

# What Fibre to the Home can do for your community

**FTTH is not just about speed...  
it's a revolution!**



**Health care of  
the future**



**Smart city,  
smart home**

**Finding a way through  
the FTTH funding maze**



**Fibre to the Home  
Council Europe**

[www.ftthcouncil.eu](http://www.ftthcouncil.eu)

# Table of contents

What is fibre to the home, and why should you care? .....	3
Better broadband boosts the economy .....	4
FTTH around the world. ....	6
FTTH is not just about speed... it's a revolution!. ....	7
Health care of the future .....	8
Working from home: good for the economy and the environment .....	10
FTTH boosts productivity. ....	11
Entertainment in the FTTH era. ....	12
FTTH for a sustainable future .....	14
Smart city, smart home (cities of the future). ....	16
Finding a way through the FTTH funding maze .....	18

## What is the FTTH Council Europe?

The FTTH Council Europe is an industry organisation with a mission to accelerate the availability of **fibre-based, ultra-high-speed access networks** to consumers and businesses.

The Council promotes this technology because it delivers **unlimited speeds** that empower the development of a flow of **new services and content** that **enhances the quality of life**, contributes to a **better environment and increases competitiveness**.

We believe that **Fibre to the Home is key to developing a sustainable future**, as it is now widely acknowledged that **FTTH is the only future-proof technology**, when it comes to bandwidth capacity, speed, reliability, security and scalability.

The FTTH Council Europe consists of **more than 150 member companies**, including many world leaders in the telecommunications industry. We have expanded our membership base to a **broader community of Fibre to the Home stakeholders**, to include content and applications providers (from media, entertainment, health and elderly care, etc.), as well as other associations, governmental and academic institutions.

All our publications, articles, pictures, video clips and other information are available on our website: [www.ftthcouncil.eu](http://www.ftthcouncil.eu)

Join us on social media:

Twitter: FTTHCouncilEU

Facebook Pages: FTTHCouncilEurope & I want Fibre

LinkedIn: FTTH Council Europe



Contact: [info@ftthcouncil.eu](mailto:info@ftthcouncil.eu)

# What is Fibre to the Home, and why should you care?

**Fibre to the Home is the most advanced technology for building the next generation of communications networks around the world. Already today, fibre connections are used by more than 130 million homes. China alone expects to have 100 million fibre subscribers by 2015. European countries such as Lithuania, Norway, Denmark, Sweden and Latvia are approaching near universal access to fibre.**

Installing new fibre all the way to peoples' homes may cost more than continuing to use the existing copper telephone and cable networks. However, all-fibre access offers far greater reliability, lower operating costs, lower energy use to run the network and – perhaps most important of all – much greater bandwidth.

Access to high bandwidth, as well as symmetrical bandwidth (when the bandwidth is high for both download from the Internet and upload to the Internet), creates opportunities to develop and exploit many new types of services and applications. These services can enhance our quality of life, while also providing more revenue streams for telecoms operators and helping to keep the cost affordable for basic communications services.

We'll talk more about new applications in the coming sections. But for now, just imagine being able to send family videos or detailed images as quickly as you can receive them, in the blink of an eye. Think of how much easier life would be if you had access to a reliable and secure connection that supported remote medical checkups, educational opportunities, or running an Internet business from home. And yes, playing interactive computer games or watching television programmes on demand, precisely when you want to view them.

### How does optical fibre work?

Fibre-optic cable is made up of thin strands of glass. Information is carried on the glass with pulses of light, usually created by lasers. The capacity of each strand – that is, its ability to carry information – can be increased to meet future needs almost without limit, simply by changing the lasers. The latest systems use lasers that emit more light pulses in less time, for instance, or use multiple wavelengths of light at the same time. Fibre is thus said to be "future-proof." It is the only communications technology for which that claim can be made. Once fibre is installed, it may not have to be replaced for many decades.

Because the glass strands are so flexible and thin (thinner than a human hair) and because they carry no electricity and are impervious to lightning and to water, they are actually far more rugged and reliable than the copper wire they replace.



They present no fire hazard. Glass does not corrode, either. Nothing hurts fibre except a physical cut or destruction of the building it is in.

Fibre, unlike copper, can also carry a signal over long distances with minimal degradation – 60 kilometres or more in installed networks. In contrast, the signal in copper networks quickly starts to degrade after just a few hundred metres.

Hundreds of fibres can be installed next to each other, inside a thin cable. Unlike electrical signals in copper cable, each glass fibre emits no external signal. There is no interference between fibres, and the signal inside each strand is far more secure from outside detection.

### FTTH for reliability

The spinning circle on the computer screen

has become synonymous with a slow or broken Internet connection. Everyone is aware that broadband over copper cables, whether telephone networks (DSL) or cable television networks, can be unreliable. And everyone knows that once a fault is experienced, it can be difficult and time-consuming to find the source of the problem.

Fibre is different. The rare problems in an all-fibre network are easily detected with equipment that can pinpoint the cause and even the location of the fault remotely, sometimes even before a customer knows there was a problem and usually without the need to send out a technician. There's less to go wrong with the network in the first place – most fibre access networks require no or only few electrical components between the central communications office and the end user. Together, this results in lower operating costs in FTTH networks compared with copper. This is a critical issue for small municipal and private networks that cannot afford to keep technicians on standby to fix problems.

In new construction, fibre costs about the same as copper, so why would an operator or property developer install an old technology like copper, which is technologically obsolete? Why would they consider a wireless system, which is fundamentally limited in capacity? A single strand of fibre-optic cable can, in theory, carry more data than the entire radio frequency spectrum combined. Even in an existing network with good quality copper cables, the ability of fibre to meet our insatiable demand for bandwidth can push the economics towards fibre.

For telecoms operators, building owners and national governments there are many compelling reasons to consider fibre, even though it may seem more expensive at first glance. This document explains why.



# Better broadband boosts the economy

In the early nineteenth century the English market town of Marlborough was an important crossroad between London and the West of England, similar in size to the neighbouring town of Swindon. Then, the train arrived. Or rather, it didn't for Marlborough. The first railroad between London and the West was routed via Swindon, which also became home to one of the largest railway repair works in the world. Today, Marlborough remains a small town of under 10,000 people, while Swindon's population has grown to more than 200,000.

Today it is ultra-high-speed broadband infrastructure that will become a determining factor in ensuring the economic fortune of cities and regions. In Europe, a number of cities have already recognised this and have encouraged investment by private companies.

- In the UK, CityFibre aims to deploy FTTH at speeds of at least 100 Mbps to one million homes and 50,000 businesses in second-tier cities, starting with Bournemouth and York.
- In Stockholm, the municipal government created a body, almost entirely funded by commercial organisations, to build a wholesale FTTH network and lease the fibre to private service providers.
- In the Netherlands, private investors have teamed with the incumbent KPN to offer FTTH to the vast majority of the population within five to ten years, resulting in 1.6 million homes already covered, of which 30% are subscribers.

While it can be argued that governments have more pressing priorities than FTTH, it can also be said that FTTH is a key to solving them:

- > economic downturn and global competition
- > education and unemployment
- > sustainability and environment
- > the digital divide
- > ageing populations

It is specifically when the economy is in a downturn that we should invest in our future and deploy FTTH. Indeed, improved telecom infrastructure could make a key contribution to Europe's economic recovery. A 10% increase in broadband household penetration helps boost a country's gross domestic product between 0.9% and 1.5%, says global management consulting firm McKinsey & Company. Doubling broadband speeds produces a 0.3% increase in GDP, according to a 2011 study by Ericsson, Arthur D. Little and Chalmers University. Strategic Networks Group, a broadband consultancy in the US, has also investigated how better broadband leads to higher productivity. In a nutshell: for a business or organisation in the US, 10% greater utilisation of the Internet will increase revenues by 24% and reduce business costs by 7%. Furthermore,

the positive return on investment on Internet-based solutions for improving productivity is 8.9% higher for fibre users than for cable users, and 14.2% higher for fibre users than for DSL users.

Even more interesting, Taylor Reynolds at the OECD has shown that "on average, cost savings of between 0.5% and 1.5% in each of four sectors (electricity, transport, energy, health) over ten years, resulting directly from a new broadband network platform could justify the cost of building a national point-to-point,



Taylor Reynolds

fibre-to-the-home network."

## FTTH creates jobs

Neelie Kroes, Vice-President of the European Commission responsible for the Digital Agenda, said: "Let me explain what digital innovation means. It starts with broadband. With the networks provided by a vibrant, healthy telecoms sector. But it goes way beyond one sector. It encompasses established software and hardware companies. Companies working in electronics, designing new components. A vibrant innovative start-up ecosystem. But ICT innovation doesn't stop there. It doesn't stop with the ICT sector. It means connected cars. And connected devices, in the Internet of Things. It means factories of the future, able to customize and perform. Smart grids for the energy network. It means companies from finance to retail

using big data. A new way to treat and deliver healthcare. It means a boost for every kind of company, of every size in every sector. ... In short, this matters for the whole economy. ... all Europe's economy is going digital. ... That is why I want a strong recovery based on real investment in networks and real digital transformation of how we organize our society and economy. ICT investments deliver half our productivity growth, but other parts of the world know this and are fighting hard. We have to use our best weapons to fight back."

In the UK, it is estimated that an investment of £15 billion (approximately €25 billion) in information and communications technology (including smart grid and broadband) would create or retain 700,000 jobs, of which 360,000 would be small business jobs, according to a report by the Information, Technology and Innovation Foundation (ITIF), a Washington-based think tank.

Fast broadband access also enables substantial productivity gains for the millions of small and medium enterprises across the country, giving them access to, for example, cloud computing benefits. As Europe continues to outsource manufacturing and becomes more and more of a service economy, we have to offer people the tools they will need to change and embrace new opportunities. Access to FTTH is one of those tools.

## Focus on finance

Many observers criticise, what they see as the high upfront cost of installing fibre-optic networks. And it's fair to say that where cables need to be buried in the ground, the cost can be high. Some say that wireless can do the job just as well. But their arguments crumble under closer examination. Although FTTH costs more initially, it offers much greater revenue potential over a longer period and has lower running expenses. However, because FTTH is a future-proof infrastructure, one that will fulfil



Neelie Kroes

our broadband needs for generations, it requires a long-term business case.

The FTTH Council Europe suggests a "layer by layer" approach to calculating the business case and return on investment, as described in our FTTH Business Guide ([www.ftthcouncil.eu/home/form-business-guide](http://www.ftthcouncil.eu/home/form-business-guide)). The "passive layer" – ducts, poles, cables and the installation works or "civils" – takes the longest to generate a return on investment, possibly as much as 15 years. For the "active components" – the electronic hardware to transmit data over the network – the investment period is much shorter, typically five to seven years. For developing new services and applications to run over the network, the payback period could be less than three years.

Operating costs with FTTH are far lower than for copper, thanks to easier maintenance, lower electricity consumption, and higher network reliability. Utilities in the US and Europe have reported savings of 40 – 90% per year compared to the cost of running a copper network, before bookkeeping and accounting adjustments.

There is an undeniable, growing demand for fibre access, offering operators an opportunity to boost average revenues per user (ARPU) significantly. It has been shown that with FTTH, an operator can generate ARPUs that are, on average, 46% higher, by offering unique services that copper cannot match, and offering them in a more reliable manner. Take-up rates as high as 93% have been recorded, according to a study carried out by Diffraction Analysis (Successful Services Strategies for FTTH Operators, 2012).

Surveys also show that FTTH customers are more satisfied customers, who are more likely to remain loyal to their service provider, rather than switch to another in search of a better deal. This is great news for service providers because it reduces

the cost of recruiting new customers, and raises revenues by reducing the proportion of customers enjoying introductory or promotional pricing. Typically, profits rise 7% or more after 18 months, according to financial models developed by Broadband Communities magazine. The first operator to deploy FTTH in a particular area enjoys a competitive advantage. Once end users discover FTTH with another operator, they become lost customers.

## The Digital Agenda

Europe's Digital Agenda is a multi-faceted project to create a single European market for digital services. The European Commission has put targets in place and

Member States are being encouraged to implement plans in order to reach those targets. The targets relating to broadband require universal availability of fast broadband at speeds of 30 Mbps or more, and at least 50% take-up of ultra-high-speed broadband services at speeds of at least 100 Mbps by 2020. National governments in many European countries have allocated funding to help meet these targets, particularly for rural and low-income areas where it is less attractive for private players to deploy new broadband infrastructure. But really, common sense should point toward the obvious: where public money is invested, it should be on future-proof solutions, namely FTTH.



## Definition of terms

### Fibre to the Home (FTTH)

is defined as an access network architecture in which the final connection to the subscriber's premises is optical fibre. The fibre-optic cable is terminated on or inside the premises boundary for the purpose of carrying communication services to a single subscriber.

### Fibre to the Building (FTTB)

is defined as an access network architecture in which the connection to the subscriber's building is optical fibre, but the connections to individual subscriber premises inside the building use a physical medium other than optical fibre. This approach is typically used where a single building houses multiple subscribers. The fibre-optic cable is terminated somewhere on or near the building boundary, such as the basement, and then the building's existing cabling is used to provide connections to individual apartments.

# FTTH around the world

**Fibre to the Home or Building (FTTH/B) adoption in Europe is gathering pace, with the total number of subscribers increasing by 29% in 2013 – substantially faster than the year before when growth was around 15% – according to the latest update to the European FTTH market panorama at end-2013.**

In total, 13 countries in the EU have experienced growth greater than 30% in FTTH/B subscribers in the past year, including Spain (64%), the Netherlands (43%), France and Portugal (each 41%).

In absolute figures the leading nations in Europe's EU28 are France and Sweden, which exceed 1.2 million FTTH/B subscribers each. Russia remains a heavyweight with nearly 9 million FTTH/B subscribers (of which 1.4 million were added in 2013), while the Ukraine has 1.3 million subscribers, and Turkey has 1.1 million.

Outside Europe, China and Japan are the unmatched world leaders, with 37 million and 24.7 million FTTH/B subscribers, respectively.

These numbers sound impressive, but there is still a long way to go. According to analyst firm Heavy Reading, a country only reaches "fibre maturity" when 20% of its households are FTTH/B subscribers. So far, only nine countries around the world have reached this threshold, and only three of them are European. The United Arab Emirates leads the Global FTTH Ranking with an impressive 85% of homes subscribing to FTTH/B, followed by South Korea, Hong Kong, Japan, Singapore and Taiwan, with subscription rates ranging from 63% to 37%. The first European country, in seventh position in the Global FTTH Ranking, is Lithuania, with 34% penetration, followed by Sweden (26.5%) and Latvia (23.3%). All other European economies remain below the 20% threshold.

In 2013, the four countries that benefited from the biggest roll outs were Spain with 2.4 million new homes passed (homes where services are available to order), France with

710,000, Portugal and Sweden with 550,000 each. This shows that even countries deemed "mature," such as Sweden, still have room for growth.

Germany and the UK both have less than 1% penetration, and once again conspicuously failed to qualify for the FTTH Ranking.

There is one new entrant to the FTTH Ranking: Switzerland, which has 2% household penetration and saw 235% growth in subscribers over the 12 months to December 2013. Out of 73,816 Swiss subscribers, 70% were new subscribers in 2013, which is the highest rate in Europe. Turkey (46%), Spain (39%) and Poland (32%) follow with lower rates but much larger populations.

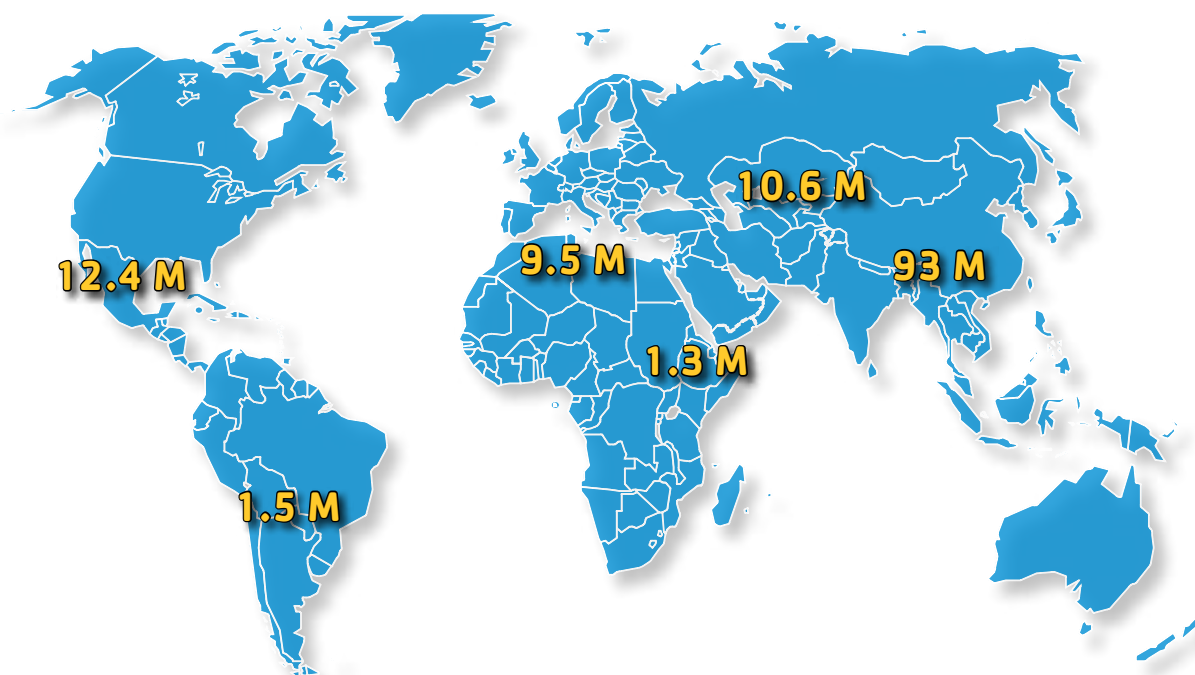
"We need to do more, and I can't help but feel that some policy makers underestimate the danger of not getting to fibre to the home networks quickly enough," said Karin Ahl, President of the FTTH Council Europe. "Within the next 30 years, 70% of the economy is likely to be driven by firms and products we know nothing about today."

The higher European growth rate of subscribers (29%) over that of homes passed (22%) is a good sign for operators, who all need to see a better return on their investment. It is also good news for end users, because a larger subscriber base will encourage more companies to develop services and applications and help drive down consumer prices.

## The European FTTH Ranking

IDATE has ranked the European economies where more than 1% of the households are FTTH/B subscribers. Currently, 23 countries in Europe meet the 1% threshold for inclusion in the ranking. (The ranking does not include smaller nations with less than 200,000 homes).

"Key countries absent from the ranking may miss out on their chance to build a sustainable future for their citizens", said Hartwig Tauber, Director General of the FTTH Council Europe. "Additional efforts are required to ensure Europe reaches the Digital Agenda 2020 broadband targets. The decision to invest in FTTH – the only future-proof solution – needs to be made today."



<sup>1</sup> To be included in the FTTH Ranking, a country must have more than 1% of households that subscribe to FTTH/B (and more than 200,000 households overall).

# FTTH is not just about speed... it's a revolution!

**What does 100 Mbps mean for you? At more than ten times the average broadband speed in most European countries, a 100 Mbps connection makes it possible to download an entire music album in five seconds, a television show in 30 seconds and a high-definition movie in just seven minutes. However, only 2% of Internet users in Europe are currently able to access this kind of speed, according to the European Commission's Digital Agenda Scoreboard 2012.**

But ultra-fast broadband over FTTH is about much more than just doing the same things faster. Some services work much better over FTTH, while others simply won't work at all without it. Healthcare and security applications, for example, demand ultra-high quality-of-service and reliability. Such services are not available on a European scale because so few people would be able to use them. But these services often do exist wherever there is a critical mass of FTTH customers to enable their development.

Think about it for a minute. Who would have wanted an automobile in 1880 when there were no roads? What would be the point of installing light bulbs in your home if there was no electricity? No new infrastructure means no new services. It's not rocket science!

In Europe, we have already seen instances where service providers have been forced to downgrade their applications so that they work less well, because the broadband networks



aren't fast enough to support them. In February 2010, German web hosting firm Strato launched an application called HiDrive, which offered 100GB of cloud storage capacity for €4.90 per month. In December 2011, it brought a similar offering to the UK priced at £19.00 (€22) per month for 500GB, but because many UK consumers were still on slower DSL connections, Strato also had to introduce a DVD send-in service.

Bandwidth requirements per household keep increasing as more activities are carried out online. The modern family is a connected family. Imagine four family members, watching video, doing homework, playing online games or just chatting to friends over the Internet, each using a different device, whether a connected television, tablet, computer or smartphone. Some next-generation services, such as home security systems or smart meters, are always-on, and will be running in the background at the same time. The number of applications and devices that require machine connectivity is ever increasing. Domestic appliances with Internet connectivity are now reaching the market, like washing machines and refrigerators!

If government-backed services such as health monitoring and remote learning are added to the mix, it is easy to see how this could add up to significant bandwidth consumption. The answer to the question "What services will fill the pipe?" is simply "All of them".

The following sections offer some compelling examples.

## Fibre: More than bandwidth!

- Fibre access networks have lower latency, which means no noticeable delay in exchanging information. This is important for applications that depend on real-time communication and high-resolution images, such as remote medical diagnostics and surgery, as well as online gaming and other interactive entertainment services.
- Fibre networks are robust and immune to electrical interference. Failures are rare, but if they do occur, they can be diagnosed remotely using technology that can pinpoint the exact location of the fault, and they can be repaired quickly, often even before the end customer becomes aware of service disruption.
- Fibre access gives customers the bandwidth they pay for, because the optical cable does not impose physical restrictions on the speed that can be achieved – unlike copper telephone cables, fibre's speed is not affected by the distance from the customer premises back to central switching points. In comparison to wireless, subscribers do not share limited frequencies with other users, and there is no electronic interference. End users thus get the same speed regardless of the number of users (as opposed to mobile) or distance from the cabinet (as opposed to copper).
- Surveys report that fibre subscribers have higher satisfaction rates with their service providers than other broadband users. In Europe this is evident in the fact that FTTH customers are more likely to be loyal to their existing service provider, and will "churn" to another provider less frequently.



# Health care of the future

Imagine being able to access a personal trainer online. Or having a medical consultation about your sick child from the comfort of your own home. Or in-home monitoring that is reliable and simple enough to delay or even avoid the need for nursing home care. Around the world, more and more of such services are being introduced. The idea is to reduce healthcare costs; improve patient outcomes by involving the most appropriate medical professionals at an earlier stage; make it easier for patients to access medical services; and encourage healthy lifestyle choices. The ability for healthcare professionals to share digital patient information, such as MRI scans or X-rays, is also important.



Specific services, such as high-definition two-way video hook-ups, will require the high bandwidth that only FTTH can provide. But even more important where home care is concerned, the services require the intrinsic reliability of fibre access networks. Fibre access is always on, and is almost completely impervious to lightning, rain and other weather problems. It is also immune to electrical interference in homes themselves.

Today, fibre access networks carry a range of health-related services, for example:

- You can do basic monitoring of bodily functions you otherwise would check during your regular check up with your doctor (for instance, blood pressure and heart rate).
- A hospital can quickly send digital X-rays to an on-call doctor who remains at home, so the doctor can examine the X-rays without having to drive to the hospital first.
- Online fitness centres allow people to exercise without going to the gym or needing to be at the same location as their trainer. Participants can join a live broadcast, participate in a personal training session or get in touch with fellow trainees.
- Home monitoring services in Sweden, using a mobile

telepresence device like the Giraff or MoSu, allow caregivers and family members to communicate with their patient/loved one over the Internet, and to move the device from one room to another around the home.

- Patients who are undergoing physiotherapy can use physical re-education systems to practice correct movements, with imaging sensors picking up any mistakes.

The introduction of such services is already helping people understand the benefits and functions of telemedicine long before they may need care.

## The impact of an aging population

Demographic changes force governments to balance growing healthcare costs with the need to reduce budget deficits. According to the 2012 Ageing Report of the European Commission Europe's

population is projected to continue to grow older, with the share of the population aged 65 years and over rising from 17% in 2010 to 30% in 2060, and those aged 80 and over rising from 5% to 12% over the same period.

Unfortunately a long life isn't the same as a healthy one. According to the OECD, the average life expectancy after the age of 65 in 2008-10 for the European Member States was 16.5 years for men and 20.1 years for women. However, after the age of 65, men could expect to lead only a further 8.4 years of healthy life, while women could expect only 8.6 years. Little surprise that in 2010 European countries spent, on average, 9% of their GDP on health, up from 7.3% in 2000.

Europeans are also getting fatter. More than half of the total adult population in Europe is now overweight or obese, leading to a rise in chronic illnesses

such as diabetes. This puts a significant burden on health services. According to WHO estimates, treating obesity-related health issues costs Europe up to 6% of its total care expenditure, and indirect costs relating to lost productivity cost the region just as much.

All this pushes governments to move from a hospital-centric system towards providing remote care to patients' homes. After all, the elderly and chronically ill tend to need regular monitoring rather than hospital visits, and often prefer to reduce the travel and waiting time those visits entail.

Innovation in medical care does not require investments in complex customer premise equipment. Video-conferencing systems that run on television sets can provide a simple and easy-to-use solution for patients who have a high-bandwidth FTTH

connection offering high speeds both downstream and upstream.



## e-Health

In the Netherlands, the town of Nuenen, which has one of the world's highest densities of FTTH subscribers, has linked its elderly population over high-speed networks to create a video-based platform of community exchange, which reduces loneliness.

Such services are only viable when a sizeable percentage of the population – at least 20% – has access to the home fibre infrastructure that turns platforms of exchange, such as high-definition video conferencing systems, into an affordable and secure reality.

But the reality is that telehealth applications with significant benefit to governments and local authorities are being constrained by the networks' ability to support them. In some cases, where patient information is transmitted via email doctors see notable benefits, but are concerned about the loss of face-to-face contact with patients. Much more could be done, such as allowing doctors and patients to communicate via video communication systems, if patients had access to high bandwidth communication at home.

Governments would like to reap the financial and social benefits of e-health. Many, however, have yet to facilitate the construction of the FTTH infrastructure on which the next century of healthcare delivery will depend.

# Working from home: good for the economy and the environment

Working from home, either part-time or full-time, is no longer just a lifestyle choice; it is now a national imperative. In Europe, the typical commute is a 30 km round trip. If everyone worked at home just one day a week, morning congestion on roads and mass transit would decrease by almost 20%! The resulting public cost savings and efficiencies could soon exceed the cost of installing a national fibre access network, and that's before the environmental impact is taken into account.

Businesses themselves benefit directly from a pervasive communications infrastructure. European businesses are relying more and more on so-called "cloud" services to link multiple offices together, across the world. Small, lightweight tablets and laptops can handle intensive computing tasks, because most of the data and software are held at central corporate IT rooms and data centres. Companies save money by needing less office and meeting space, and by being able to disburse their activities away from large office towers in central cities. Decision-making happens faster. With real-time access to data, everyone is more productive.

## FTTH is the catalyst

Unfortunately, the whole approach fails if networks are not robust. Networks need great swathes of bandwidth in both the downstream and upstream direction. They must be ultra-reliable.



They must be ultra-secure. Only FTTH can meet those needs.

A survey sponsored by Network Solutions, The State of Small Business Report, 2011, found that, for small businesses generally, the use of Internet business services is correlated with competitiveness. Even a small business with local customers needs e-mail and a website. Employees who work from home often need to log on to company systems or at least share files

with colleagues. That adds up to a lot of people who require reliable broadband at home for business purposes.

And what about starting a home-based business? All over the world, families have been pushed to do that, to make up for the lack of job opportunities in the worldwide recession. In the United States, according to surveys by Michael Render at RVA LLC, FTTH-enabled working at home generated \$42 billion in revenue in 2010.

## Home: the new classroom

E-learning has begun to radically shape the lives of college students as well as part-time learners worldwide. Even students who spend all of their time on campus are likely to take some classes from their dormitory rooms, perhaps to catch up on lectures that they missed. And of course, retraining workers who have been displaced from their jobs is an essential part of rebuilding a struggling economy.

As you might imagine, e-learning works best over reliable, high-bandwidth connections. French firm Erdenet is in the business of supplying web-based learning courses that students can follow at their own pace, using interactive video and online collaboration. With an ordinary DSL connection, it's very difficult to add rich media such as two-way video and interactive maps. This is a tool that calls out for a fibre access connection, directly linking the pupil to the rich-media experience.



# FTTH boosts productivity

Europe competes with Asia's cheap labour in large part by innovating – both in software and in manufacturing technology. Communications networks contribute to the running of factories and corporate data centres, of course. But in the long-term, there is another contribution that is perhaps even more important: smart minds are stimulated by exposure to information, experiences, and innovative services via powerful broadband networks, both at work and at home. Asian countries understand the potential of broadband, and have pushed fibre access to the point where Asia has nearly 75% of all FTTH customers.

Unfortunately, Europe is well behind Asia in measures of broadband success. In the European Union, according to a 2010 study by MICUS Management Consulting GmbH, *The Impact of Broadband on Growth and Productivity*, companies adopting broadband-based processes improve their employees' labour productivity on average by 5% in the manufacturing sector and by 10% in the services sector. However, due to the relatively slow adoption of broadband-based services in Europe, in particular among small and medium-sized businesses (3% per year on average), the macroeconomic productivity

improvements attributable to broadband came to only 0.29% on average per year over the period 2004–2006.

Poor and under-developed areas often derive even greater benefit from broadband fibre access. In a 2009 report, *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, the World Bank reported that every 10-percentage-point increase in broadband penetration accelerates economic growth in low- and middle-income countries by 1.38 percentage points – more than in high-income countries and more than for any other telecommunications service.

## FTTH keeps communities alive

There is evidence that FTTH impact is most pronounced in rural areas, where take-up rates are higher because of pent-up consumer demand. In many sparsely populated regions, the existing

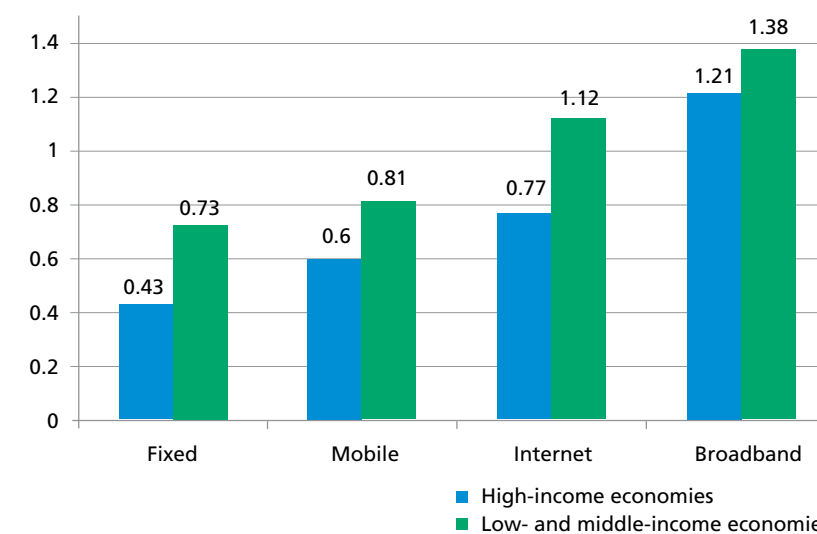
broadband networks are substandard, and inhabitants are farther away from entertainment, education and health services than urban dwellers.

Many rural areas are struggling to keep their communities alive. FTTH allows local governments to:

- Increase the economic attractiveness of their local region, retain citizens and businesses, and attract new businesses;
- reduce the urban-rural divide by enabling e-health, e-education, e-government, thus widening access to services typically located in cities;
- enable people from more isolated regions to have more direct communication with family, friends and colleagues;
- preserve local culture and maintain a sense of local identity by encouraging consumption of local crafts, foods, and performing arts.

Local authorities should "Think Fibre!"

How investing in broadband can boost economics



Note: the vertical axis represents the percentage increase in economic growth per 10% increase in telecommunication penetration.

Source: World Bank (2009)

Even though the impact of broadband differs from country to country and region to region, the volume of untapped customer demand is significant everywhere, according to the ITU/BCDD report, *Broadband: A Platform for Progress*.



# Entertainment in the FTTH era

**Anything you want to watch, on any screen at any time – this is the new world of entertainment. Linear, broadcast television is giving way to video-on-demand. Traditional satellite and terrestrial transmissions are giving way to Internet Protocol (IP) delivery methods.**

Today's audience, used to the benefits of the Internet, wants to watch their favourite shows at any time and expects extra services, content and information. Time-shifted viewing and video-on-demand services such as YouView, Lovefilm and Netflix meet this demand to some extent. But all too often viewers are forced to choose between the immersive, collective home cinema experience and laptop viewing – albeit with greater choice of content.

The online gaming industry is expanding too. Including both online and on-disc sales, the computer gaming industry grossed more than \$65 billion worldwide in 2011, about \$18 billion of it in Western Europe. For comparison, global box office movie receipts were only about one third of that figure. Digi-Capital forecasts the entire global gaming business will bring more than \$100 billion in 2017. And, by the way, the stereotype of gamers as young adolescent males is completely out of date. The average age of players in the US (the biggest market) is 30, and 45% of them are female, according to the Entertainment Software Association (ESA).

Gamers prefer FTTH because it gives them special advantages – lower latency and much faster upload speeds. They can see the effect of pulling the trigger about a third of a second sooner than their online competitors using VDSL connections. As more people join in, the requirements increase: multiplayer games need higher network bandwidth to accommodate as many players as possible at any one time.

Fibre access is also vital for the future of television. Although television is widely available through the Internet, most programmes still seem to be reaching our homes through old-fashioned coaxial cable with all the limitations that implies. The number of IPTV subscribers globally has yet to hit the 100 million mark, according to a market study by RNCOS (Global IPTV Market Forecast to 2014) – a tiny figure when you consider that virtually every household in Europe has a television. Television services are ready to step into the future, but are being hindered by an ageing infrastructure.



Today's copper-based cable television and Internet connections simply cannot accommodate the growing bandwidth demand generated by on-demand entertainment. Imagine five family members, each watching high-definition video-on-demand or playing a video game. That requires 50 to 75 Mbps with HDTV. Ultra-high-definition television has a resolution of 3840 x 2160 pixels, with four times the image resolution, four times the data requirements, compared to the best 1080 pixel high-definition set today.

## Fibre to the television

Optical technology not only enables extremely high audio and video quality and an unlimited number of channels, it also offers interactivity and makes additional features possible. Multiple streams can be viewed and recorded simultaneously and video-on-demand is easily accessible.

Since FTTH is provided to a known location – the consumer's home – the consumer's identity is known to the service provider. This implies a high level of security for online transactions, such as pay-per-view services. Also, user profiles can be created, enabling personalised content suggestions and user-specific targeted advertising. Broadcasters and advertisers can now think of the television as a two-way channel, through

which viewers can offer feedback and suggestions.

## Tomorrow's television

Forward-looking companies are already showing us what can be done when the Internet is combined with television in new and exciting ways. Google TV, for example, merges television viewing, online gaming, web surfing and social networking into one single user experience. Televisions and game consoles could be linked in real time to provide high-definition, multi-user video chat sessions. The possibilities are endless.

Video-on-demand will become pervasive. Apple says it now has nearly 600 million active users in its iTunes store, who are able to purchase and download music and movies anytime and anywhere there is Internet connectivity. The massive success of the catch-up television service in the UK, BBC iPlayer, demonstrates that there is a large audience that is increasingly

hungry for this type of programming.

However, as these technologies become more widely adopted, they will also further increase the strain on available bandwidth. With traditional broadband and cable networks, programmes may jitter and repeatedly pause in order to buffer, which means a lot of customer complaints.

New, interactive ways of "consuming" television are leading to increasing convergence between the worlds of broadcast and broadband, and operators and content providers need to act upon this. Optical fibre offers vast bandwidth, and in the future significant upgrades can be made directly on terminal equipment, with no need to replace the fibre itself.

In short, tomorrow's television will only realise its full potential if it's fibre-powered.

# FTTH for a sustainable future

## Energy savings

Managing an electrical grid used to be relatively straightforward. There are two kinds of electrical power plants: base load and “spinning reserve”. Base load generators, which typically use nuclear fuel, coal or gas, provide a consistent output that cannot be easily turned on and off in response to sudden changes in demand. Sudden outages or peak demands are handled by small gas turbines running on standby mode, or by releasing water from pumped storage.



In the past decade, everything has changed. The main energy supply now includes highly variable renewable energy sources such as wind farms, solar cells or solar-steam plants. Individual homeowners send surplus electricity from their solar panels and tiny wind turbines back to the grid, depending on the weather.

Having a “smart grid” would make it easier to balance the supply and demand. The electrical grid would work more reliably if peak consumer demand and weather patterns could be anticipated, and customers could enjoy lower electricity rates to encourage them to use electricity when supply was plentiful and/or demand scarce.

Smart meters will also make domestic and business customers more aware of their energy consumption. Appliance makers are already selling equipment that uses a home wireless connection or a specially equipped electric meter to display information to the customer and send data back to energy suppliers. Factories and data centres, which are major consumers of electricity, can be advised to stagger lunch hours and maintenance periods to avoid a power interruption when supply is scarce.

Smart grids can also recover from storm damage faster by routing power to where it is needed, and can sense when power is being stolen for unauthorised use. Smart grids in coordination with industrial control systems can make automatic adjustments to everything from traffic lights to surveillance cameras to sewage and water pumps.

emissions as people travel less, and from other benefits. The pro-environment balance can only grow as new network applications and services come into being.

In work commissioned by the FTTH Council Europe, analysts at PricewaterhouseCoopers and Ecobilan developed a complex model for calculating the environmental impact of FTTH networks throughout their entire lifecycle.

The study team considered three different geographies (dense urban areas, less-crowded urban areas and rural areas), four different deployment techniques (existing ducts or sewers, traditional trenches, micro-trenches and aerial) and two FTTH technologies (GPON and Active Ethernet). For each possible combination, the team examined the environmental impact of manufacturing the necessary equipment, transporting it to the site, deploying it, powering it and ultimately disposing of it.

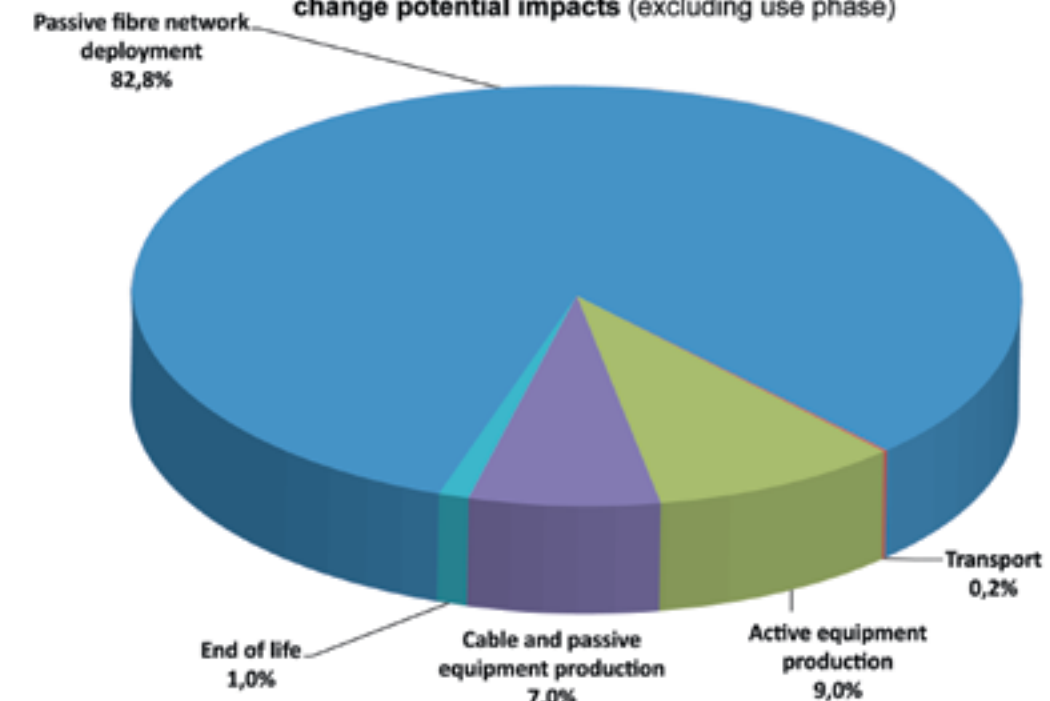
Different types of environmental impact were considered, including depletion of energy and other resources, air acidification, formation of photo-oxidants, eutrophication (depletion of oxygen in water), environmental toxicity and release of greenhouse gases. In terms of the release of greenhouse gases – the biggest contributor to climate change – nearly all of the negative impact was associated with laying the fibre. This means that the length of new ducts per home passed is a critical factor in the environmental impact of any particular deployment.

## Environmental impact

The environmental cost of building and operating fibre access networks has been calculated to be far lower than for copper. And even the small environmental cost of installing new fibre infrastructure is soon offset by environmental savings from reductions in greenhouse gas

To calculate the benefits, the analysts considered only a limited set of applications: teleworking, telemedicine and home assistance using high-end videoconferencing. Extrapolating from current trends, the team assumed that 10% of the working population would be able to telework for three days per week;

Relative contributions of the different FTTH network deployment phases to climate change potential impacts (excluding use phase)

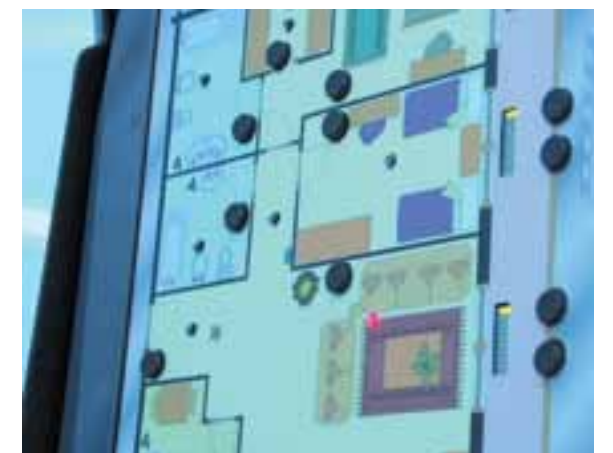


About 83% of the greenhouse gas emission from FTTH networks comes from deployment, and most of that is due to manufacturing and groundwork to lay the ducts. Sharing ducts or establishing open access networks will reduce the environmental impact.

that 20% of the elderly population could benefit from home assistance, and that telemedicine would be used for dialysis treatment, doctor consultations and transfer of medical images.

Based on these assumptions, the team calculated that, “the environmental impact of the deployment of a typical FTTH network will be positive within less than 15 years on average.” For some impacts, such as eutrophication, the deployment would reach environmental payback in less than ten years. Adding new applications to the network, beyond the few that were considered in the model, could significantly reduce the payback period.

There is no point building a FTTH network if it is only going to be used like a copper-based network. To have a real impact on society, the network should be exploited to maximum effect; in other words, by taking advantage of fibre’s ability to erase distance.





# Smart city, smart home (cities of the future)

**Competition among cities has entered a new dimension. In most communities, the various elements like transport services, energy and security systems operate in a closed manner with no connectivity between them. In a smart city, intelligence is created by linking inhabitants and systems, transporting information seamlessly, reliably and instantly.**

Large cities need to become smart to manage growth. Smaller communities need to become smart to retain their population and enhance lifestyle and economic opportunities.

Many European cities aspire to smartness, but so far few have installed the right network to do the job: FTTH. Only optical fibre has the reliability and the scalable capacity to supply data when and where it is needed: real-time traffic information to an ambulance driver; the location of underground gas mains to a construction foreman; remote access to lessons for a sick-at-home ten-year-old child; prompt, professional medical aid for an elderly gentleman who has collapsed on the street; the arrival time of the next bus, how much fuel it uses, and when it needs maintenance; the location of the nearest taxi or nearest parking space... the list is endless.

Governments in smart cities can use data to discover small inefficiencies that would have otherwise escaped notice, and to schedule maintenance and staffing with minimum inconvenience and cost. In a smart city, any civil servant at any agency can transact business for any other agency in any other location, and many transactions can be handled online, with face-to-face video if necessary, instead of in person.

Smart cities are green cities, conserving energy while maximising quality of life.

## Cooperation is the name of the game

Creating a smart city is not a "one-man show"; everyone needs to "buy in" to the concept if it is to be successful. An inclusive framework is needed to ensure that everyone receives a return on their investment. And there is one common denominator, which can have significant impact on these modern urban challenges: a broadband network based on optical fibre:



## Different routes to being smart

Manchester in the UK is a founder member of the EuroCities network, which aims to promote the idea that, "by making a conscious effort to use innovative digital technologies to improve living and working conditions, we can develop a more inclusive and sustainable urban environment". The work includes a variety of initiatives: for example, involving citizens in testing energy management systems through smart meters, working with government agencies to open up data, developing a next-generation access fibre based digital infrastructure and working with local residents to equip them with the skills to support the co-production of new community services.



Amsterdam in the Netherlands also has smart city ambitions. The Amsterdam Smart City project was co-founded by electricity distributor Liander, telecoms incumbent KPN, and the economic agency Amsterdam Innovation Motor in close cooperation with the city authorities. The goal is to develop innovative technologies and approaches to sustainable economic development, while also encouraging Amsterdam's citizens and businesses to modify their behaviour in ways that promote this goal. By setting up small-scale local projects, Amsterdam Smart City makes it possible to test new initiatives that can subsequently be implemented on a large scale.

The city of Sankt Gallen in Switzerland intends to become a smart user of energy for transport, heating and electricity, hoping to cut the current consumption of 1490 GWh to 1060 GWh by the year 2050, and to generate all the energy used by the city from renewable sources. To reach the targets about 140 tasks have to be implemented. As a foundation for these tasks, the city has deployed FTTH through the municipal power utility company.



**Residents** are already investing in smart homes by connecting sensors to networks to control and automate heating, video surveillance, lighting, plant watering, and so on. To take full advantage of these investments, remote control of these processes is required.

**Urban city councils** everywhere are facing financial pressure in the economic downturn as they have to maintain general services, from health care to waste collections, with less money. Even simple ideas, such as dimming streetlights after midnight, can reap major cost savings. An important element is the sharing of official data among council departments as well as with the wider public and local businesses.

**Energy utility companies** must cope with the introduction of renewable power sources as they strive to meet sustainability goals. Encouraging customers to install and use smart meters is a key component of achieving their goals.

**Public transport services** must provide more complex schedules and tariffs, adapt to modern requirements for cashless payment, and continue to provide services even in the face of traffic congestion. The big challenge for cities is to integrate different modes of transport – rail, automotive, bicycle and walking – into one convenient, easily accessible, time efficient, affordable, safe and green system.



**The world of business** demands a strong, reliable communications network; financial losses caused by network disruptions add up rapidly and irreparably, and will multiply as cloud services proliferate. The availability of a high-speed, high-quality, fibre broadband network is today an essential pre-requisite to establish any business.

The common need for all of these parties: fibre to the home or business.





# Finding a way through the FTTH funding maze

The idea of building FTTH networks can be unsettling for local and national governments. The up-front capital cost tends to be higher than for wireless or copper and it typically takes longer for the project to go cash-flow positive. But potential investors need to consider the whole picture: operating costs can be far lower with fibre than copper, and the revenue potential is much higher – especially if the network operator can provide 20 to 200 online services beyond the classic three (voice, video and data) or attract outside content providers to offer such services through open-access or bundling agreements.

Despite what municipal officials may have heard, it is often easier to build a profitable fibre access network in small or even rural communities than it is to build it in a big city. There are more opportunities for national or European subsidies. There may be fewer customers for every kilometre of installed fibre, but there is less competition for those customers and a greater desire for better connectivity in areas where broadband services have often been substandard for years.

A number of small communities are even helping to build the network using their own labour and equipment. Many homeowners in Scandinavia have made their own connection to the network – often enough that it might be considered the norm there. About ten years ago, a Norwegian energy supplier, Lyse, decided to supply fibre connections to homes, including clusters of 300 or 400 houses in rural areas, under the brand Altibox. The operator keeps connection costs low by asking customers to dig their own trenches. It now has 17% of the total Norwegian broadband market and a success rate of around 60% of homes passed. There is also an example in the UK, the Broadband for the Rural North (B4RN) project in Cumbria, which plans to connect properties across 21 communities with FTTH by the end of 2014. The original 2011 plan for only eight communities was extended due to high demand.

Analysts from Comsof and Atesio calculated the expected cost of achieving Europe's Digital Agenda broadband targets (100% of homes passed and 50% of homes with subscribers) across the EU countries. Initial results give a total cost of €202 billion, which is much lower than previous estimates. Moreover, around €7 billion of European funding should be available for investment in high-speed broadband infrastructure through the Connecting Europe Facility (CEF). This "seed money", in turn, is expected to attract between €50 and €100 billion of further public and private investments, thus generating a substantial proportion of the total investment required.

Why such a difference? The new estimates include a fine-grained



analysis of population density. Introducing modest levels of infrastructure sharing and reuse can drive tens of billions of euro in additional savings. The numbers, by the way, are in line with recent industry estimates in Europe and in the United States.

The FTTH Council Europe has a free, detailed guidebook about financing FTTH projects, which is available to download at [www.ftthcouncil.eu/EN/home/form-business-guide](http://www.ftthcouncil.eu/EN/home/form-business-guide).

## Many different business models

The key question for all players, both public and private, is how to finance multi-year infrastructure projects affected by short-term business uncertainties. There is no single answer, because local situations vary. Below is a summary of the general approaches taken by FTTH projects in Europe.

**Municipal network:** the local government

assumes ownership of a fibre-optic network serving the population in its territory. The decision to build a municipal network is, in many cases, triggered by the concern that the town or city will be left behind as telecoms operators roll out FTTH/B networks in high-profit areas only. In some cases, the geographic scope of the municipal model may reach more than one community.

There are three common business models:

- **Retail:** the municipality becomes the service provider to its citizens and businesses.
- **Wholesale** ("open access"): the municipality provides access to the infrastructure to third-party service providers for a fee.
- **Finance only:** the network is owned, operated and maintained by a private provider that leases services to the local population (public-private partnership, described below).



**Utility involvement:** in some European countries, electric utility companies drive FTTH projects, typically using their own resources (cash or debt). This makes sense for a number of reasons. Some utilities see the provision of broadband infrastructure as a natural fit with their existing business, especially as they start to provide "smart grid" capabilities. Utility companies own rights of way to their existing infrastructure so don't need to purchase new in order to deploy an access network. In some countries there is pressure to bury overhead cables, which creates an investment opportunity. The most visible example of utility involvement is in Denmark, where utility companies owning FTTH networks in rural areas have combined their marketing efforts under a single brand, called Waoo!

**National government funding:** under this approach, the government takes on the funding burden either through direct grants, low-rate loans from a national development bank, or universal service fund allocations (Japan, Korea, France).

**Public-private partnership (PPP):** a contract is formed between a public sector partner and private industry, usually by creating a special purpose project company to sign the contracts. PPPs are ideal candidates for long-term project financing, where lending is based on project-specific cash flows,

and lenders rely on project contracts, rather than the assets of the project sponsors, as security. This form of financing has also been used for some municipal networks in Europe.

**Operator-funded:** an FTTH network sponsored by an incumbent or an alternative carrier is typically funded out of the capital budget of the company, although some have managed to secure equity or debt funding for this purpose, e.g. from the European Investment bank (EIB).

**Alternative operator:** under this model, the operator (typically a cable operator but maybe a new entrant) deploys FTTH/B in direct competition with the incumbent. This is the model of CityFibre in the UK; Numericable, SFR and Free in France; and FastWeb in Italy, for example.

**Operator-funded with public policy stimuli:** under this model, the operator assumes primary funding responsibility but is supported by public policy initiatives aimed at improving a potentially unattractive business case.

## Some recommendations

Writing in Broadband Communities magazine, [www.bbcmag.com](http://www.bbcmag.com), Costas Troulos of Diffraction Analysis makes the following recommendations for governments, regulators and policymakers:

- **Share what you can spare.** Sharing existing public infrastructures, such as utility ducts, trenches and poles, can help accelerate the rollout of FTTH. Public stakeholders, including municipalities, governments and policymakers, should explore ways that public infrastructures and rights-of-way can be made available to all parties interested in deploying fibre networks.
- **Facilitate collaboration among stakeholders.** Regulators and policymakers at all levels of public administration facilitate cooperation between access providers and rights-of-way holders. Collaboration can improve market dynamics, enhance competition and avert potential monopolistic practices.
- **Get the financing in place and on time.** One common shortcoming of public funding is that all the funds are typically made available at the start of the project. As a result, publicly backed projects start out cash-rich but do not necessarily have financing in place to support later phases. The timing of public financing needs to match the progressive nature of network deployment and cover all phases of network development and service marketing.





# Don't miss out! Because it's YOUR day!

On 4 November, people all over the world will celebrate the inaugural **Gimme Fibre Day**, an annual "event" created by the FTTH Councils Global Alliance\* to celebrate the only future-proof broadband access solution and showcase how fibre has positively impacted communities across the world.

Organise your own **Gimme Fibre** activity (on 4 November) and let us know what you are up to. We invite you to organise events, product launches, special customer offers, etc.

*The date for this annual celebration of fibre optics was selected because it corresponds with the birthday of Nobel Prize winner Sir Charles Kuen Kao, the man who changed the way the world communicates. Sir Kao was jointly awarded the 2009 Nobel Prize in Physics for "ground-breaking achievements concerning the transmission of light in fibres for optical communication".*

Showing your commitment to FTTH is easy. Just request your **Gimme Fibre Day** visuals kit by sending an email to [gimmefibre@ftthcouncil.eu](mailto:gimmefibre@ftthcouncil.eu) and promote YOUR day however you want.

\* The FTTH Council Global Alliance consists of the FTTH Council Africa, FTTH Council Americas, FTTH Council Asia Pacific, FTTH Council Europe and FTTH Council Middle East & North Africa

All and more on **Gimme Fibre Day** soon on  
[www.gimmefibre.eu](http://www.gimmefibre.eu)



**Fibre to the Home**  
Council **Europe**

[www.ftthconference.eu](http://www.ftthconference.eu)