

# **Fibre-to-the-Home (FttH) in the Netherlands**

**Erik Compter, Jan Schepers**

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# Fibre-to-the-Home (FtH) in the Netherlands

## Introduction

New rankings were presented at the annual Fibre-to-the-Curb (FtC) conference on 29 February by the FTTH Councils of Asia, Europe and North America on the number of households connected to fibre in each country. The Netherlands was ranked twelfth worldwide, after Norway, Sweden, Denmark and Iceland, among others. South Korea leads the global rankings, with around 31 percent of households connected to a fibre-optic network. Hong Kong comes second with 23.4 percent, followed by Japan at 21.3 percent. Sweden follows at a distance with 7.1 percent of all homes connected with fibre.

While still small in terms of number of users, the Dutch FtH market has started to take serious shape recently, supported by a number of important announcements. At the presentation of its annual results for 2007, KPN said it aims to bring FtC nationwide within three years. The operator expects to spend EUR 1.0-1.5 billion annually on the plans in the period to 2010. KPN and Reggefiber announced in October 2007 that they would cooperate on building the new fibre-optic network in Almere. KPN will offer services over the network built by Reggefiber. The agreement marks the cooperation of two leading players on the FtH market, although to date, the two have yet to add more cities or regions to the partnership.

Due to a lack of demand, Lijbrandt Telecom shelved in January 2008 plans to roll out a fibre-optic network in Lisse. The project was based on the premise that at least 40 percent of households would have to sign up for services, but the investment threshold was not met. In March 2008, Arnhem also failed to reach the 40 percent mark for its fibre project in the De Laar neighbourhood, and provider XMS said the network as a result could not be profitable. Network company NEM Arnhem had already designed the project and obtained the necessary permits.

The cable network operators are also active. In 2007 UPC Broadband achieved speeds of 120 Mbps on its network in Amsterdam, working with Cisco Systems. This was Europe's first roll-out of EuroDocsis 3.0 and M-CMTS technology in an existing network, which brings speeds of 200 Mbps within reach. Zesko also plans to test EuroDocsis 3.0. The networks of its subsidiaries Casema, @Home and Multikabel will be ready from June 2008 for EuroDocsis 2.0, according to a spokesman for the companies. As a result, they are also prepared for the successor, 3.0. This standard, through channel bundling, makes even higher up- and download speeds possible. As such, neither of the cable groups has expressed any interest in FtH.

This report gives an overview of current developments on the Fibre-to-the-Home (FtH) market in the Netherlands, as well as expected developments in the coming years. The report is based on earlier research by Telecompaper, results from other (public) research, public information and (confidential) information obtained from oral and written interviews with representatives of companies directly and indirectly involved with FtH developments in the Netherlands. Appendix 1 gives a list of businesses and their representatives interviewed in the course of Telecompaper's research for this report.

## Fibre-to-the-Home model

In order to analyse the Fibre-to-the-Home initiatives, Telecompaper has used a three-tier model. The model shows the three possible functional divisions in providing FtH services. Current practice in many, although certainly all, cases is for one party to manage both the passive and active layers, while the services are provided by third parties. In many cases the model is only theoretically applied, while in practice one or more layers are managed by just one company.

The three layers are:

- passive layer (1<sup>st</sup> tier)
- active layer (2<sup>nd</sup> tier)
- services layer (3<sup>rd</sup> tier)

The passive layer includes the physical cables (fibre optics and ducts for laying cables) and the technical space where network equipment is deployed. The market assumes depreciation terms of 20-30 years for the passive infrastructure.

The active layer includes network equipment for transporting data over the FttH connection and fibre-optic network. This includes the required customer premise equipment. Active components are usually depreciated over the medium term (3-5 years). The active layer is usually associated with the 'operator' function.

The services layer includes all the services that can be provided over the FttH connection, such as internet, telephony, radio and television, video-on-demand, camera surveillance, etc.

Appendix 2 shows which market parties are involved at each layer in current FttH projects.

### Open network model (non-discriminatory access)

While in theory FttH networks are well designed for a so-called open network model, in practice this is rarely applied. An open network model means that service providers (third tier) can obtain non-discriminatory access to the FttH network. While many market parties claim to support such a model, users of many FttH networks cannot yet choose from several service providers (see Appendix 2, Table 2). Furthermore, many market players find the lack of a well functioning open structure no surprise, with one noting: "Competition based on infrastructure has proven to be an unstable model, look at the disappearance of a large number of independent ISPs".

The lack of open networks to date may have two explanations. First is that the operator of the FttH network may also be a service provider and may (initially) not allow any other service providers access. [Confidential commercial information removed] Another explanation could be that there is little interest among service providers, usually because the FttH networks only reach a limited number of potential customers, offering little economic incentive. It's not clear in every situation why there is no choice among several service providers. The only network where there is a choice among several service providers (internet, telephony, radio and TV) are Rotterdam Lloydkwartier/Nesseland and Amsterdam CityNet. Management of both networks is run by BBned, which clearly is the only market player at the moment to develop the open network model and offer several providers for each service on its FttH networks.

Most of the market players interviewed expect that the unattached service providers will play only a marginal role. [Confidential commercial information removed] Their share on the broader market is already very small, and they have limited investment possibilities. The other ISPs will be driven by their parent company's strategy. [Confidential commercial information removed]

### FttH roll-out in the Netherlands

There have been numerous announcements on FttH plans in recent years. Especially municipalities and housing corporations have seen optical fibre as an attractive investment, for various reasons. Nevertheless few large-scale projects have come off the ground, for reasons including political and financial difficulties and lack of consumer interest. In short, many initiatives have remained limited in scope or only achieved preliminary planning.

Reggefiber's arrival on the scene has been crucial for a number of projects, according to interviews and research. For example, OnsNet Nuenen and CityNet Amsterdam were able to make the next step in their development thanks to this investor. In recent years, Reggefiber has taken (controlling) stakes in a number of FttH projects. The table below shows the FttH operators in which Reggefiber is an investor (first column). The exact amount and extent of the participation did not form part of this research.

Table 1: FtTH networks with Reggefiber participation, as of 31.12.2007.<sup>1</sup>

FtTH operators with Reggefiber participation	Network type	Networks
GNA <sup>2</sup>	FtTH	Amsterdam CityNet
GNEM <sup>3</sup>	FtTH	GNEM Dudok/Patio, Portaal, Vasthorst
Lijbrandt	FtTH	Lijbrandt Hillegom
NEM Amersfoort	FtTH	Amersfoort De Alliantie
NEM Almere	FtTH	AlmeerNet
NEM Eindhoven	FtTH	OnsNet Eindhoven
NEM Nuenen	FtTH	OnsNet Nuenen
NEM Brabant	FtTH	OnsBrabantNet
NEM Rijssen-Holten	FtTH	TwenNet
Lloydkwartier/Nesselande	FtTH	Lloydkwartier/Nesselande
Y-3net <sup>4</sup>	FtTH	Y-3net Deventer
Lijbrandt	FtTB	DUWO Amsterdam, Den Haag, Oegstgeest
Unknown	FtTB	De Key Amsterdam
NEM Eindhoven	FtTB	Vestide Eindhoven
Lijbrandt	FtTB	SLS Leiden
Unknown	FtTB	Stadswonen Rotterdam

Reggefiber has become the largest and most influential player on the Dutch FtTH market. Alongside this company, a number of others are directly or indirectly involved.

## Outlook

The leading FtTH players are Reggefiber, KPN, XMS<sup>5</sup> and GNA. OnsNet initiatives in the province of Noord-Brabant are related to Reggefiber. KPN and Reggefiber announced to join forces in Almere and the rest of the market sees this cooperation as a combined start for the rest of the country. Although the parties have difficulties to make a forecast, some of the parties think that only these two companies will survive in the glass fibre market. There is another possibility that only one party stays in the market. KPN could purchase Reggefiber or a telecom operator from abroad (like France Telecom, Deutsche Telekom) could make a move. It is seen as a logical step for KPN to switch over to FtTH.

## Business cases and customer demand

As the first FtTH networks have been operational at most a few years, there is little known yet on the customers switching from DSL or cable to FtTH. It is clear from the interviews that the business cases for deploying FtTH networks (passive and active layers) are based on a minimum percentage of 50% homes taking services, known as 'homes activated'. Prior to network deployment, defined neighbourhoods are assessed for sufficient demand. If the minimum is reached, deployment goes ahead, with the expectation that in the run-up and introductory phases demand will increase further. While the expected activation percentage is not always fixed in advance, there were at least two projects recently abandoned due to lack of local interest (Lisse and Arnhem South).

The percentage of houses with a fibre-optic line that actually use the connection varies by project. This is influenced by various factors. Those most commonly named are the (local) marketing approach, the demographic make-up of the neighbourhood and the services offered. For example, the penetration in areas with a high number of middle- and high-income households is higher than in areas with a large number of elderly or immigrant residents. In Nuenen (OnsNet), all the households were offered a year of free internet, radio and TV service, as well as a free phone line (calls were still billed). After the first year,

<sup>1</sup> This list is based on information from Reggefiber.

<sup>2</sup> Glasvezelnet Amsterdam cv (GNA) is a consortium with the shareholders including housing corporations Algemene Woningbouw Vereniging, WBV Het Oosten, Woonstichting De Key, Woonstichting Rochdale and Stichting Ymere, investors Reggefiber and ING Real Estate and the City of Amsterdam. The housing corporations, investors and city each hold a third of the shares.

<sup>3</sup> Glasvezel Netwerk Exploitatie Maatschappij (GNEM) is a company controlled by Reggefiber.

<sup>4</sup> Y-3net is an initiative of the housing corporation Rentré Wonen. Reggefiber participates in Y-3net.

<sup>5</sup> Reggefiber has a controlling stake in XMS.

standard charges applied. The result of this approach was that apart from a few dozen households, everyone continued to take the FtH services. In other projects where residents had to pay from the start of the services, the take-up was much lower than in Neunen. [Confidential commercial information removed]

It is too early to say how penetration develops over time. Most of the projects are still in the early stages of roll-out and connecting the first subscribers.

Resident cooperatives and local project developers both assess demand for FtH before any direct investment is made in the network. In both cases, a certain percentage of households must show interest for the project to go ahead. The difference is that cooperatives offer households the opportunity to participate in the financing of the network, making them a partial owner. Local project developers merely look at demand for services to assess whether over time the network deployment and maintenance will be profitable. Interested customers sign a subscription contract, but they are not a participant in the network.

In a few cases (Nuenen, Eindhoven), a cooperative was set up from the start to ensure sufficient demand. In these two cases, the minimum activation of 50 percent of homes was clearly exceeded, showing a clear willingness among residents to change service providers. However, these two are clearly exceptions, with both the cable operators and KPN seeing no clear pattern among customers switching to the FtH service. These cases aside, ADSL and cable internet providers have admitted to losing "some" market share in areas where FtH is offered. The amount of market share lost is in line with the market share won by the FtH providers. In places where there is high take-up of FtH services, the existing ADSL and cable providers lose significant market share. However this is only local market share, and for the incumbent players, this is still a very small part of their total customer base.

To respond to the new competition, cable operators especially have started local marketing campaigns. While the FtH players claim that all their competitors start rival promotions, KPN has said it cannot do this. The operator is not allowed to run special promotions in certain regions, and as a result KPN is of the opinion that it has no way of trying to retain customers in areas where FtH is offered. For example, in Nuenen KPN has become a marginal player. Also in Hillegom, KPN has been unable to maintain its local market share and lost a significant number of customers.

All market players agree that there's no way back once a household has chosen for fibre. There are no known cases of this in the Netherlands or in other countries, apart from the odd individual.

### Wireless technologies

Opinion is divided over the competitive qualities of wireless technologies. Most market players see wireless technologies such as HSPA, LTE or WiMAX as complementary to Fibre-to-the-Home. Still, the cable operators especially see possibilities and/or threats from wireless. [Confidential commercial information removed] This is comparable to mobile-only households, which are already evident in the telephony market. Over five years, this could reach 10 percent.

[Confidential commercial information removed]

Fujitsu notes that WiMAX is not a technology that is easily deployed as a counterpart to fibre or other fixed connections. That kind of deployment requires houses to be fitted with special hardware. In November 2007, KPN said that in areas where it had no ADSL coverage, it would use broadband wireless technology. Tests showed that HSPA was the most efficient technology given that the company already had the HSPA network deployed.

### Fibre coverage throughout the Netherlands

Based on Telecompaper's analysis and interviews with market players, the vast majority of the Netherlands (70-80%) should be covered with fibre connections within 12-15 years, by 2020-2023. It is important to note here a number of influential factors.

First, 100 percent coverage is not achievable, the same as with any type of infrastructure. It can be expected that mass roll-out of FtH will start with the large cities and Randstad, followed by the less

commercially attractive areas. This is the timeframe applied to all types of infrastructure. We are talking in this case about the expected plans for a mass roll-out, as currently all the FtH initiatives are local projects spread across the country. If in the next few years a number of impediments are removed (as discussed in this chapter), the bigger players are expected to start a roll-out on a larger scale. This will lead first to coverage for more populated areas, before moving to less profitable areas. Based on this assumed roll-out plan, we can estimate that the large cities would be covered within 3-5 years and the top 20 cities, of which most are outside the Randstad, would be covered within 10-12 years.

Second, the available building capacity is a limiting factor. Based on the current labour market capacity, nationwide roll-out would take at least 7-10 years. The construction market capacity is currently around 200,000 lines per year and an excavation crew can prepare around 350 meters per day, while Dutch households cover hundreds of thousands of kilometres. While at the current rate it would take well over the 15 years mentioned earlier, programmes have started to increase capacity. The Netherlands counts around 7 million households, and at 600,000 lines per year, it would take 12 years for nationwide coverage. However, time is needed to scale up to 600,000 lines a year. Assuming it takes three years to reach this rate of deployment, we can estimate 15 years to achieve 100 percent coverage. This is a realistic scenario according to various parties.

Third, the Netherlands' early mover advantage in broadband networks may prove a limiting factor for FtH. The Netherlands is a world leader in penetration of broadband services, and the quality of existing ADSL and cable networks is high. This means less immediate necessity for fibre, and is also part of the reason why some FtH projects are being shelved. Over time FtH will be seen to have advantages over traditional networks. The reason for consumers to switch to fibre-optics is triple-play services and a number of additional value-added services such as HDTV. New services will also appear on the consumer market, such as video telephony. FtH also offers a quality that can take telework into a new phase. Set-top boxes are also becoming more intelligent. Within a few years, households will have media centres that control appliances and devices throughout the home. FtH makes such innovations possible, while the current networks can do few or none of these things. Over the short term, a fibre line also increases the value of a home. This is an advantage over DSL and cable, but an advantage that will fade as FtH becomes more widespread.

The fourth and biggest impediment to nationwide FtH is financing. There will be areas with no access as it simply is not profitable to bring fibre to certain areas. Fibre-optics is too expensive for nationwide deployment.

Improvements in the technology and easier deployment methods will lead to acceleration in deployment. However, at the moment a specialist technician is still needed to hook up a fibre connection. If the number of specialists with the required training increases and the connection process is simplified, the roll-out will benefit.

At the end of 2007 the number of homes passed is around 200,000, including Fibre-to-the-Building (FtB) initiatives. Based on the plans made, the market capacity and the rate of deployment, the number of homes passed in 2011 will reach between 600,000 and 700,000. [Confidential commercial information removed]

### Financing

Financing of the current FtH networks is largely dependent on investments by commercial businesses (Reggefiber, KPN). Housing corporations are involved indirectly, but they cannot carry the costs. In Amsterdam, the municipality is involved as an investor. There was a difference of opinion among the parties involved though, both over the participation itself and over the future role of the city.

[Confidential commercial information removed]

There is a future role for banks in financing the infrastructure. To date, financial institutions have not shown interest, but if they open up to FtH, deployment can move to the next stage. The initial investors [Confidential commercial information removed] will partner with such companies once they see which way the wind is blowing.

While some parties see no role for local government, others think the national government could do more to support fibre projects. The opinion is that the government should see FttH not only as a triple-play service provider but also as a possible solution to some of its other problems. For example fibre connections could increase home working and reduce traffic problems, which would benefit the economy. While market parties say they understand the government's official policy of network indiscrimination, they see other ways for the government to make a contribution. "The government could think about a subsidy scheme, such as a tax rebate like with the "pc-privé" project."

## The broadband market and its players

### Reggefiber

As noted earlier, there is currently just one major player on the FttH market, and that is Reggefiber. Reggefiber focuses on operating a backbone network (Eurofiber, Telecom Utrecht) as well as developing local fibre-optic networks for the business market (Fastfiber, Telecom Utrecht) and the consumer market. As of 1 January 2008, Reggefiber reports [Confidential commercial information removed] FttH connections deployed. Reggefiber is expected to grow by [Confidential commercial information removed] connections per year. [Confidential commercial information removed] Within three years, the company is expected to have around [Confidential commercial information removed] active connections. [Confidential commercial information removed]

If FttH is to play an important role, speeds will have to increase further and services will have to develop further (think IPTV). At the moment there is no need, as, among other reasons, FttH has yet to show a strong increase in the number of subscribers. Reggefiber says it is not interested in playing a role as services provider. But according to the company, most service providers are only interested in launching on the network if it reaches at least 200,000 customers. Given that this scale of network is not likely before some time in 2008 or 2009, there are situations where Reggefiber is forced to offer services itself, as it is difficult to attract other service providers.

Almost all the existing FttH networks offer the same services as those on cable and ADSL networks. The reason is that the number of subscribers has yet to justify developing new services. The turning point for new services is estimated at around 800,000 subscribers. Reggefiber expects from that point to see serious developments in high-speed services. Until then, the service offerings are in line with what's available on existing infrastructure. Reggefiber is not active, itself or with associated companies, in developing services.

Reggefiber's roll-out strategy is to develop a business case for each town/region, in order to determine whether deployment of a FttH network would be profitable. [Confidential commercial information removed] If the business case proves positive, Reggefiber will invest in the network. Reggefiber makes some use of P2P connections, and the connection to the home is always just one fibre pair. According to the company, it is in principle not possible to expand the number in existing fibre-optic networks as there is limited room in the fibre-optic cable.

Reggefiber does not expect any serious competition in the FttH networks market, as deploying such networks is a long-term venture. Depreciation terms associated with the construction of FttH networks run normally for 20-30 years. This makes it difficult for other parties to enter the market. Private FttH projects have a very difficult time attracting external financing without a financially strong partner such as Reggefiber.

Most of the FttH network projects in which Reggefiber has a stake are managed by VolkerWessels Telecom, under contract from Reggefiber (active layer). Reggefiber and VolkerWessels have the same parent company, namely Reggeborgh.

### KPN

Reggefiber is currently the leading player, but in the (near) future competition is expected from KPN, which is already looking at projects in Enschede and Almere. In 2008 and the first part of 2009, KPN is taking the time to assess the possibilities of the FttH market, and the company will not speculate about

what will happen after that. In 2008, as part of its All IP network plans, the operator is rolling out FtC. Based on its experience with what mix works best, the company will plan further. At the moment it has yet to plan its strategy here. In 2005, KPN already announced that 28,000 street cabinets would be connected to fibre-optics, over the period 2006 to 2010, and VDSL would be used to connect to the customer.

As FtH gains scale in the Netherlands, KPN does want to know what's happening. As TV is very important to consumers, there is a reason for KPN to invest in fibre. If fibre becomes a success, KPN wants to be an important part of it, the company has said. While competitors would like to keep KPN out of this market, they acknowledge it is a logical step. The copper network is losing its customers and as such its value, while fibre-optics is seen as extremely future-proof. A number of market parties suspect that the VDSL lines deployed as (essential) part of the All IP project will be replaced within a couple years by FtH connections. They also expect that VDSL will not even be deployed in whole parts of the country where KPN will likely move directly to fibre. All the players interviewed see a leading role reserved for KPN. KPN itself is still keeping its options open. Both KPN and Reggefiber said they have no plans to extend their cooperation in Almere to other cities. Others note the complementary roles of Reggefiber and KPN and see Almere as the first step to a joint bid for the whole country. [Confidential commercial information removed]

KPN is currently involved in two FtH projects in the Netherlands that are rolling out in existing neighbourhoods. These are Enschede (passive layer, operator and services provider) and Almere (operator and services provider). It will also soon start as a services provider in Amsterdam.

KPN sees the cable network operators as the biggest threat when it comes to FtH. The company expects that they will react to KPN's own eventual fibre plans with an upgrade of their networks. That is just one part of the story; the cable operators will also respond with promotions to retain customers in areas where fibre becomes available.

For KPN's FtH plans, the regulatory environment is an important issue. The company says it wants certainty from the regulator. This has a big influence on the business case for FtH. At the moment that certainty isn't there, so a start needs to be made. Across Europe, it's unclear how regulators will deal with FtH initiatives. When it comes to retail regulations, KPN sees itself restricted from differentiating local offerings. On the wholesale side, there are no regulations yet. For copper, services are regulated based on costs, but for fibre there is no regulation. KPN would find it strange if fibre was regulated the same as copper, as the basis is completely different. The fibre-optic network is financed from the company's own investments, and as such the old policy doesn't apply. Where KPN now and in the future rolls out FtH, it uses P2P connections. Access lines on KPN projects are made by connecting one fibre pair to the fibre-optic network. However KPN has said it is possible to add more fibre pairs, although that is not the case with current FtH projects.

In addition to the FtH projects in existing neighbourhoods, KPN has been deploying TriNet lines in new-build areas for several years. BAM Infratechniek and Volker Stevin Telecom jointly set up TriLink, which has a framework agreement with KPN for the design, deployment, management and maintenance of telecommunication networks in large new-build locations. TriLink realises these access networks using a newly developed network structure: TriNet. TriNet implementation in new-build areas provides homes with fibre, as well as conventional copper cables for standard voice connections. When the residents need a quicker connection, they can be directly connected to the fibre-optic network. As far as is known, the TriNet lines are not yet being used over fibre. As a result these lines are not included in table 3 of appendix 3. In 2006, KPN had 30,000 of the so-called TriNet access lines deployed. In 2007, the total reached 67,000. It can be expected that yet this year KPN will start with providing only FtH connections for homes at larger new-build projects.

## Cable

The cable companies have no concrete FtH plans. Their standpoint is that the current coax lines can still compete for some time with FtH and VDSL from KPN.

The cable operators have invested considerably in upgrading their networks in recent years. There is little necessity for them to replace the existing coax lines with FttH connections as, in contrast to ADSL, the coax access lines can still compete in terms of bandwidth with fibre-optic lines. Both Zesko and UPC are monitoring FttH, but in the near term will not deploy any other infrastructure than the current hybrid fibre coax network (HFC network).

In the long term it is an option. However in that case, it's not a question of just laying fibre in the last mile. The consequence of deploying fibre is that the management of the network in many areas would have to change. Also the platforms running on it would need to be adjusted. In other words, the turning point to justify the technical and economic demands has not been reached yet. The network is sufficient and the investment costs are still too high in comparison to the eventual benefits. [Confidential commercial information removed]

### **BBned**

In the fibre-optic network market, BBned positions itself as (wholesale) supplier of open networks, where it operates primarily as network operator (layer 2). As network operator, BBned is responsible for the deployment of active network components and their management. BBned is also present at layer 3 (service providers), with its service providers BBeyond (business market) and Alice/Pilmo and InterNLnet (consumer market), but in each situation offers other, competitive service providers non-discriminatory access to its managed network. BBned has chosen in principle to not own any of its own fibre-optics (passive layer), but does sometimes make an exception (such as at business parks) when there is sufficient demand but no other party is prepared to lay the physical infrastructure. BBned uses P2P technology and one fibre pair per home.

In addition to the existing FttH networks Rotterdam Nesseland and Lloydkwartier, BBned is also operator of the under-construction GNA network. BBned won this contract through a public tender by Glasvezelnet Amsterdam (GNA). Given Reggefiber's strong grip on the FttH market, it remains to be seen if there will be enough growth opportunities for BBned to operate third-party FttH networks. It seems unlikely that players like Reggefiber and KPN will outsource this function in the future. For KPN the operator function is core business, while Reggefiber has its own sister companies where it can outsource the operator function (VolkerWessels Telecom, which has the same parent company as Reggefiber – Reggeborgh – has a special unit for network management). Notably none of the companies interviewed named BBned as an important player on the FttH market, either in the current market, where BBned has an essential role, or in the future.

## Appendix 1

To get a picture of the market, Telecompaper held confidential interviews with a number of parties active on the FttH networks market, offering services over these networks or experiencing competition from FttH. A number of companies approached by Telecompaper (Eurofiber, Y-3net, XMS) referred us back to their controlling shareholder Reggefiber.

Below is a list of the parties interviewed.

Company	Representative(s)
BBned	[Name], Legal advisor [Name], Product management
EuNetworks	[Name], Manager operations
Fujitsu Services	[Name], Director telecom
GNA	[Name], Director
KPN	[Name], Regulatory officer [Name], Director W&O All IP [Name], Director CM glas
Reggefiber	[Name], Legal counsel [Name], Manager business development Eurofiber [Name], Marketing manager FttH
UNET	[Name], Director
UPC	[Name], Senior business developer [Name], Vice-President Business development
Zesko	[Name], Director Regulatory & Public Affairs

## Appendix 2

The following table gives an overview of which service providers are active on each FtH network. For each project, the relevant players for each of the three layers are presented. (As a supplement to this report, a price overview of each of the service providers is available, split according to city, speed and available products).

Table 2: Market parties involved in FtH networks in the Netherlands.

Project	Passive layer	Active layer	Services layer
Almere Fiber Pilot	AFCo <sup>6</sup>	First Mile Ventures <sup>7</sup>	<ul style="list-style-type: none"> <li>UNET (internet, telephony), HERTZinger Satelliet (TV, radio)</li> <li>KPN (internet, telephony, TV, radio)</li> </ul>
AlmeerNet	Reggefiber	KPN	<ul style="list-style-type: none"> <li>In the course of 2008, service providers will be added</li> </ul>
Amersfoort Nieuwland	NEM Amersfoort	NEM Amersfoort	<ul style="list-style-type: none"> <li>XMS<sup>8</sup> (telephony, internet, TV)</li> </ul>
Amersfoort Vathorst	GNEM	GNEM	<ul style="list-style-type: none"> <li>XMS (telephony, internet, TV)</li> </ul>
Amsterdam CityNet	GNA	BBned	<ul style="list-style-type: none"> <li>Concepts ICT (telephony, internet, TV, radio)</li> <li>Fast ICT/Qfast (telephony, internet, TV)</li> <li>InterNLnet (telephony, internet)</li> <li>Alice<sup>9</sup> (telephony, internet, TV)</li> </ul>
GNEM Patio	GNEM	GNEM	<ul style="list-style-type: none"> <li>XMS (telephony, internet, TV)</li> </ul>
GNEM Portaal	GNEM	GNEM	<ul style="list-style-type: none"> <li>XMS (telephony, internet, TV)</li> </ul>
KPN Glasnet Enschede	KPN	KPN	<ul style="list-style-type: none"> <li>UNET (internet, telephony, mobile telephony), HERTZinger Satelliet (TV, radio)</li> <li>Introweb (internet, telephony, TV, radio)</li> <li>Solcon (internet, telephony), HERTZinger Satelliet (TV, radio)</li> <li>Concepts ICT (telephony, internet, TV, radio)</li> </ul>
Lijbrandt Hillegom	Lijbrandt	Lijbrandt <sup>10</sup>	<ul style="list-style-type: none"> <li>Lijbrandt (telephony, internet, TV)</li> </ul>
Naaldwijk-Woerdblok	CAIW	CAIW	<ul style="list-style-type: none"> <li>CAIW (telephony, internet, TV)</li> </ul>
OnsBrabantNet (Helmond, Geldrop-Mierlo, Valkenswaard, Best)	NEM Brabant	NEM Brabant	<ul style="list-style-type: none"> <li>Edutel (internet, telephony), HERTZinger Satelliet (TV, radio)</li> </ul>
OnsNet Eindhoven	NEM Eindhoven	NEM Eindhoven	<ul style="list-style-type: none"> <li>Edutel (internet, telephony), HERTZinger Satelliet (TV, radio)</li> </ul>
OnsNet Nuenen	NEM Nuenen	NEM Nuenen	<ul style="list-style-type: none"> <li>Edutel (internet, telephony), HERTZinger Satelliet (TV, radio)</li> </ul>
Rotterdam Lloydkwartier, Rotterdam Nesselande (Glasvezel Rotterdam) <sup>11</sup>	Ontwikkelingsbedrijf Rotterdam <sup>11</sup>	BBned	<ul style="list-style-type: none"> <li>Luna (internet)</li> <li>Concepts ICT (telephony, internet)</li> </ul>
TwenNet	NEM Rijssen/Holten	NEM Rijssen/Holten	<ul style="list-style-type: none"> <li>Concepts ICT (telephony, internet)</li> <li>Solcon (internet, telephony), HERTZinger Satelliet (TV, radio)</li> </ul>
Y-3net Deventer	Y-3net	Y-3Net	<ul style="list-style-type: none"> <li>Concepts ICT (telephony, internet, TV, radio)</li> <li>Alice (telephony)</li> <li>Y-3net (TV)</li> </ul>

<sup>6</sup> Almere Fiber Company. The organisation is currently controlled by the municipality, but it intends to eventually bring in other partners.

<sup>7</sup> First Mile Ventures BV manages all the active network elements and is a subsidiary of Broadband Innovative Solutions NV, the holding which also controls UNET BV.

<sup>8</sup> Xtra Media Services (XMS) is a subsidiary of GNEM and provides services on the GNEM fibre-optic networks.

<sup>9</sup> Alice is a new services package from BBned. Pismo is discontinued as a result.

<sup>10</sup> Lijbrandt is the only service provider on its network in Lisse. Lijbrandt buys in the services from third parties.

<sup>11</sup> The passive layer was developed by the Ontwikkelingsbedrijf Gemeente Rotterdam (OBR). Reggefiber has said though that one of its affiliates operates the passive infrastructure.

## Appendix 3

The table below provides an overview of all the current FtH networks under construction. Private initiatives with a few dozen connections have been left out.<sup>12</sup>

Table 3: Overview of all the current FtH networks including those under construction.

Project	City / region	Homes passed (January 2008)	Homes connected (January 2008)	Homes activated (January 2008)	Homes passed (plan)
AlmeerNet	Almere				
Almere Fiber Pilot	Almere				
NEM Amersfoort Nieuwland	Amersfoort				
GNEM Vathorst	Amersfoort				
Amsterdam CityNet	Amsterdam				
Silodam	Amsterdam				
GNEM / Patio	Bussum / Hilversum / Naarden				
GNEM / Portaal	Arnhem / Leiden / Nijmegen / Soest /Utrecht				
Hillegom	Hillegom				
KPN Glasnet	Enschede				
LomboX	Utrecht				
Naaldwijk-Woerdblok	Naaldwijk				
OnsBrabantNet	Best / Geldrop-Mierlo / Helmond / Valkenswaard				
OnsNet Eindhoven	Eindhoven				
OnsNet Nuenen	Nuenen				
Rotterdam Lloydkwartier	Rotterdam				
Rotterdam Nesselande	Rotterdam				
NEM / TwenNet	Rijssen-Holten				
NEM / Y-3net / Rentré Wonen	Deventer				
Other Reggefiber projects	Various cities				
Other KPN projects and others	Various cities				
	<b>Total FtH</b>	<b>144.015</b>	<b>130.539</b>	<b>29.893</b>	<b>621.424</b>

Confidential

[Confidential commercial information removed]

<sup>12</sup> Information in the table reported in the confidential report is based on interviews with various players in the fibre-optic market.

## Appendix 4

The table below gives an overview of Fibre-to-the Building (FttB<sup>13</sup>) networks of which Telecompaper has knowledge.

Table 4: Overview of Fibre-to-the-Building (FttB) initiatives.

Corporation / renter	Operator	City / Region	Homes passed/connected (January 2008)	Homes activated (January 2008)
BPF Bouwinvest (Het kwartier)	Telecompleet	Amsterdam		
DUWO	Unknown	Amstelveen		
DUWO	Lijbrandt	Amsterdam		
DUWO	Lijbrandt	Den Haag		
DUWO	Lijbrandt	Oegstgeest		
DUWO/TU	TU Delft	Delft		
De Key	PinkRoccade	Amsterdam		
Nijenrode	Unknown	Breukelen		
Vestide	NEM Eindhoven	Eindhoven		
Universiteit Twente	UT / ITBE	Enschede		
IN-Groningen	RuG RC	Groningen		
SLS	Lijbrandt	Leiden		
SSHN	UCI-KUN	Nijmegen		
Stadswonen	BBned	Rotterdam		
WonenBreborg	Unknown	Tilburg		
SSHU	CapGemini	Utrecht		
SSHW	WU FB / ICT	Wageningen		
<b>Total FttB</b>			<b>40.602</b>	<b>40.590</b>

Confidential

[Confidential corporate information removed]

<sup>13</sup> Apartment complexes (in particular student and youth housing) owned by the housing corporations mentioned are fitted with Fibre-to-the-Building (FttB). Fibre-to-the-Building is a variant of FtH, where the complex as a whole has a fibre-optic connection, but the individual residences are fitted with a different technology (usually cat. 5 Ethernet connection). No research was conducted on the possible future developments in the number of FttB connections.

## Appendix 5

The table below gives an overview of the project plans for large-scale FtH networks.

Table 5: Status of FtH projects.

Project	Owner/operator	City / region	Target	Delivery (year)	Status
Almere	Reggefiber/KPN	Almere	70,000	2011	KPN and Reggefiber are cooperating on the new fibre-optic network in Almere, which will cover all new and existing neighbourhoods in the city. In total almost 70,000 households will have access to the FtH network. Roll-out will take 2.5 years.
Arnhem	GNEM	Arnhem	66,000	Unknown	The mayor of Arnhem and GNEM signed an agreement on 4 July 2007 to bring fibre to all the homes in Arnhem. This means 66,400 residences, of which one-third are privately owned and two-thirds are rental properties. In March 2008 the project in De Laar was dropped due to insufficient interest.
Glas Helder!	Unknown	The Hague	240,000	2010	In 2004, the city of The Hague announced plans to connect all homes and businesses to a fibre-optic network by 2010. Under the name Glas Helder!, considerable progress has been made on connecting businesses and institutions, but little work has been done to connect households.
GNA	GNA	Amsterdam	[Confidential commercial information removed]	2013	[Confidential commercial information removed]
KPN Glasnet	KPN	Enschede	25,000	2008	In April 2006 KPN acquired CasaNet and announced its intention to provide optical fibre across Enschede. Roll-out in Enschede-South is essentially complete, and the timing of the further roll-out will depend on the experience with this first phase. KPN expects to take a decision later in 2008 or in 2009. .
Lijbrandt Telecom	Lijbrandt Telecom	Lisse	Unknown	Unknown	Due to insufficient local interest, plans for a fibre-optic network in Lisse were shelved in January 2008 by Lijbrandt Telecom. From the start, the project developers said they needed at least 40 percent of households to sign up for services, but the minimum was not reached.
OnsNet	NEM Brabant	region Eindhoven	200,000	2010	NEM Brabant, a Reggefiber initiative, intends to connect 200,000 homes over fibre in the Eindhoven area. Concrete plans are in place for a number of municipalities already (Best, Geldrop-Mierlo, Helmond and Valkenswaard).
Rotterdam	Rotterdam	Rotterdam	300,000	2014	A few years ago Rotterdam announced plans (after clearance from the Andriessen Commission) to cover the entire city with fibre. Apart from fibre-optic networks in the newly built neighbourhoods of Lloydkwartier and Nesseland, little has been done so far on the project. In the two neighbourhoods, take-up has shown little growth.
Y-3net	Y3-net	Deventer	40,000	2009	The original plan was to connect 40,000 residences in Deventer with fibre from Y-3net. This has now been scaled back to a preliminary estimate of 11,500 homes. Work started in early 2007 in the south-eastern part of Deventer.