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FTTH in The Netherlands 2010 Q1

by Stratix Consulting

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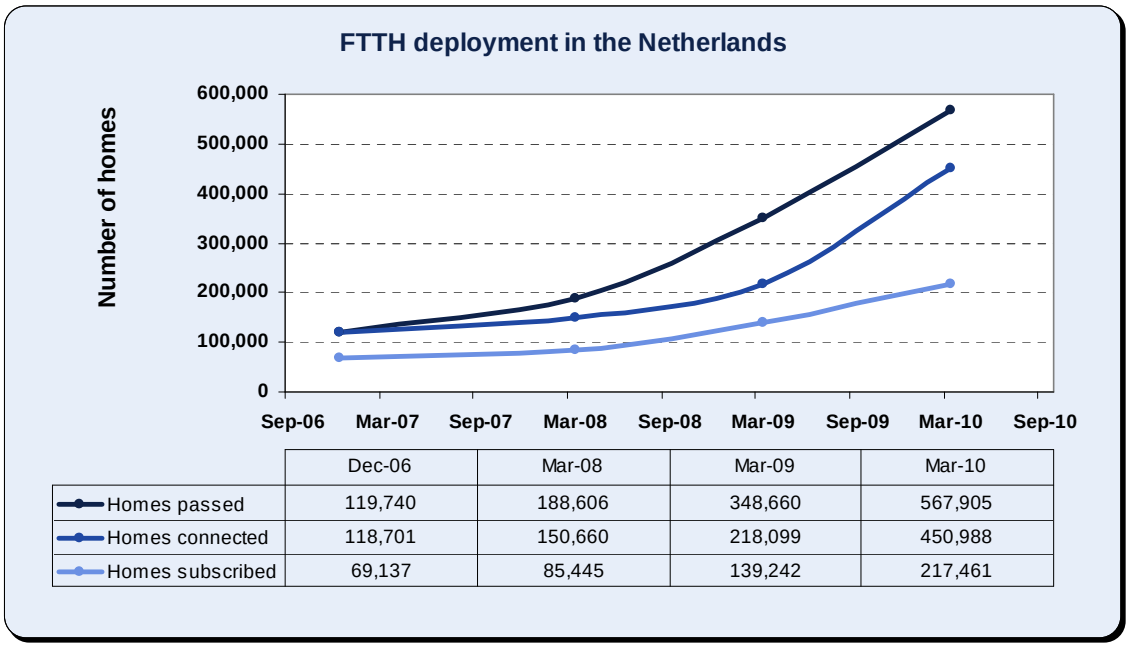
1 The Netherlands: FTTH deployment overview 1Q2010

The Netherlands is currently one of the few countries in Europe where genuine Fibre-to-the-Home is installed on a serious scale, alongside Fibre-to-the-Building and Fibre-to-the-Curb. In comparison with our March 2009 overview, the number of homes (households) passed has grown from 349 thousand in the first quarter of 2009 to 568 thousand in the first quarter of 2010, an increase of 63%.

Of those 568 thousand homes passed, about 79% or 451 thousand homes are actually homes connected (fibre brought into the meter cupboard[1], ready-for-service), a growth of 107% compared to 218 thousand homes connected in March 2009.

The largest FTTH-provider Reggefiber, with incumbent KPN as a minority shareholder, releases public statistics on homes passed and connected since 2009. Most other FTTH-providers are still quite secretive on the actual number of subscribers. Nonetheless, Stratix Consulting has been able to uncover actual service subscriber numbers for many projects using local press and other public sources. Our subscriber data is specific to municipal level and in several cases detailed to the district and/or neighbourhood level. From this data we can state with confidence that the number of active subscribers has grown from at least 139 thousand in the first quarter of 2009, to 217 thousand in the first quarter of 2010, an annual increase of 56%.



	Dec-06	Mar-08	Mar-09	Mar-10
Homes passed	119,740	188,606	348,660	567,905
Homes connected	118,701	150,660	218,099	450,988
Homes subscribed	69,137	85,445	139,242	217,461

Figure 1: Connecting homes picked up with roll out but subscriber growth trails

In this detailed report we present our general analysis of the FTTH market as well as the data on the various projects in the Netherlands.

[1] In the Netherlands, meter cupboards are located inside the home.

1.1 Sources and methodology

Stratix Consulting bv has compiled this overview generally from public sources:

- Announcements and press releases by organisations that develop Fibre-to-the-Home projects
- FTTH project / service registration websites
- (Local) press coverage
- Municipal lists on home densities / neighbourhoods
- Activated and routed IP address blocks (when directly linked to FTTH)

We list comparisons with earlier reports that provided data for December 2006, March 2008 and March 2009. Because certain networks came to our knowledge after publication of these older reports, we have made minor revisions to the 1Q2009 figures in this report.

To give a more in-depth overview of the current status of FTTH deployment in the Netherlands, we expanded our database, with information about postal codes served, network architecture and topology, and network ownership models. Furthermore we adjusted the structure in our database to better fit a 3-layer network model for FTTH networks. As a result we now make a distinction between the network owner (passive fibres and ducts) and the network operator (active equipment) in our data on FTTH networks.

We have continued collecting detailed information on household numbers at neighbourhood levels, along with data on fibre deployment in those neighbourhoods. In addition, our database contains various search options and the ability to generate visual maps of fibred areas in Google Maps.

As of 2009 our terminology on FTTH/B is in line with the terms defined by the FTTH Council Europe[2]. Thereby indicating new market realities, where in several cases fibre has been pre-installed up to the doorstep, but not yet brought into a home's meter cupboard.

We use the term 'homes passed' to indicate the potential number of premises to which an operator has capability to connect in a service area (but the premises may or may not be connected to the network). The term 'homes connected' indicates the number of premises which are connected to an FTTH/B-network. And, finally, the term 'homes subscribed' indicates the number of premises that are both connected to a FTTH/B-network and have at least one service in use on this connection under a commercial contract.

The multiyear projection for 2010-2012 is based on current market parties' announcements on roll out schedules in various areas and communities. It is not a prognosis model and thus does not account for FTTH-project delays, additional housing developments in fibred areas nor for any assessment of the feasibility of additional projects.

This report focuses solely on residential area projects and does not list fibre City-rings and optical local loops extending into business parks.

[2] http://www.ftthcouncil.eu/documents/studies/FTTH-Definitions-Revision_January_2009.pdf

1.2 Disclaimer

This report represents our current knowledge on the state of FTTH in the Netherlands. However, we might have overlooked some projects that should have been included in the multiyear projection. If you want to inform us about such projects, please mail to ftth@stratix.nl.

Due to our various business relations with market parties we are frequently aware of company data on a confidential basis. We do not publish such data here; only those data are presented that we could attain via public sources, except for some occasions where market parties have informed us about their progress and have given permission for inclusion.

2 FTTH in The Netherlands: Facts and figures

Stratix Consulting has compiled for the 4th consecutive year an overview of FTTH in the Netherlands. This year we have expanded our database with additional information on type of FTTH architecture, network technology and network ownership models. With this information an interesting characterisation of the Dutch FTTH market can be brought forward.

The dominant technology for fibre networks in the Netherlands is optical active ethernet[3], a point-to-point technology which accounts for 89% of all homes passed. This type of technology is popular in Europe, while the rest of the world seems to have a strong preference for various flavours of passive optical networking (PON); a point-to-multipoint technology.

In the first quarter of 2010, the most occurring network ownership model in the Netherlands is the so called Carrier Owned model (70% of homes passed), although ownership models where real estate parties are involved seem to be growing in popularity (20% of homes passed). Unlike many other countries rolling out fibre networks, the Dutch central and local governments are rarely involved (financially) in fibre deployment, which makes fibre deployment in The Netherlands dependent on private investment.

Another interesting finding that we could derive from our data, is that the majority of homes passed in the Netherlands is genuine FTTHome (89%), rather than FTTBuilding. FTTB is in most countries a popular, cheap alternative in which appartment buildings are (inter)connected with aerial cables or access to public ducts is used. However, this is not the case for the The Netherlands, where 80% of homes consist of single dwelling units and aerial cabling is in practice not allowed by local permitting regulations. Also, the weak composition of Dutch soil has blocked the construction of large utility ducts in the metropolitan areas. Such large utility ducts would gradually float up towards street level as many of the most populous parts of the country are located below sea level.
The combination of the geographical features and type of housing characteristics has resulted in a sparse deployment of FTTB, which is primarily rolled out in the Netherlands to student dormitories and thereby spread around university towns.

2.1 FTTH roll out concentrated in a few provinces

The FTTH-projects in the Netherlands installed and under construction in 2009 and early 2010 are unevenly dispersed over the various provinces.
The only province without FTTH is Zeeland. In this province the regional cable operator / multi-utility company Delta captured nearly the entire residential market in 2002/2003, with an aggressive broadband-via-cable-modem offering. Since then, hardly any ADSL user has been recorded in residential homes according to polls. The other provinces that previously lacked FTTH projects have gained some (Friesland, Drenthe) but the main activity has remained confined to five provinces: Noord-Brabant, Flevoland, Overijssel, and Noord-Holland. Table 1 shows the distribution per province.

[3] Active optical networks rely on optical Ethernet switches, powered equipment to distribute the signal. Each signal connects to a single customer premises. Often referred to as Point-to-Point (P2P)

Table 1: Overview homes passed per province shows concentration in a few provinces

Province	Homes/households province	Homes passed 1Q2010	Homes passed 1Q2009	Homes passed 1Q2008	Homes passed 4Q2006
Drenthe	208,040	925	0	0	0
Flevoland	154,670	78,462	48,627	13,220	3,700
Friesland	279,280	60	0	0	0
Gelderland	847,230	46,797	24,692	21,181	14,912
Groningen	274,180	1,013	1,013	1,013	1,013
Limburg	501,200	200	200	200	0
Noord Brabant	1,047,650	156,898	72,897	24,615	17,032
Noord Holland	1,245,160	77,051	66,185	50,789	23,397
Overijssel	472,990	94,001	56,081	15,181	11,900
Utrecht	537,400	58,702	41,274	27,594	16,424
Zeeland	165,569	0	0	0	0
Zuid Holland	1,578,520	53,796	37,691	34,813	31,362
Total Netherlands	**7,311,889**	**567,905**	**348,660**	**188,606**	**119,740**

FTTH roll out has surpassed the threshold of more than 50% of homes in the province of Flevoland, the province consisting of areas reclaimed from the sea since the second World War with many new urban developments. . The second province in homes passed penetration level is Overijssel, Reggefiber's home base. The highest percentage of actual FTTH subscribers can be found in Noord-Brabant at near 8% of all homes. Similar to previous years, the Northern provinces, Zeeland (South-West) and Limburg (South) are not experiencing substantive activity with FTTH roll out in residential areas, however, in Friesland (Leeuwarden) and Drenthe (Meppel) the first projects have been initiated in 2009. Zuid-Holland, the most populated province in the Netherlands with more than 3 million inhabitants and 1.578 mln homes, is trailing in absolute and relative numbers. A complete overview is shown in Figure 2.

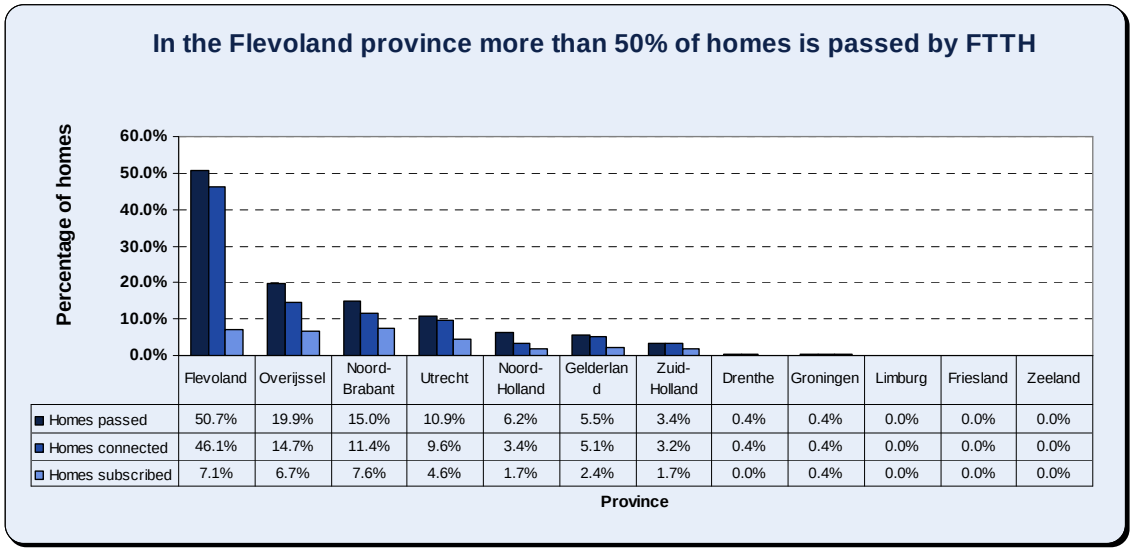


Figure 2: Overview of FTTH coverage per province

2.2 Penetration per municipality strongly diverges

For a geographic overview of all municipalities that engage in FTTH in the Netherlands, we refer to Figure 3.

Figure 3: Dutch municipalities with FTTH projects in place or under construction

In the period between 1Q 2009 and 1Q 2010, 18 new fibre projects were initiated in municipalities that were not listed in last year's overview. Gelderland is the province where the majority of new projects were launched (6 new projects), followed by Noord-Brabant (5 new projects). Interesting to note is that most of these new projects were initiated in mid-sized provincial towns that count between 10- and 15-thousand households.

Annex B of this report provides a detailed overview of the data we found per municipality on homes passed, connected and subscribed to FTTH or FTTB per Q1 2010. This data is quite revealing on the state of roll out per municipality as well as the very different penetration levels.

For instance, our data on the town of Almere shows that although the construction of the fibre plant is near completion, actual activation by KPN was relatively low. The main causes for this were the problems KPN had in getting their delivery processes functioning well and technical issues with analogue video over fibre, a service they then decided to discontinue.

Table 2 contains a top ten of municipalities based on FTTH/B subscriber penetration. When assessing this top ten, it becomes clear that up to 2010 the largest successes have appeared in mid-sized provincial towns with closely-knit communities. Such towns have proven to be

highly suitable for demand aggregation projects, which is crucial in reaching the amount of pre-registration that Reggefiber requires before commencing fibre deployment.

Table 2: Top ten municipalities based on FTTH/B subscriber penetration

	Province	Municipality	Households	Homes passed	Homes connected	Homes subscribed
1.	Noord-Brabant	Nuenen, Gerwen en Nederwetten	9,170	100%	94%	84%
2.	Noord-Brabant	Best	11,590	95%	65%	65%
3.	Zuid-Holland	Hillegom	8,730	85%	85%	64%
4.	Noord-Brabant	Geldrop-Mierlo	16,360	100%	61%	61%
5.	Noord-Brabant	Laarbeek	8,560	100%	60%	60%
6.	Noord-Brabant	Valkenswaard	13,670	98%	58%	58%
7.	Noord-Brabant	Veldhoven	18,020	97%	51%	51%
8.	Overijssel	Rijssen-Holten	13,170	91%	45%	45%
9.	Noord-Brabant	Schijndel	9,100	100%	96%	30%
10.	Noord-Brabant	Son en Breugel	6,280	97%	87%	29%

Another interesting observation is that large cities in The Netherlands are clearly underperforming at the deployment of FTTH. Although the geographical lay-out of large cities, characterised by a high density of homes, should be beneficial in rolling out FTTH, projects initiated in these cities are prone to delays and low subscriber numbers. An explanation can be found in the fact that it has proven quite challenging to connect homes in multi-level buildings, which constitute the majority of homes in large cities. When connecting a home located in a multi-level building, access to a downstairs neighbour's residence is often required. In practise people are often not home and have proven hesitant to rearrange their schedules to accommodate their upstairs neighbour, due to a lack of social cohesion. In general social cohesion eases demand aggregation commercial strategies for market entrants. An overview of the penetration rates for several large cities in Netherlands is shown in Table 3.

Table 3: FTTH/B penetration rates in large cities

Province	Municipality	Households	Homes passed	Homes connected	Homes subscribed
Noord-Holland	Amsterdam	416,430	11%	4%	2%
Zuid-Holland	Rotterdam	296,420	4%	4%	2%
Zuid-Holland	's-Gravenhage	240,300	0%	0%	0%
Utrecht	Utrecht	157,300	13%	13%	7%
Groningen	Groningen	107,880	1%	1%	1%
Noord-Brabant	Eindhoven	106,230	25%	23%	14%

2.3 Low subscriber conversion in KPN fibre areas

KPN recently published their half-year results, which revealed some in-depth information on their performance in the FTTH market. For Q2 2010 KPN reported 288 thousand homes passed with fibre, via Reggefiber, of which 26 thousand had been activated (subscribed)[4],

[4]KPN Half year results 2010, http://www.kpn.com/corporate/aboutkpn/investor-relations/Half-year-results-2010.htm

whereas for Q1 2010 KPN had reported 210 thousand homes passed and 21 thousand homes subscribed. These figures suggest that KPN's current conversion rate for its FTTH activities is a disappointing 10%.

Additional analysis based on Stratix figures shows that the overall conversion rate for FTTH areas where KPN is the active operator (i.e. 'KPN homes passed') is actually 20%. This number also includes FTTH subscribers from ISPs other than KPN. KPN reported in december 2009 some difficulties with ramping up their *provisioning streets*.
These rates are in sharp contrast to the performance in non-KPN areas on Reggefiber's FTTH passive outside plant, where the overall conversion rate is 43%. This is schematically shown in 4.

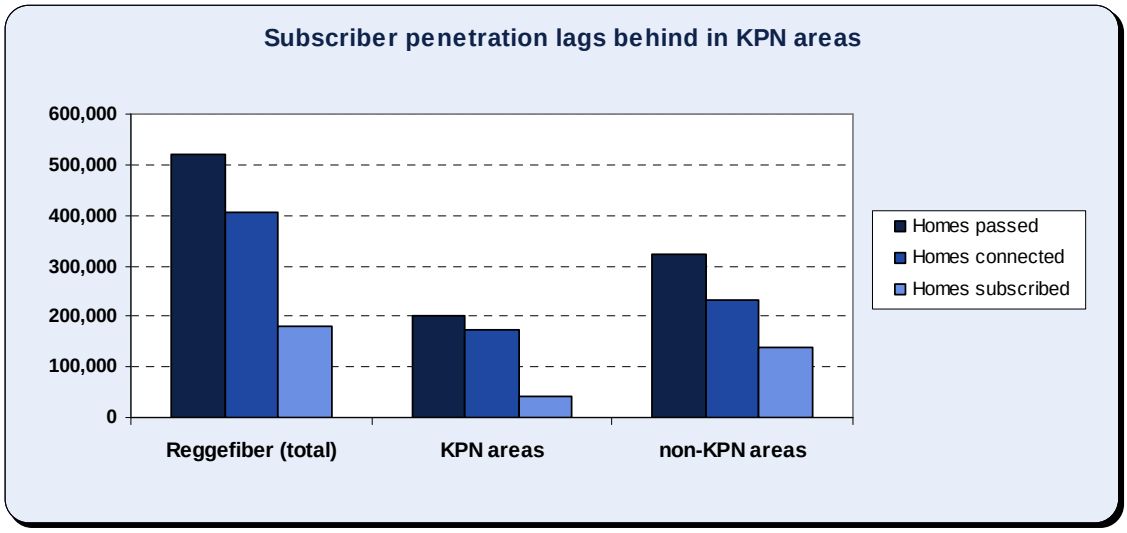


Figure 4: Reggefiber FTTH penetration[5] broken down in KPN and non-KPN areas

2.4 Key events for the FTTH market in The Netherlands

FTTH roll out in the Netherlands entered a new stage in January 2009, with the approval of the acquisition of a 41% stake by KPN in fibre local loop constructor Reggefiber by the Dutch Competition Authority ('Nederlandse Mededingingsautoriteit'). As a result of the capital injected in Reggefiber, due to this minority stake acquisition, the firm had scaled up its roll out efforts in 2009. The raised efforts of the new combination also drove the construction industry into large-scale redesigns of their business processes into a more standardised approach.

The capital boost has resulted in a countercyclical acceleration of construction efforts, precisely during the quarters in which the Dutch economy shrank due to the global credit crisis. As a result of this crisis, attempts by Reggefiber to attract loans to leverage the owner's equity did not succeed in 2009. According to KPN, Reggefiber was financed with 76% owner's equity and a mere 24% in loans.

[5]Including numbers for GNA Amsterdam, in which Reggefiber aqcuired a majority stake in Nov. 2009

The first major event was the acquisition in February 2009 by Reggefiber of 70% of Glasvezelnet Amsterdam (GNA). Reggefiber expanded its original stake of 33.3% in exchange for a commitment to construct an additional 100 thousand fibre optic loops in addition to the already constructed 43 thousand (homes passed). These additional loops, however, will be homes connected. Also KPN will enter the Amsterdam market as an active operator (alongside the current operator BBned).

The second major event in 2009 was the decision by the Dutch government to use the Crisis and Recovery Act ('Çrisis- en herstelwet') to revoke restrictions on municipal authorities, enacted in 2006, to act as a co-investor in new local loop developments. This act passed the Dutch Senate in March 2010.

On demand of the Dutch House of Representatives, the Dutch government installed a Taskforce Ultrafast Broadband[6] to advice the Dutch government on how further roll out of next generation networks could be stimulated by municipalities and provinces. Activities included assessing the risks and opportunities, developing a menu guide for local authorities, and investigating the ways and means to stimulate ultrafast broadband services. When the Taskforce delivered its report in March 2010, a week after the municipal elections, it was received by a caretaker government and shelved. No major policy actions are foreseen during 2010, as negotiations for a new government after the 2010 national elections are still ongoing.

One of the reasons to establish a Taskforce was the decision of many municipalities and provinces to sell their stakes in Power Utilities, for which they received a combined sum of €17 billion, a sum far exceeding any financial requirement to roll out FTTH in the Netherlands (which can be estimated at ca. €7 billion for local loop construction).

As a result, municipal and provincial authorities are now exploring new financing schemes. In this, they needed guidance on the legality and the desirability of different possible roles for local government.

2.5 Rollout projections 2010-2012: Construction industry at full capacity

In our December 2006 report on FTTH we presented rollout projections, based on what has turned out to be overoptimistically paced investment plans for several projects. Operational realities during 2007 have delayed the Amsterdam GNA project's completion date with 6 months. In 2008 the pace of roll out gradually picked up again and in 2009, a higher pace was achieved.

Nevertheless, the current pace and project schedules suggest that the classic initial stage 'hockey-stick' curve of accelerating growth in FTTH deployment is shifting towards the inflection of a linear growth stage. Figure 5 provides the revised projections of FTTH homes passed until year-end 2012. These numbers are solely based on current market parties' announcements on roll out schedules.

[6]Originally called Taskforce Next Generation Networks.

Firms in the construction industry estimate that full production capacity for constructing FTTH is currently around 300 thousand lines per year. This means that with 220 thousand new fibre optic local loops produced in the past year, the Dutch fixed network construction industry is running close to full production capacity. A neat feat to accomplish for an industry sector in an economy which is experiencing the most severe recession since the 1930s. Moreover, this pace also signals a threshold the industry now has to take on.

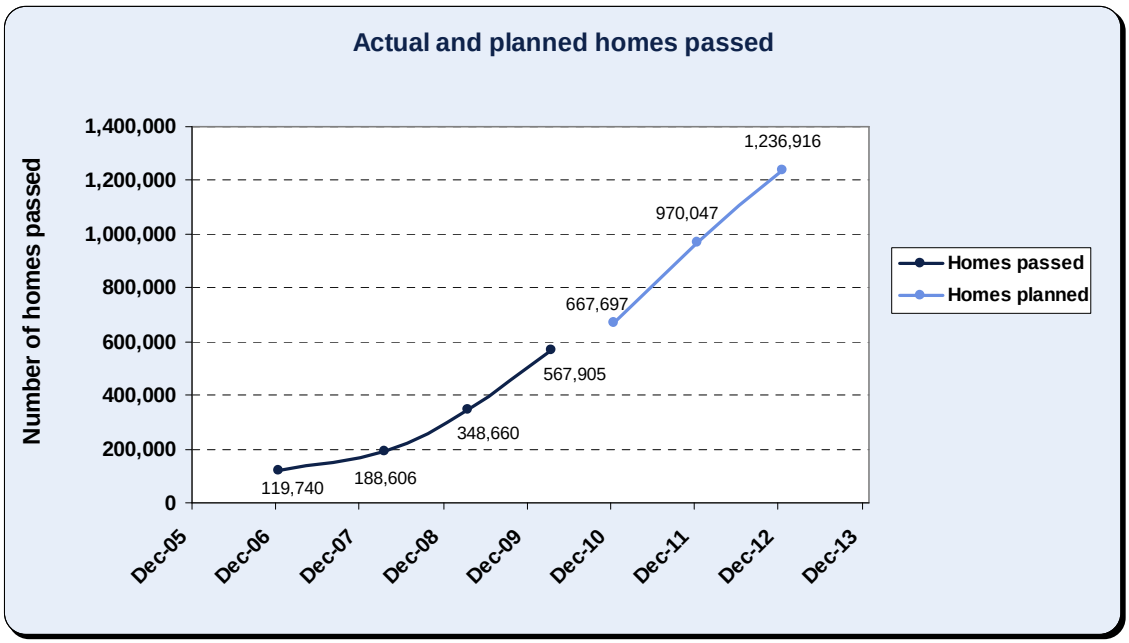


Figure 5: Current project plans shows a growth path to 1.2 million homes in December 2012

At a pace of 300 thousand lines per year, FTTH roll out toward 90% of Dutch homes (7.3 million in total) will require over 20 years. Expanding combined construction capacity towards 600 thousand new loops per year would require hiring more staff at construction firms and engaging in training programs etc. Although digging trenches is a rather low-skilled job, it seems that many firms are hesitant to take on the risk of additional hires. Instead, much of the construction work today is already subcontracted by the leading firms to smaller firms and jobbers, often independent construction workers that are hired via temporary work agencies.

The rise and spread of such independent single-person contractor firms in the construction industry at large is now identified as a prime source of the unexpectedly low level of unemployment increase after the 2008 credit crash. According to the Eurostat method of unemployment accounting, unemployment in the Netherlands has risen from 2.8% in autumn 2008 to a mere 4% today, despite a collapse in building new houses.

> *Stratix Consulting assesses from talks with construction industry firms that ramping up FTTH production capacity to 600 thousand per year will add approximately 2000 direct jobs in constructing. Moreover, additional jobs in provisioning, active equipment construction etc. are expected to match that figure.*

3 Overview of Dutch market developments

3.1 'Ultrafast broadband' may be politically correct, but the market sells 'fibre'

In 2009 cable operator UPC decided to market its new DOCSIS 3.0 service under the brand name 'Fiber Power', and Competitive Local Exchange Carrier Tele2 decided to sell its VDSL2 service under the moniker 'FiberSpeed'. Also NLkabel, the Dutch association of coax-cable-based CATV firms touts that 96% of their networks already consists of optical fibre.

To fend off the commercial threat of new entrants in the fixed networks market deploying FTTH, market parties based on coaxial or twisted pair copper networks have opted for an 'Intel Inside' branding of their fibre backhauls to diminish the novelty product advantage that FTTH seemed to have created for itself.

Politically correct lobbyists and politicians on the other hand are still maintaining that it is all about 'new services'. This strongly resembles the initial stage of always-on high speed Internet access roll out at the turn of the century, when the policy discussion was about 'broadband services' which were thought to be about more than high speed Internet access. Some marketers, most prominently KPN, decided not to sell ADSL, but a service, and came up with a fancy marketing name (in their case 'MxStream'). Instead, the public simply asked for the product name ADSL, and the branding policy was abandoned in 2003.

It is obvious that new entrants, often without any local brand recognition, differentiate from cable and DSL by selling what makes their product new instead of the 'services'. Such acts define the market and marketing space. This competitive marketing reality is in contrast with the Politically Correct market definitions in which services play a central role. Exemplary for this was a speech by the chairman of Dutch regulator OPTA in December 2009 in which he argued against what he observed as a desire of politicians to distort the market for broadband services by mainly discussing investments in fibre networks, when he did not see a demand for services requiring 'ultrafast broadband'. If `ultrafast broadband' was what is sold in today's market we wouldn't see counter-marketing positioning to FTTH with FiberPower for coax and FiberSpeed for a VDSL2 service.

Moreover, a policy debate on the desirability of fibre deployment focussed solely on services requiring 'ultrafast broadband' is incomplete, as it ignores new applications that cannot be implemented without optical fibre and are outside the broadband (Ethernet) domain. Examples of such applications are commercial Quantum Cryptographic Key Distribution[7] or using fibre loops to relay all (DVB-S) channels from entire satellite orbital positions at very low incremental investment[8].

> *Thinking about fibre deployment as only an upgrade toward 'ultrafast broadband' misses the point. FTTH roll out is a replacement of the outside plant with fibre, a new transmission medium that enables not only extremely high*

[7]Introduced in August 2009 by Siemens, http://www.siemens.nl/persinfo/pressinfo.asp?id=1644
[8]Introduced in 2009 by Global Invacom, http://www.globalinvacom.com/products/fibre.php

bandwidth communications, but also provides for high reliability links with very low operating costs as well as new applications outside the high bandwidth domain, that are not easily served by copper networks or require additional digging of coaxial cables.

Most large cable operators have launched DOCSIS 3.0 services as a response to FTTH. They have upgraded their current DOCSIS 2.0 networks at a cost of ca. € 100 mln engaging in an operational gamble that traffic growth will keep pace with their electronics upgrade cycle (the so-called evolutionary model), and the cost of cable modem termination systems will not explode. At the same time 'marketing' with 'Fiber' in the services name suffices to keep FTTH-competition at bay.

Most smaller cable operators are on the other hand deploying FTTH to new areas or run pilots. A special case is a group lead by CAI Westland, the 4th CATV operator in the Netherlands, that is engaged in a full scale replacement of the existing coaxial plant with FTTH.

3.2 Policy and regulation: OPTA takes the driver's seat

After the major decisions made in the last months of 2008 on KPN's investment in Reggefiber, the Dutch Competition authority NMa and OPTA followed up with an extension of the regulatory decisions to regulate Reggefiber, to all its subsidiaries. The initial decision had overlooked the fact that Reggefiber created local operating companies with local co-investors in many municipalities. As a result initial regulation did not extend to them.
However, the more relevant decisions in 2009 / early 2010 were on tariffs, not only those of optical fibre loops, but in particular the copper ULL tariff and the tariff for opening the coaxial cable.

Table 4: Regulated local loop access tariffs differ for near equal construction costs per home

Access network		Wholesale access tariff per month	Avg construction cost per home connected
ULL - MDF access	(KPN)	€ 5.99	€ 1000
Coax - CATV resale	(Ziggo)	€ 8.45	€ 800
Coax - CATV resale	(UPC)	€ 8.83	€ 800
OLL – ODF access: actual	(Reggefiber)	€ 12.00 - € 15.00	€ 775 - € 1025
OLL – ODF access: ceiling	(OPTA tariff)	€ 14.50 - € 17.50	€ 775 - € 1025

The low wholesale prices for copper loops (ULL) and coax resale are peculiar from a Forward Looking - Long Run Incremental Cost perspective (FL-LRIC). Today the construction cost of a new outside plant for either a copper, coax or fibre optic network in an existing residential area are roughly equal per home passed / connected, as trenching for buried cabling by far dominates construction costs alongside mounting riser cables into the homes.

Therefore, far lower rates can only be explained by a line of reasoning that (silently) assumes that the old copper and coax networks will not be replaced. This however does not account for the cost of removal of cables that are left after customers are migrated to a new parallel (fibre) network.

Incumbent copper and coax network owners constructed most of their current access networks in the 1960s – 1980s. Therefore the book values of their depreciated networks are far below current replacement costs, in which present-day labour cost must be accounted for.

A regulator might think that by setting rates low, they are avoiding windfall profits to the incumbents. However, if that were to be the main objective, OPTA could have considered forcing incumbents to create a provisional fund for the removal of the old cables in order to skim off the windfall profits. It is very questionable whether current wholesale access prices reflect the costs for the complete lifecycle of the access networks, including removal. Even more so when considering that the regulated ULL-rates went down from € 13 in 2002 to € 6 today, while the original policy of OPTA in the 1999-2000 timeframe on ULL was that those rates would be adjusted upwards.

OPTA's tariff policy was one of the reasons that in 2009 two major CLECs, Online, a Deutsche Telekom subsidiary, and Tele2 terminated their initial negotiations with Reggefiber to launch an FTTH-trial and decided to opt for VDSL2 from the Central Office instead.

OPTA, by setting very different wholesale tariffs between old and new access networks, influences the market offerings. By effectively underpricing competing copper and coaxial plants, when assessed on a FL-LRIC model, a substantive investment hurdle is created for FTTH deployment. This difference in wholesale access rates is an important factor in the viability of FTTH deployment. It creates an artificial funding gap between the fibre loop and the copper loop of ca. € 8 pro month that has to be overcome by the retail service providers.

Whether it is wise for local government to get involved in covering the current funding gap, by channelling public investment money into new FTTH networks, or whether OPTA should do a serious revisit on their entire set of regulations for various access tariffs is an interesting point of debate.

> *Stratix Consulting thinks it is advisable to engage in a serious economic policy debate on the wisdom of allowing incumbents to price below replacement costs, and to contemplate whether they have to reserve money for removing old cables in order to drain windfall profits. As opposed to creating a political-economical environment that forces FTTH constructors to chase public co-investment, primarily because the regulator's tariff policies have induced low wholesale and consumer prices, as well as a price-squeeze for local loop rental rates for new entrants.*

3.3 Actual retail prices rise, premium market in EU perspective

In OPTA's regulation of Reggefiber's ODF Access they included a provision that allowed for a CPI-indexation of the wholesale rental of an optical local loop pair. CATV subscriptions have also been rising during the last decade. One of the observations in 2010 was the upwards adjustment of retail service prices with various FTTH providers.

The fact that wholesale rentals are CPI-indexed allows passive local loop networks to qualify as Real Estate. This is also reasonable considering the fact that new construction is dominated by labour costs and thus replacement costs tend to experience upward price pressure.

However, analysts and companies have been astonished in comparing the Dutch FTTH market prices for a full bundle (typical €50 - €60 per month) to, among others, the French and German broadband bundle prices (€30 per month). The Netherlands has become a rather peculiar broadband market with four main features:

- highest broadband access penetration per capita in Europe and OECD;
- high average bandwidth per broadband access line;
- high average retail price, majority of residences already use VoIP+broadband;
- high economics of density, reducing average construction cost.

The above features are strongly beneficial for the business case of FTTH market entrants. However, these benefits are offset by the desire by local regulators for buried utility cabling (no aerials) and by a high percentage of single family homes (ca. 80%). This causes a considerable higher CAPEX per home, and keeps Fibre-to-the-Building confined to a limited market.

The fact that not only prices are relatively high, but retail prices were also adjusted upwards in the first quarter of 2010 is a distinguishing feature for the Dutch market. We observe an upward pricing trend, a bit like the Compact Disc sales in the 1980s and 1990s, where the Netherlands was both experiencing a high price market as well as the average Dutch households owning the most CD's in Europe. In February 2010 Reggefiber/XMS launched 1 Gbit/s connections, with a first contract for 200 Mbit/s symmetric triple play bundle at € 130 per month. This might be seen as an act to outpace cable competitor UPC who launched FiberPower 120 (120 down and 10 Mbit/s up) a DOCSIS 3.0 based triple play bundle at € 97.80. It is however, also a demonstration that in the Netherlands the high retail revenues are linked to high capacity Internet Access, and far less to TV or Voice offerings.

3.4 Despite FTTH delivery difficulties KPN scales back on FTTC rollout

December 15, 2009 KPN gave a press conference on their future broadband policies after having trialled with 5 FTTH projects (in co-operation with Reggefiber) and 5 FTTC projects. KPN claimed that at that time they had rolled out FTTC to areas with 450,000 lines, while FTTH network construction by Reggefiber surpassed original plans and already reached 462,000 homes.

KPN announced that they decided to focus in 2010 on improving their provisioning processes for FTTH and on so-called VDSL2 – Central Office (VDSL2-CO) and invest € 50 million. Meaning they effectively put a brake on their FTTC-projects in street cabinets and will instead install VDSL2 technology in central offices next to the existing Main Distribution Frames (MDF).

As a new strategy it was a serious change of direction compared to their 2006 All-IP strategy. The original plan was to install VDSL2 at a large scale in street cabinets and vacate near 1200 of their MDF-locations, and additionally convert their tandem exchange locations and large central office buildings into roughly 200 Metro Core Locations.

KPN has already sold off a number of MDF-locations to Real Estate firms, currently leasing them back. This has effectively shrunk their balance sheet, but they will remain a tenant in a number of those buildings for the time being.

Most of the press coverage of the KPN FTTH strategy conference, seems to have missed the point that KPN will put VDSL2 in street cabinets on hold from 2010 onwards.

> *With their decision to put FTTC on hold in 2010, KPN effectively confirmed that installing VDSL2 in street cabinets does not make economic sense in head-on competition with DOCSIS 3.0 as the investment cost to launch this intermediary service far surpasses that of the direct competition. A point already made last year in our FTTH report.*

3.5 CLECs decided to implement VDSL2 in Central Offices first

KPN's move seems to be influenced by the decision in September 2009 by Tele2 to launch FiberSpeed, their VDSL2–CO service, as well as a similar decision by BBned, who started implementing VDSL2 in central offices in 43 large MDF locations in 4Q2009. In 2010 Online, the third major DSL platform owner confided in a side note to a journalist that they had discontinued their efforts to do an FTTH trial in Almere and instead also opted for VDSL2-CO.

As a result the three largest DSL-platform operating CLECs have decided to postpone a rapid shift to FTTH, and alternatively implement VDSL2 from the Central Office as a low CAPEX intermediate route to counter the new DOCSIS 3.0 services launched by several cable operators.

On July 19th, 2010, it was announced that Tele2 had acquired BBned for € 50 mln. BBned is the third CLEC in number of connections, but with mostly specialist wholesale ISP and SME customers. With this strategic manoeuvre Tele2 also acquired BBned's FTTH active equipment operations in Amsterdam and Rotterdam.

Tele2 also acquired the technical back-end and back office services BBned's subsidiary InterNLnet provides to XMS, a large FTTH service provider owned by Reggefiber since March 2010. Until that date InterNLnet held a 49% stake in XMS.

As a result Tele2 already gains a relatively cheap entry into the market as an FTTH active equipment operator on passive FTTH loops owned by other firms.

> *It remains to be seen whether Tele2 will immediately trail KPN in rolling out as an active FTTH operator in the new batch of 100,000 lines that will be constructed in Amsterdam.*

3.6 A renewed expansion of the specialist providers to apartments

2009 showed an interesting renewed push forward in the market by specialist providers targeting apartment blocks, residences for the elderly and residential high risers as well as dormitories. Firms like OONO, Utelisys and Teleplaza expanded in this segment of the market. Historically a firm like Lijbrandt Telecom, acquired by Reggefiber, was also active in this segment, combining CATV, telephony and Internet access with building connected services like emergency alarm, intercom and camera supervision.

Also active in this segment is Hertzinger, a firm that was already renown for installing Communal Satellite Receivers in apartments. Hertzinger entered the FTTH market in 2004 as a supplier of analogue CATV-services and acted as the optical CATV operator on most of the early FTTH networks. After they sold their CATV over fibre operations to Reggefiber (now operating as Glashart Media), Hertzinger renewed its efforts in the apartment market.

Hertzinger is not only installing Satellite Distribution systems but also Common broadband Internet Access networks in their projects, which typically comprise a few hundred apartments. Hertzinger, however, often uses DSL or multiline DSL and not a Fibre optic connection to link those apartment buildings to the Internet. Therefore their installed customer base is not included in Stratix FTTH/B figures. It is to be expected that these apartment buildings will however collectively be connected via fibre optics, as soon as FTTH is rolled out in their areas, adding these homes to our database as separately listed FTTB homes passed.

In the early stages of the Dutch FTTH market the (social) housing corporations and student dormitory owners (which in the Netherlands are typically separate non-profit entities, not owned by universities and colleges) were the first to engage in large-scale contracts, deploying FTTB or even FTTH. In 2009, these corporations have expanded efforts in retrofitting their properties. In several new buildings Fibre loops are now installed into the apartments. Housing corporations often tender specialist service providers either to provide triple play or a combination of Common Internet Access with Common Satellite Receivers.

The falling costs of Satellite head-end equipment as well as equipment for converting DVB-S2 to DVB-T and DVB-S2 to IPTV, has created a niche market for installers and service providers. These niche players provide owners of apartment blocks with offerings that compete with CATV triple play, by combining (Common) Satellite-TV-receivers with a common fibre for (public) Internet.

The removal of visually disturbing dishes was an initial argument for the landlords of housing corporations to participate in the deployment of FTTH. However, many of their tenants' favourite satellite TV-stations lack distribution rights for the cable in Europe. For a block of apartments, only reception via a so-called Common Satellite Receiver is permitted under the Treaty of Rome and an allowance agreement slated with Dutch copyright collection organisation.

For existing FTTH projects by housing corporations, the inability to broadcast satellite TV stations has resulted in a reduced service uptake, as the CATV-component is not appealing in those markets. However, in 2009 various firms have launched Common-Satellite-TV-over-Fibre technology. This will allow owners of apartment buildings to provide their residents with a (Common) Satellite feed over fibre, instead of a separate satellite capable coax.

> *The very fact that it is now possible to distribute optical satellite signals to many apartments potentially introduces new legal issues on how far freedom-of-reception stretches. Also it will provide different options for landlords / housing corporations who desire to get rid of satellite dishes from tenants balconies. Stratix Consulting believes that smart solutions for distributing satellite TV stations over fibre can become a main driver in rolling out FTTH/FTTB in Dutch apartment buildings. In particular as the Dutch apartment market is dominated by low income households with a relatively large share of immigrants, who want to be able to view TV-channels that are not available on CATV-services.*

4 Emerging FTTH Business Models

4.1 Patient Capital investors converting small CATV nets to fibre

On April 1st, 2009, Rabo Bouwfonds Dutch Communications Infrastructure Fund (RBCIF) acquired the coaxial cable network of Krimpen a/d IJssel without monetary compensation. Krimpen is a Rotterdam suburb with near 29.000 inhabitants and 12.000 homes, where a local CATV foundation had not sold off the network as most others had.

The key characteristic in this acquisition was that the Krimpen cable foundation charged their subscribers a mere € 8.95 pro month (incl. VAT). Calculations made by Stratix for similar CATV networks show that such a monthly fee is insufficient at present day to pay for a replacement of the local outside plant, effectively meaning that CATV networks that charge those low monthly rates are gradually wearing out their existing network and underfunding the long run operations of their network.

One of the features of the Krimpen coax network was that it still lacked two-way capability. According to the press release issued by the selling party, the acquisition of this network was in exchange for a promise by the patient capital (pension fund) driven fund to construct FTTH to all homes in Krimpen in 2010. With this agreement Krimpen will leapfrog ahead of most towns in the Netherlands by early 2011. CIF Krimpen, the new entity, has announced plans to shut down the old coax network in 2012 (a so-called cut-over strategy) and instead install symmetric 1 Gbit/s connections and analog + digital TV over fibre to all homes.

At these monthly rates for basic TV services, the owners of those networks effectively need a substantive revenue stream from complementary triple play services to recoup a replacement. Therefore municipalities that continue to ask such low subscription rates as a 'service to their community' are on a path that is not sustainable in the long run.

These acquisitions by RBCIF show a significant point. While in 2005/2006 Warburg Pincus and Cinven acquired three cable systems, with a combined reach of 3.6 million homes, for a staggering combined sum of € 5.2 bln, or near € 1500 per subscriber, the current price for an existing cable system has fallen to € 0, as long as the purchaser is willing to foot the bill for replacing the outside plant.

In 2008 the outside plant of CAI Westland, another municipality owned network, was the first acquisition by RBCIF with pension fund 'Pensioenfonds Vervoer' as their key funder. The new owners then engaged in a voluntary unbundling of the network. Breaking it down into a passive cable plant, which the investors treat as a real estate asset, a plant facilities management company and a service provider, which in case of CAI Westland was bought out by the former cable system management team.

The deal with Krimpen incited two local political parties in Albrandswaard, a nearby municipality on the outskirts of Rotterdam, to push for a similar deal for their independent cable franchise. The proposition in which a Patient Capital investor funds an open fibre network and franchises the local cable operator as its first anchor tenant, voluntarily

unbundling the passive plant from the active services, is becoming an attractive alternative for independent cable operators to selling the network to one of the two major cable operators.

4.2 A different 'business model' for passive fibre outside plant

In deploying FTTH, the approaches of RBCIF and Reggefiber have a small, but relevant difference, with regard to the set up of the Optical Distribution Frames (ODF). Reggefiber constructs a single ODF with the two fibres terminated next to each other for each home (a flat (SC/PC) blue optical connector and an angled (SC/APC) green connector for CATV), which enables the wholesale lease of the pair to a service provider. RBCIF, on the other hand, installs a separate blue SC/PC ODF and a green SC/APC ODF. In this approach, a CATV operating company may lease the green ODF, covering the entire town at once, to launch CATV services over the green fibres. The blue ODF is then available for a second renter (a telco, presumably a firm like KPN), to launch (IP) services to the whole town.

In each case the renter of the *blue* or the *green* ODF is foreseen to handle the regulatory obligations for wholesaling fibres to CLECs, in the case that the renter of ODF-access is earmarked by the regulator as a significant market power. In this model the investor of the passive local loop plant is 'out-of-the-loop' for regulatory supervision, as the lessee takes that burden.

With two anchor lessees active in a town, one on the *blue* ODF and one on the *green* ODF, one from a CATV background and the other from a Telco, this business model seems to be geared toward a 'smooth migration' of the existing local duopoly in two competing access networks (a copper one and a coaxial one) toward a single cabled outside plant with two independent single fibre ODFs and anchor tenants.

At the time of writing of this report, in several cable systems owned by RBCIF the first subscribers to FTTH are receiving service.

> *Stratix Consulting thinks the CATV cut-over strategy is an interesting challenge to Reggefiber's 'built-it-and-seduce-subscribers' model. As the small cable operators are not assigned significant market powers by OPTA, there has not been a regulatory review of this business model.*

There is however, a firm regulatory precedent from the way OPTA dealt with the TriLink outside plant consortium, which KPN had created in 2002 with construction firms VolkerWessels and BAM NBM. In that case the construction firms built out copper networks in greenfield areas and engaged in 5 year Built-Lease-Transfer contracts with KPN, which lacked funding and access to capital markets in 2002 due to the telecom crash. OPTA decided to treat these new local loop networks, despite different ownership, as just a part of KPN's copper network and enforced unbundled local loop obligations.

It is still to be seen whether KPN's current commercial strategy to maintain its copper network alongside Reggefiber's fibre optic loop, will be continued after they have fixed their

provisioning processes and are able to reliably cut over their existing customer bases in all fibred towns.

> *Stratix Consulting thinks that from a long run investment cycle perspective it makes much more sense to also apply a cut-over model not only for coax networks but for copper networks too. This effectively means that the fixed cash flow from services on old plants are shifted toward the fibre optic outside plant, in which case costs are cut by discontinuing the old copper plant.*

4.3 The provincial 'business model' not discussed in public

Many Dutch provinces and municipalities gained a considerable windfall profit from selling off their shares in electric power utilities Nuon and Essent in 2009. The combined revenues from those sales (€ 17 bln) are also far larger than the cost of constructing FTTH in the Netherlands (estimated at € 6 – 7 bln for the passive local loop).

In the present-day tight credit market some provinces and municipalities have eyed the possibilities to act as (minority) co-investor to reinvest some of the profits from selling their utilities in new infrastructure in their areas, or to invest in senior bonds issued by the owner of a new local loop plant in their area. In exchange for their participation or loan the provinces and municipalities obtain the position to enforce requirements of open access to fibres in the newly created outside plant.
This approach has been pioneered by the city of Amsterdam, by acting as one of the co-investors (with housing corporations and Reggefiber) in the deployment of the GNA fibre network. It has been put to State Aid scrutiny and accepted as a proper application of the Market Economy Investor Principle.

CATV public affairs lobbyists fiercely contest a repeat of the Amsterdam type of investment by the now heavily endowed provinces and municipalities. Their claim is that funding a fibre roll out is not technology neutral and provincial and local governments should instead finance broadband applications and services development that also operate over their DOCSIS3.0 plant.

A considerable number of Provincial Deputies and Municipal Aldermen seem hesitant to replicate the Amsterdam model. Some are looking to tender the infrastructure as a Service of Public Economic Interest ('Dienst van Algemeen Economisch Belang').

There is however also a third route discussed in the corridors. Regional governments could finance, develop and construct the subterranean ducting structures in their towns and areas and open them for access for any firm willing to blow fibre in it.

This business model 'not discussed in public' has a series of advantages.

1. It only requires a one-time opening of the soil for ducting construction
2. Municipal or Governmental ownership of ducting system is outside Telco regulation
3. It is allowed by the European Regulatory Framework, as in many large cities outside the Netherlands local government own ducts and conduits for utilities.
4. It removes the barrier of entry that exists in the Netherlands on aerial infrastructure

This last point is of crucial importance. The construction of aerial cable (FTTH on poles) is allowed, but it is effectively obstructed by most local and regional governments for 'esthetic reasons'. The typical investment cost per meter of an aerial construct of fibre optic cables via poles is € 6 per meter. The cost of a subterranean stretch is ca. € 30-36 per meter, 5 to 6 fold the cost per meter.

The rather high CAPEX per home for FTTH in the Netherlands is for a very large part the result of local permitting of rights-of-way and the preference for subterranean construction. A municipality or province that removes those barriers to entry by installing an open duct infrastructure and leasing it for open access on a non-discriminatory basis effectively is allowed to absorb near 80% of the CAPEX per home.

> *Stratix Consulting observes that the option to act as a ducting-only investor by local governments, optionally co-financed by retirement funds with the municipality or province as a bond provider to the entity from last year's utility sale endowments, is an underestimated business model. Next to the already existing business and investment models like MEIP and the Service of Public Economic Interest, this model offers a promising alternative, in particular as it is targeted at the main economic problem for FTTH, namely the large barrier to entry for subterranean local loop network construction.*

5 Stratix' expectations for 2010-2011

2010 will be the year in which KPN should get its FTTH provisioning processes in order and get the IT operational. It is rumoured that KPN has already invested € 100 mln in their new IT systems to support both the FTTH as well as VDSL2-CO based fixed networks. This would mean that a firm like KPN is spending nearly as much on IT-systems and software development as it is planning to invest in active equipment platforms inside the central offices for FTTH and VDSL throughout 2010.

Reggefiber and RBCIF, with its operations in converting coax networks to fibre, are definitely the largest two investors rolling out FTTH networks. 2010 will be the year that those firms not only grow in homes passed and homes connected, but also have to show an increase in homes subscribed to match the first two.

An interesting segment for fibre deployment is in (residential) apartment buildings, where homes passed, connected and subscribed run closer in parallel and the investment bill is often (partially) footed by the landlord of the real estate object.

Stratix therefore expects to see more efforts in the so-called *cut-over* strategy, as well as a renewed activity by the residential apartment operators,

Many municipalities as well as provinces are reviewing their regained options to act as a co-investor in FTTH projects. We expect that the main activity of these entities will be devoted to discussing possible ways to invest and whether to tender a network or an advanced ultrafast broadband service. Actual channelling of public money into new local loop construction is not to be expected before 2011, if at all.

Stratix Consulting expects that politicians and regulators at the national, provincial and local level will continue to discuss Politically Correct ultrafast broadband deployment and services. Wholesale access at low rates for the more socially useful 'lifeline' and 'utility' services (e.g. smart metering) do not require ultrafast broadband and will remain outside the discussion. Also the migration of connected street furniture from ageing copper networks to FTTH plants is expected to remain outside the discussions on FTTH construction.

We also do not expect politicians to see direct optical Satellite-over-fibre distribution as a new business opportunity enabled by fibre. They tend to phrase that as part of the TV-services market.
Enabling this cheap technology as well as raising competition for TV distribution services may need some legal adjustments in today's copyright regime, which has turned out not to be as technology neutral as originally thought. Current TV distribution copyright jurisprudence assumes that distributors have the technical capability to single out specific TV-channels (not conveying the entire set of signals from one or more satellite positions at once). Under this assumption, distributors can be considered re-broadcasters of those single TV-channels and therefore be held liable for copyright payments or infringements. As such we do not expect much to occur in 2010 with Satellite-over-fibre except in a few apartment buildings, despite a large trial in the UK with this technology connecting 16,000 homes by BT-Astra-BSkyB.

We expect not only incumbents, but most parties at the supply side to step up their effort to keep the € 17 bln from the 2009 Power distribution company sales, away from investment in new local loops. They will continue their attempts to deflect this potential source of finance towards 'socially useful' services development projects, as these tend to be more complementary to their main asset base instead of in direct competition.

We expect that many supply side parties will continue to argue that financing firms which develop 'socially useful' software and services constitutes a better stimulus spending rather than financing firms that 'hand out spades' to people trenching and running the cables to homes. NLkabel, the association of cable companies, is again pushing this lever to induce redirection of government money flows to services development only.

With their push NLkabel might provoke the announcement by the Dutch government of a more serious Cost Benefit study that weighs policy decisions on investing in new services (software) development vs funding of cable network construction. For instance by assessing the barriers to entry for each kind of activity c.q. market, the risk structure of the developments and how easy it is to get funding from different sources in application development or win venture capital.

Local loop economics indicates no more then a single network per area will be feasible, in particular under the open network business models. As such, the cut-over model by RBCIF leasing out entire towns and areas at once is an interesting alternative to the per loop wholesale lease.

We expect that regulators and competition authorities in 2010 or early 2011 will be confronted with the need to assess a cut-over business model. At least we expect a revisit of the existing ODF Access regulations, which are based on leasing pairs of fibres and are based on Reggefiber's approach. In particular the questions will be raised what the lease rate should be per single fibre when one loop of a pair is leased out to one company and the other loop to a different company.

Another question will be whether it will become possible, like today with copper line sharing (where PSTN/ISDN is provided and absorbs the monthly rental), to ask an access rate of less than € 1 for access to the second, unused fibre when the first loop is already in use. Such arrangements would enable many new services in particular in the utility domain, allowing affordable access for smart metering, or enabling Satellite-over-fibre distribution. The situation on how to decide on two different firms each renting out a single loop is today not yet covered under OPTA's regulations of Reggefiber's ODF Access.

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Glossary - Definition of terms

CLEC (Competitive Local Exchange Carrier) A telecom provider that competes with other, already established carriers (usually the incumbent carrier).

ADSL (Asymmetrical Digital Subscriber Line) An xDSL technology, that enables faster data transmission over copper telephone lines than a conventional dial up modem can provide. It is called asymmetric because the download and upload speeds are not symmetrical (download is faster than upload).

DOCSIS (Data Over Cable Service Interface Specification) A standard for delivering data over cable TV infrastructure, typically for subscriber Internet access services. DOCSIS 3.0, the most recent standard, will allow cable operators to provide (shared) data rates in the hundreds of Megabit/s.

DVB-S (Digital Video Broadcasting - Satellite) An international standard for digital TV broadcasting via satellite. DVB-S2 is a refinement of the original DVB-S standard that achieves an approximately 30% higher data rate.

DVB-T (Digital Video Broadcasting - Terrestrial) An international standard for digital TV broadcasting over terrestrial networks, where analogue TV antennas are used to receive the transmissions.

FL-LRIC (Forward Looking Long Run Incremental Costs) A costing methodology to determine the costs of an efficient network operator necessary for the provision of a certain service. The long run incremental costs to be estimated are forward-looking costs, estimated on the basis of the least cost technology of appropriate quality, level and functionality.

FTTB (Fibre-to-the-Building) Communications architecture in which the final connection to the subscriber's premises is a communication medium other than fibre. The fibre optic communications path is terminated on the premises for the purpose of carrying communications to a single building with potentially multiple subscribers.

FTTC (Fibre-to-the-Curb) Communications architecture in which the final connection to the subscriber's premises is a communication medium other than fibre. The fibre optic communications path is terminated on the curb side for the purpose of carrying communications to potentially multiple buildings with potentially multiple subscribers.

FTTH (Fibre-to-the-Home) Communications architecture in which the final connection to the subscriber's premises is Optical Fibre. The fibre optic communications path is terminated in or on the premises for the purpose of carrying communications to a single subscriber.

Local Loop The physical connection from the subscriber's premises to the carrier's Point of Presence (POP). The local loop can be provided over any suitable transmission medium.

MDF (Main Distribution Frame) Refers to a patching frame for copper lines, connecting equipment (inside plant) to cables and subscriber carrier equipment (outside plant). The MDF is a termination point within the local telephone exchange where exchange equipment and terminations of local loops are connected by jumper wires at the MDF.

ODF (Optical Distribution Frame) Refers to a patching frame for optical fibres, connecting equipment (inside plant) to fibres and subscriber carrier equipment (outside plant).

PON (Passive Optical Network) A point-to-multipoint, fibre to the premises network architecture in which unpowered optical splitters are used to enable a single optical fibre to serve multiple premises, typically 32-128. A PON configuration reduces the amount of fibre and central office equipment required compared with point to point architectures.

SDSL (Symmetric Digital Subscriber Line) An xDSL technology that offers symmetric bandwidth upstream and downstream (download speed is the same as upload).

ULL (Unbundled Local Loop). The provision of access to both ends of a local loop on a permanent basis, allowing the installation of equipment or the lease of any such equipment, in order to provide services over the local loop.

VDSL (Very High Speed Digital Subscriber Line) An advanced xDSL technology, providing faster data transmission over the existing infrastructure of copper wires, in particular over short distances. VDSL2, the most recent standard, deteriorates quickly from a theoretical maximum of 250 Mbit/s at source to 100 Mbit/s at 0.5 km and 50 Mbit/s at 1 km, but degrades at a slower rate from there. Starting from 1.6 km (1 mile) its performance is equal to ADSL2+.

Annex A Stratix FTTH knowledge centre

Stratix Consulting has compiled an extensive database with details down to neighbourhood levels. Interested parties can send a request to ftth@stratix.nl to receive more information on our database and how to get access.

A.1 A preview of our database

Our database contains information at neighbourhood, district, municipal and provincial levels. A complete list of database variables can be found in paragraph A.3. The FTTH information included in the database is linked to a Google maps mash-up, which allows for a geographic representation of the data.

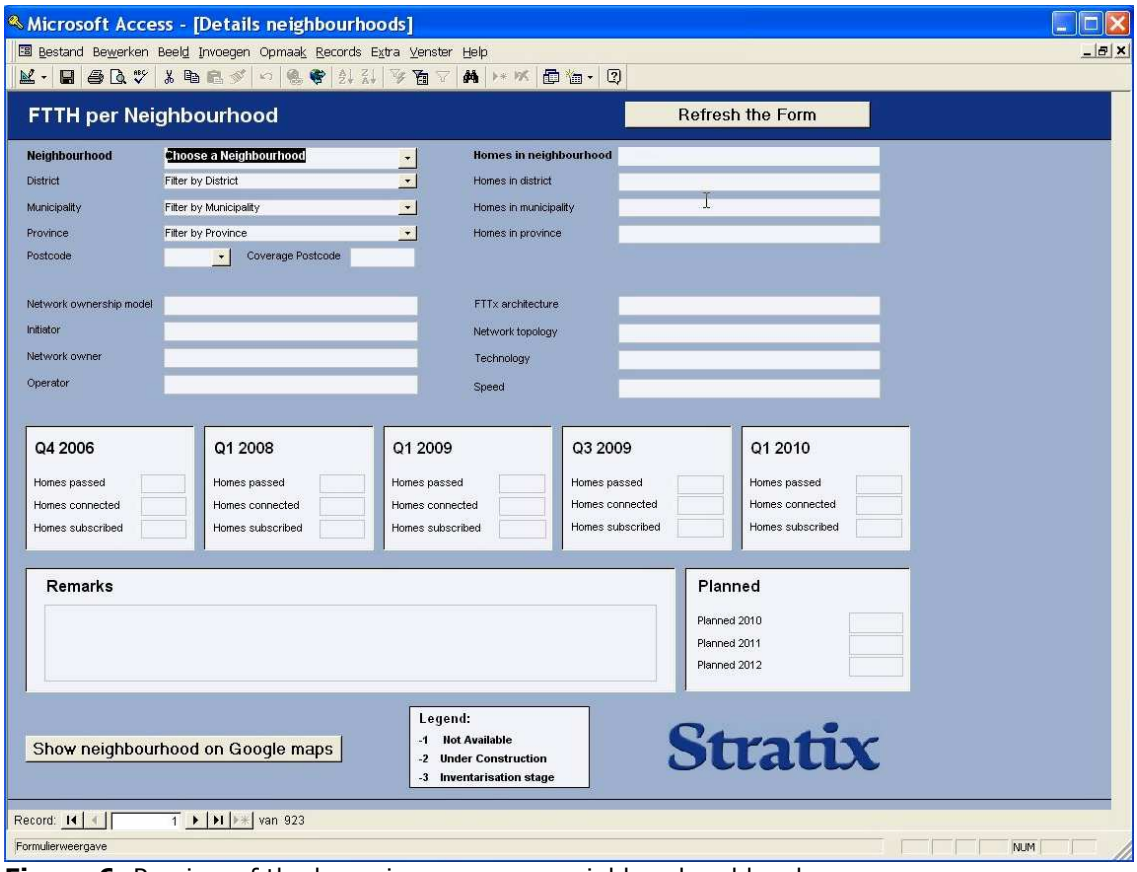


Figure 6: Preview of the browsing screen on neighbourhood level

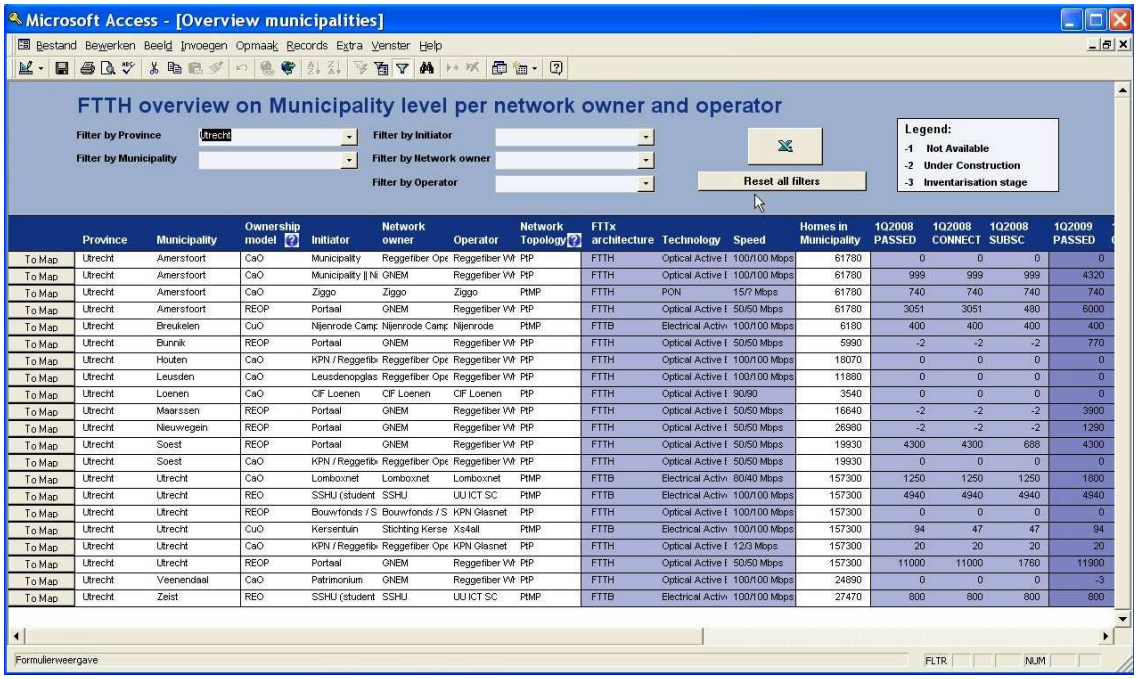
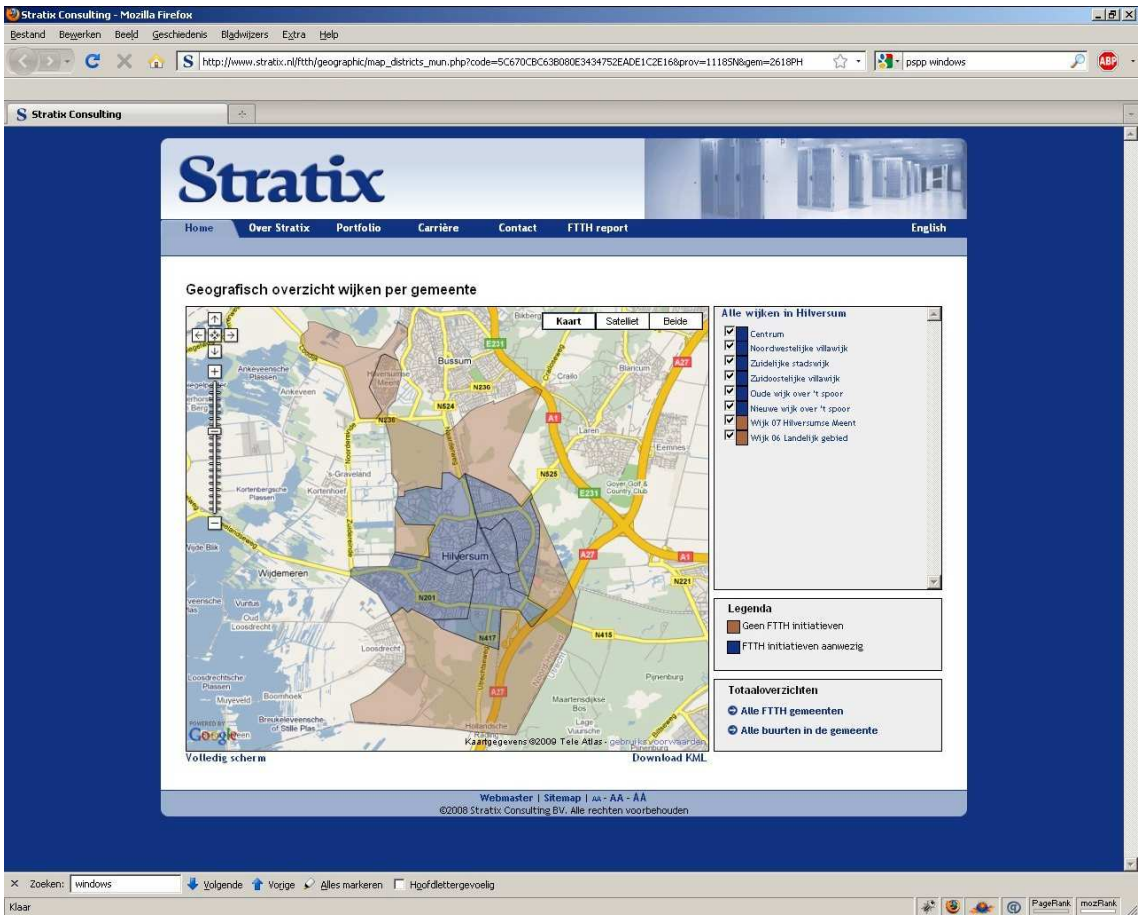


Figure 7: Preview of the table view on municipality level

A.2 Geographic overviews

As mentioned in the previous paragraph, FTTH information from the database can be geographically represented as in the figure below. We provide an online sample page of the mapview on our website, which can be accessed at: http://www.stratix.nl/ftth/geovoorbeeld.php



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A.3 List of database variables

Variable	Description
FTTH ID	Unique ID composed of CBS geo-codes
Province	CBS province naming
Municipality	CBS municipality naming
District	CBS district naming
Neighbourhood	CBS neighbourhood naming
PROV_CODE	CBS province coding
GM_CODE	CBS municipality coding
WK_CODE	CBS district coding
BU_CODE	CBS neighbourhood coding
Remarks	Remarks on the progress or current situation of a project
Network ownership model	Type of network ownership model in place
Initiator	Name(s) of part(y)(ies) responsible for the initiation of the project
Network owner	Name of owner of the passive network
Operator	Name of operator of the network
Topology	Type of network topology in place
FTTX architecture	Type of FTTx architecture in place
Technology	Type of fibre technology in place
Speed	Highest available speed on the network for end-users
Most occurring postcode	Most occurring 4-digit postcode in neighbourhood
Coverage postcode	Postcode coding based on percentage coverage of most occuring 4-digit postcode in neighbourhood
Homes/households province	Total number of homes/households in province
Homes/households in municipality	Total number of homes/households in municipality
Homes/households in districts	Total number of homes/households in district
Homes/households in neighbourhood	Total number of homes/households in neighbourhood
Homes passed province	Potential number of premises in a province to which an operator has capability to connect, but the premises may or may not be connected to the network
Homes passed municipality	Potential number of premises in a municipality to which an operator has capability to connect, but the premises may or may not be connected to the network
Homes passed district	Potential number of premises in a district to which an operator has capability to connect, but the premises may or may not be connected to the network
Homes passed neighbourhood	Potential number of premises in a neighbourhood to which an operator has capability to connect, but the premises may or may not be connected to the network
Homes connected province	Total number of premises in a province which are connected to an FTTH/B-network
Homes connected municipality	Total number of premises in a municipality which are connected to an FTTH/B-network
Homes connected district	Total number of premises in a district which are connected to an FTTH/B-network
Homes connected neighbourhood	Total number of premises in a neighbourhood which are connected to an FTTH/B-network
Homes subscribed province	Total number of premises in a province that are both connected to a FTTH/B-network and at least one service on this connection is in use under a commercial contract
Homes subscribed municipality	Total number of premises in a municipality that are both connected to a FTTH/B-network and at least one service on this connection is in use under a commercial contract
Homes subscribed district	Total number of premises in a district that are both connected to a FTTH/B-network and at least one service on this connection is in use under a commercial contract
Homes subscribed neighbourhood	Total number of premises in a neighbourhood that are both connected to a FTTH/B-network and at least one service on this connection is in use under a commercial contract

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Annex B Overview at municipal level of FTTH/FTTB homes passed, connected and subscribed 1Q2010

Province	Municipality	Households	Homes passed	Homes connected	Homes subscribed
Drenthe	Meppel	13,930	925	875	n.a.
Flevoland	Almere	75,400	60,682	57,500	7,500
Flevoland	Dronten	16,280	10,040	7,700	2,000
Flevoland	Lelystad	31,630	0	0	0
Flevoland	Zeewolde	7,740	7,740	6,100	1,500
Friesland	Dongeradeel	10,220	60	n.a.	n.a.
Friesland	Leeuwarden	48,070	u.c.	u.c.	u.c.
Gelderland	Aalten	11,120	inv.	inv.	inv.
Gelderland	Arnhem	73,080	6,144	6,144	1,720
Gelderland	Berkelland	18,000	1,700	u.c.	u.c.
Gelderland	Druten	6,970	0	0	0
Gelderland	Elburg	8,340	4,500	3,150	1,300
Gelderland	Heumen	6,670	0	0	0
Gelderland	Lochem	13,710	710	530	245
Gelderland	Nijkerk	15,170	8,260	8,150	2,480
Gelderland	Nijmegen	86,190	19,507	19,507	9,472
Gelderland	Oost Gelre	11,750	inv.	inv.	inv.
Gelderland	Ubbergen	4,170	100	100	u.c.
Gelderland	Wageningen	20,720	3,276	3,276	3,276
Gelderland	West Maas en Waal	7,270	0	0	0
Gelderland	Wijchen	16,100	2,600	2,600	1,800
Gelderland	Winterswijk	12,230	inv.	inv.	inv.
Groningen	Groningen	107,880	1,013	1,013	1,013
Limburg	Beesel	5,710	200	200	180
Limburg	Weert	20,730	0	0	0
Noord-Brabant	Best	11,590	11,050	7,500	7,500
Noord-Brabant	Eindhoven	106,230	27,048	24,545	15,057
Noord-Brabant	Geldrop-Mierlo	16,360	16,360	10,000	10,000
Noord-Brabant	Heeze-Leende	6,030	inv.	inv.	inv.
Noord-Brabant	Helmond	37,830	2,510	1,633	1,633
Noord-Brabant	Laarbeek	8,560	8,540	5,120	5,120
Noord-Brabant	Nuenen	9,170	9,170	8,600	7,740
Noord-Brabant	Oss	32,460	100	100	n.a.
Noord-Brabant	Schijndel	9,100	9,100	8,740	2,730
Noord-Brabant	Sint-Oedenrode	6,970	5,900	5,310	1,170
Noord-Brabant	Son en Breugel	6,280	6,080	5,470	1,825
Noord-Brabant	Tilburg	97,460	1,867	1,867	1,809
Noord-Brabant	Uden	16,750	15,430	13,887	4,010
Noord-Brabant	Valkenswaard	13,670	13,360	7,944	7,944
Noord-Brabant	Veghel	14,740	12,913	10,000	3,870
Noord-Brabant	Veldhoven	18,020	17,470	9,205	9,205
Noord-Holland	Amstelveen	38,730	3,000	3,000	3,000
Noord-Holland	Amsterdam	416,430	47,353	15,078	8,676
Noord-Holland	Bussum	14,610	1,971	1,366	235

Stratix

Province	Municipality	Households	Homes passed	Homes connected	Homes subscribed
Noord-Holland	Diemen	11,790	1,268	1,268	1,268
Noord-Holland	Haarlem	72,400	622	622	622
Noord-Holland	Haarlemmermeer	58,000	540	540	n.a.
Noord-Holland	Hilversum	39,880	13,927	12,172	550
Noord-Holland	Naarden	7,240	1,370	1,370	205
Noord-Holland	Various	7,000	7,000	7,000	7,000
Overijssel	Deventer	44,180	37,100	30,700	12,280
Overijssel	Dinkelland	9,490	131	131	131
Overijssel	Enschede	75,780	36,900	25,100	10,950
Overijssel	Haaksbergen	9,730	7,950	7,500	2,230
Overijssel	Hengelo	36,170	inv.	inv.	inv.
Overijssel	Rijssen-Holten	13,170	11,920	5,960	5,960
Overijssel	Wierden	8,760	u.c.	u.c.	u.c.
Utrecht	Amersfoort	61,780	21,170	14,913	7,948
Utrecht	Breukelen	6,180	400	400	400
Utrecht	Bunnik	5,990	770	770	215
Utrecht	Houten	18,070	u.c.	u.c.	u.c.
Utrecht	Leusden	11,880	inv.	inv.	inv.
Utrecht	Loenen	3,540	u.c.	u.c.	u.c.
Utrecht	Maarssen	16,640	3,900	3,900	1,090
Utrecht	Nieuwegein	26,980	1,290	1,290	360
Utrecht	Soest	19,930	4,300	4,300	1,200
Utrecht	Utrecht	157,300	20,152	20,105	10,537
Utrecht	Veenendaal	24,890	5,920	5,170	2,360
Utrecht	Zeist	27,470	800	800	800
Zuid-Holland	Delft	52,170	5,011	5,011	5,011
Zuid-Holland	Dordrecht	54,050	8,600	8,600	1,720
Zuid-Holland	Hillegom	8,730	7,431	7,431	5,575
Zuid-Holland	Krimpen aan den IJssel	11,760	71	71	71
Zuid-Holland	Lansingerland	19,240	7,700	5,390	1,540
Zuid-Holland	Leiden	61,250	11,798	11,798	5,786
Zuid-Holland	Oegstgeest	9,810	540	540	540
Zuid-Holland	Rotterdam	296,420	11,554	11,554	6,730
Zuid-Holland	's-Gravenhage	240,300	326	326	326
Zuid-Holland	Westland	38,960	765	46	46
Total FTTH municipalities		**3,097,000**	**567,905**	**450,988**	**217,461**

inv. = inventarisation stage
u.c. = under construction
n.a. = not available

Numbers of 'homes connected' and 'homes subscribed' on a municipality level are based on actual numbers derived from multiple data sources and are in a few cases based on Stratix own estimates. These numbers do not include projects that are currently under construction, nor do they include projects for which we couldn't find any data. Our extensive database contains data at district and neighbourhood levels and provides additional information on the current status of local initiatives.