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PROMOTING BROADBAND:

THE CASE OF ICELAND

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1 Introduction

1.1 The broadband challenge

Broadband networks, enabling high-speed and always-on Internet connections, are coming to be seen by many to be critical for economic growth and development, both at the national and global level. The increase in available bandwidth is set to bring about a variety of new applications and services that will radically transform the way we lead our daily lives. Many economies, municipalities, and communities, therefore, are investing heavily in the deployment of broadband networks. However, building and supplying adequate infrastructure is only the first step. In fact, in many regions, the rate at which users are adopting broadband technologies has been disappointing, despite their wide availability. Governments and industry have now begun addressing the demand side of the broadband challenge, by looking at ways in which the take-up of broadband services can be accelerated.

In this respect, inhabitants in the Nordic countries have been particularly early adopters. This report focuses on broadband access in one such Nordic country, Iceland. It examines the country's network infrastructure, the current level of broadband penetration and the main corporate and governmental initiatives for promoting demand. Iceland is an excellent example to study, given its technologically savvy population and active fibre rollout programme. The country also boasts the world's highest number of Internet users per capita.

1.2 The meaning of broadband

As defined by the International Telecommunication Union (ITU), in its ITU-T Recommendation I.113, broadband has transmission capacity that is *faster* than primary rate ISDN, that is to say 1.5 or 2.0 Mbit/s. But many telecommunication providers sell services to consumers at speeds of 144 kbit/s, labelling these "broadband" services. It is to be noted that the OECD (Organisation for Economic Co-operation and Development) considers downstream access of 256 kbit/s (with 128 kbit/s upstream) as broadband¹. For the purposes of this paper, broadband is taken to refer to high-speed, high-capacity communication technologies of which xDSL (digital subscriber lines) and cable modems are currently the most popular. Other means for providing broadband access to the Internet include optical fibres, wireless LANs, fixed wireless services, satellite, and dedicated leased lines.

1.3 About the report

The information and analysis presented in this report forms part of the background material for a New Initiatives Workshop² convened in Geneva in April 2003 by ITU. Country case studies on Japan, Canada, the Republic of Korea and Hong Kong, China will also be presented. This ITU workshop is meant to serve as a forum for telecommunication policy-makers, national telecommunication regulators, industry players and user groups to exchange information and experiences on the best ways to promote broadband deployment and use around the world. The workshop will examine the different strategies followed by ITU member states for promoting broadband networks.

The present study is divided into six chapters. Chapter two of this report provides a background to the country of Iceland, its geography, demographics and economy. Chapter three provides a history of telecommunication regulation in the country, including some of the key milestones in telecommunication development. Chapter four takes a closer look at the broadband market, the level of competition, the main players, network infrastructure and services. Chapter five examines the main strategies, policies and regulations in place for promoting broadband. Chapter six concludes with an analysis of the key success factors, and the main opportunities and challenges for broadband development in Iceland.

2 Country background

2.1 Geography and demographics

Between the Atlantic Ocean and the Greenland Sea, and just short of the Arctic Circle, lies Iceland, one of the least populated and most isolated of the Nordic countries. The island is home to 288'000 people and has



a landmass of 103'000 square kilometres, giving it a population density of 2.79 inhabitants per square kilometre. It terms of size, it can be compared to Ireland or the state of Virginia in the United States. The island is continually increasing in size (at a rate of about 2 centimetres per year) due to the expanding continental drift between the North American and Eurasian tectonic plates. Not surprisingly, the country is characterized by heavy geothermal activity and has been the victim of a number of serious earthquakes and volcanic eruptions over its short history. Its terrain is mostly plateau, interspersed with mountain peaks, ice fields and fjords along the coasts. Among Iceland's most distinctive features are its glaciers, which cover over 11.5 per cent of its total surface area. Its rich natural resources provide the country with important supplies of fish, geothermal power and hydropower. Most towns and cities are located along a narrow coastal belt, as most of the country's interior regions are uninhabitable. The vast majority of the population (93 per cent) lives

in urban areas and about 62 per cent live in and around the capital, Reykjavik. The country is remarkably homogeneous, due to its relatively short history and low immigration levels. The national language, Icelandic, has changed very little from the original tongue spoken by the first permanent settlers who came from Norway in the late 9th century. Many Icelanders speak Danish and their knowledge of the English language is fairly advanced. The national currency is the Icelandic Kronur, which is equal to about 1.3 US cents.

Iceland's first inhabitants are believed to have been Irish monks, who regarded the island as a sort of sanctum until the early 9th century. The country's first permanent settlers came from Norway and the British Isles. The country's parliament and the world's oldest, *Althing*, was set up in the year 930. By the early 13th century, peace had given way to political treachery and violence. The famous Mount Hekla erupted in 1300, 1341 and 1389, causing widespread death and destruction. To make matters worse, the plague that struck Norway in 1349 decimated two-thirds of the country's population and effectively cut off trade and supplies. At the end of the 14th century, Iceland was brought under Danish rule. Disputes between Church and State resulted in the Reformation of 1550 and Lutheranism became the country's religious doctrine. For the next two centuries, Iceland endured Danish profiteering, attacks by international pirates, and an increasing number of natural disasters.

In 1874, a constitution was drafted and Iceland was once again permitted to handle its own domestic matters. In 1918, Iceland was made an independent State within the Kingdom of Denmark, with Copenhagen retaining responsibility for defence and foreign affairs. On 17 June 1944, while Denmark was occupied by Germany, Iceland became an independent State.

Table 2.1: Basic social and economic indicators for Iceland

	1997	1998	1999	2000	2001	2002
Population (000s)	273	275	279	281	287	288
Gross Domestic Product (GDP) (US\$ billion)	512.7	567.5	606.5	658.3	744.2	744.4
GDP Per Capita (US\$)	18'780	20'636	21'738	23'427	25'930	25'847
Average Annual Exchange Rate Per US\$	70.90	70.96	72.34	78.62	97.40	91.46

Note: In March 2003, the exchange rate per US\$ was 77.82 ISK

Source: International Telecommunication Union, Iceland Statistics

2.2 Human development

The standard of living in Iceland is high. The country ranks seventh among the 162 countries that make up the United Nations Development Programme (UNDP) Human Development Index (HDI)³ and is placed in the 'high' human development group. In this respect, it ranks ahead of Denmark, Finland, Switzerland and Hong Kong, China, but behind Norway, Sweden, Canada and the United States. [Table 2.1](#) provides some relevant social and economic indicators for the country.

2.3 Political economy

When Iceland became a republic in 1944, the post of President was created to fill the void left by the Danish King. Most executive power, however, rests with the government and its head, the Prime Minister, who must have majority support of the *Althing* Parliament. Parliamentary elections in Iceland are held once every four years. The current government is a coalition of the conservative Independence Party (led by Prime Minister David Oddsson) and the rural-based Progressive Party.

Due to its characteristic geothermal activity, Iceland is rich in sources of energy: electricity and hot water are available at very low cost to its inhabitants. Its economy is mainly driven by exports. The fisheries industry accounts for the majority of exports. Other major exports include aluminium, ferro-silicon alloys, electronic fishing machinery and equipment, pharmaceuticals, and woollen goods. Information technology is also an important growth area. Most of Iceland's exports are to European Union and EFTA (European Free Trade Association) countries, Japan and the United States (which is Iceland's largest trading partner).

Over the last decade or so, significant deregulation has opened Iceland's economy to greater competition. In the early 1990s, the Government initiated structural reforms and a reassessment of economic policies pursued in earlier years. In 1994, this process was accelerated as Iceland joined the European Economic Area (EEA) and started implementing European Union (EU) legislation and directives. At the core of these reforms was a greater emphasis on an extensive liberalization programme and the privatization of State-owned enterprises. Some of the sectors, however, such as fishing and agriculture, remain heavily regulated. The GDP per capita in Iceland was US\$ 26'397 at the end of 2002.

Iceland enjoyed strong economic growth in the 1990s. Inflation, however, rose sharply at the end of the decade. In late 2001, the country fell into a recession, and the Government had to take fiscal measures to decrease inflation. According to the Central Bank of Iceland, the inflation rate for 2002 was 2 per cent and it is estimated to remain at the same level through 2003. Iceland's economy grew by 5.5 per cent in 2000, 3 per cent in 2001, and a near 0 per cent in 2002. Growth is expected to rise to 2-3 per cent in 2003.

3 The regulatory environment

3.1 Telecommunications legislative framework

With the implementation of the agreement on the European Economic Area (EEA) in 1994, Iceland, Liechtenstein and Norway (EFTA⁴ States) adopted more than forty years' worth of regulatory precedent from the European Union (EU). With the exception of economic and taxation policy, all relevant EU legislation for the internal market has been integrated into the agreement. The levels of implementation of harmonization of European regulation in EEA/ EFTA States are comparable to those of the European member states. Moreover, in line with the information and consultation procedures with the EU under the Agreement, EEA/EFTA States provide regular input to the direction of European legislation.

The Icelandic Government undertook to abolish the historical monopoly in telecommunication services and foster competition. This resulted in the incorporation of Póstur og sími (Post and Telecom Iceland) as a limited liability company in 1996/97 and the creation of the regulator, the Post and Telecom Administration (PTA). At the beginning of 1998, postal services were once again separated from telephone services, and Iceland Telecom Ltd. (Landssími, or Síminn) was formally established.

The 1996 revisions to the *1993 Telecommunications Act* made provisions to open the telecommunication sector to full competition from 1 January 1998 in line with much of the EU. The new *1999 Telecommunications Act*, which came into effect in January 2000, mandated the opening up of the incumbent's telecommunication network to competitive providers. In addition to local access, the *Act* also covered new licensing regimes, interconnection, number portability and carrier pre-selection. In May 2001, after much parliamentary debate, legislation was passed regarding the privatization of Landssími, the incumbent operator. However, the share offering was unsuccessful and in March 2003, the company was still 99 per cent State-owned.

The following 2002 EU directives have been incorporated into a new telecommunication legislative package:

- Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive);
- Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (Authorisation Directive);
- Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive);
- Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

3.2 Key governmental entities

The two public sector entities governing the telecommunication sector are the Post and Telecommunications Administration of Iceland and the National Competition Authority. Given that European regulations on telecommunications are based on both principles of the internal market and competition policy, the work of two entities often converge. In fact, there is formal cooperation between the telecommunication regulator and competition authority in most European countries, including Iceland.

3.2.1 The Post and Telecommunications Administration

The national regulatory authority is the Post and Telecommunications Administration of Iceland (PTA), which was set up in 1997 with powers pursuant to the provisions on open network access. In 1999, the *Althing* passed new legislation governing the authority (Act No. 110/1999).

The tasks of the Administration under the 1999 Act involve, on the one hand, supervision, and, on the other hand, various administrative responsibilities such as licensing and contract negotiation. As is the case in many other European countries, the PTA's responsibilities cover three main areas: the granting of operational licences for posts and telecommunications, the supervision of licensees and the enforcement of the Government's telecommunication policy and regulations. Other tasks include the resolution of disputes between market players, type approval for subscriber equipment, fostering international cooperation, and providing advice to public authorities. Systematic efforts are being made to enhance the monitoring capabilities of the PTA and its resources for protecting the interests of consumers and service providers.

3.2.2 Ministry of Transport, Tourism and Telecommunications

The formal establishment of the Ministry of Transport, Tourism and Communications took place when the Ministry of Industry and Communications was split into two different entities in 1969.

The Ministry's mandate covers the following matters:

- Roads and road construction.
- Lighthouses, harbours, the Harbour Improvement Fund and dams.
- Aviation and airports.
- Navigation.
- Planning of land, air and sea transport operations.
- Operations of transportation companies under the auspices of the State.
- Monitoring ships, ship inspection, ship measurements, ship
- Registration, legal registration of seamen and their occupational rights.
- Tourism, restaurants, tourist bureaus, traffic centres and the Icelandic
- Tourism Fund.
- Passenger surface transportation and matters relating to taxi drivers.
- Post and telecommunications.

The responsibilities of the Ministry include, *inter alia*, preparing draft legislative proposals for parliament, issuing work permits and professional licences, publications and information dissemination. The following organizations are under the Ministry's supervision: the Public Road Administration, the Icelandic Maritime Administration, the Icelandic Civil Aviation Administration, Marine Accident Investigation Committee, Aircraft Accident Investigation Board, the Icelandic Tourist Board and the Post and Telecom Administration. International cooperation is also an important feature of the Ministry's activities.

3.2.3 Competition Authority

Iceland's Competition Authority is entrusted with the task of ensuring the availability of quality goods and services for consumers at reasonable prices. This is achieved through the promotion of active competition and fair trade practices. The Competition Authority is responsible for the surveillance of telecommunication undertakings, as well as other types of undertakings, under competition law. Among the more important tasks of the Authority is ensuring compliance by companies with market power to rules on financial accounting separation. The authority's mandate is set out in the Competition Act (Act No. 8/1993, as amended by acts no. 24/1994, 83/1997, 67/1998, 82/1998 and 107/2000) and includes issues such as collusion, market dominance, mergers and unfair business practices. This ensures consistency in the application of competition rules from sector to sector. With the passing of Act No. 107/2000, the role of the competition authority was substantially widened, for instance through the broad prohibition of anti-competitive collaboration and collusion by business enterprises.

4 The market for broadband

Icelanders have always been ahead in their adoption of new technologies and services. It is not surprising, therefore, that the term "Broadband" as it is used in Iceland refers only to high-speed Internet connections

over fibre optic cables, and does not, for instance, cover DSL networks. Síminn, in fact, has branded its Internet service over fibre “Internet over the Broadband” or *IuB*. In this case, “the Broadband” refers to Síminn’s fibre optic city network. This chapter describes the growth of the Internet in Iceland, the main players in the market, infrastructure development and service penetration.

4.1 Origins and growth of the Internet in Iceland

One of the milestones in Iceland’s telecommunication history was the laying, in 1906, of a submarine telegraph cable from Scotland through the Faeroe Islands and on to the East Coast of Iceland. At the same time, a telegraph and telephone line was laid to the capital, Reykjavik. 1906 also saw the creation of the Icelandic State Telephone Service, “Landssími Íslands”.

The submarine cable effectively ended the country’s isolation and marked the early beginnings of the country’s information society. In 1912, the first underground telephone cable was laid in Reykjavik and three years later, Landssími set up the first radiotelegraph station on the outskirts of Reykjavik. The next important step was the introduction of automatic telephone stations in Reykjavik and Hafnarfördur in 1932. In 1935, telephone and postal services were consolidated. The rollout of telephone lines in rural areas was completed around 1960.

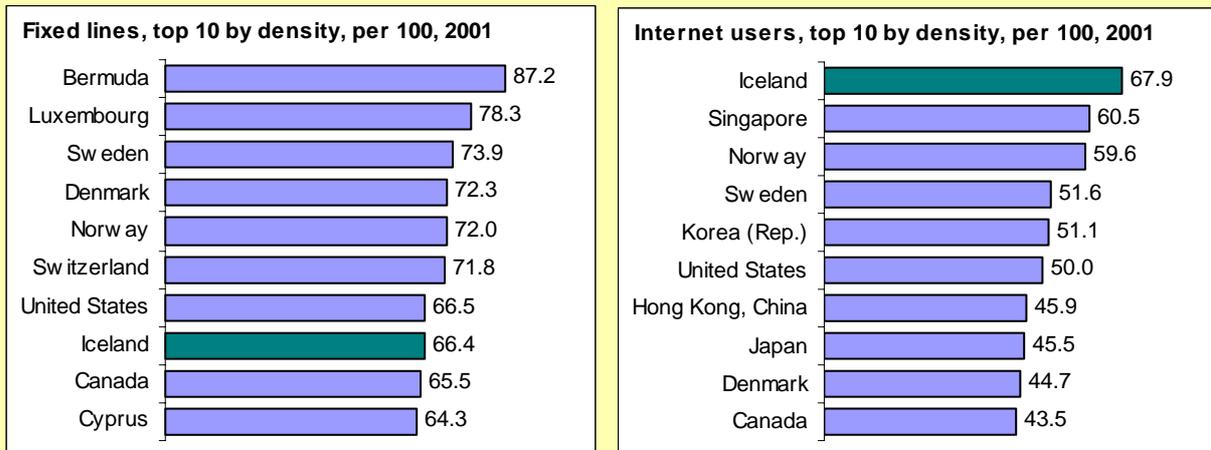
In 1962, the SCOTICE submarine cable between Scotland and Iceland was opened. Telex services were then made available in Iceland, and proved very popular with companies and institutions. A year later, the ICECAN cable between Iceland and Canada became operational. In 1980, the Skyggnir Earth Station came on-line, and telephone traffic to other countries was first carried out via satellite. This made direct dialling to other countries possible for the first time. Skyggnir still accommodates part of the traffic and is also used as a back-up route. In 1994, a new submarine cable, CANTAT-3, began carrying international voice and data traffic. The initial investors in the cable were Teleglobe, Landssíminn, TeleDanmark, British Telecom and Deutsche Telekom. Íslandssími bought the indefeasible right of use (IRU)⁵ in the cable in 2000. Lina.Net is currently leasing cable capacity from Teleglobe.

Iceland was connected to the global Internet in 1986, through a UUCP connection from the Marine Research Institute in Iceland to the European Unix Network (EUnet) headquartered in Amsterdam. During the same year, the University of Iceland was connected to the Marine Research Institute. With this connection, the Icelandic Network (ISnet) was given access to the Internet.

In 1989, an Internet Protocol (IP) connection was established with NORDUnet in Denmark. This connection used IP over x.25. In March 1997, ISnet was directly connected to TeleGlobe in Montreal (Canada) and Iceland’s connectivity was extended from Europe to North America. In 1990, the first permanent leased line connection to NORDUnet’s central site in Stockholm was set up.

Since then, Internet use in Iceland, like in other Nordic countries, has grown at a phenomenal rate. At the end of 2001, 68 per cent of its population was online, that is to say 195’000 people ([Figure 4.1](#)). As such, Iceland had the highest Internet penetration in the world. The number of fixed and mobile lines in the country also places it in the top ten worldwide. It is hardly surprising, therefore, that in terms of combined fixed line, mobile and Internet density, Iceland finds itself at the top of the world ([Figure 4.2](#)).

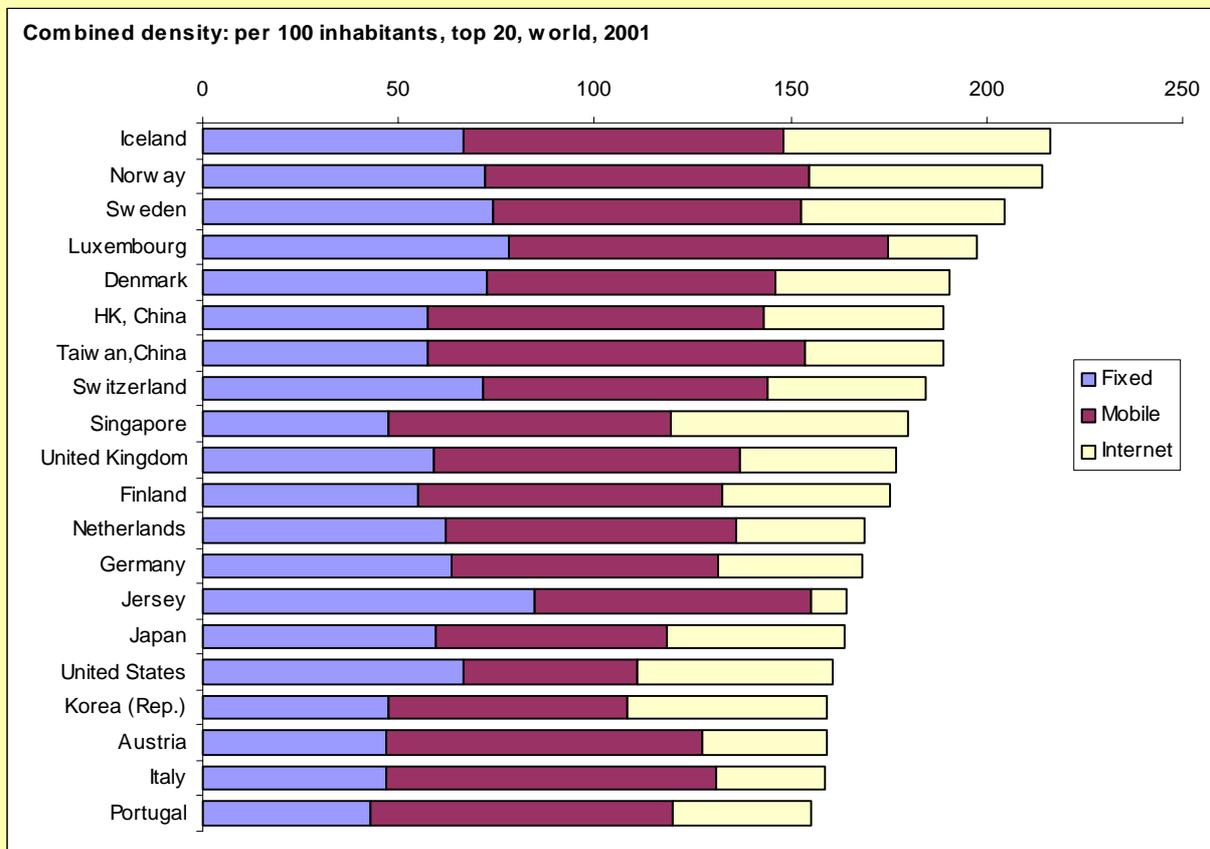
Figure 4.1 Fixed lines and Internet penetration - Iceland in top 10 (at year-end, 2001)



Source: International Telecommunication Union

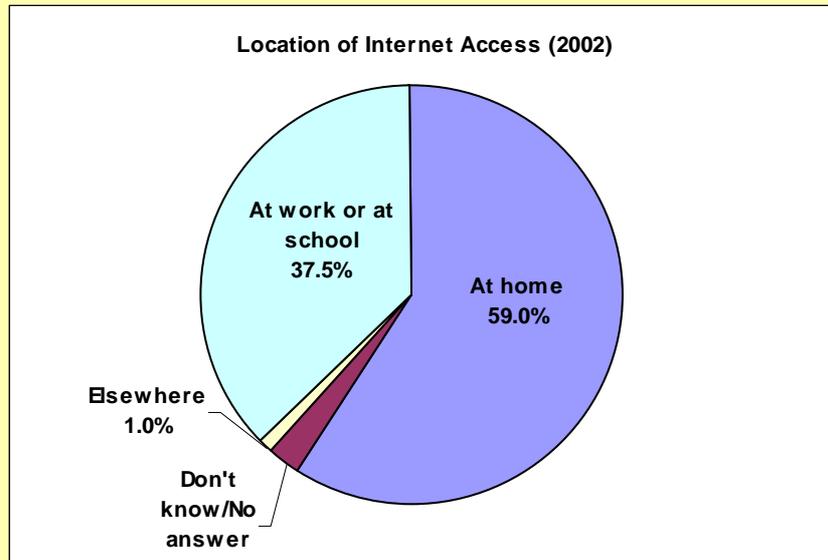
The small island is, in fact, one of the world's most technologically sophisticated societies⁶. Icelanders have typically embraced new technologies with little reserve and the country is often used as a test bed for the innovations of foreign companies. The use of e-banking and e-government applications is high as is the penetration of high-speed access networks. The penetration of personal computers was about 42 per cent at

Figure 4.2 Iceland at the top of the world: combined fixed, mobile and Internet density (at year-end, 2001)



Source: International Telecommunication Union

Figure 4.3 Where do Icelanders use the Internet the most?
 Percentage of respondents using the Internet, aged 16-75, April 2002



Source: Price Waterhouse Coopers.

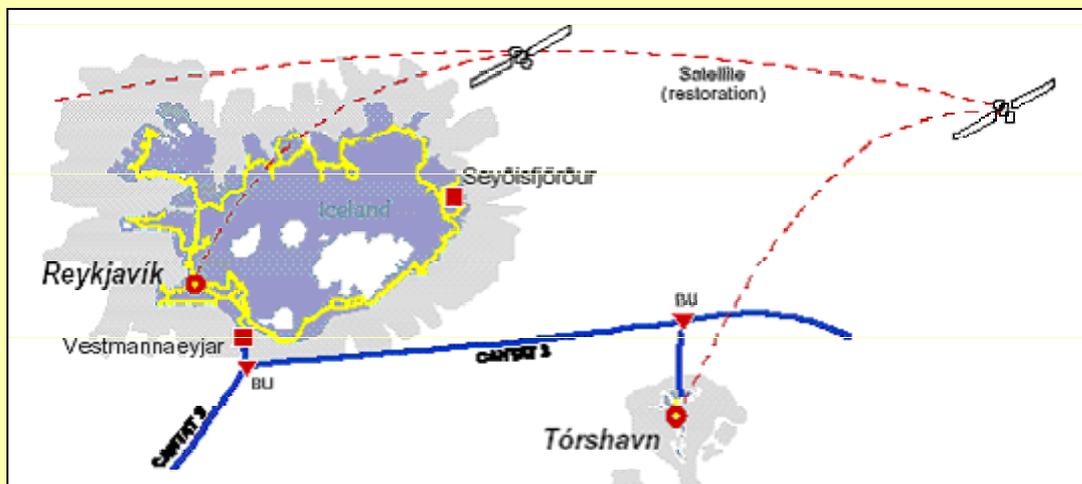
the end of 2001. The results of a survey conducted by Price Waterhouse Coopers in March and April 2001 indicate that the majority of Icelanders have Internet access at home (Figure 4.3).

4.2 Current and planned international connectivity

As mentioned above, Iceland’s international Internet connectivity is provided through the CANTAT-3 submarine cable, which passes via Germany, the United Kingdom and Denmark through the Faeroe Islands to Iceland and finally to Canada. Restoration is achieved through satellite links. CANTAT-3 has served as the only high-speed fibre optic connection for Iceland and the Faeroe Islands to the outside world since 1994 (Figure 4.4). This level of connectivity has been deemed unsatisfactory, as the cable has had to undergo repair on numerous occasions.

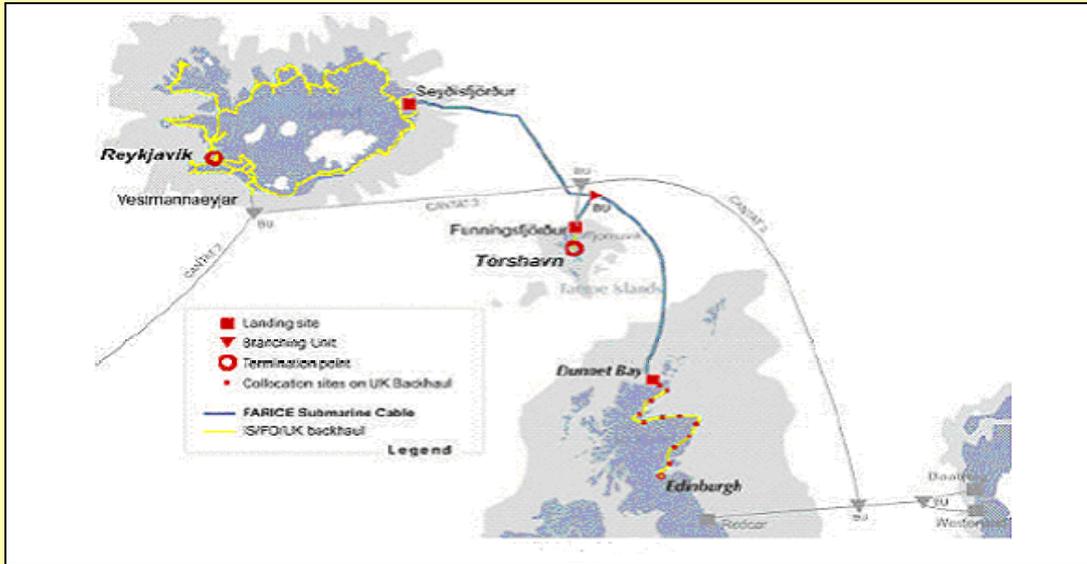
The idea of improving connectivity by building a new cable connecting Iceland and the Faeroe Islands with

Figure 4.4 CANTAT-3 and international connectivity arrangements



Source: FARICE

Figure 4.5 The new FARICE cable route



Source: FARICE

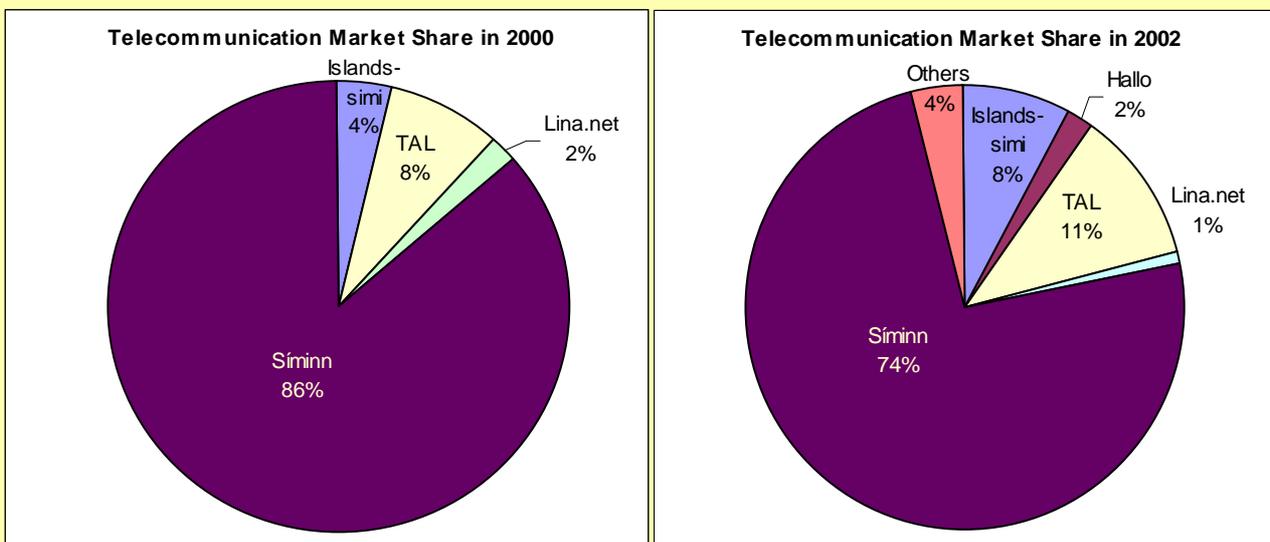
the rest of the world has been on the drawing boards for some time. In early 2002, the two incumbent operators, Iceland Telecom and Faeroese Telecom, formally joined forces to work on a new cable project by the name of “FARICE”. In September 2002, FARICE was incorporated as a new limited liability company entrusted with managing the project. The route for the new cable is sketched out in [Figure 4.5](#).

4.3 The main players

Due to significant merger activity, the Icelandic telecommunication market as a whole is now characterized by a duopoly. In 2002, two of the smaller players, Halló Frjáls and TAL, merged with Íslandssími, making the latter the main competitor to the incumbent. The incumbent’s market share overall dropped 12 per cent between 2000 and 2002 ([Figure 4.6](#)). This section focuses in on the main players in the Icelandic broadband Internet market: Síminn, Íslandssími, Lina.net, the Reykjavik Power Company and the National Power Company.

Figure 4.6 Telecommunication market share in Iceland

Market Share by operator in 2000 and 2002 (prior to the acquisition of TAL and Halló by Íslandssími)



Source: Íslandssími, Síminn

4.3.1 Landssíminn or “Síminn”

Landssíminn is Iceland’s historical operator. The name “Landssíminn” comes from the old Icelandic word for thread, “sími”, which had fallen into disuse. The word was then re-used to designate a telephone. In 1935, the telephone and postal services were consolidated, but in 1998 they were split up again, leading to the creation of Iceland Telecom Ltd or Landssími Íslands hf. Typically, Icelanders refer to the company as Síminn”. Efforts at privatizing the company were made in 2001. The low value of the purchase offers combined with the general economic downturn in the industry, resulted in a decision to postpone the privatization process.

The company offers fixed and mobile telephony, local loop services, high-speed Internet access, and data transmission services. Síminn began building its optical fibre network in 1985. In 1986, the fibre ring network around the country became operational (Figure 4.10). The rollout of the fibre network in the city of Reykjavik began in 1995. Bi-directional nodes were set up in 2000 and Internet services over fibre (Internet over the broadband or “IuB” services) were first made available commercially in the summer of 2002.

4.3.2 Íslandssími

With deregulation and the introduction of competition in the mid 1990’s, new players were able to enter the Icelandic market. Established in August 1998, Íslandssími is Iceland’s second full-service provider. A privately-owned company, it has been offering fixed, mobile and data transmission services since October 1999. Columbia Ventures (United States) is the main investor in the company (40 per cent) and the rest of the shares are held by Icelandic banks and financial institutions. Íslandssími itself owns 92 per cent in the Internet wholesale company Internet Ísland (Isnic), 7 per cent in the fibre optic backbone company Lina.net and 16.5 per cent in P/F Kall, the fixed and mobile operator in Faeroe Islands. Íslandssími owns a part of the CANTAT-3 submarine cable, with two 45 Mbit/s fibre optic connections to the United States and the UK. The company also owns a satellite earth station on Reykjavik’s Öskjuhlíð hill, serving as a backup route.

In 2000, Íslandssími signed an agreement with the Reykjavik Energy (OR)’s Lina.net to build a fibre optic network around power transformer stations in Reykjavik. The company invested about 33 per cent of total project cost of about 2 billion Icelandic Kronur (US\$ 25.5 million). As a result, they now own 2 out of the 96 pairs of optic fibre cables that were laid. The project was completed in the summer of 2001.

When the company was first established, its main focus was data transmission services for the corporate market. Since then, the company has extended its services to residential users offering voice telephony (in 2000) and mobile telephony (in 2001). International voice telephony was first offered through carrier pre-selection. Due to mandated unbundling of the incumbent’s local loop, the company now offers ISDN premium rate access services as well as ADSL (see below). Íslandssími’s high-speed Internet services are primarily available in the greater Reykjavik area.

At the end of 2002, Íslandssími merged with Internet (and fixed line) service provider Halló Frjáls and mobile operator TAL. After the merger, the company’s share of the mobile market rose to 30-35 per cent, its share of the Internet market to 50 per cent and its share of the data transmission market to 37 per cent.

4.3.3 Lina.net

Lina.net was set-up by the Reykjavik Power Company (OR) in June 1999, with the objective of establishing a data transmission network over the company’s power grid. Network rollout first began on 7 August 1999 and was virtually completed by January 2001. The total area of the backbone network in Greater Reykjavik is about 410 km.

Initially, the company had envisaged a project to lay fibre to the home (FTTH). However, equipment purchased from Ericsson turned out to be a considerable investment, and the company decided to shift its focus to the corporate market and fibre to the building (FTTB) solutions. In early 2003, Lina.net sold the fibre network back to the power company. Therefore, OR now owns seventy to eighty percent of the fibre network (and Lina.net), and Íslandssími (and a company by the name of Skyrr) owns the rest. However, Lina.Net still retains ownership over one out of two the fibres connecting Iceland to the Vestmannaeyjar Islands and the CANTAT-3 submarine cable (The other one is owned by Síminn). Currently, the company offers predominantly fibre solutions (e.g. VLAN and dark fiber) to corporate customers. In 2002, it was granted a fixed-wireless access (FWA) license.

4.3.4 Reykjavik Energy (OR)

Reykjavik Energy (“Orkuveita Reykjavíkur” or OR) was established in January 1999, following a joint venture between the Reykjavik Geothermal Company and the Reykjavik Electricity Company. At the end of 2000, the Reykjavik Water Company merged with the other two, making OR the biggest utility company in Iceland. The company is 100 per cent owned by the City of Reykjavik.

OR took the decision to enter the telecommunication market at the end of the last decade and its first step was to establish Lina.Net in 1999. Its next step was to begin the rollout of optical fibres around its transmission stations. OR is also continuing to play an active role in research and development (R&D) on energy sources, like environmentally clean hydrogen. At that time, as mentioned above, Íslandssími bought a share in the fibre network, amounting to 2 pairs out of the 96 pairs of fibre.

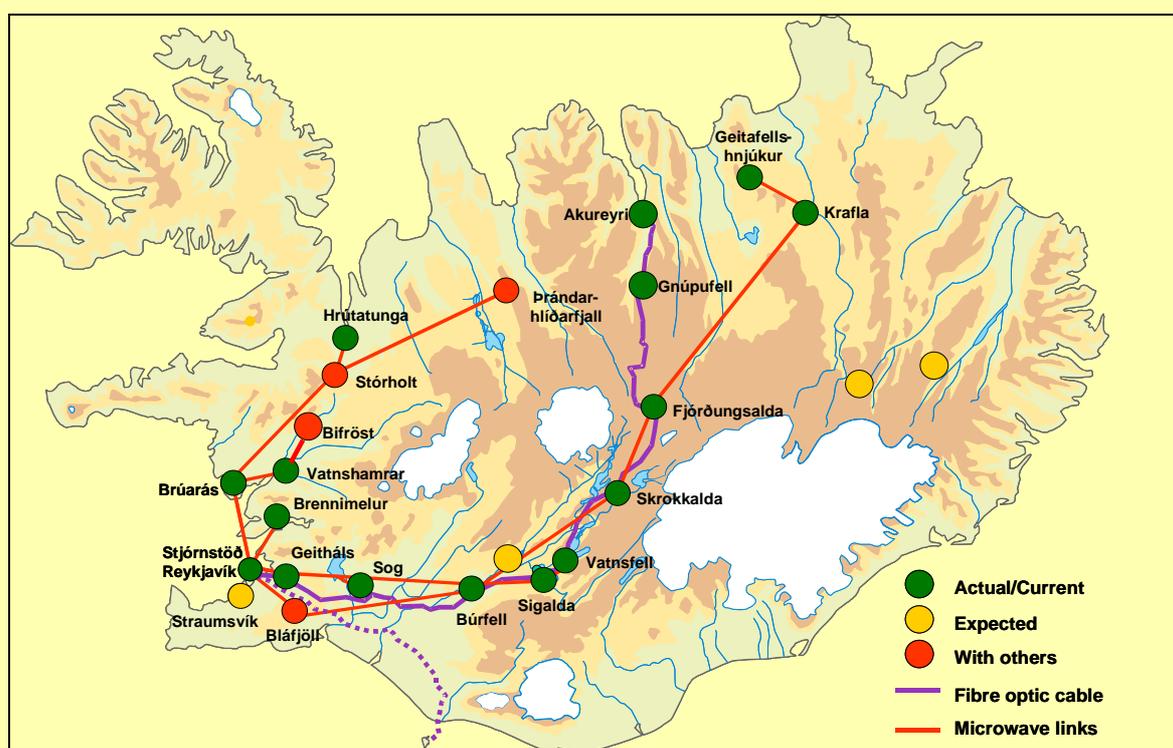
4.3.5 National Power Company (Landsvirkjun)

The National Power Company, or Landsvirkjun, was established in July 1965, with the objective of harnessing hydropower through the development of power-intensive industries, as well as meeting a rapidly growing demand for energy. Its task was to supply electricity to the southern and western regions of Iceland. It was initially owned jointly by the City of Reykjavík and the Icelandic State. A new law enacted in 1983 entrusted it with the responsibility of supplying electricity to the entire country. In the same year the municipality of Akureyri, the largest town in north Iceland, acquired a share in the company. The current shareholders in the company are the Icelandic State (50 per cent), the city of Reykjavík (45 per cent) and the town of Akureyri (5 per cent).

In 2000, the national power company established a 100 per cent owned subsidiary, Fjarski, to take over the operation of the telecommunication networks between its many different power plants across Iceland. The company’s objective is to expand these networks based on microwave links and fibre optic cables. This expansion became possible after the introduction of a fully liberalized telecommunication markets in Europe and Iceland in 1998. Before that time, the telecommunication networks of the National Power Company

Figure 4.7 National Power and telecommunications

Map of Fjarski’s fibre and microwave network



Source: FJARSKI

were limited to a closed user group function. Fjarski's services are currently based on leased lines and access to its facilities across Iceland. The company offer services exclusively to the business sector. A map of Fjarski's fibre optic and microwave network as of 2002 is shown in [Figure 4.7](#). In 2002, Fjarski, together with Lina.net, was granted a fixed wireless access (FWA) license by the regulator.

4.4 Broadband networks and services

The deployment of broadband Internet networks in Iceland has been fairly rapid. For instance, the rollout of fibre optic cables in Iceland began as early as 1985 and xDSL services over twisted copper pair were first introduced in 2000. This section takes a closer look at the country's broadband infrastructure and service penetration.

4.4.1 Digital subscriber lines (DSL)

The first ADSL trial was conducted in Iceland from December 1999 to April 2000. In April 2000, commercial services were deployed in the greater Reykjavik area. By early 2001, ADSL was available to a majority of larger townships. As of January 2003, every town with over 1'000 inhabitants had access to DSL services. It is expected that all towns with 500 or more inhabitants will be covered by the end of 2003. Higher-speed SDSL services were introduced to corporate customers in 2002.

The DSL market, like the telecommunication market as a whole, is characterized by a strong duopoly. Síminn owns most of the residential customers whereas Íslandssími's main focus is the corporate market. In late 2002, Íslandssími bought service providers TAL and Halló Frjáls. Due to these acquisitions, Íslandssími's share of the DSL market was 31 per cent at the beginning of 2003 (5'170 subscribers), compared to Síminn's share of 69 per cent (19'100 subscribers). As of January 2003, about 52.8 per cent of the population had access to Íslandssími's ADSL services and 78 per cent to the incumbent operator's services. Overall, 86 per cent of the population had access to ADSL services.

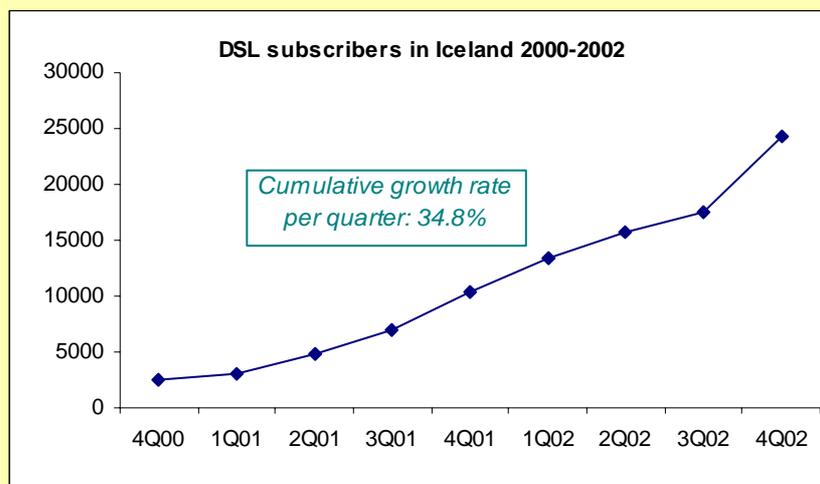
Residential ADSL services are sold via do-it-yourself kits in stores run by Síminn or Íslandssími, but also in computer stores and bookshops. In addition to a set-up fee, the user pays his or her monthly bill in two parts, the ISP charge and the ADSL monthly rental, although some providers, such as Síminn, offer bill consolidation in conjunction with their own ISP, Síminn Internet. Most ADSL packages allow for unlimited domestic download but include a cap on foreign download. Depending on the provider, monthly packages can vary from 37 US\$ to 60 US\$ a month, for a 512 kbit/s connection and 100 Mbits of foreign download ([Table 4.1](#)). It is to be noted that Íslandssími's prices are considerably lower than Síminn's.

Prior to the introduction of broadband, no flat-rate packages for dial-up Internet access were available in Iceland. Dial-up users have always been billed on a per-minute basis, at a cost of 1.69 ISK/minute (US\$ 0.02). Typically, ISPs do not levy subscription charges. In early 2000, Íslandssími started an ISP based on the "Freerise" ISP model, where users did not pay subscription charges. ISPs would receive the full interconnection charge from the telephone carrier, and this was used to subsidise their Internet service. In response, Síminn began offering ISPs a share of the call revenues. Consequently, other free ISP's began operating based on this model.

In order to increase their subscriber base, some competitive providers resell the incumbent's ADSL connections, e.g. Íslandssími, Lina.Net, Vortex, Halló Frjáls, Margmidlun, etc. Íslandssími has branded the service as its own, by reselling Síminn's connection along with their own ISP service and billing the user directly. With this approach, Íslandssími bears the responsibility for bad debts, but has a more direct relationship with the customer. In contrast, the service provider Halló Frjáls, before its take-over by Íslandssími, attracted customers to its ISP service through the use of Síminn's strong brand, but handed over the ADSL portion of the service back to the incumbent. Íslandssími plans to migrate all of 3'200 resale customers (about 40 per cent of its total subscriber base) to its own network by the end of 2003.

Figure 4.8 DSL take-up in Iceland

Number of DSL subscribers between December 2000 and December 2002 with cumulative growth rate



Source: Operator data.

There were 24'270 ADSL subscribers in Iceland at the end of 2002, amounting to almost about 8.6 per cent of the nation's population and over 22 per cent of total Internet users. The average growth rate per quarter between 2000 and 2002 was 34.8 per cent, with the most significant growth occurring in the last quarter of 2002 (Figure 4.8). Íslandssími alone reports 500 new subscribers per month during 2002 (see Section 5.4). Iceland's 2002 DSL penetration is higher than all of its Nordic and European neighbours. Almost nine per cent of its population uses some form of broadband access (DSL, fixed-wireless access or FTTH). In this regard, it ranks fourth in the world, ahead of Denmark, Sweden and Belgium, but behind Korea (Rep.), Hong Kong, China and Canada (Figure 4.9).

4.4.2 FTTx: High-speed access over fibre

Not surprisingly, Síminn, the State-run incumbent operator, was the first to deploy a fibre network (known as Iceland's information highway) in 1986. The network is in a ring formation covering most of the inhabited areas near the island's shores (Figure 4.10). The core network runs ATM (Asynchronous Transfer Mode) and, in some areas, IP (Internet Protocol). In 1995, the company began rolling out an additional fibre access network in the capital city, Reykjavik, and other large towns. The company named this network "Breiðband" or "Broadband". In 2001, the State-owned Reykjavik Power Company (OR), in conjunction with Lina.net

Table 4.1 ADSL Packages

ADSL packages offered in Iceland in US\$ (January 2003)

	Síminn	Íslandssími
ADSL (256/128 kbit/s) With 100 Mb foreign download included	47.9	37.2 (discontinued due to ADSL II)
ADSL (512/256 kbit/s) With 100 Mb foreign download included	60.8	37.2 (previously 48.9)
ADSL (512/256 kbit/s) With 500 Mb foreign download included	71.9	59.1
Price per additional Mb (foreign download only)	0.032	0.032

Source: Interview data, Operator websites

and Íslandssími, followed suit by deploying another fibre network in the greater Reykjavik area, around its power transformer stations.

The fibre access network is designed to upgrade or replace the traditional copper access network. However, the network was first used to re-broadcast analogue television signals in 1998, since that was the first business case for the available network capacity. Bi-directional nodes on Síminn's network were installed five years after rollout, in 2000, in order to allow for both uploads and downloads. In the summer of 2002, after 18 months of testing, Síminn's residential "Internet over Broadband", branded as "IuB", was born. Broadband in this case refers to Síminn's fibre optic access network. The speed of IuB is 512 kbit/s downstream and 128 kbit/s upstream, and is roughly comparable, therefore to the average ADSL package. However, the access is shared as the operator's fibre installations (i.e. pipe) have a maximum capacity.

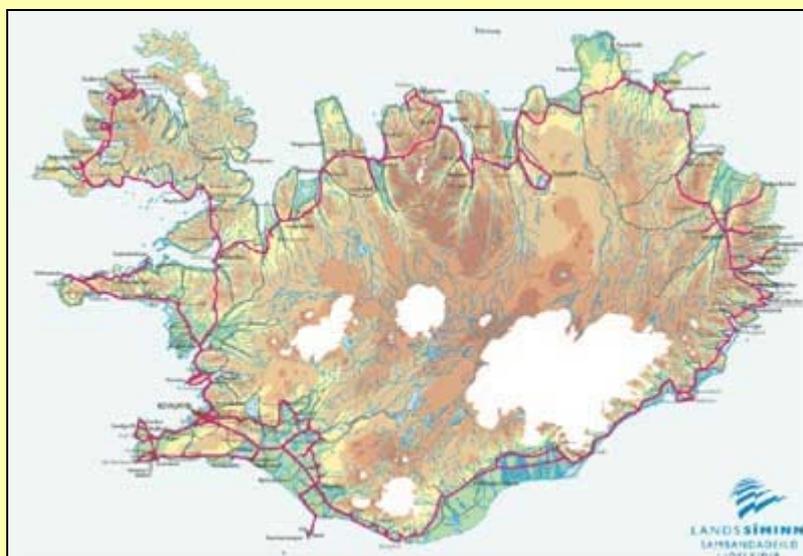
Currently, Síminn is the only operator offering residential fibre access, or IuB. Since 1995, all new buildings in Iceland are being equipped with, at a minimum, fibre to the curb (FTTC). Older buildings with six or more apartments are equipped with FTTB (building) supplemented by coaxial cable between floors and individual apartments. Buildings with less than six apartments are being equipped with FTTC with coaxial cable covering the last few metres to the building and the connection between floors. In 2003, the threshold was changed from buildings containing nine apartments to buildings containing only six apartments. Typically, all corporate customers with more than 2 Mbit/s connectivity have fibre to their premises (FTTB).

In January 2003, 35'000 households were within reach of Síminn's fibre network and out of these, 15'000 households have access to the high-speed IuB service. By the end of 2003, 30'000 will have access to the service. Thus far, 500 households have subscribed. 35-40 per cent of Síminn's customer base use either ADSL or IuB to access the Internet.

Neither Íslandssími nor Lina.Net offer fibre connections to the residential market, preferring instead to target corporate customers through providing FTTB solutions. Íslandssími provides FTTB to about 100 corporate customers. The Reykjavik Power Company, OR, originally deployed its fibre network through Lina.net for the purposes of providing Internet connections over power lines. This service, branded as "Raflina", was commercially deployed in the spring of 2001. The system uses the power company's transmission centres and power lines to connect to the metropolitan fibre network (Figure 4.11). The service is currently being offered and marketed by OR itself. Through Raflina, speeds of 4.5 Mbit/s are technically feasible, but OR can only offer a guaranteed bandwidth of 256 kbit/s. The service is available only in the city of Reykjavik and in designated areas. 90 per cent of Raflina connections are residential ones. In January 2003, there were some 400 subscribers. The future viability and competitiveness of this service remains to be seen, as it is still, like in many other countries, in its early stages of development.

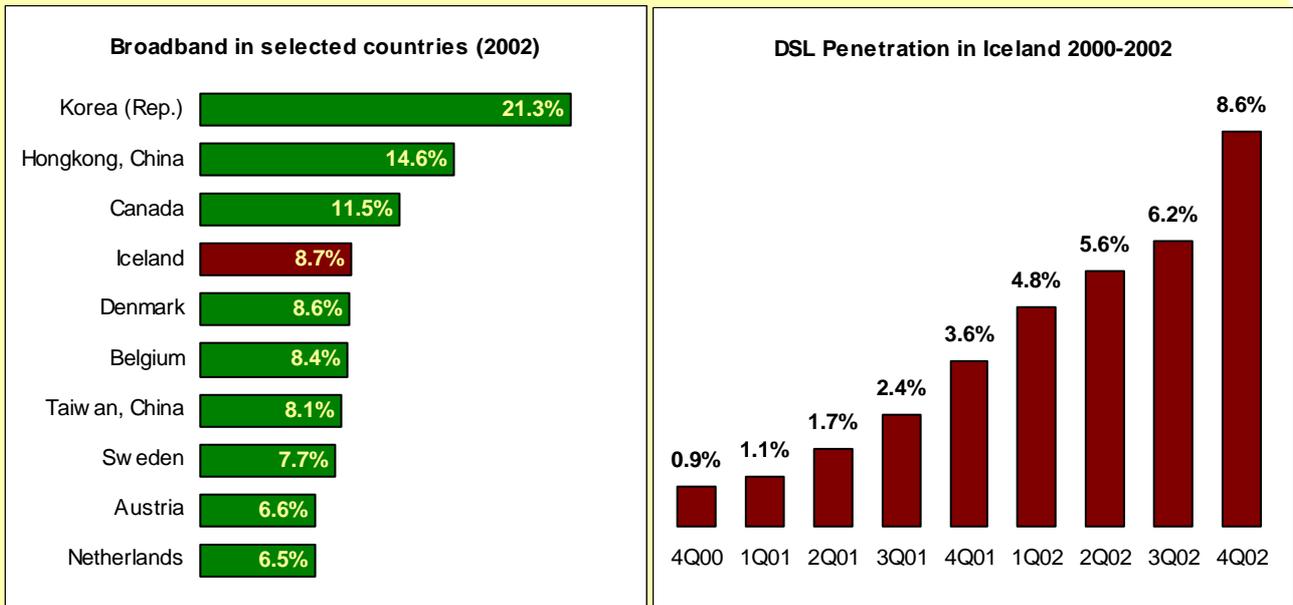
Figure 4.10 The Fibre Island

Map of Incumbent Operator's nationwide fibre optic network



Source: Síminn.

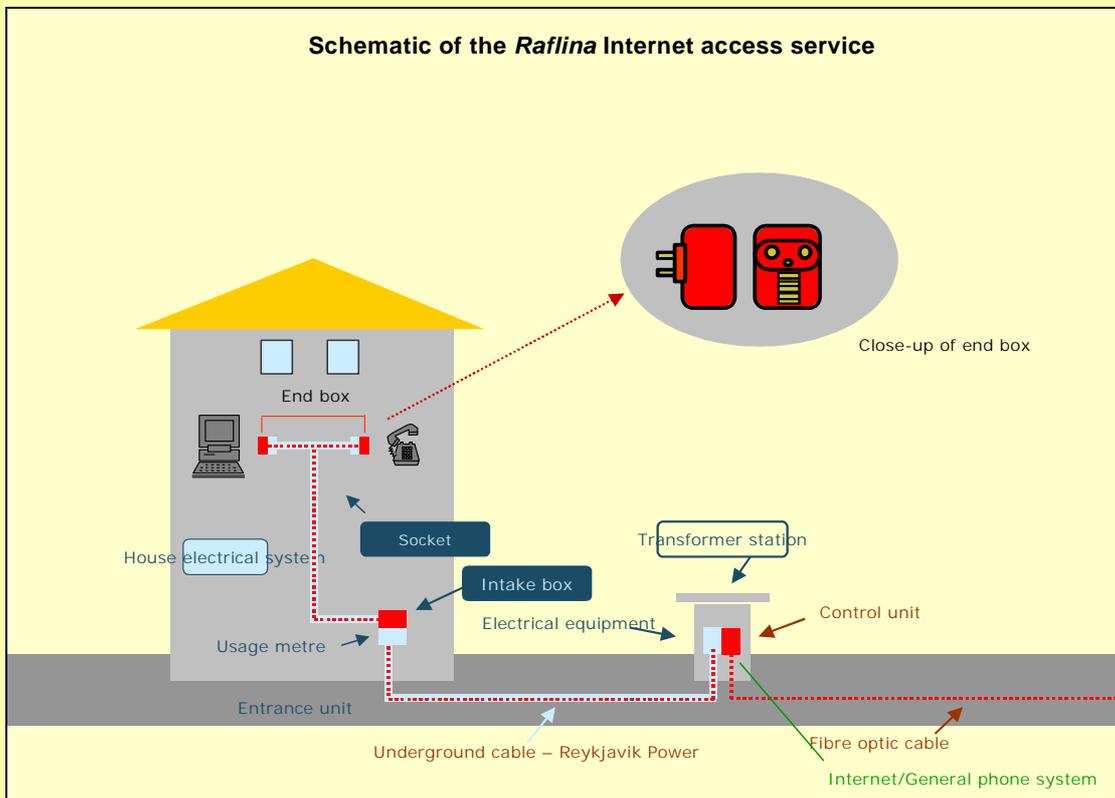
Figure 4.9 Broadband (DSL, wireless, cable, FTTH etc...) penetration in Iceland and selected countries (2002)



Note: The figure for Iceland does not include subscribers of Fixed-Wireless Access or business users
 Source: International Telecommunication Union, Operator Data.

Figure 4.11 Internet power

Architecture of the Raflina Internet connection offered by the Reykjavik Power Company and Lina.net



Source: OR, Lina.Net.

In terms of network expansion, Síminn has an agreement with utility companies whereby it is advised when a project is under way to dig up a particular road. Síminn then uses this opportunity to lay fibre. The other metropolitan fibre network used by Lina.Net and Íslandssími is majority owned by the city's power company and as such, no formal agreement is needed.

4.4.3 Wireless access

4.4.3.1 Do-it-yourself wireless home networks

Both Íslandssími and Síminn have been selling Wi-Fi⁷ (802.11b) equipment, based on the IEEE 802.11 series of standards, for residential and SOHO⁸ purposes, since November 2000. Íslandssími does not envisage a market for hotspot services in Iceland, largely due to the fact that the country's inhabitants live in small, concentrated areas. Síminn, however, plans to explore the business case for Wireless LAN hotspots sometime in 2003.

4.4.3.2 Fixed-Wireless Access

Fixed-Wireless Access (FWA) services have been on offer by Lina.net since November 2000, through their "Loftlína" (or "airline") brand. Lina.Net bought the fixed wireless system from Skyr⁹, who initially purchased the system from Gagnaveitan, the holder of the FWA license. . The maximum capacity is 2 Mbit/s over a shared connection. There are currently 6 rooftop clusters in Reykjavik, on which there are 12 fixed wireless access points, with each point capable of serving 12-20 customers. Each cluster of access points has a range of approximately 15 km in each direction. At first, Loftlína was sold predominantly to residential customers. The most common package is the 512 kbit/s connection. However, after the introduction of cheaper ADSL services, small and medium-sized enterprises have become the most common users. In January 2003, there were 600 subscribers of the service, accounting for an estimated total of about 7'000 users. Lina.net formally received a license for FWA in January 2002.

A smaller company by the name of EMAX will begin offering wireless services based on the Wi-Fi standard in 2003. By erecting a number of Wi-Fi transmitters outside city centres, they are aiming to capture the rural market. The transmitters have a two-kilometre range and will form part of a wide area network (WAN). Íslandssími is in negotiation with EMAX for joint service provisioning.

4.4.4 Digital TV

Iceland's incumbent telecommunication operator, Síminn, has been providing television services since 1998, initially through the re-transmission of foreign TV channels. The service is known as "The Broadcast" and in the early days, it gave users the possibility of viewing 23 foreign channels sold on a subscription basis, as well as six local channels free of charge. In addition, the service broadcasts most Icelandic radio-stations as well as 10 different foreign music channels offering a wide range of musical genres. The ongoing objective of the Broadcast is to make new options available for consumers and to develop content services in line with the development of broadband Internet technologies. In 2002, Síminn started digital broadcasting over its fibre access network (branded "Síminn Breiðband") and increased its offer to 40 foreign TV channels and 20 foreign radio stations. Síminn's fibre network is now available to over 35'000 households. Of these households, about 5'500 have subscribed to digital television services. [Table 4.2](#) sets out the different packages available over the broadband network.

4.4.5 Future Trends

In the near future, Lina.Net plans to continue selling bandwidth primarily to corporate customers. It is currently examining the business case for Voice over Broadband, as well as digital TV over fibre. Íslandssími plans to add on a wireless component to their service portfolio: by the first quarter in 2003, they plan to bundle an 802.11b wireless service with an ADSL connection. Síminn is looking into future synergies between wireless home networks and pervasive computing. Over the next few months, both Síminn and Íslandssími plan to upgrade their networks with a new, more robust, ITU standard, G.SHDSL, which can offer speeds of 2 to 19 Mbit/s.

Table 4.2 Broadcast over broadband

Television Packages available over Síminn's broadband network

A Europe	B Mix	C Prime
<p>Scandinavia: DR1, Dr2, NRK1, NRK2, SVT1 og SVT2. Germany: ARD, PRO7, SAT1 og ZDF. France: France-2 og M6. Italy: Rai Uno. Spain: TVE. Radio: Music Choice</p>	<p>CNN, Sky News, CNBC Europe, BBC World, BBC Prime, Eurosport, TCM, Cartoon Network, Discovery, Animal Planet, National Geographic, VH-1, Travel MTV, Pro Sieben, M6 Radio: Music Choice</p>	<p>A + B. Also included: FoxKids, Nickelodeon, Discovery Civilisation, Discovery Sci-Trek, Discovery Travel & Adventure, Fashion TV, Hallmark, Adult Channel, MUTV, Extreme Sports, Eurosport News, ESPN Classic, Smash Hits og Kerrang! Radio: Music Choice</p>
<p>Monthly charge: 2'295 ISK 29.29 USD</p>	<p>Monthly charge: 2'595 ISK 33.13 USD</p>	<p>Monthly charge: 3'995 ISK 51.02 USD</p>

Source: Síminn

5 The promotion of broadband

5.1 Effective regulation

5.1.1 Unbundling the local loop

Increased competition and effective regulation are essential for a healthy broadband market. In this regard, unbundling the local loop is seen as one of the key mechanisms for hastening the deployment of high-speed Internet networks. In April 2000, the European Union acknowledged that non-binding measures are unlikely to introduce true local loop unbundling within an appropriate timeline. In December 2000, it issued regulations on local loop unbundling (LLUB) including the following provisions:

- Incumbent operators are to provide competitors with full access to local copper loops on fair, reasonable and non-discriminatory terms;
- Physical access is to be granted at any technically feasible point on the copper loop, including collocation;
- The price of access must be cost-based;
- Operators must publish prices, terms and conditions.

In Iceland, the *Telecommunication Act* came into force at the end of 1999, stipulating, *inter alia*, that operators with significant market power (SMP) were to open up access to the local loop. As of 1 October 2000, the *Act* empowers the regulator (PTA) to grant providers direct access to specific customers. Moreover, all operators signed an agreement on process and procedures regarding the leasing of supply lines at the end of 2000, based on the above EU regulations. Pursuant to this agreement, two LLUB services have been on offer in Iceland:

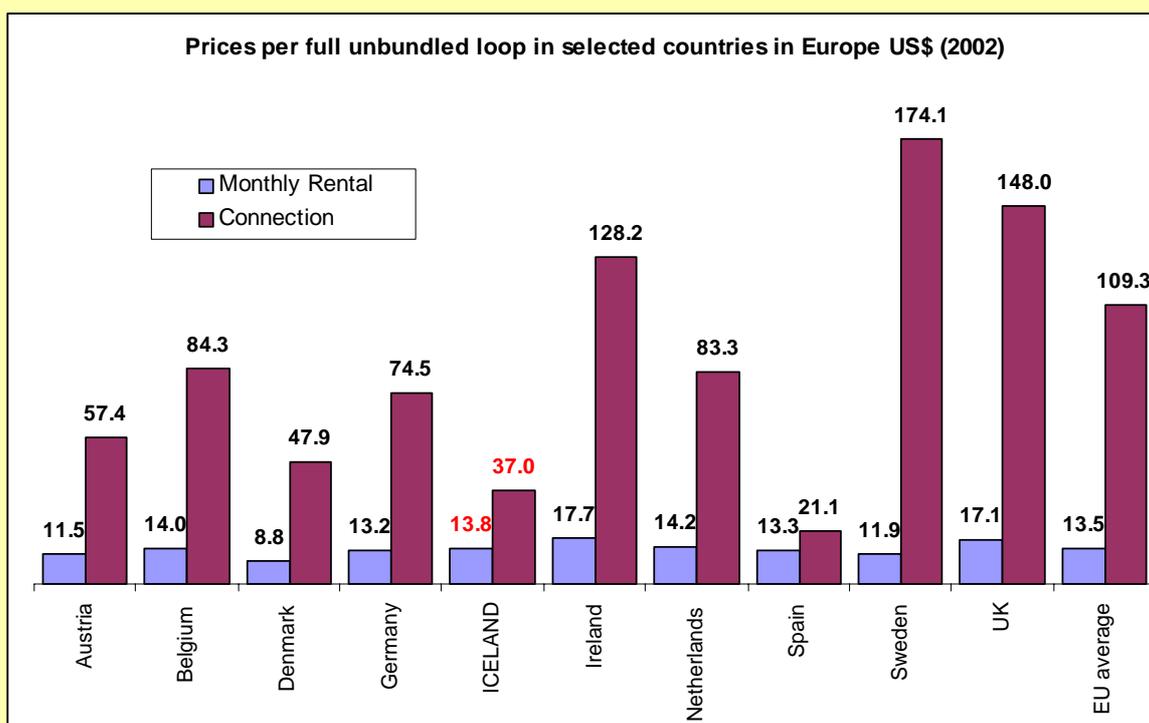
- 1) *Full Access*: the competitive provider has access to the entire line (for both voice and data);
- 2) *Shared Access*: the competitive provider can offer customers voice or data transmission, e.g. xDSL only

Bitstream access is not yet available, and the option has yet to be requested by any service provider. Shared or full access is perceived as more advantageous, given that the competitive local operator exerts more control over both the line and the customer. As of January 2003, 95 per cent of local loop services on a shared basis, and of those about 99 per cent have opted for the data-only service. As of March 2003, there were 4'751 shared access lines provided by the incumbent to only one competitive provider, Íslandssími (since its merger with Halló and TAL). In the case of shared access, the incumbent continues to provide telephony service, while the alternative operator delivers high-speed data services over the same local loop, using its own DSL modems.

In 2000, the PTA re-balanced telecommunication tariffs in Iceland. For instance, there was a significant increase in the residential line rental, while charges for international calls decreased. A working group was then set up, consisting of the incumbent operator, competitive providers and the PTA, to establish procedures and processes for unbundling the local loop. At that time, the cost for unbundled services was based on historical and current costs. Síminn submitted its first draft Reference Unbundling Offer (RUO) in January 2003. The regulator is currently examining the RUO based on the latest recommendations from the European Union. A preliminary agreement has been reached between the PTA and the main market players, and has been in force up until March 2003 (Table 5.1). In terms of the monthly fee, Iceland falls just short of the EU average of US\$ 13.5 for full access. However, compared with other countries in Europe, the connection or set-up fee to be paid is very low (Figure 5.1). A costing study, based on long run incremental costs (LRIC) is planned.

Figure 5.1 Prices for full unbundled loop in selected countries

Monthly rental and connections per unbundled local loop in selected countries in Europe (2002)



Source: European Commission, PTA.

Table 5.1 Pricing structure for local loop unbundling

Pricing Agreement based on Síminn's Reference Unbundling Offer (2003)

Set-up/connection fee (in each case)	2950 ISK or 37.00 USD
Shared Access (voice only)	825 ISK or 10.35 USD
Shared Access (data only)	272 ISK or 3.41 USD
Full Access (voice and data)	1097 ISK or 13.76 USD

Source: PTA, 2003

5.1.2 Infrastructure sharing

In order to enable new entrants to offer broadband services at competitive prices, mechanisms for infrastructure sharing have been encouraged. Since 2001, the incumbent Síminn has provided competitive carriers access to in-house wiring through an arrangement it calls “co-mingling”. In such cases, the incumbent prepares a common facility (e.g. a room), in which competitive providers can install and operate their own equipment. Síminn also offers “neighbour co-location” services, whereby it prepares a facility outside the room or building hosting its own facilities.

The number of MDF (main distribution frames) and local exchanges available for unbundling in March 2003 was 196, of which 58 were DSL-enabled. Collocation is being implemented in 22 locations, which accounts for 11 per cent of all locations.

5.1.3 Universal service and access

The definition of universal service has been quick to evolve in Iceland. In 1999, a policy decision was made to extend the concept of universal service to data transmission lines. On 10 August 2000, Regulation 641/2000 under the *Telecommunications Act*, also known as the ISDN regulation, was passed by the Icelandic parliament. Under this regulation, data transmission at a minimum speed of 128 kbit/s must be guaranteed to all households in Iceland. As of February 2003, 98 per cent of Icelandic households had access to ISDN.

In 2000, the Minister of Communications created a Data Transmission Working Group, to study the cost of data transmission in Iceland and the methods for strengthening telecommunication infrastructure and services. The Group handed its report and proposals to the Minister in April 2002. The main conclusion of the report was that broadband should be made available to all Icelanders at the same price. In this context, the Group proposed the establishment of a fund to be managed by the PTA, which would subsidize the difference in cost, for a 2 Mbit/s broadband connection, between rural areas and urban areas. This would allow small and medium-sized enterprises outside large urban centres to access broadband networks at the same price as their urban counterparts. This proposal is currently under consideration by the Minister.

5.1.4 Licensing fixed-wireless access

In order to enhance competition and increase alternatives for Internet access, the Icelandic government took a decision in June 2001 to open up spectrum for the provision of wireless broadband access. The Post and Telecommunications Administration announced that two frequency bands were to be made available for fixed wireless access (FWA) services and invited all interested parties to send in applications before the end of July 2001. The frequency bands in question were 3400 – 3600 MHz and 10.15 – 10.30 GHz. Only 2 applications were received, and both of these were in the 3.4-3.6 GHz band. The following FWA licenses were issued in January 2002:

- *Lina.Net*: 3400 - 3450 / 3500 - 3550 MHz (i.e. 2 x 50 MHz);
- *Fjarski*: 3473 - 3500 / 3573 – 3600 MHz (i.e. 2 x 27 MHz).

As mentioned above, Lina.Net actually began offering commercial services as far back as November 2000, when it bought a FWA system from Skyrr. The company intends to limit network deployment to the Reykjavik area. Fjarski plans to build up local FWA networks in 24 different communities outside the Reykjavik area, focusing on the business market.

5.2 Policy development

5.2.1 The Information Society Policy of 1996

The Government's first policy statement on the information society was made on 23 April 1995. This statement set out objectives concerning the use of information technology for the improvement of public administration activities and economic growth. In the year that followed, political discussion and debate among various public stakeholders led to the formulation of Iceland's information society policy of 1996.

In October 1996, the Icelandic government released their policy on the information society in a public document entitled "The Icelandic Government's vision of the information society"¹⁰. The document sets out the Government's strategy for the development of the information society, in particular the need for the country to capitalize on two aspects of its national character: openness to innovation and preservation of cultural uniqueness.

The main objective of the Government's vision is for Iceland to be in the forefront of the world's nations in terms of the "the utilization of information technology in the service of improved human existence and prosperity". In this respect, the policy emphasizes the role of government in fostering the development of the information society. As the greatest user of information technology in the country, the Government has a significant and direct influence on the market. And as such, the policy argues, it is the Government's responsibility to pave the way for other parts of society to head in the same direction, through precedent, encouragement and counsel.

The policy covers a number of fields: democracy and equality, economy, education, research, culture, public health, telecommunications, mass media, travel, legislation and ethics. Under the telecommunications heading, the main objective cited is as follows: "adequate domestic and foreign telecommunications must be assured at a competitive price which can lead to a surge of progress and services on the forefront internationally". The report clearly states the government's intention to stimulate, in particular, the take-up of broadband technologies, as one of the methods listed to achieve this objective is "the build-up of a wide-band network ... speeded up with organized efforts being directed at implementing a wide-band transport system throughout the country". Other methods for developing the market include freedom of access, for instance to governmental services, and the increase in transport capacity within the country and internationally.

5.2.2 The Information Society Task Force

In 1997, following the publication of the Government's policy outlined above, a development project for the information society was established for a period of 5 years. Under the Office of the Prime Minister, an "Information Society Task Force" was created to steer this project and to promote the implementation of the Government's 1996 strategy. The Task Force is made up of representatives of five ministries: Transport, Tourism and Telecommunications, Industry and Commerce, Education and Research, and Finance. The mandate of the Task Force was to run until 1 September 2002 but has been since extended for a further year.

A number of advisory groups were also created. These meet regularly to discuss the progress of information society initiatives in the country. One such advisory group is made up of representatives of all 14 ministries. Another is made up of various organizations such as trade unions, industry associations, consumer associations etc.

5.3 Implementing the information society policy

Since 1996, the Government of Iceland and individual ministries¹¹ have published strategy papers and action plans for the information society. Many plans have been realized and public sector organizations have taken significant steps towards utilizing information technology to streamline routine tasks. For instance, an increasing number of services and information are now available directly through public sector websites. Tax

return and customs clearance forms are fully interactive online services. In addition, in accordance with the Government's vision, various projects for the promotion of the information society have been launched.

5.3.1 Taking stock

After the 1996 policy, the Icelandic Government made considerable efforts to evaluate the current situation for broadband in order to develop strategies for the future. This section describes two key evaluations of the Icelandic market, one in 1997 and one in 2000. The results of these evaluations were carefully studied by the Icelandic government, and in particular the Information Society Task Force, in the exercise of its mandate.

5.3.1.1 *Experts Committee Report on Telecommunications: Towards New Times*

On 27 November 1997, the Icelandic Ministry of Telecommunications appointed five experts to compile a report on telecommunication policy in Iceland. This report was published to coincide with the deadline for liberalization within the European Union in 1998. The Committee's task was to describe the current status of telecommunications in Iceland and to evaluate its development into the next century. The Committee was also asked to evaluate the operations of the incumbent, Síminn, and to address the need to dilute State ownership of the carrier. The authors of the report recommended that a new data transmission network be built, quite apart from the regular fixed-line telephone network. The reason cited for this was that the current network would prove inadequate for the carriage of future traffic, such as traditional and interactive broadcasting. The report pointed out that the data network did not need to be built on the same technical solution throughout the country - the main objective would be to ensure high-speed connection for the entire nation on a cost-efficient basis. Whatever the solution chosen, it should be capable of accommodating fixed connections, wireless solutions and satellite connections, as the case may be. The main technical objective cited by the authors was for each user in Iceland to have the possibility of a 6Mbit/s connection speed, a bandwidth equal to 2 television channels including one with an interactive connection. It is important for the system and network to be scalable in accordance with the evolving demand for bandwidth in the market. The report suggested that the possibilities for open access should not be limited: in other words, little use should be made of end-user equipment such as decoders and descramblers, and applications should be made available on the data transmission system itself. The authors also recommended that the network be based on international data transmission standards, such as the latest Internet Protocol version, IPv6.

5.3.1.2 *Digital Iceland: Report on Broadband Matters*

The Information Society Task Force and the Ministry of Communications commissioned a paper in January 2000 on the status broadband in Iceland. The objective of the report was to map current transmission capabilities of in Iceland and analyse bandwidth demand for the next few years, both domestically and internationally. The main findings of this report are as follows:

- The number of Internet users might not change much over the next few years, but the demand for bandwidth will increase dramatically;
- Based on domestic and international experts, it is estimated that bandwidth demand and usage will double each year in Iceland and many other parts of the world. This holds no less true for international bandwidth in and out of the country. Therefore, it is clear, within a few years, the international cable CANTAT-3 will no longer satisfy the demands of Icelandic users;
- There should be guaranteed interconnection and sufficient bandwidth between wholesale entities in Iceland to ensure the carriage of domestic traffic. Moreover, a reliable and secure restoration method should be available in cases when the CANTAT-3 submarine cable is down;
- Current telecommunication policy states that every household in Iceland should have access (if desired) to 128 kbit/s ISDN connection. Thus far, this only applies to eight per cent of households (January 2000). In light of this policy (which was incorporated into national telecommunication legislation), it is expected that the majority of homes will have connection to the Internet via ISDN within a few years (this report was released after the ISDN Universal Service decision had already been taken)¹².
- Although the incumbent operator has now reached a stage where it can provide broadband services to a vast majority of homes, the report states that usage is still limited. This is due to the fact that competition is not strong enough and Síminn's dominance of the market is undeniable. The report

urges the Government to consider a policy whereby the incumbent's basic transport and infrastructure services would be separated from its other operations.

- Price is a key driver for broadband take-up. Lowering prices will encourage residential and corporate users to adopt broadband technologies. If real universal service is to be achieved, then the significant price differential based on where a user lives within the country should be abolished.

5.3.2 Information society projects

Further to the Government's policy, it was agreed that a minimum of 150 million ISK, at that time about US\$ 1.5 million, would be needed to fund various projects over the four-year period 1998-2002. Individual ministries were then able to apply for a portion of these funds to support specific projects. The fund has been included in the State budget since 1998 and accounts for around 0.1 per cent of the overall budget.

In order to guide the Ministries in their applications, the 1996 policy identified the following three priority areas for development projects:

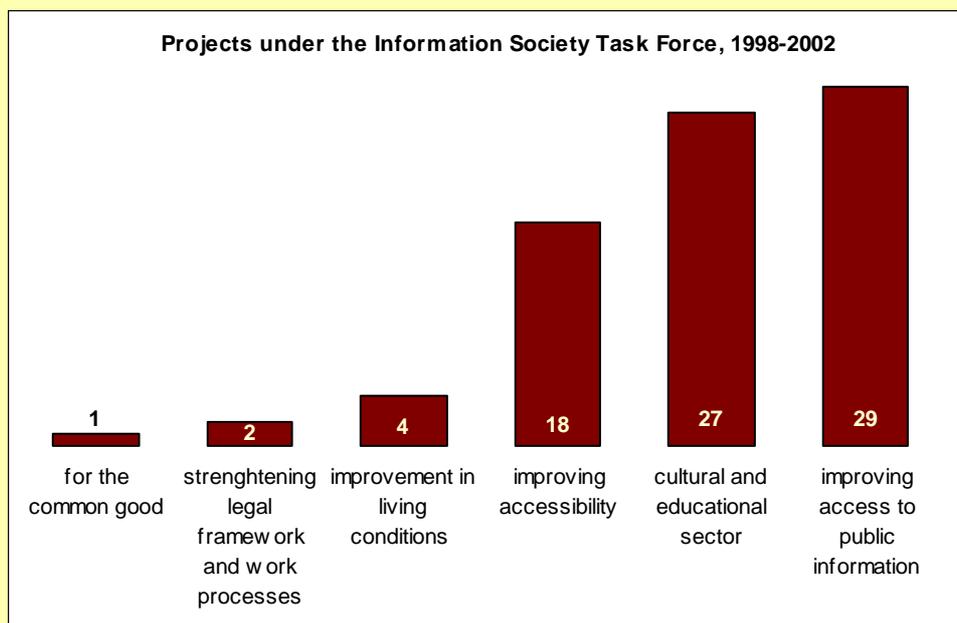
1. Campaigns promoting **general computer literacy** of the nation, pragmatic processing of information and assessment of its value. This will be supported by an increased emphasis on instruction in the mother tongue and foreign languages.
2. **Transport capacity and transport security** of information in computer-readable format locally and internationally should meet standards and keep up with the rapid growth in demand. The cost of data transport for the public and for companies should be minimal.
3. The Government's **policy of tender offers should be enforced** for the purchase of software for government institutions and ministries. Emphasis will be placed on participation by software manufacturers in development projects sponsored by government institutions. Better utilization of the money allocated to software should be made.

Between 1998 and 2002, individual ministries submitted proposals to the Information Society Task Force, and if accepted, the Task Force and the Ministry each contribute 50 per cent towards the project cost. There were about 133 projects accepted by the IS Task Force during its mandate. Due to overlap in some of the projects, the total number of implemented projects was around 80. Overall, a vast majority of projects focused on the first priority, i.e. computer literacy, education, public information ([Figure 5.2](#)). Recent projects include e-commerce and e-government development and the language engineering initiative. Smaller projects such as Women and the Information Society, which encourages young women to work and/or study in the IT sector, have also been created¹³. Other examples are set out below:

- *Parliamentary Debates*: Since October 1998, all parliamentary debates have been broadcast over the Internet.
- *Tax returns project* (Ministry of Finance): Project for the electronic filing of individual and corporate tax returns. In 2002, 75 per cent of the country's tax returns were submitted on line.
- *Model School Project* (Ministry of Education): Project allocating funds to three primary schools and three secondary schools for the purposes of buying IT materials and educating staff. These schools are meant to serve as a model for other educational institutions across Iceland. The six schools were selected out of 23 applicants. Examples of selection criteria include: current use of IT, support from municipality, level of motivation of management, faculty and parents. The results have been evaluated by an academic assessment group, and have been overall positive.
- *Icelandic Health Network* (Ministry of Health): Project to develop a secure nationwide health network. The network is currently in the design phase (See 5.5.2).
- *E-Agriculture project* (Ministry of Agriculture): The project *Nytjaland* or "The Icelandic Farmland Database" is the result of a joint effort of several agricultural government agencies. *Nytjaland* is meant to be a comprehensive digital database with basic information about the country's farmland. The project is based on three components: division of the surface into vegetation classes and land quality; mapping of all farm boundaries, and populating the database with this information. The database would also include links to other relevant databases like the Soil Conservation Service, the

Figure 5.2: Information society projects

Number of information society projects accepted by the Task Force between 1998-2002, split into different categories



Source: Information Society Task Force, Iceland.

National Land Survey of Iceland and the Land Registry of Iceland. The aim is to have all of this information accessible in one portal. The database will be in the public domain and has many applications in rural planning, development, and resource management.

A number of e-government applications have been implemented and these are discussed below, under the heading of content development.

5.4 Corporate strategies

5.4.1 Doubling the speed

In an effort to increase take-up of broadband services by users, Íslandssími launched an aggressive marketing campaign, known as ADSL II, in May 2002. The company discontinued its lower speed ADSL package, and began offering its 512 kbit/s ADSL connection for the price of a 256 kbit/s connection. The marketing campaign incorporated speed visualizations such as dynamic monster-like PC mice. The company is of the view that a crucial element in any marketing strategy for broadband is an understanding that most users do not grasp the difference between, for instance, DSL and ISDN. Thus, providers must sell these services with a minimum of technical jargon and acronyms. Following the introduction of the ADSL II marketing campaign, Íslandssími's ADSL subscriber base doubled ([Figure 5.3](#)). The company has been adding an average of 500 additional subscribers a month.

5.4.2 “Pinging” the gamers

One of Síminn’s strategies for attracting broadband customers is to focus on the PC gaming market. Gamers are a lucrative user segment, as they typically opt for the faster connections and the larger download packages. The incumbent operator has a long-standing on-line community for youth users, now the most popular in Iceland. They also hold video gaming competitions in large auditoriums. One of the biggest challenges for their competitor, therefore, is to lure these big spenders away from the incumbent’s service. In this regard, Íslandssími began a targeted advertising campaign in 2002 based on “ping time”. When a game is played on line (rather than locally), gamers typically face a delay or latency, which is displayed as “ping time”. This represents the amount of time it takes for data from the gamer to be sent to the games server (i.e. the firing of a shot), and back to the gamer’s machine again. As can be expected, latency can greatly affect a user’s enjoyment of a game. In their marketing campaign, Íslandssími emphasized the need for Icelandic gamers to focus on gamers in Europe, when playing overseas games, due to time zones and cultural affinities. In this respect, they claim that their “ping time” to Europe is far shorter than Síminn’s. The campaign has been successful, as a number of gamers transferred to Íslandssími’s broadband services in 2002.

5.5 Partnerships for broadband

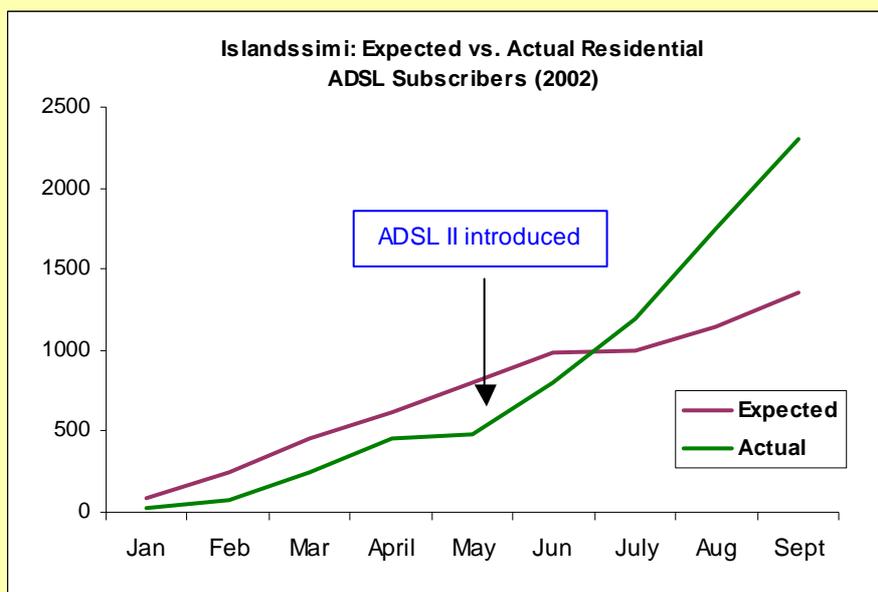
5.5.1 FSNet

The Government’s 1996 information society policy declared that Iceland’s educational system should adapt to the changing dynamics of today’s society and equip its students for the workplace of the future. In this context, the policy stresses the importance of information technology as an integral part of the country’s educational curricula as well as a means to enable access.

In line with these objectives, high-speed connections were to be made available on Síminn’s network to 60 high schools, colleges and continuing education centres in the country. Most schools were connected in February 2003. The timing for other schools depends on any contractual obligations with alternative Internet service providers. All of the larger schools now have 100 Mbit/s connections and a few smaller schools are being equipped with 2 Mbit/s connections. The overall cost of this FSNet project was around ISK 500

Figure 5.3: 2002 ADSL Boost

Growth in Íslandssími’s residential ADSL base following introduction of ADSL II campaign in 2002



Source: Íslandssími

million or US\$ 6.3 million. The Ministry of Science, Education and Culture accepted a proposal by Skyrri in cooperation with the incumbent operator Síminn to provide these connections. The network creates a solid foundation for an information highway for educational institutions. The introduction of the FSnet drastically changes the possibilities of remote areas to participate in various distance education and work programmes. The FSNet network is also connected to the research and development institutes and universities in accordance with a plan introduced by the Ministry of education.

5.5.2 Health network development

Like the education sector, the health service is seen as a large user of telecommunication systems, one that will make greater and greater demands for transmission capacity, mostly due to the need for the transmission of large digital images. The 1996 policy on the information society states, as its one of its objectives, that “the quality and effectiveness of the public health service should be increased through purposeful utilization of information technology”. In this context, Iceland’s Ministry of Health has proposed that a health network be developed, connecting all hospitals and medical institutes in Iceland. The Health network will go live in 2004 and be fully operational in 2006. The aim is to create and record all medical notes, prescriptions and test results in an electronic format for transmission over a secure network. The intention is to use available infrastructure to the extent possible. Due to the sensitive nature of the information stored and exchanged, access to the network will be carefully controlled and strict security standards, rules and procedures will be applied. The “name server”, at the heart of the network, will keep records of all institutions and individuals with access to the network, as well as their specific access permissions. As of 2002, all software systems designed or implemented in the health sector will be required to adhere to the specifications of this planned network architecture.

5.6 Content development

5.6.1 E-government projects

The Information Society Task Force has been in consultation with the Joint Ministerial and *Althing* Consultative Committee on the Information Society as well as Joint Consultative Committee of Municipal Authorities, Industry and Employee since 1997. One of the results of this ongoing consultation was the decision to include a fourth area to the initial three priority areas for information society projects (see section 5.3.2): e-government and e-commerce. Additional funds were allocated to this fourth priority area in April 2000.

The following lists a selection of successful e-government applications under this programme:

- All public libraries and research institutes in the country have joined hands in a consortium known as “HVAR”¹⁴. HVAR is a nationwide access portal to electronic databases and e-journals. This common library system is an integrated virtual library, where users have access to, *inter alia*, 31 different databases, more than 7’500 full text journals, and 350’000 literary works of English and American poetry.
- In the mid-1990s, in collaboration with a local software company, three government offices jointly developed a document handling system based on Lotus Notes. This has now become indispensable in all ministries and embassies, both as a management tool and in terms of fulfilling the Government’s obligations pursuant to the *Information Act of 1996*.
- The main software systems of the Icelandic administration are now undergoing a major overhaul. This involves 19’000 employees in around 300 institutions. Based on a well-known Internet-enabled e-business software suite, the intention is to provide the foundation for implementation e-government as well as employee and citizen relationship management in Iceland. The new systems will replace legacy systems, some of which date as far back as 1978.
- In March 2002, the Government of Iceland signed a contract with ANZA, an independent service provider to operate an Electronic Marketplace for public procurement. On this e-marketplace, government institutions will have access to suppliers’ catalogues and price lists in a standardized format. This will allow them to better compare prices and place orders. At their end, suppliers will be able to confirm orders, issue electronic invoices, and communicate electronically with the accounting systems of both parties. The pilot project included several selected buyers (three universities, two

hospitals, the State purchasing agency and ANZA) and three large suppliers. The Minister of Finance officially opened the e-marketplace for business in June 2002. ANZA is also offering e-Marketplace services to the private sector. One of the goals of the Ministry of Finance is that all purchasing of the Icelandic state in certain product groups will be done electronically by 2005, through this e-marketplace.

5.6.2 Nordic Council of Ministers

A research programme, by the name of Nordunet 2, was established in 2000. The general aim of the Nordunet 2 programme was to help secure the position of Nordic countries at the leading edge of Internet development. Between 2000 and 2003, Nordic countries were able to make project proposals in the following categories: telemedicine, digital libraries, infrastructure development, distance education/e-learning. The 20 projects awarded focused on network utilization and network-based applications. The programme was financed by the Nordic Council of Ministers and by the Nordic governments to the tune of 30 million Danish Kroner over three years (US\$ 4.3 million). Iceland was a partner to 4 out of the 20 awarded applications, whereof it was the main applicant on one. This is a respectable ratio, concerning the fact that the country represents one per cent of the region, both in population and economy.

5.6.3 National Committee on Digital TV

The Ministry of Communications established a National Committee on Digital TV in 2002. The Committee is currently working on an agreement to promote digital television broadcasting. It is planning a bidding process for the selection of the best network solution. The government is hopeful that with the provision of broadband and digital television to every home, Iceland can ensure its role as one of the most technologically advanced societies in the world. The committee's work will also feed into the creation of enhanced teleworking programmes and data transmission capabilities across the country.

5.7 The way forward

December 2002 marked the end of the five-year mandate of the Information Society Task Force. In early 2002, the intention was to create a committee composed of representatives of the political parties to take over the mandate of the Task Force, but this did not materialize. The country is fast approaching an election (to be held in May 2003), and thus this decision will most likely be steered by strong political interests. What is certain is that some new entity will be created, though its shape and objectives are as of yet unknown.

On 14 March 2003, the Icelandic Parliament adopted a new legislative package for telecommunications, based on the 2002 EU regulatory framework. This new *Telecommunications Act 2003* covers both telecommunication and broadcasting networks. Broadcasting content, however, is still covered by the *2000 Broadcasting Act*. Some of the highlights of this new legislation include:

- Abolition of requirement for individual telecommunication licences;
- Obligations regarding access, transparency, non-discrimination, accounting separation and cost based wholesale prizes will only be applied to operators which are proven to have significant market power, following a market analysis based on competition law methods;
- Detailed rules on data protection;
- Rules on digital TV networks and conditional access systems. These rules mandate the provision of network access on fair, reasonable and non-discriminatory terms. They also cover access to application programming interfaces (API). The government is currently considering the inclusion of must-carry obligations.
- The new legislation calls for an analysis of the 18 new markets¹⁵ proposed by the EU. One of the markets that will be analysed is the wholesale market for broadband access (No.12. in the EU recommendation), including the possibility of allowing bit stream access.

It is hoped that this new regulatory package will promote competition, facilitate the entry of new players, and encourage content development. As such, it is expected to have a positive influence on the take-up of wireline and wireless broadband in the country.

6 Conclusions

It can be said that, in most countries, factors influencing the adoption of broadband include the proportion of active users of the Internet, the availability of broadband connections, the cost of these connections and the level of government intervention. In this regard, Iceland is no different. The country's deployment of broadband started on a solid footing, as it is home to the world's highest number of Internet users per capita as well as a highly-educated, urbanized, and technophile population. Moreover, both State and industry have been fairly aggressive in promoting infrastructure development and service take-up.

With regard to DSL, for instance, Iceland has the fourth highest number of users per capita. The nation's relative success in this area stems from, *inter alia*, decreasing residential tariffs, effective regulatory initiatives, and the use of broadband within learning institutions. Moreover, an evolving universal service policy guaranteeing an ISDN connection to every home in the country served to promote both technical capacity and user awareness. Indeed, the role of government has been undeniable. Fibre networks in Iceland were mostly financed with State funds, through the public historical operator and power companies. Government-sponsored programmes for application development have also enhanced the potential uses of broadband.

Although Iceland is ahead of its European neighbours in terms of broadband use, there is still work to be done. The cap on foreign download imposed on users, for instance, may prove to be a significant disadvantage in the long term. Improving international connectivity through the FARICE project is a first and crucial step in this regard. Content development is another important challenge. For instance, one of the main reasons for the slow take-up of Síminn's digital television service (over fibre) is that the content package offers little added value over regular terrestrial television. Other factors likely to accelerate broadband demand in Iceland include a continuing focus on educational initiatives and a decrease in local loop unbundling charges.

And the story has only just begun. Broadband development throughout the world is in its nascent stages. Almost 90 per cent of Icelanders have access to some form of high-speed Internet access, but connecting the remaining 10 per cent will prove the most challenging and expensive. Moreover, true broadband speeds of over 2 Mbit/s are still rare.

Iceland is now at a stage in which it is trying to transform itself from an early adopter of broadband technologies to a mass market. In this regard, it will be interesting to observe the evolving role of the country's utility companies, as both infrastructure developers and service providers. Furthermore, like in many other markets, the division of revenues from broadband between an increasing number of players in the value chain, e.g. mass media companies, content developers, retail players, software companies, network operators and so on, remains to be seen.

ENDNOTES

¹ Some technologies allow more bandwidth for downloading and less for uploading, in an effort to offer a better experience over a limited connection. The OECD definition of broadband can be found in Ausushi Umino, "Broadband Infrastructure Deployment: The Role of Government Assistance", OECD Working Paper, May 2002.

² The objective of the New Initiatives Programme is "to advise the Secretary-General, in an informal manner, on new topics of a regulatory, policy or other nature of high-current interest which cut across the work of the ITU Sectors, with a view to possible inclusion of these topics in the regular work programme of the Union" (ITU Council Decision 496). The topics of the workshops are selected from areas of high current interest by the Secretary-General in consultation with the Member States and Sector Members.

³ The [UNDP's](#) HDI is a composite of key indicators of well-being such as life expectancy, literacy, school enrolment and per capita GDP. For the 2002 Human Development Indicators, see <http://www.undp.org/hdr2002/>

⁴ European Free Trade Association (see <http://www.efta.int/>)

⁵ Indefeasible Right of Use (IRU) refers to the effective long-term lease or temporary ownership of a portion of the capacity of an international cable. IRUs are specified in terms of a certain number of channels of a given bandwidth. An IRU allows large ISPs to provide its customers guaranteed international service on a long-term basis.

⁶ See Networked Readiness Index, Country Profiles - Iceland, Harvard University, 2002. Iceland ranked second overall on Harvard's Network Readiness Index.

⁷ For more information on Wi-Fi, see the Wi-Fi Alliance web site at <http://www.weca.net/OpenSection/index.asp>

⁸ SOHO stands for Small Office or Home Office.

⁹ Originally, Skyrr bought the system from Gagnaveitan (who had the original license from the regulator). Skyrr still resells some of the Loftlína connections (100 subscribers).

¹⁰ See <http://www.stjr.is/interpro/for/for.nsf/pages/wpp0237>

¹¹ The most active are the Ministry of Health and Social Security and the Ministry of Education, Science and Culture.

¹² In early 2003, almost 98 per cent of homes were equipped with ISDN connections of 128 kbit/s.

¹³ See <http://www.simnet.is/konur>

¹⁴ See <http://www.hvar.is/>

¹⁵ See http://europa.eu.int/information_society/topics/telecoms/regulatory/maindocs/documents/recomen.pdf