internet speeds, ahead of only Mexico and Turkey.

Rolling out a high-speed network is an economic imperative for Ireland. For any country seeking to compete in the modern global economy such infrastructure is essential. However for Ireland, as an island economy, with its reliance on international high-tech corporations and its aspiration to become a centre of research and development, shortcomings in this area will be a serious impediment to progress.

Next Generation Access provides a challenge, but also a fantastic opportunity for Ireland. We are currently at a point where a large-scale, well-targeted and front-loaded investment could see us leap-frog other developed economies in terms of next generation broadband infrastructure, securing a key strategic advantage in a competitive global market.

Despite the immense importance and urgency of the issue, the current government continues to drag its feet. Just as it did with first generation broadband infrastructure, it displays no urgency, not appearing to view investment in high-speed networks as a priority. Worryingly, the Programme for Government contains nothing more than a vague aspiration to "encourage the progressive shift to Next Generation Networks". The Minister has started a consultation process on the issue, and a National Advisory Forum on next generation broadband is due to be established and publish recommendations at some point in the coming months. However this only represents the preliminary stages of a consultation process, and deadlines even for that have been pushed back – the recommendations were due to have been published by the end of last year.

In this document, Fine Gael spells out why visionary and far-sighted policies are needed, and sets out its vision of a diversion of already-committed funds in an investment to secure rapid NGA rollout across Ireland.

II. Context

Next Generation Network (NGN) is a label used to refer to several different concepts. This document will avoid the complex technical issues surrounding issues such as "packet-based" networks, Internet Protocol (IP), and the effect on local exchanges and core nodes, which are better left to industry experts. Instead, it focuses on the need for a dramatic step-change in the speed and bandwidth of broadband connectivity in Ireland, and will use the term Next Generation Access (NGA) to refer to a fibre-optic cable-based network that is capable of facilitating broadband internet speeds of over 10Mbps and often much higher. Through such networks it will be possible to transport all the telecommunications and media needs of a business or household – data, images, voice and TV/video. By using such networks, companies can offer new products and services simply by providing new software to the customer, without the need to modify the actual network connection. With such networks in place, R&D, innovation and product development become infinitely easier, and the capacity to work from home becomes a realistic proposition for many more people.

Many of Ireland's developed economy competitors have long since seen the importance of investment in Next Generation Access.

Korea is recognised as the world leader in such investment. Through its "Korea Information Infrastructure Project" (KII), launched in March 1995, the government invested US$800 million in putting a government-owned fibre-optic backbone network in the ground. Successive investments by both private and public sectors have seen the country remain close to the top of global league tables for both penetration and average speeds ever since. It now enjoys average download speeds of 43.3Mbps.[1]

Japan is another country in which the government recognised at an early stage the importance of investment in high-speed internet infrastructure, and the country now enjoys average speeds of 93.6Mbps.

[1] Comparative international figures are taken from the OECD's most recent broadband statistics, June 2007 for penetration, October 2007 for speeds, http://www.oecd.org/sti/ict/broadband.

In general our European competitors are at a less advanced stage of development. Nonetheless, countries of comparable or lower population density to Ireland have both vastly higher percentages of subscribers and much higher average speeds, such as Sweden (28.6%, 21.4Mbps), Finland (28.8%, 13Mbps) and Norway (29.8%, 11.8Mbps).

Meanwhile in Ireland only 15.4% of the population subscribes to broadband.[2] Even worse, users enjoy an average speed of only 3.011Mbps, third lowest of 35 OECD countries, with only Mexico and Turkey worse than us. This speed is well below the OECD average of 13.7, and barely in the same league as even our non-Scandinavian neighbours such as France (44.1), Italy (13), Portugal (12.9), and the UK (10.6).

As Ireland languishes at the bottom of the league table for bandwidth and speeds, the prospect of us continuing to develop as a centre of R&D in technology becomes more and more of a challenge. Innovation becomes impossible without NGA: far from Ireland becoming a testing-ground for innovative new products and services, we will find that after they have been developed in other countries they cannot even be used here. Furthermore, the longer Ireland's schools do not have access to high-speed broadband connection, the more future workers and prospective innovators will grow up without skills in this area, further compounding our competitive disadvantage vis-à-vis other countries.

The importance of an adequate broadband infrastructure for Ireland is clear, as are the benefits and return of an ambitious, visionary investment programme. *The direct benefit to the Korean economy of its Korean Information Infrastructure project has been conservatively estimated at US$4billion, five times the government investment.* Furthermore, in 2005 the European Commission estimated that 25% of EU GDP growth and 40% of productivity growth were due to ICT dissemination. In addition they noted that differences in economic performances between industrialised countries are largely explained by the level of ICT investment, research and use and by the competitiveness of electronic communications services and media industries.

[2] Ireland is experiencing rapid growth in broadband penetration, and the most recent figures from Comreg (December 2007) indicate a penetration rate of 16.35%, or 18.4% if mobile broadband figures are included. We have chosen to work from the most recent OECD figures in this document so that international comparisons can be made.

For these reasons, Fine Gael argues that high-speed fibre-based broadband connectivity is crucial to the well-being of the country. This document is not intended to be a comprehensive plan for the roll-out of NGA in Ireland: many of the complex technical issues in this area will have to be resolved by experts in the industry and the Department. However, in order to drive the change now required, State investment and political leadership are urgently needed. In this context, Fine Gael asserts that we now need to proceed with the development of such connectivity with as much priority as if our electricity, telephone or water networks were in as bad a state as our broadband network.

III. A proposal for the rapid roll-out of high-speed network

Fine Gael has undertaken research and consultations to formulate a preliminary proposal for how best to rapidly achieve such connectivity. There is a very important role for the private sector, but experience internationally has shown the need for the State to invest in key pieces of infrastructure, both where it is uneconomical for the private sector to do so, and where there may be concerns about the ownership of such assets by a potential private monopoly. Fine Gael is convinced of the value of supporting private sector innovation, expertise and efficiency to perform their functions wherever commercially viable, in conjunction with and complementing public sector investment under the NDP.

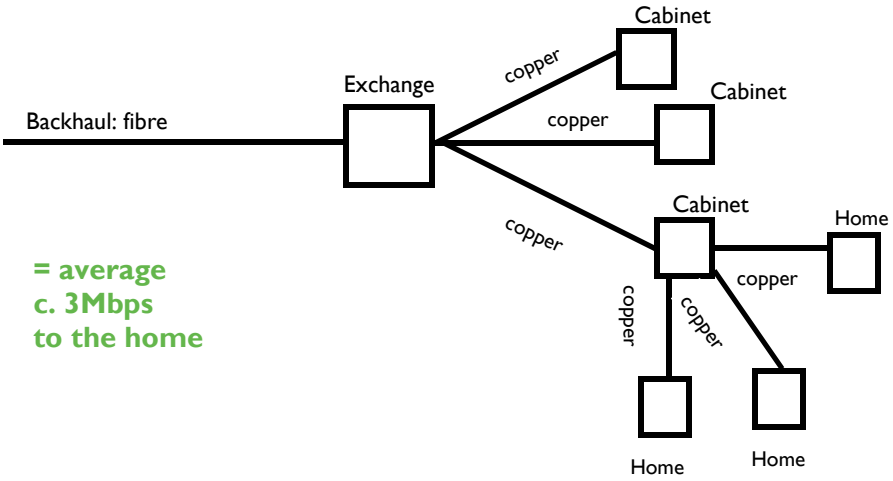
The importance of fibre

The key to rolling out a high speed network is getting fibreoptic cable into the ground around the country as quickly and efficiently as possible. Such cable can carry signals of much higher bandwidth than the copper that makes up most of Eircom's current network. Copper and fibre cable can be combined to good effect – with, for example, a copper cable connection to a house branching off from fibre backbone – meaning that it is not necessary to create an entirely new fibre network to replace all existing copper. Last mile copper connecting into each home can be upgraded to fibre on an incremental basis.

It is a fact that the closer to the home/business the fibreoptic cable goes, the higher the bandwidth enjoyed by the user. *Thus some countries have started in recent years to achieve widespread "fibre to the home" or "FTTH". Unsurprisingly, the two countries with the by far the highest proportion of such connections – Japan, with 36% and Korea with 31% – also have two of the three fastest average speeds. Sweden – with at 16% the third-highest proportion of FTTH connections – has the fourth-highest average download speeds.*

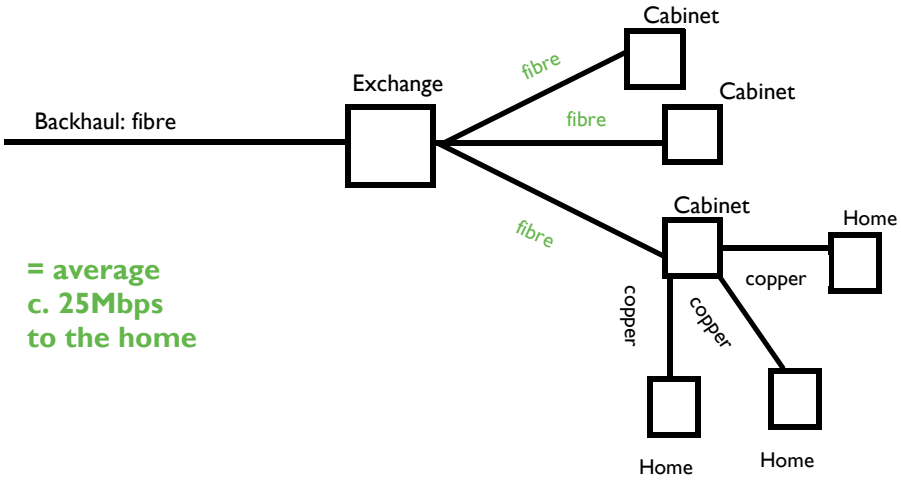
In the short term, installing a FTTH network throughout Ireland is not realistic. It is estimated that rolling out such a network today would cost in the region of €4billion. For this reason, Fine Gael proposes prioritising the achievement of a "fibre to the cabinet" (FTTC) or "fibre to the kerb" (FTTK) network in as much of the country as possible as soon as possible. The connection from the kerb to the home will still be copper wire, but the fact that the entire network from the kerb back will be fibre will mean that speeds of up to 25Mbps can be achieved.

Current Network



= average c. 3Mbps to the home

Fine Gael Proposal



= average c. 25Mbps to the home

Putting in place such a network will achieve the desired effect of a massive step-up in Ireland's broadband speeds in a realistic time-frame and without imposing an unacceptable burden on the public purse. FTTH will still remain a long-term goal that will be pursued, but the priority in the short-term will be to get fibre to the cabinet in as much of the country as possible.

In parts of the country, there is already a substantial amount of fibre in the ground. Eircom, BT and UPC all own high-quality fibreoptic backhaul connections. Through the MANs Phase I programme, the government has put fibreoptic rings around 27 large towns nationwide. This infrastructure is owned by the State, and managed and leased to private telcos by a private company, E-net. The MANs Phase II will put similar cable around 90 further towns. 63 of these projects have at this time been started.[3] In addition, large private companies such as Eircom, UPC, Smart and BT have begun laying fibreoptic cable in many parts of the country's larger urban areas.

However the pace and extent of fibre deployment is still too slow. For this reason, political drive and leadership is demanded in order to dramatically quicken the pace of change.

[3] It is important to note that many of the fibreoptic rings built under MANs II will face serious problems in relation to connection to backhaul networks. Most MANs also face "last mile" problems - i.e. access from the ring to the customer.

The importance of ducting

For technical reasons, fibreoptic cable must be housed in underground pipes known as ducts. Studies have estimated that 80% of the investment in an FTTH network is accounted by civil engineering costs – in large part comprised of the digging of trenches and the laying of such ducts. The percentage is significantly less in the case of a FTTK network, but the absence of ducting in the ground nonetheless represents a significant obstacle hindering the investment by private sector companies in laying fibre cables. This absence means that only established companies with large balance sheets can consider such investment; and even then only at a relatively slow pace and in high population-density areas where there is a prospect of a commercial return.

For this reason, Fine Gael argues that ducting is an appropriate area for State investment. The roll-out and management of a comprehensive nationwide network of ducts would remove a crucial barrier to investment by private sector companies, thus accelerating and expanding the deployment of fibre network throughout the country.

Furthermore, one duct can house more than one fibreoptic cable: rolling out ducting can thus allow the State to invest in infrastructure without unfairly benefiting one private company. In fact, providing open-access ducting will encourage competition between network providers. The development of competition at a wholesale level in this way should – crucially – drive private companies to step up the speed of their investment in deploying fibre, and ensure efficiency and innovation

This regulatory model of facilitating competition at a wholesale level by opening access to ducts is one which is gaining currency internationally. Most recently France Telecom announced in October its intention to fully open its ducts to competitors. Opening access to ducts would accelerate the "ladder of investment" regulatory model favoured by the EU Commission, by removing an important barrier to new market entrants rolling out their own infrastructure.

Crucially, the achievement of a network of open-access ducting would ease fears of a wholesale monopoly and ensure that a crucial piece of nationwide infrastructure would be in the control of the State, and not a private sector company whose interests may not coincide with those of the public.

Finally, such an investment would avoid the possible future scenario of competing network providers digging up the same piece of road to install adjacent ducts, and other manifestations of the same kind of duplication of infrastructure that characterised mobile phone mast development.

The importance of wireless

Stimulating private investment in fibre through installation of and management of a network of ducting will only realistically fulfil the NGA needs of at most the 70-80% of Ireland's population that live in the most urbanised areas. It is imperative for many crucial reasons to avoid accentuating the "digital divide" that already exists between rural and urban areas in terms of access to broadband. This can only realistically be achieved by exploiting the potential of wireless technologies to deliver high-speed internet to rural areas.

IV. A blueprint for the rapid achievement of a nationwide network of ducting

1. Consolidation of existing public ducting networks

There is already in place in Ireland a substantial network of backhaul ducting under the ownership of the State. The ESB has a 1300km figure-of-eight shaped network of 48-strand fibre cables stretching throughout the State. Bord Gáis has substantial ducting throughout the country (some of it through its division Aurora Telecom) as do the NRA, Iarnród Éireann and Bord na Móna. There is also of course the MANs.

A previous attempt to tie this network together (known as "Project Dingle") failed for two reasons: it attempted to consolidate the cable as well as the ducting, and it was not pursued with adequate political will and determination. Fine Gael is confident that by acting with the drive that an infrastructural project of this importance merits, significant progress will be made. A private company will be contracted to manage according to strict targets access to all this state-owned ducting

2. Opening access to privately-owned ducting

There are also several privately-owned telecommunications companies who currently own substantial ducting networks throughout the country. The Department should enter into negotiations with the private operators for the purpose of assessing the possibility of the ducting being made available on a commercial basis to other operators who may wish to use it. Such negotiations have been successful in other countries. *France is one of the world's NGA success stories, with at 44Mbps the second highest average speeds globally, and excellent penetration rates. Late last year, in response to negotiations with the regulator, France Telecom has agreed to make a voluntary commercial offer for wholesale access to its ducts.*

While recognising that detailed negotiations are necessary with private operators, Fine Gael is also convinced of the need to regulate if necessary to provide open access to ducting networks where appropriate to facilitate competition. Achieving open access to these ducts will be crucial to encourage alternatives to private monopoly ownership of the wholesale network. Opening access to privately-owned ducting will also remove a major barrier to investment by market entrants in fibre network. Thus the efficiencies created by private sector competition will exist in wholesale network provision. This will go a long way towards solving backhaul problems faced by many Phase II MANs, will quicken the pace of fibre-installation as far as the cabinet, and will obviate the need for heavy government regulation of wholesale prices throughout much of the country, thus saving the taxpayer money.

Such regulation is not unprecedented internationally. Regulation that would mandate non-discriminatory duct access on all owners of infrastructure that is suitable for the deployment of optical fibre is likely to be adopted in France in the near future. Similar regulation was also proposed by the German regulator last April, and expanded in June in response to criticism from the European Commission which felt that the opening of ducts did not go far enough. The Commission itself is advancing proposals for regulation that would mandate the opening of privately-owned ducting.

Fine Gael recognises that there will still be some regulatory issues to resolve in this regard, in relation to setting prices for access to ducting and also with regard to rural areas where there is monopoly ownership of fibre. We recognise the need to encourage private investment into the market and will be willing to engage constructively with private interests and with the regulator in this regard.

3. A legislative framework for ensuring ongoing expansion

Much of the cost of putting ducting in the ground is accounted for by the actual cost of the digging. Therefore it is imperative that a legislative framework is put in place for ensuring that whenever roads are dug up for other purposes – maintenance, repairs, house-building, and of course construction of new roads – ducting is also installed. Forfás recently signalled its support for such legislation in its December 2007 broadband report. *Such legislation has also been put in place with success in other countries, the Stockholm model being the most frequently-cited.*. Such legislation will lay the basis for an ever-expanding backhaul ducting network under state ownership.

Fine Gael also proposes that building standards regulations be revised to require the installation of ducting to all new buildings that can facilitate fibre-optic cable. This will ensure that all buildings built in the future are FTTH-enabled via state-owned ducting from the kerb to the house.

It will also be crucial to ensure that all vital broadband-related infrastructure – upgrading of cabinets, digging of ducts both in the core network and as far as the home where operators find it commercially viable to install FTTH – be subject to fast-track planning processes.

4. Financing required infrastructure through NDP2

The National Development Plan 2007-2012 allocates €435million to communications and broadband projects. A detailed breakdown of this figure has not been forthcoming from the Minister, except to say that €35million of it was spent in 2007, and that some of the remaining €400million will be spent on remaining commitments under MANs II and the NBS.

It can be deduced therefore from the fact that the entire cost of MANs II is somewhere between €80 and €130million that there is approximately €300million remaining to be allocated for communications projects.

The cornerstone of Fine Gael's plan therefore involves a frontloading of the approximately €300million available under NDP2 for NGA infrastructure.

Fine Gael argues that rather than continuing with MANs-style investment by the State in laying ducting and fibre in urban areas throughout the country, exchequer funds would be better spent on infrastructure that encourages the private sector to invest in NGA in both urban and rural settings using all technologies available. Such an approach will encourage a more rapid rollout of NGA and promote more wholesale competition.

Exactly where these funds should be spent can only be decided after a comprehensive audit by the Department of the infrastructure that exists in the ground already, and in consultation with industry experts. Clearly the State should not be duplicating privately owned infrastructure, if open-access to the infrastructure is available at a reasonable cost. This audit will also include assessments of the viability and cost of high-speed wireless technologies in areas where, because of distances involved, laying ducting would be too expensive.

Fine Gael proposes that a contract for the administration of available capital on behalf of the State and the construction and management of the infrastructure be put out to private tender. The contract involved will be similar to those awarded to build and manage the MANs. The contract will include specific, ambitious targets in relation to roll-out of infrastructure and achievement of connectivity. It is self-evident that any such investment will need to be consistent with EU state aid rules.

In many cases, once an audit exists, it will be possible to achieve connectivity between different backhaul networks at relatively low cost. It is well-known that there are substantial pieces of ducting infrastructure around the country currently unused because one or both ends remain unconnected to a network. One major problem that is often highlighted is the lack of connectivity between the MANs Phase II rings and any backhaul network. In such cases targeted investment can add substantial value to the overall network by linking such important unused assets to it.

Much of the funds will need to be spent on rolling out ducting between the exchange and the cabinet in urban and suburban areas where such infrastructure does not already exist. In many cases this will solve the "last-mile" problem associated with the MANs. There are international precedents for such a proposal. *In 2003 the Taiwanese government announced the Broadband Duct Construction Project, involving an investment of approximately US$900million over five years in the construction of 6000km of public broadband ducting which would then be leased to private sector telecoms operators. The aim of this, according to the government, is to "greatly improve the bandwidth and quality of last-mile connectivity in Taiwan and stimulate genuine competition among local network services providers". It is too early to assess the success or otherwise of this project, but the government estimates that it will achieve 4.2million residential users of FTTH by 2010, which would be a staggering achievement given that the total number of broadband subscribers in the country currently is 4.5million.*

Rolling out substantial amounts of ducting between the exchange and the cabinet will bring about a major improvement in the fibre deployment in Ireland, enabling private operators to install fibre to the cabinet throughout much of the country at relatively little cost. It must be recognised that upgrading the infrastructure between the exchange and the cabinet is not just a ducting issue, there is also a need to significantly upgrade cabinets (at the kerbside) to facilitate fibre.

5. Investment in wireless

Private operators such as Eircom, UPC, Smart and BT are currently rolling out fibre where possible in preparation NGA competition. It is therefore likely that not all of €300million available under NDP2 will need to be spent on ducting. State involvement in other NGA technologies should also be considered, in particular in the area of wireless infrastructure.

In many isolated rural areas, wireless technology is essential. The capability of such technologies to supply high-bandwidth connectivity is developing rapidly, through systems such as "wireless fibre", and state support to such technologies may need to be considered. Wireless technology is also crucial for the development of platform competition in urban areas.

Furthermore, the switch-off of analogue television in 2012 will lead to a freeing-up of spectrum that could be used to supply high-bandwidth broadband. The allocation of spectrum issue needs further consideration at a policy level.

6. National Broadband Scheme

While the National Broadband Scheme, and the government's approach to it, needs to be debated independently of this document, one major problem needs to be highlighted. There is little point in using the NBS to provide first generation broadband to isolated parts of the country, while the rest of the country is being upgraded to NGA. There is a clear danger of deepening the urban-rural divide if we do not attempt to roll out high-bandwidth connectivity through this scheme. The tendering process should be for provision of high-speed service, not solely connectivity that will be obsolete almost as soon as it is rolled out, as under the contract current conditions.

7. Prioritising NGA for schools

Fine Gael believes that providing next generation broadband access to every school in the country should be an immediate government priority. To deliver this, the government should invite tenders from the private sector to supply high-bandwidth access within a set period of time. NGA will not only provide schools with new multi-medial opportunities to improve education and teaching, but it will also prepare students for the new technologically advanced challenges they face. If Ireland is to be considered as a centre for technology and innovation, then we must prepare our workforce from primary school level.

In relation to government buildings and government-provided services, NGA has a significant role to play in delivering real e-government.

8. Further issues

This document does not purport to be the solution to all of Ireland's broadband woes. Clearly some issues will remain around the local access network – i.e. the line going from the cabinet to the house – such as the need for sub-loop unbundling through regulation.

There should also be a long-term aspiration to replace the copper line to most houses with fibre over a phased period. Insisting on adequate ducting to all new houses and on other measures contained in this document, will contribute to ensuring that this happens over time.

Other issues that will need to be addressed include the uncompetitive cost of backhaul going off the island, and the need to address the demand side of the problem. Proactive government policy will be needed to ensure competitive pricing for computers, hardware and software, and education programmes should be considered to instruct older members of society in the use of ICT.

V. Conclusion

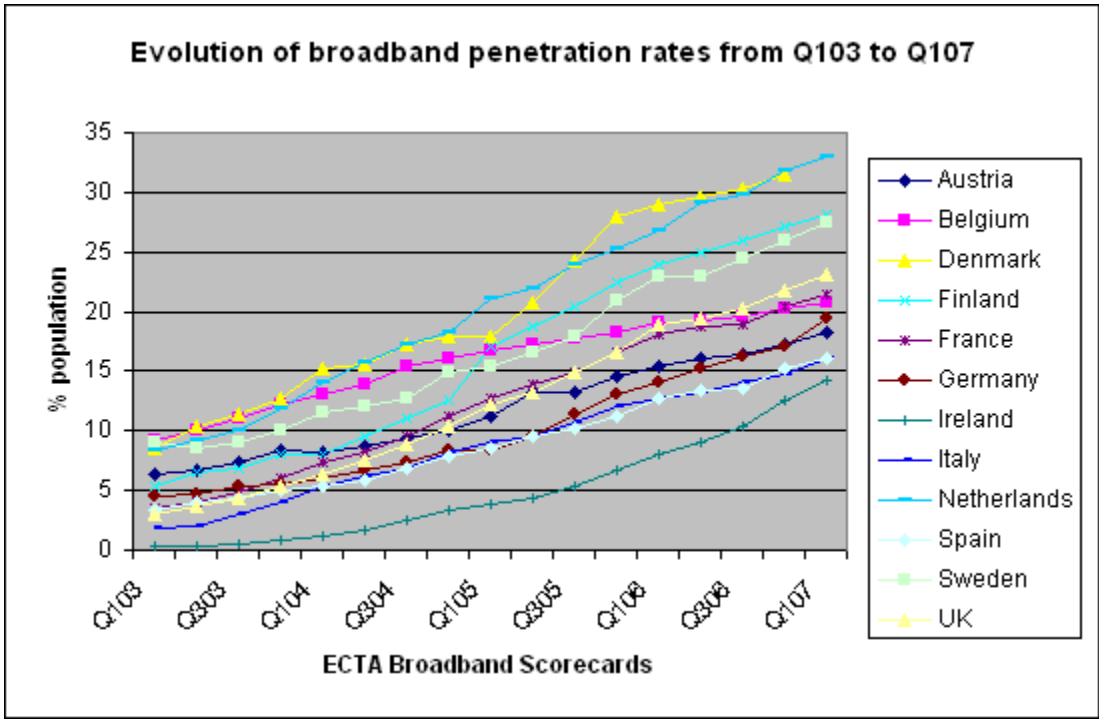
The time is long overdue for Ireland to prioritise investment in high-speed broadband infrastructure using a proven formula that provides rapid results and value for public money spent. Failure to do so will have very serious consequences for the future of our economy and country. Adopting a brave and visionary policy now – like Korea did ten years ago – will give Ireland the opportunity to leapfrog our competitors and give the country an enormous advantage in years to come.

In the National Development Plan, at least €300million is available for investment in NGA infrastructure. Fine Gael argues that rather than the State continuing to invest in owning fibre, this money can be spent in a smarter way that delivers better results.

In this document Fine Gael sets out a clear, detailed blueprint for a frontloaded government investment programme that can do exactly that.

List of Appendices

Appendix I


Evolution of broadband penetration rates from Q103 to Q107
% population
35
30
25
20
15
10
5
0
Q103
Q303
Q104
Q304
Q105
Q305
Q106
Q306
Q107
ECTA Broadband Scorecards
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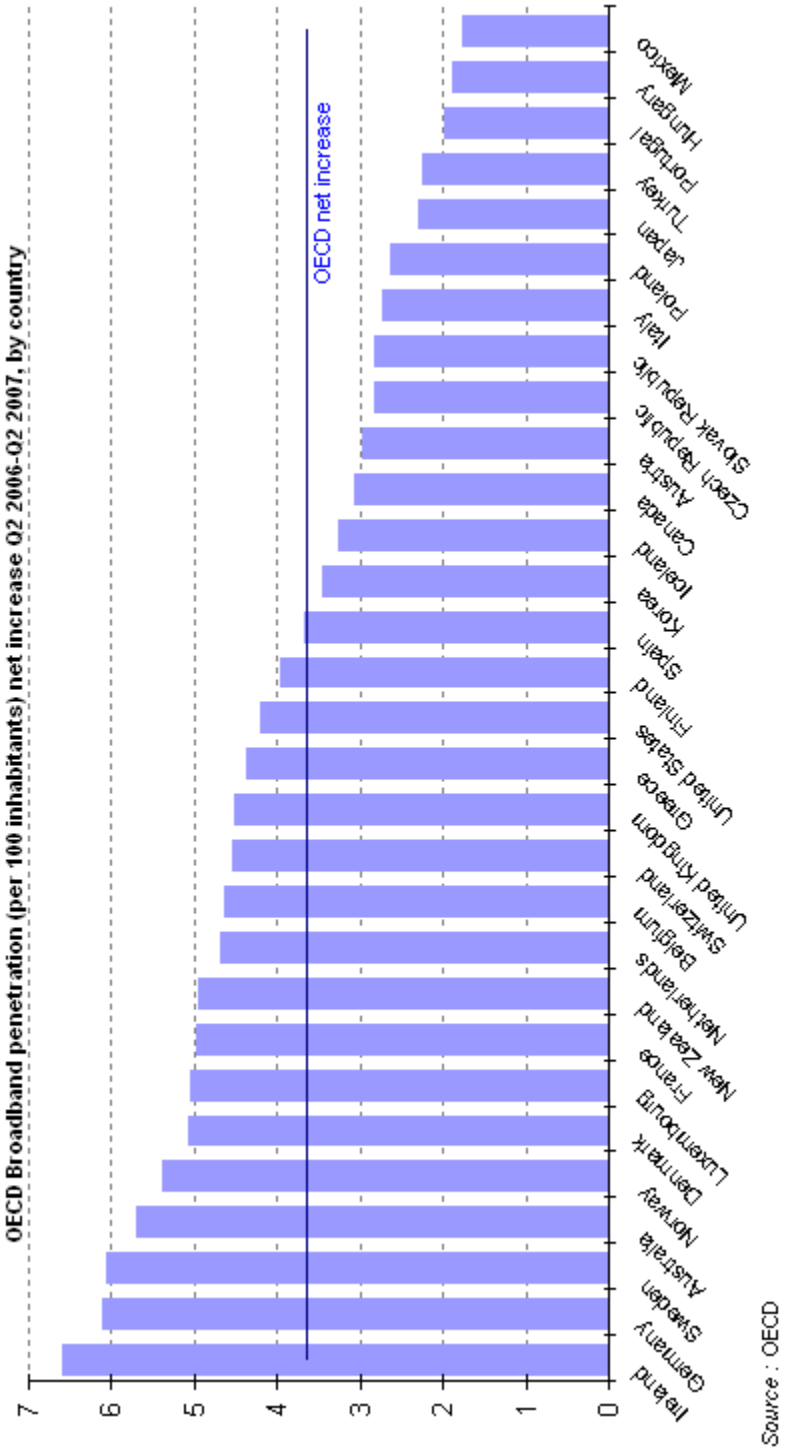
France
Germany
Ireland
Italy
Netherlands
Spain
Sweden
UK

Appendix 2


OECD Broadband penetration (per 100 inhabitants) net increase Q2 2006-Q2 2007, by country
OECD net increase
0
1
2
3
4
5
6
7
Iceland
Germany
Sweden
Australia
Norway
Denmark
Luxembourg
France
New Zealand
Netherlands
Belgium
Switzerland
United Kingdom
Greece
United States
Finland
Spain
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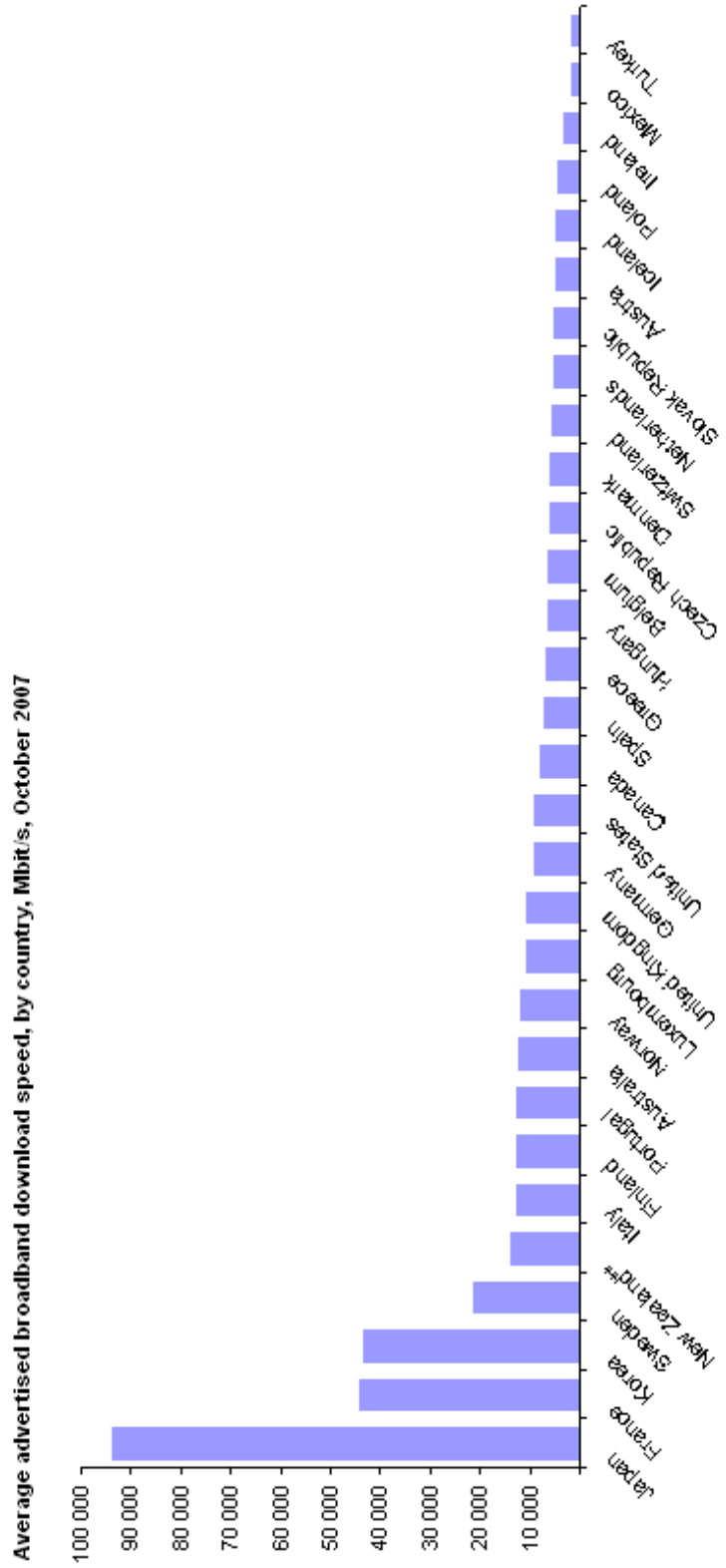
Portugal
Hungary
Mexico
Source : OECD

Appendix 3


Average advertised broadband download speed, by country, Mbit/s, October 2007
100 000
90 000
80 000
70 000
60 000
50 000
40 000
30 000
20 000
10 000
Japan
France
Korea
Sweden
New Zealand*
Italy
Finland
Portugal
Australia
Norway
Luxembourg
United Kingdom
Germany
United States
Canada
Spain
Greece
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Slovak Republic
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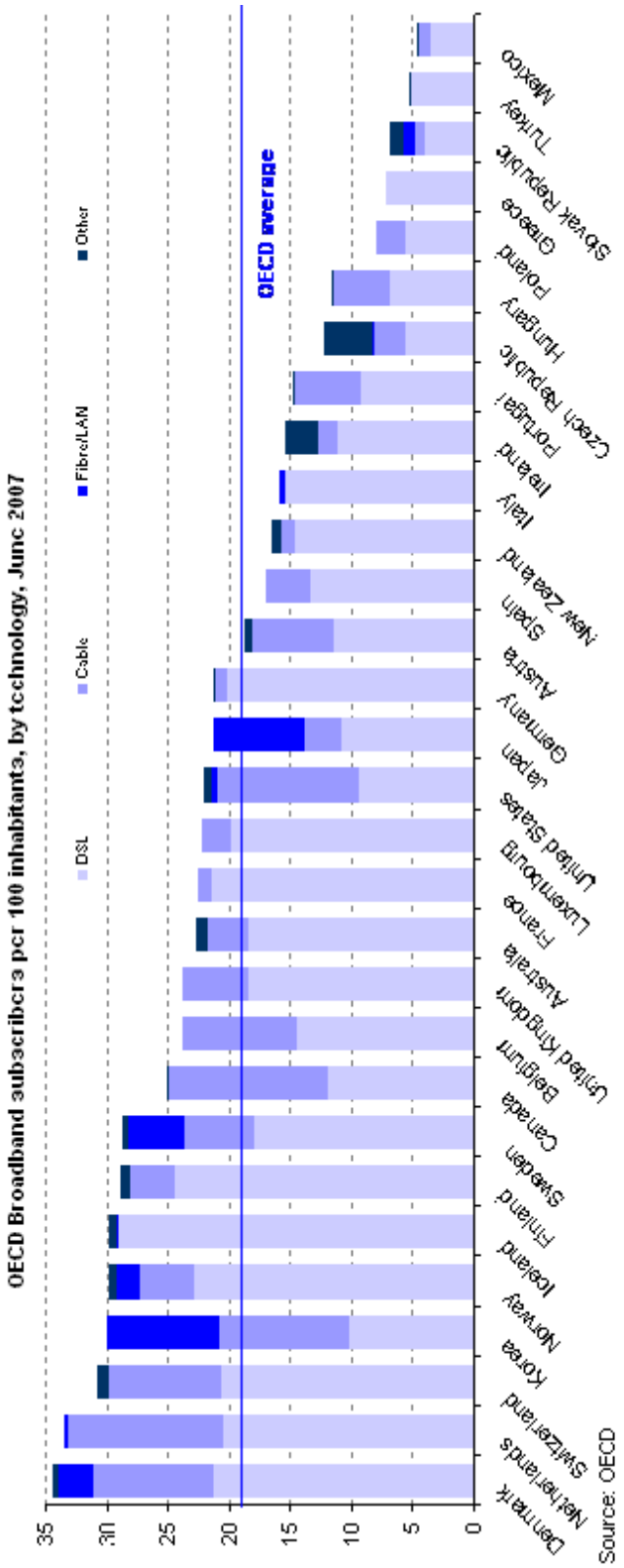
Iceland
Poland
Ireland
Mexico
Turkey

Appendix 4


OECD Broadband subscribers per 100 inhabitants, by technology, June 2007
DSL
Cable
Fibre/LAN
Other
OECD average
0
5
10
15
20
25
30
35
Denmark
Netherlands
Switzerland
Korea
Norway
Iceland
Finland
Sweden
Canada
Belgium
United Kingdom
Australia
France
Luxembourg
United States
Japan
Germany
Austria
Spain
New Zealand
Italy
Ireland
Portugal
Czech Republic
Hungary
Poland
Greece
Slovak Republic
Turkey
Mexico
Source: OECD

Notes

Notes