

# Consulting



## Broadband Coverage in Europe

Final Report

2009 Survey

Data as of 31 December 2008

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80106  
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**IDATE**  
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# 1. Methodological notes

The goal of this report is to deliver the final results of the survey on Broadband coverage and take-up across Europe (29 countries, i.e. EU-27 Member States + Norway and Iceland) at the end of 2008. Averages have been calculated for 4 different country groups:

- EU-15, which covers the 15 Member States of the European Union as it was organised just before 1 April 2004;
- EU-15 + 2, which covers the EU-15, plus Norway and Iceland;
- EU-25, which covers the 25 Member States of the European Union until December 2006;
- EU-25 + 2, which covers the EU-25, plus Norway and Iceland;
- EU-27, which covers the 27 Member States of the European Union;
- EU-27 + 2, which covers the EU-27, plus Norway and Iceland.

The data contained in this document were collected by IDATE and its partners, from broadband networks operators, regulators and various sources in each country examined (see methodological report).

All of the principal broadband platforms were taken into consideration: primarily ADSL, cable and FTTx (including VDSL), but also other platforms such as WLL/WLAN, satellite and PLC. 3G coverage and take-up (measured by the number of 3G SIM cards and 3G PC cards sold) were also examined, but separately from fixed broadband access.

## Data refer to the situation as of 31 December 2008

The survey distinguishes **Urban, Suburban and Rural areas**, with the following definitions:

- Urban area: a population density superior to 500 people/km<sup>2</sup>;
- Suburban area: a population density between 100 people/km<sup>2</sup> and 500 people/km<sup>2</sup>;
- Rural area: a population density below 100 people/km<sup>2</sup>.

In some countries, such as Malta or Iceland, this breakdown does not apply because of their small size.

Segmentation by **download rate** (for ADSL, cable modem or FTTx) is as follows:

- less than 256 kbps (bottom limit for being classified as broadband according to the Commission),
- from 256 kbps (included) to 512 Kbps included,
- from 512 Kbps excluded to 1 Mbps included,
- from 1 Mbps excluded to 2 Mbps included,
- from 2 Mbps excluded to 8 Mbps included,
- from 8 Mbps excluded to 30 Mbps included,
- more than 30 Mbps.
- 

We have split the provenance of DSL connections into 3 categories:

- DSL access sold directly by incumbent carriers through retail offers;
- DSL access sold by third-party ISPs through wholesale offers marketed by the incumbent carrier (simple resale or bitstream);
- DSL access through unbundling offers (shared access or full unbundling).

Throughout the report, “**DSL Coverage**” figures refer to the percentage of the population that depends on a Local Exchange equipped with a DSLAM. In other words, coverage measurement includes those people (Households or Businesses Units) who reside too far from these switches to be able to purchase a DSL connection even if they wanted to do so.

The term “**Eligibility**” refers to “the percentage of the population that depends on Local Exchanges equipped with a DSLAM and **excluding** those people (Households or Businesses Units) who reside too far from these switches to be able to purchase a DSL connection even if they wanted to do so”. Furthermore, these eligibility percentages will differ for the available download rates. For instance, eligibility for a downstream rate of 2 Mbps will be lower than eligibility for access running at 512 Kbps.

No eligibility data exist for all countries as operators cannot measure precisely how many local loops are too long to support DSL, added to which new technical developments can increase eligibility levels (e.g. the introduction of REACH DSL).

In some countries (e.g. Poland and the Czech Republic), where fixed telephone lines are not available to all households, DSL coverage was recalculated to obtain the actual percentage of the population that can be physically equipped with DSL (see detailed calculations in the country monographs).

Throughout the report, “**Cable modem coverage**” figures refer to the percentage of the population living in households actually passed for cable. In other words, unlike DSL coverage figures, cable modem coverage also corresponds to Eligibility figures.

As concerns **3G customers**, measurement is based on the number of broadband mobile customers. Figures refer to subscribers using 3G-based services and paying specifically for broadband data packages in a few cases only (e.g. the UK, Spain). More often, they refer to active 3G subscribers (i.e. mobile users with a 3G-capable handset and at least one connection to a 3G-based service over the past 3 months, regardless of the duration or the amount of data transmitted). Definitions differ from one country to another but we could estimate that, on average, less than half of 3G capable handsets were used by active 3G users (62.2 million active users at the end of 2008 compared to 134 million 3G capable handsets).

3G coverage is measured as a % of population (according to locations of residence) and as a % of territory. Wherever possible we distinguish between 3G and enhanced networks (more specifically HSDPA). Figures on 3G coverage refer to the mobile network with the highest rate of coverage in each national market.

- Country-specific data were also used to establish European benchmarks and averages. Averages have been calculated on a weighted basis. Furthermore, as previous surveys covered only Western European countries (EU-15 + Norway and Iceland), we have provided two sets of benchmarks:
- the first comparing and averaging data at year end in 2007 only, covering the 29 countries examined in this survey,
- the second one with time series, covering the EU-25 + 2.

NB: In the tables and graphs, “n.a.” or no indication means that data is not available (while “0” indicates that there are no subscribers) and “n.r.” is used when categories are not relevant.

## 2. Executive summary

There were 115.1 million fixed broadband subscribers in the 29 European countries surveyed<sup>1</sup> at the end of 2008, a 12% increase over the previous year. This translates into a 22.8% penetration rate (22.8 subscribers per 100 inhabitants) on average, and 25.3% when looking only at Western European countries (the EU-15 + Norway and Iceland). Country by country, take-up figures range from 11% in Bulgaria to 37.3% in Denmark.

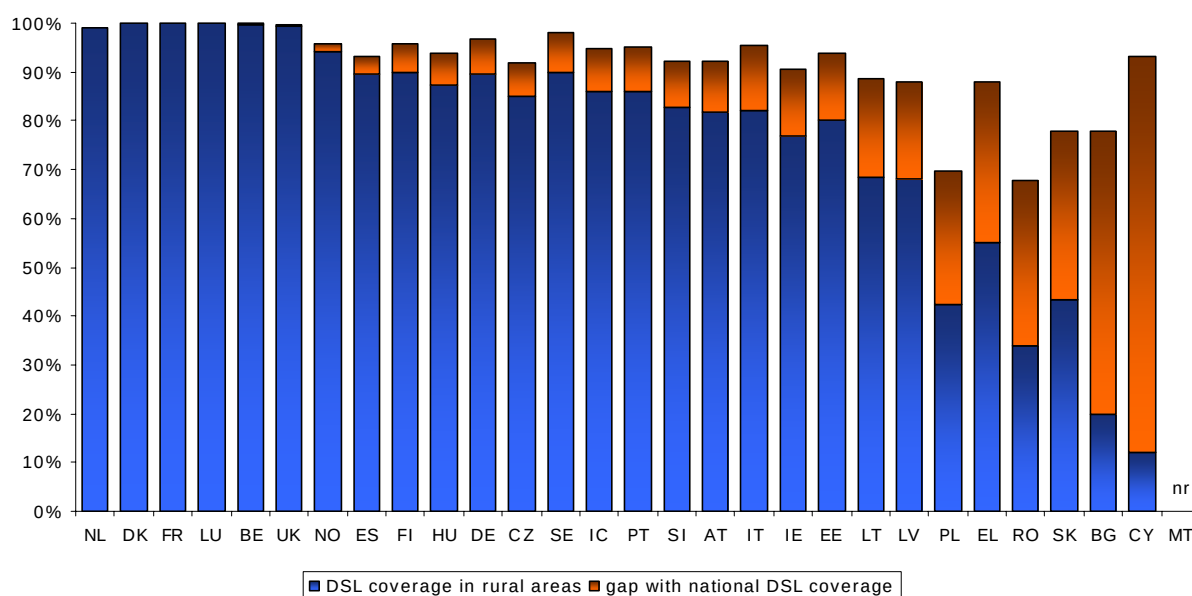
DSL and cable modem are by far the most prominent technologies. With 91.0 million subscribers, DSL accounted for 79.1% of total fixed broadband connections at the end of 2008 while cable modem accounted for 15.1% of the subscriber base (17.4 million subscribers). The remaining 5.8% are connected chiefly via fixed wireless access and FTTx technologies.

### DSL coverage close to 93%

One of the reasons why DSL is the dominant access mode is that the POTS network on which DSL technologies operate is very widely available. At the end of 2008, average DSL coverage was close to 93%, and even up to 97% in the EU-15+2: this is 1.6 points higher than at the end of 2007, and more than 5 points higher than at the end of 2006. At the national level, DSL coverage is now over 88% in 25 countries. Only four countries (Romania, Poland, Slovakia and Bulgaria) are still lagging behind with coverage ratios in the 65%-70% range.

However, these national figures still reveal discrepancies between urban/suburban and rural areas. On average in the EU-27+2, DSL coverage in rural areas was at 77% at the end of 2008, compared to 97.9% in urban areas (and 92.8% at national levels): the gap between coverage in urban and rural areas is particularly significant in Cyprus, Bulgaria, Romania and Slovakia, but minimal in Benelux countries, Denmark and France.

**Figure 1: Gaps ranging from 0% to 81% between DSL coverage in rural areas and national DSL coverage**



\* Definition of rural areas not applicable in Malta

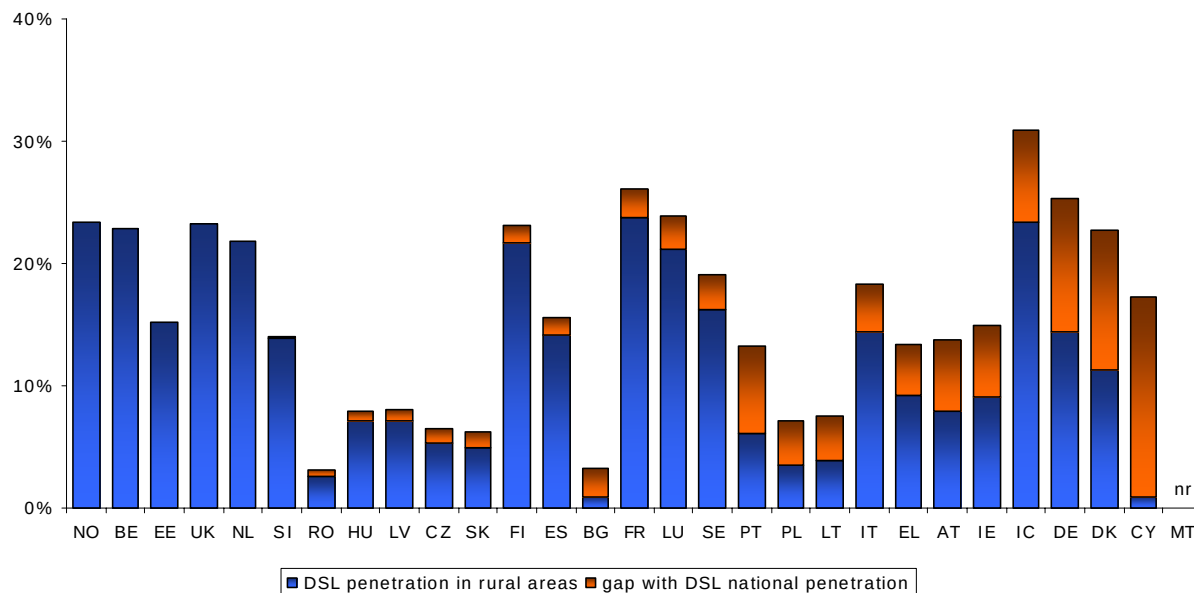
Source: IDATE survey

As to DSL penetration, national figures range from 3.1% in Romania and 3.2% in Bulgaria to 30.9% in Iceland, with a weighted average of 18.0% for the 29 countries (21.1% for Western countries). At the end of 2008, 9 countries were over the 20% mark (same number as at the end of 2007) with France and Germany at over 25%. There are disparities between penetration levels in rural areas and national levels which are generally larger in relative terms, which means that in rural areas, not only

<sup>1</sup> EU-27 plus Norway and Iceland

does deficient coverage limit penetration, but the late introduction of broadband in those areas has created further delays in take-up. The German and Danish markets stand out here, with national DSL penetration rates of 25.2% for the former and 22.8% for the latter, but only 14.4% and 11.3%, respectively, in rural areas.

**Figure 2: Gaps of 0% to 13% between DSL penetration in rural areas and national DSL penetration**



Source: IDATE survey

### 62% of DSL connections with download speeds over 2 Mbps

On the matter of download speed, 61.7% of DSL users subscribed to offers with speeds of over 2 Mbps, and 13.6% to a service running at over 8 Mbps. Connections delivering speeds of over 2 Mbps account for 70% or more of all broadband accounts in 8 countries (Belgium, the Czech Republic, Denmark, Iceland, Norway, Portugal, Spain and the UK) while they accounted for only 5% in Poland and 10% in Cyprus. On average, disparities between the connection rates subscribed to nationally and in rural areas are shrinking.

Regarding the origin of DSL access, 55.8% of DSL connections were supplied directly by incumbent carriers to end users at the end of 2008, with competing offers being now based chiefly on unbundled lines (31%), while resale/bitstream offers only account for 13.1% of all connections. Unbundling remains far less common in rural areas (17.5% of DSL connections, compared to 17.8% via resale/bitstream solutions).

Cable modem availability is low compared to DSL: the average national coverage rate was only 43.4% at the end of 2008, and cable is not available at all in two countries (Italy and Greece). In some large countries (France, the UK), cable is available primarily in big cities, with an average of only 13.7% coverage in rural areas.

Cable modem penetration was 3.5% at the end of 2008 (17.4 million subscribers in the 29 countries), but only 0.9% in rural areas.

Download speeds are generally higher than for DSL: in particular, connections with download speeds over 8 Mbps account for 30.5% of total cable modem subscriptions, while they represent only 13.5% of DSL subscriptions.

In the mobile segment, 3G population coverage reached 79% at the end of 2008, with seven countries (Denmark, Malta, Sweden, the Netherlands, Latvia, Norway and Luxembourg) at or above 95%. A large part of 3G networks have been upgraded to HSDPA and/or HSUPA: 3G+ population coverage stood at 74.4%. However, geographical coverage remains lower as rural areas in particular are still underserved in numerous countries. In most European countries, UMTS territory coverage has reached 90-100% in urban areas but it is only 10-20% in rural areas in a large part of them.

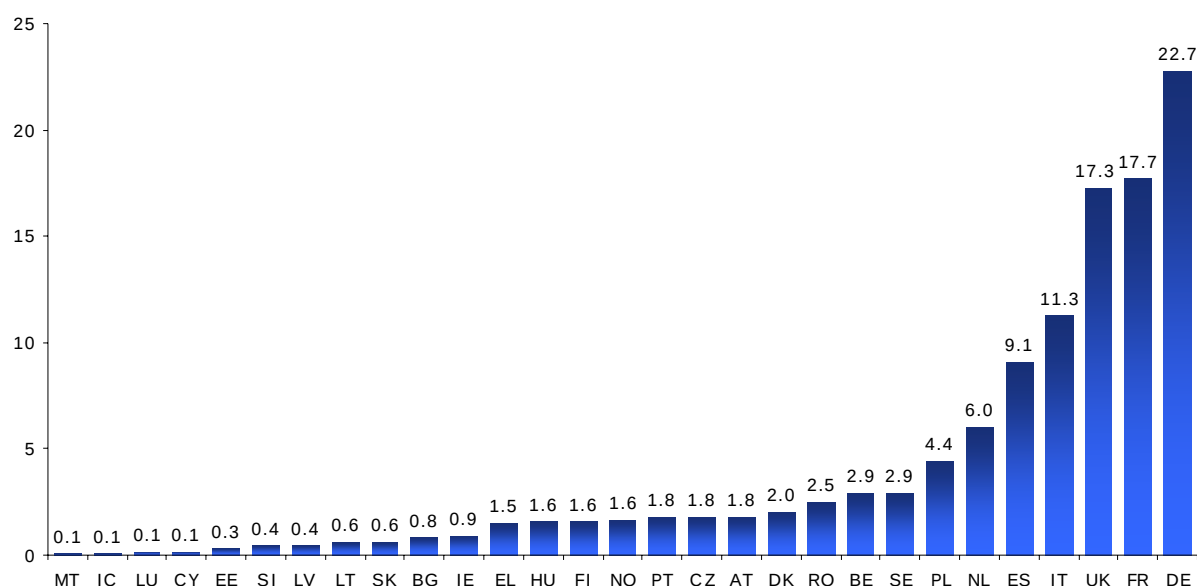
## 3. European benchmark

### 3.1. EU-27 + Norway & Iceland at the end of 2008

#### 3.1.1. Fixed broadband subscriber bases and penetration

##### Subscriber base

Figure 3: Fixed broadband subscriber base at the end of 2008 (in million subscribers)



There were 115.1 million fixed broadband subscribers at the end of 2008 in the 29 European countries covered by the survey, representing a 12% increase over the previous year (102.4 million subscribers at the end of 2007<sup>2</sup>). Germany (22.7 million), France (17.7 million each) and the UK (17.3 million) are the largest contributors to this base; the three countries together account for just over 50% of the broadband subscriber base in the region, in addition to contributing 55% of the past year's growth. The most dynamic markets in relative terms were Greece (+48%), Cyprus (+43%) and Latvia (+37%), although admittedly starting from a much smaller base.

Table 1: Fixed broadband subscriber bases at the end of 2008 (in million subscribers)

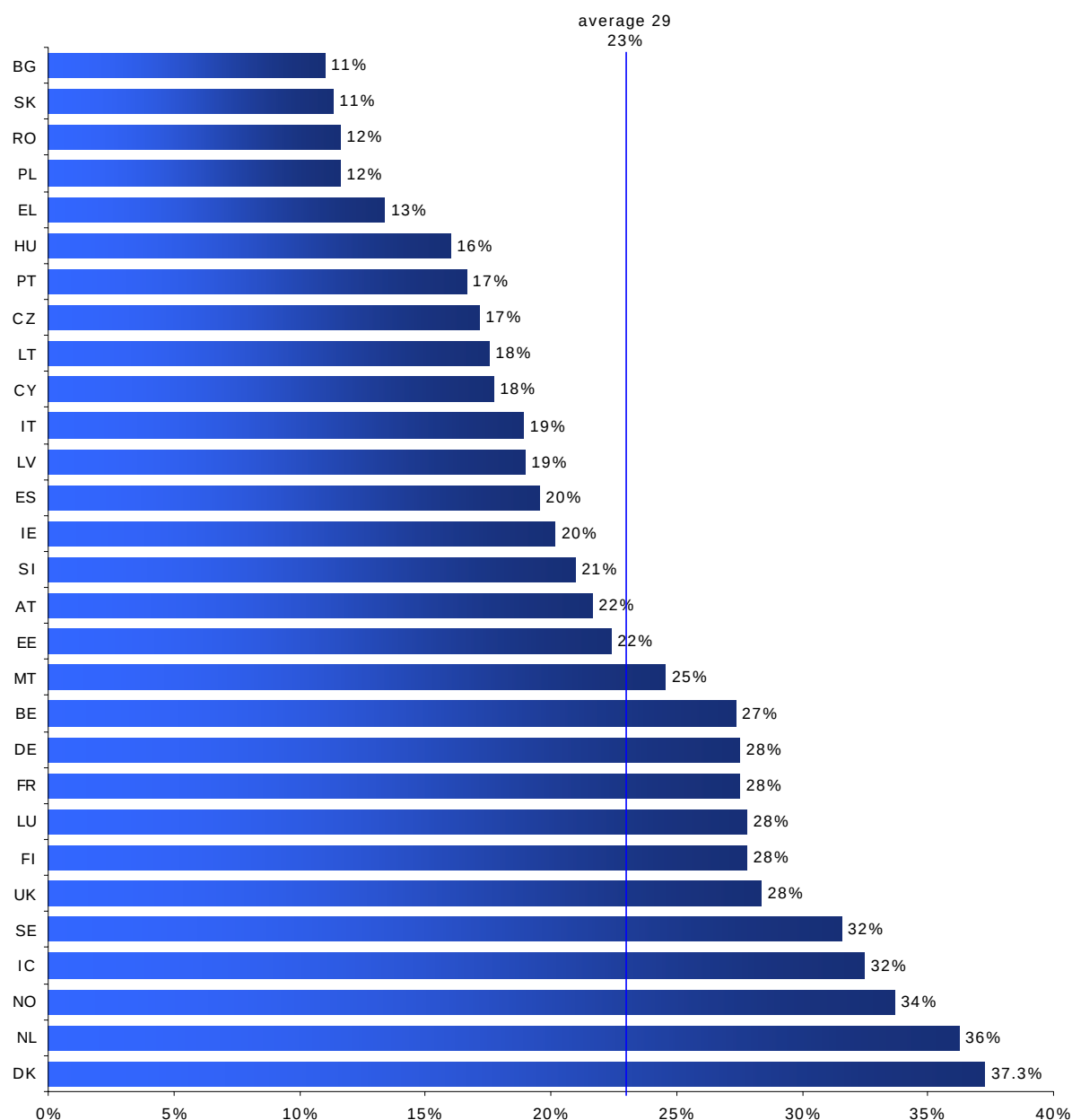
| EU-15  | EU-15 + 2 | EU-25   | EU-25 + 2 | EU-27   | EU-27 + 2 |
|--------|-----------|---------|-----------|---------|-----------|
| 99.629 | 101.348   | 110.069 | 111.788   | 113.360 | 115.079   |

<sup>2</sup> Some figures from last year's report have been adjusted.



## Fixed broadband penetration

Figure 4: Fixed broadband penetration at the end of 2008



In terms of penetration, figures range from 11% in Bulgaria to 37% in Denmark, with a weighted average for the 29 countries of 22.8%. Most Scandinavian countries and the Netherlands all report penetration rates over 30%, which are the highest in the world (only South Korea also appears in this range). Among the largest countries, the UK, France and Germany are now very close to this group with penetration rates of around 28%, while Spain and Italy still lag behind at around 20%. Take-up is generally lower in Eastern European countries, with Greece and Portugal also being home to relatively low penetration levels.

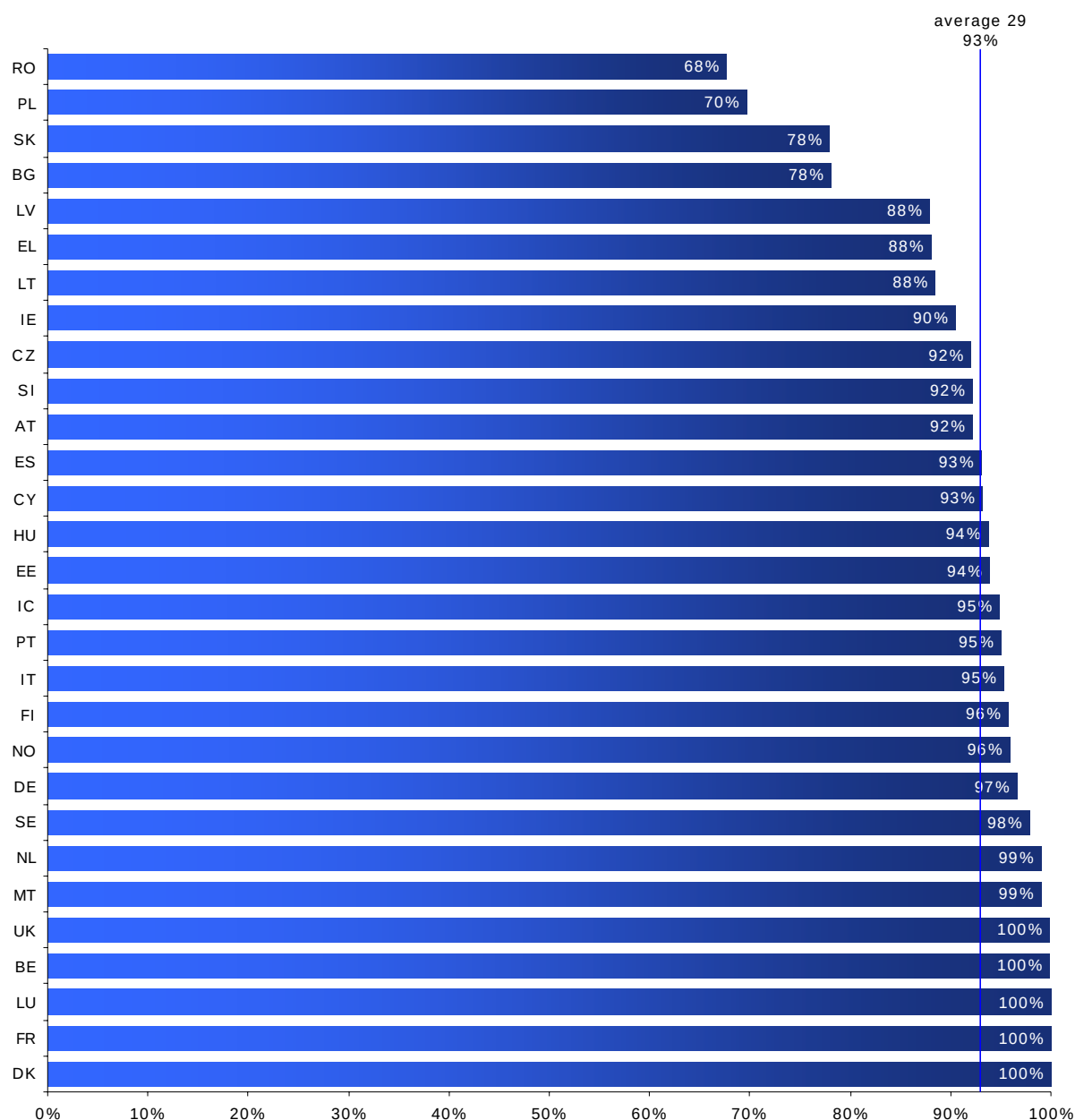
Table 2: Fixed broadband penetration at the end of 2007 (broadband connections as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 25.2% | 25.3%     | 23.4% | 23.5%     | 22.7% | 22.8%     |

### 3.1.2. DSL coverage and penetration

#### DSL coverage

Figure 5: National DSL coverage at the end of 2008

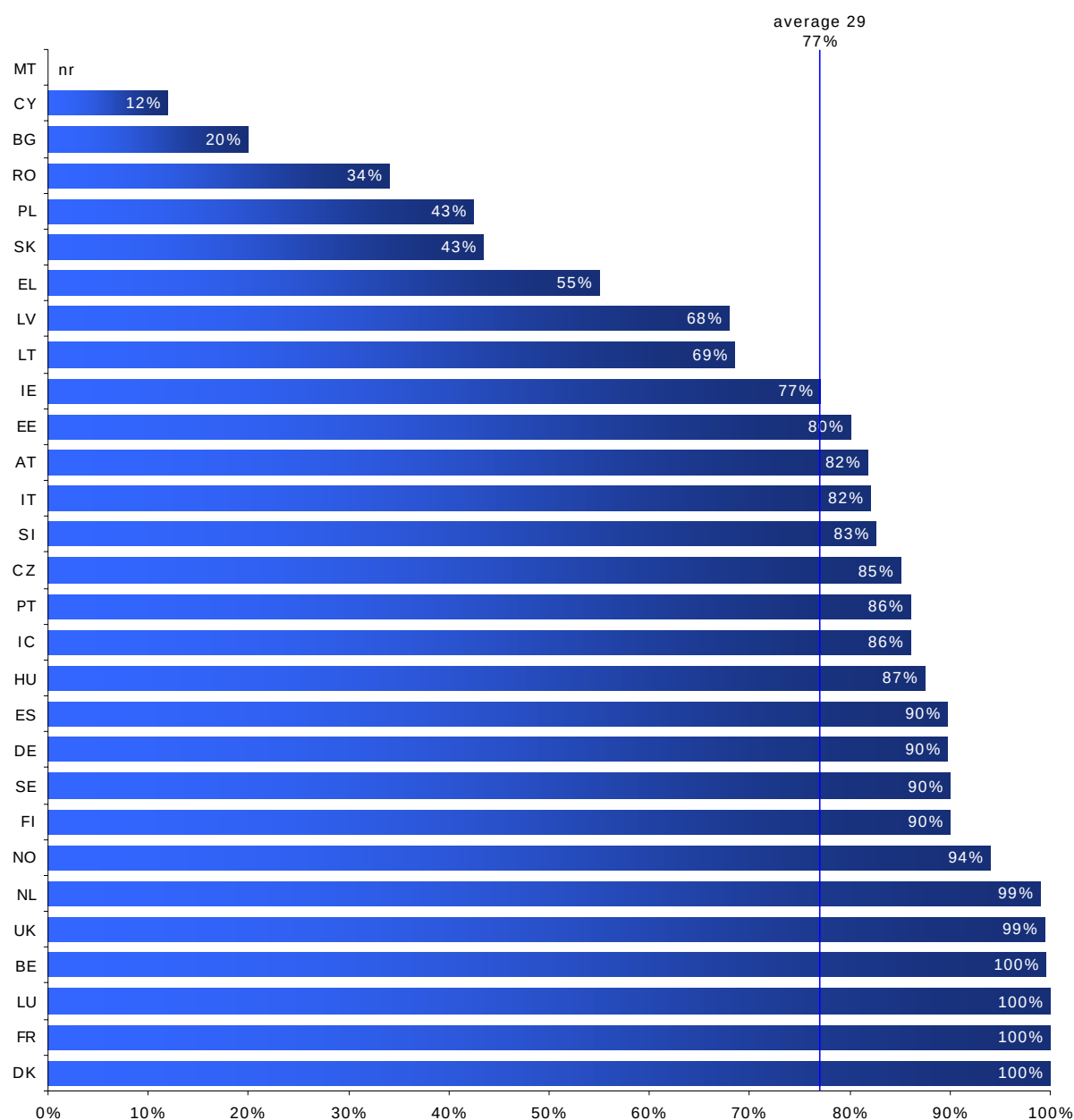


DSL coverage at the national level ranged from 68% (Romania) to 100% or very close to 100% (Denmark, France, Luxembourg, Belgium, the UK) at the end of 2008, with a regional weighted average of 92.8%. In comparison with the average for EU-25 + 2 at the end of 2007, DSL coverage increased by 1.6 points in 2008. Only three Western European countries (Greece, Ireland and Austria) are below the average, while three new Member States (Malta, Estonia and Cyprus) are above it.

Table 3: DSL coverage at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 96.8% | 96.8%     | 94.1% | 94.1%     | 92.7% | 92.8%     |

Figure 6: DSL coverage in rural areas at the end of 2008



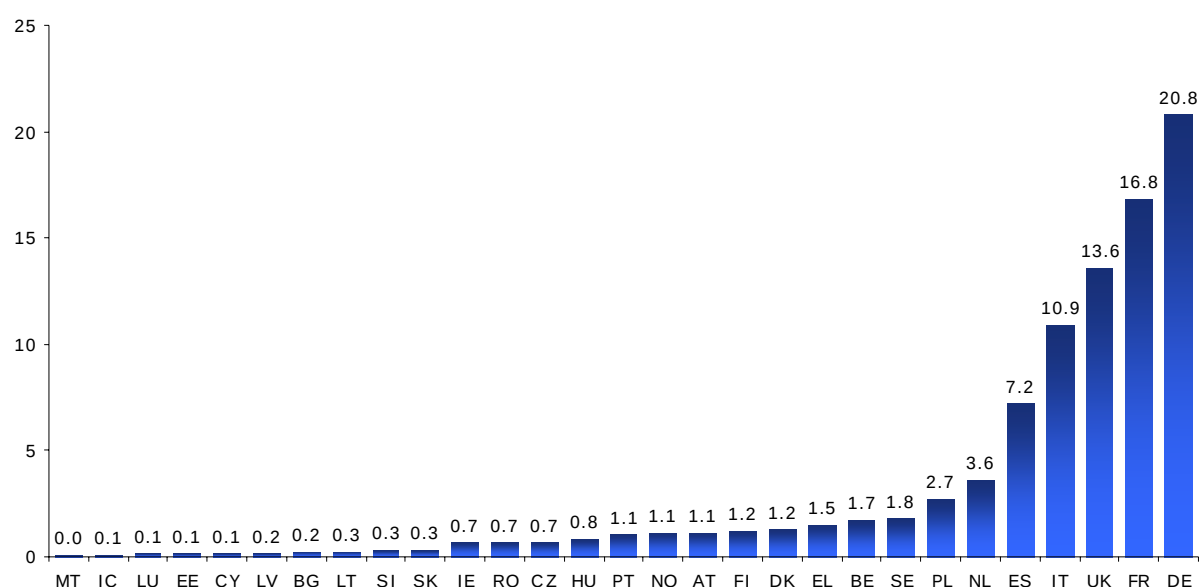
Coverage in rural areas is 77% on average in the 29 countries surveyed. Compared to figures at the end of 2007, coverage in rural areas in EU-25 + 2 has gained 2.4 points, increasing from 79.9% to 82.3%. However, this is still 12 points below the national average (only one point less compared to the situation at the end of 2007). The gap between rural and national coverage even increases to 16 points when we include Bulgaria and Romania which, along with Cyprus, are countries where ADSL is available in only a few rural areas.

Table 4: DSL coverage in rural areas at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 90.3% | 90.4%     | 81.9% | 82.3%     | 76.6% | 77.0%     |

## DSL penetration

Figure 7: National DSL subscriber base at the end of 2008 (in million subscribers)

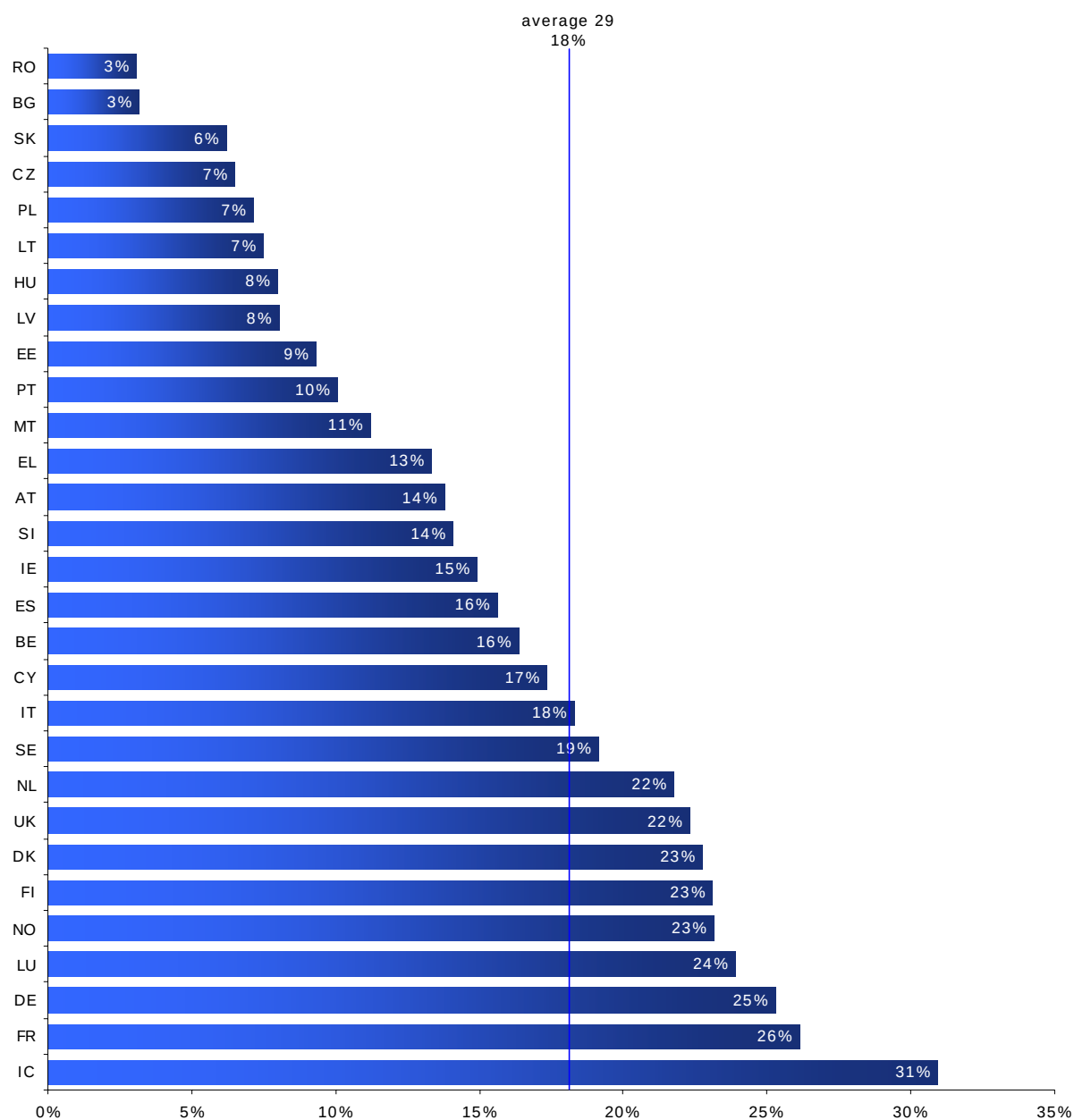


There were 91 million DSL subscribers at the end of 2008 in the 29 countries covered, representing a 12% increase in a year. Germany (20.8 million), France (16.8 million), the UK (13.6 million) and Italy (10.9 million) are by far the largest contributors, and together account for 68% of the regional DSL subscriber base (nearly the same percentage as at the end of 2007).

Table 5: National DSL subscriber bases at the end of 2008 (in million subscribers)

| EU-15  | EU-15 + 2 | EU-25  | EU-25 + 2 | EU-27  | EU-27 + 2 |
|--------|-----------|--------|-----------|--------|-----------|
| 83.299 | 84.506    | 88.868 | 90.077    | 89.758 | 90.967    |

Figure 8: National DSL penetration at the end of 2008

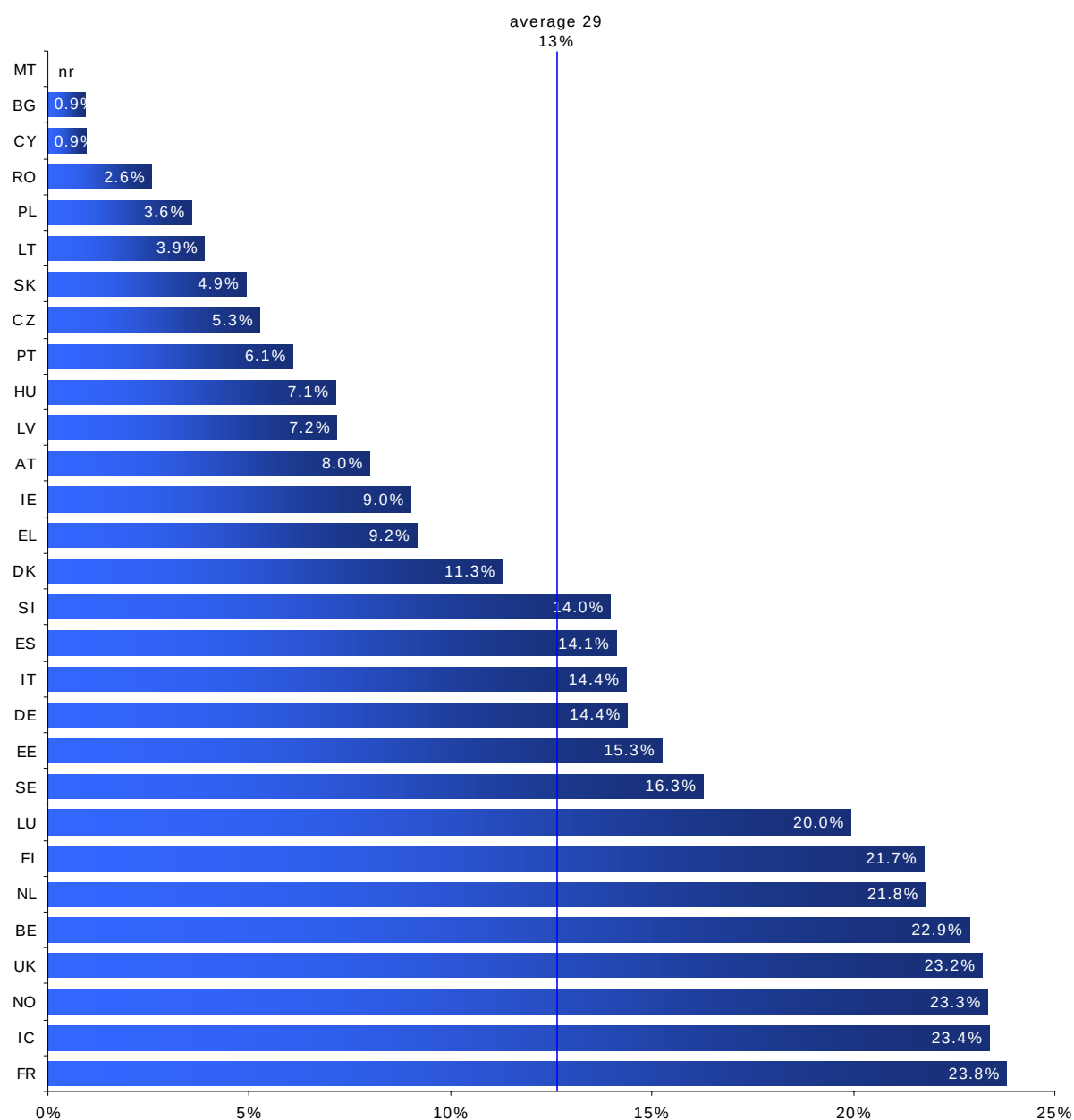


In terms of penetration, figures range from 3.1% in Romania to 31% in Iceland, with a weighted average for the 29 countries of 18.1% (compared to 16.2% at the end of 2007). Aside from Nordic countries, France, Germany and the UK are now amongst the leaders here, with penetration rates of 22% and over.

Table 6: National DSL penetration at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 21.1% | 21.1%     | 18.9% | 19.0%     | 18.0% | 18.1%     |

Figure 9: DSL penetration in rural areas at the end of 2008



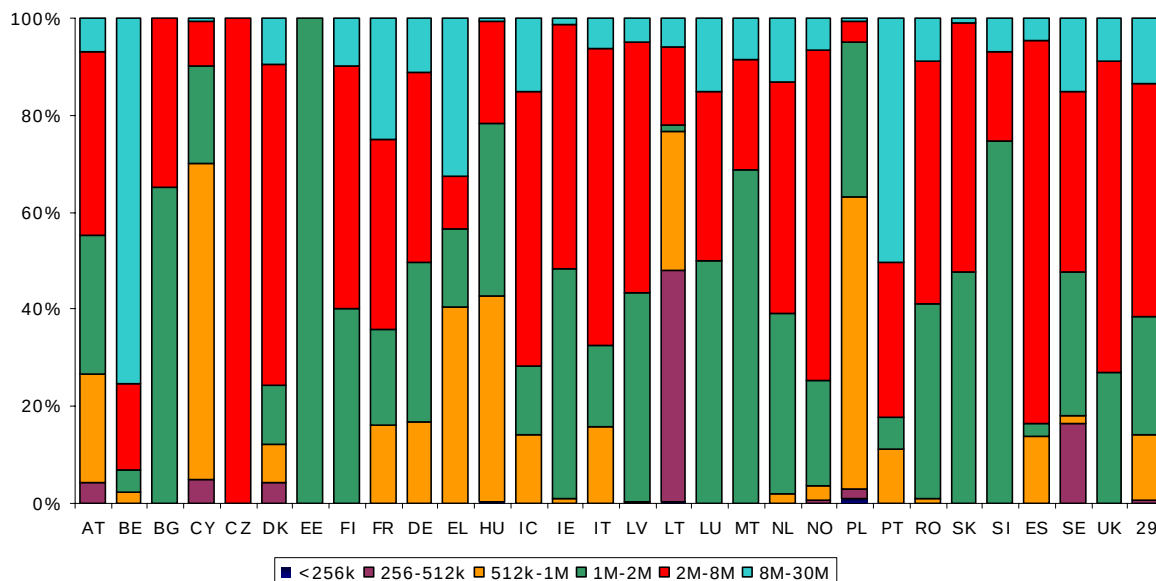
DSL penetration in rural areas is still below national levels (13.6% on average vs. 18%) but it did increase substantially in 2008: by 9.2% compared to the end of 2007.

Table 7: DSL penetration in rural areas at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 16.6% | 16.8%     | 13.5% | 13.8%     | 12.3% | 12.6%     |

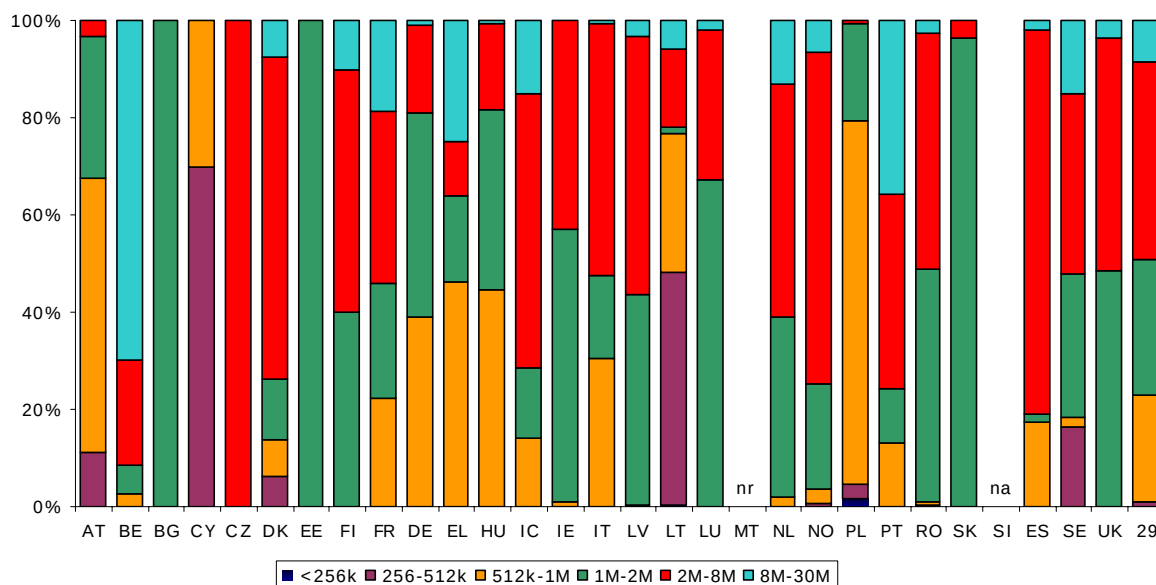
## DSL download rate segmentation

Figure 10: DSL subscriber bases broken down by download rates, at the end of 2008



On average, one out of every two DSL customers subscribes to offers with download rates of between 2 Mbps and 8 Mbps, while 13% subscribe to download rates over 8 Mbps (ADSL2+), one third of them being located in France, and more than 60% when including Germany and the UK. Meanwhile, only 0.6% of customers subscribe to download rates of up to 512 kbps. In most countries (19 in total), connections delivering download speeds of over 2 Mbps now account for 50% or more of total DSL connections. In rural areas, DSL connections with download speeds over 2 Mbps still account for less than 50% (14 points below national levels).

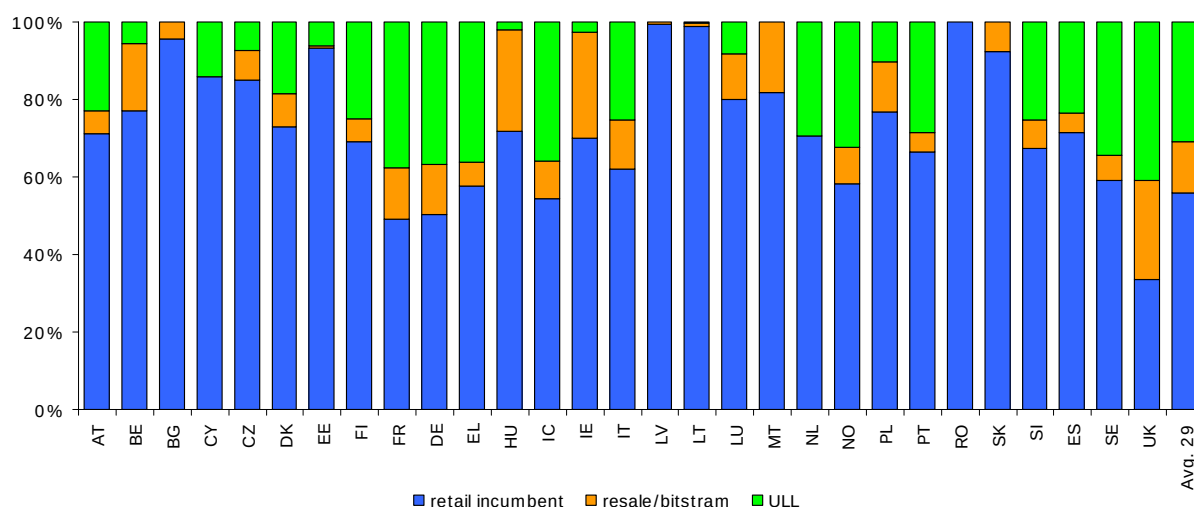
Figure 11: Breakdown of rural DSL subscriber bases by download rate, at the end of 2008



\* Average calculation excludes countries where figures are not available.

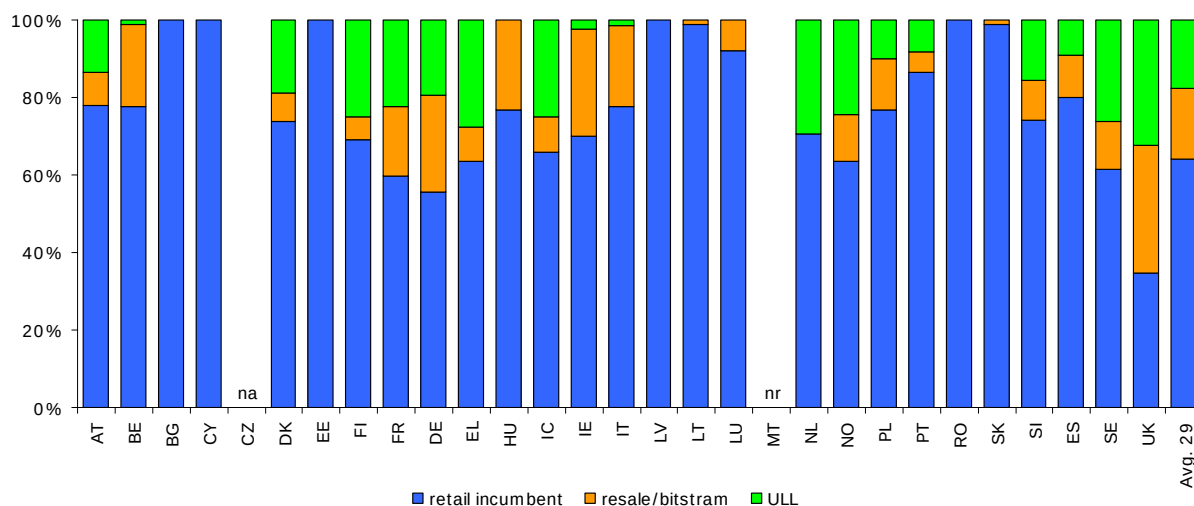
## DSL access origin

Figure 12: DSL subscriber bases broken down by access origin, at the end of 2008



On average, 55.9% of DSL connections are supplied directly by incumbent carriers (56.1% at the end of 2007), while 13.1% are sold through resale and bitstream offers (vs. 16.6% one year before) and 31% through unbundling (vs. 27.3% the previous year). LLU is particularly well-entrenched in the UK (41% of DSL connections at the end of 2008), France (38%), Germany (36.7%), Greece and Iceland (36% for both). Not surprisingly, unbundling remains less developed in rural areas (only 17.7% on average) due to the smaller size of local exchanges which makes it less economical for a competitive supplier to install its own DSLAMs. Resale offers are a slightly more successful, accounting for 18.1% of connections.

Figure 13: Breakdown of rural DSL subscriber bases by access origin, at the end of 2008



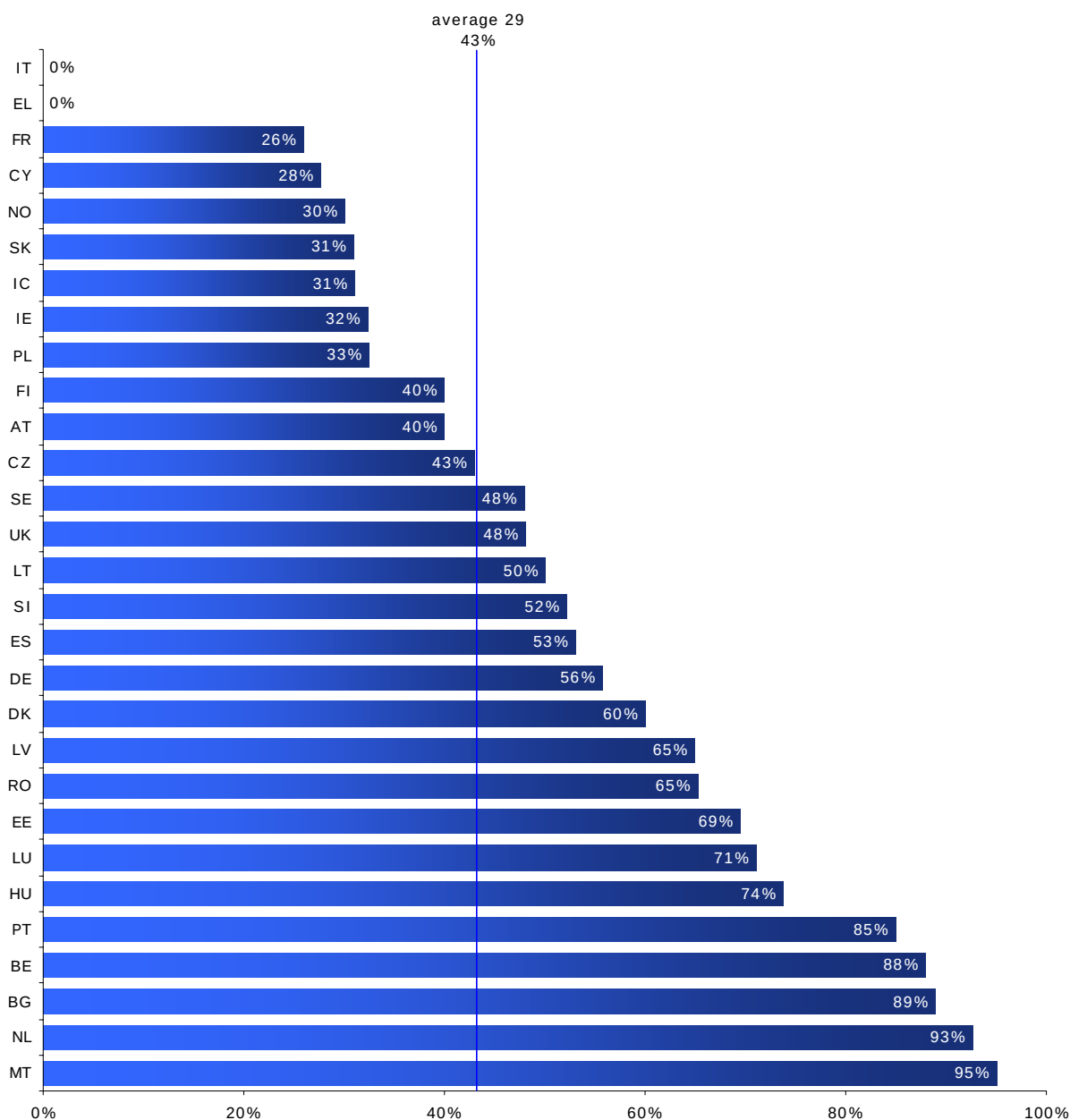
\* Average calculation excludes countries where figures are not available.



### 3.1.3. Cable modem coverage and penetration

#### Cable modem coverage

Figure 14: National cable modem coverage at the end of 2008

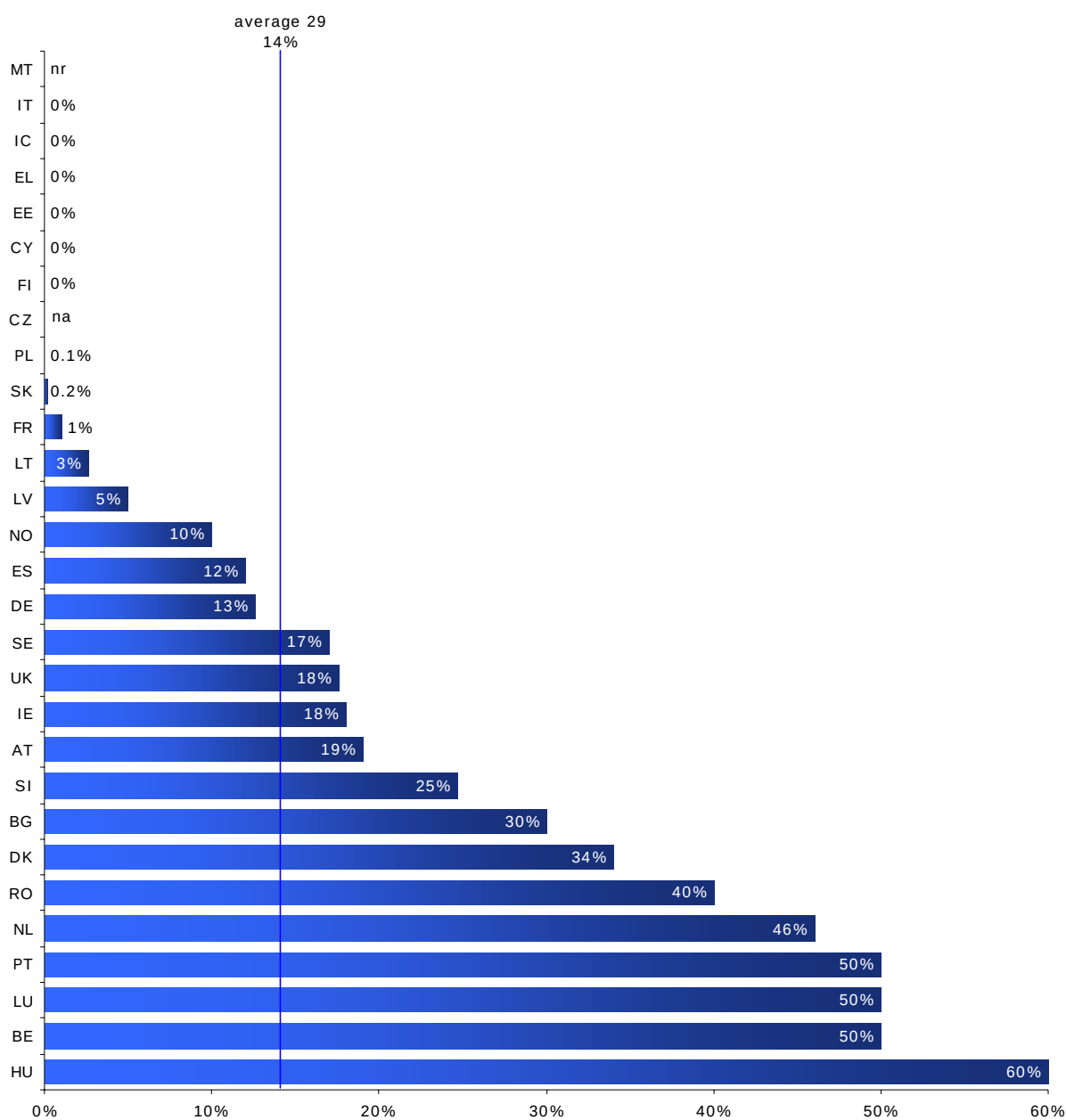


Cable modem coverage at national levels ranged between 0% (Greece and Italy, where it is not at all available) and 95% (Malta) at the end of 2008, with a regional weighted average of 43.4%. It is generally more ubiquitous in Eastern European countries, especially in Bulgaria, Hungary, Estonia, Romania and Latvia (all four countries with national cable modem coverage levels of over 65%) and in Slovenia and Lithuania (with coverage of around 50%).

Table 8: Cable modem coverage at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 41.7% | 41.5%     | 41.9% | 41.7%     | 43.6% | 43.4%     |

Figure 15: Cable modem coverage in rural areas at the end of 2008



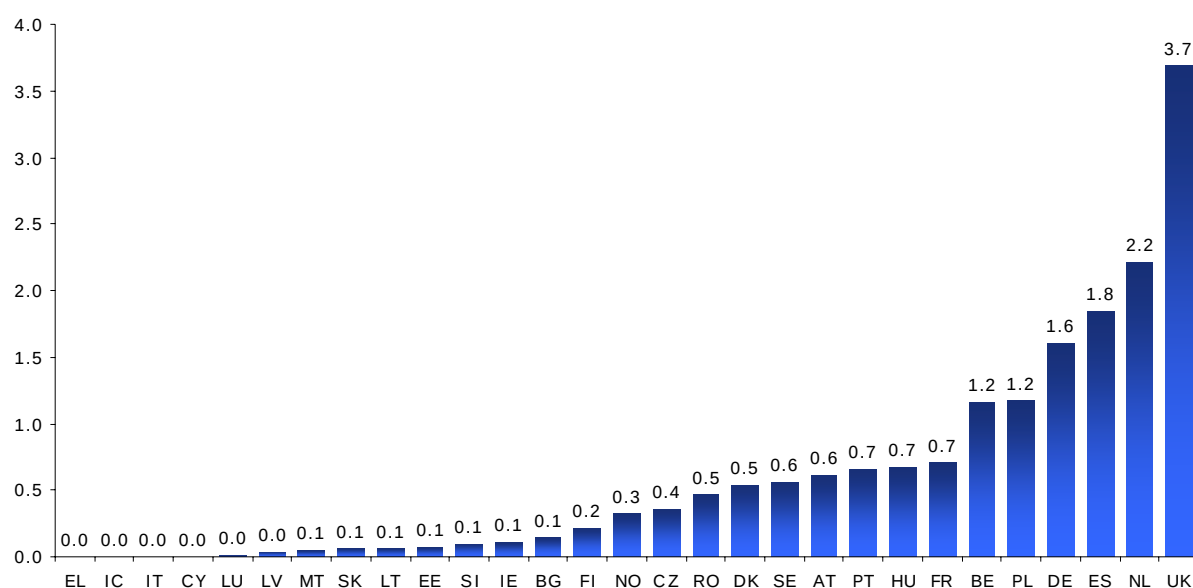
In rural areas, cable modem coverage has reached 13.7% on average, which is 5 points more than at the end of 2007, but still far below coverage at national levels due to the fact that, in many countries (France, the UK), cable is available primarily in big cities only.

Table 9: Cable modem coverage in rural areas at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 11.1% | 11.1%     | 10.7% | 10.7%     | 13.8% | 13.7%     |

## Cable modem penetration

Figure 16: National cable modem subscriber bases at the end of 2008 (in million subscribers)

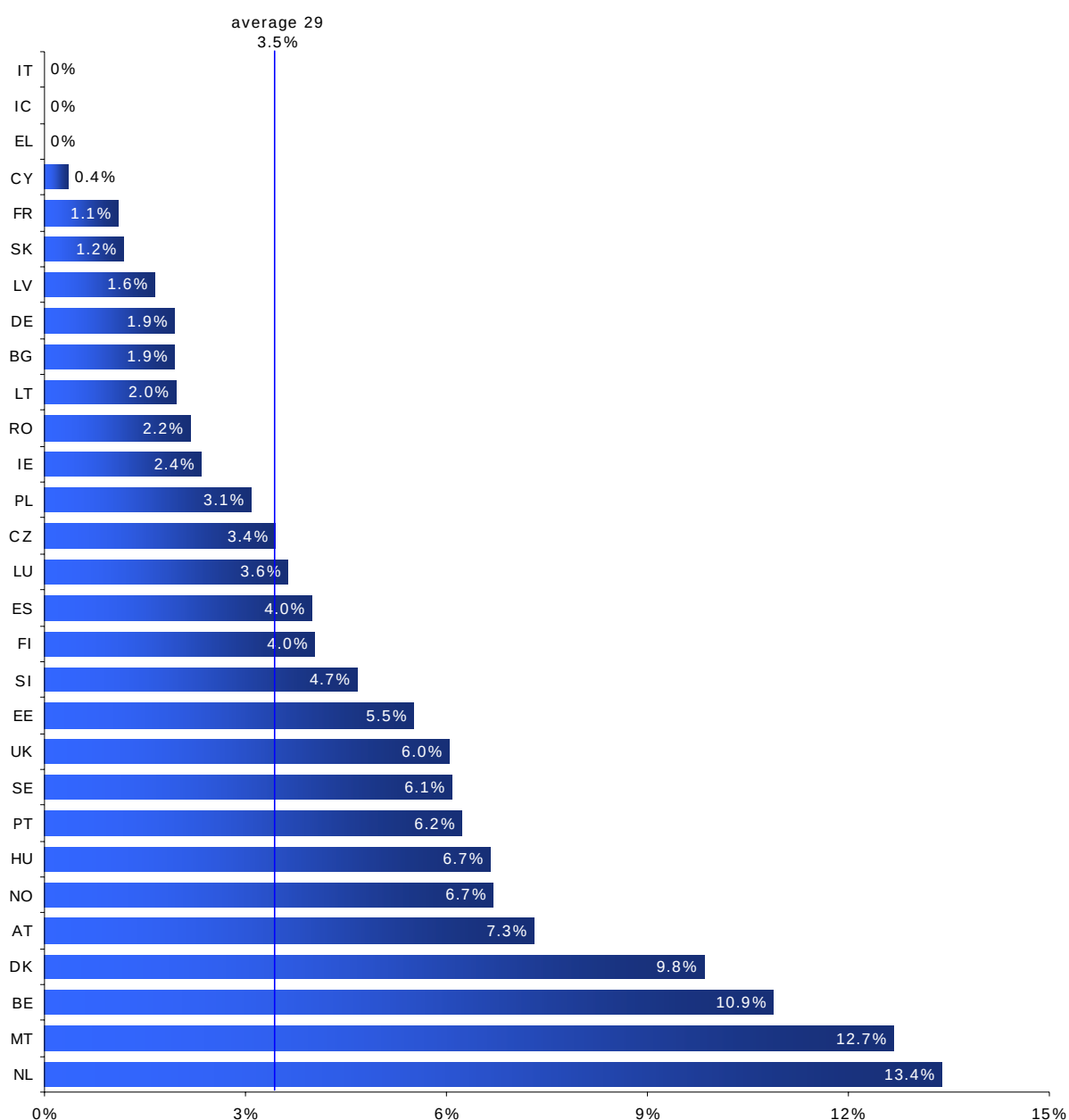


There were 17.4 million cable subscribers at the end of 2008 in the 29 countries covered, which represents a 12% increase over the year before (15.6 million cable modem subscribers at the end of 2007). The UK still leads the way with 3.7 million subscribers, or 21% of the regional total. The four largest cable modem markets in Europe (the UK, Netherlands, Spain and Germany) account for more than half of the regional subscriber base.

Table 10: National cable modem subscriber bases at the end of 2008 (in million subscribers)

| EU-15  | EU-15 + 2 | EU-25  | EU-25 + 2 | EU-27  | EU-27 + 2 |
|--------|-----------|--------|-----------|--------|-----------|
| 13.903 | 14.224    | 16.497 | 16.818    | 17.107 | 17.428    |

Figure 17: National cable modem penetration at the end of 2008

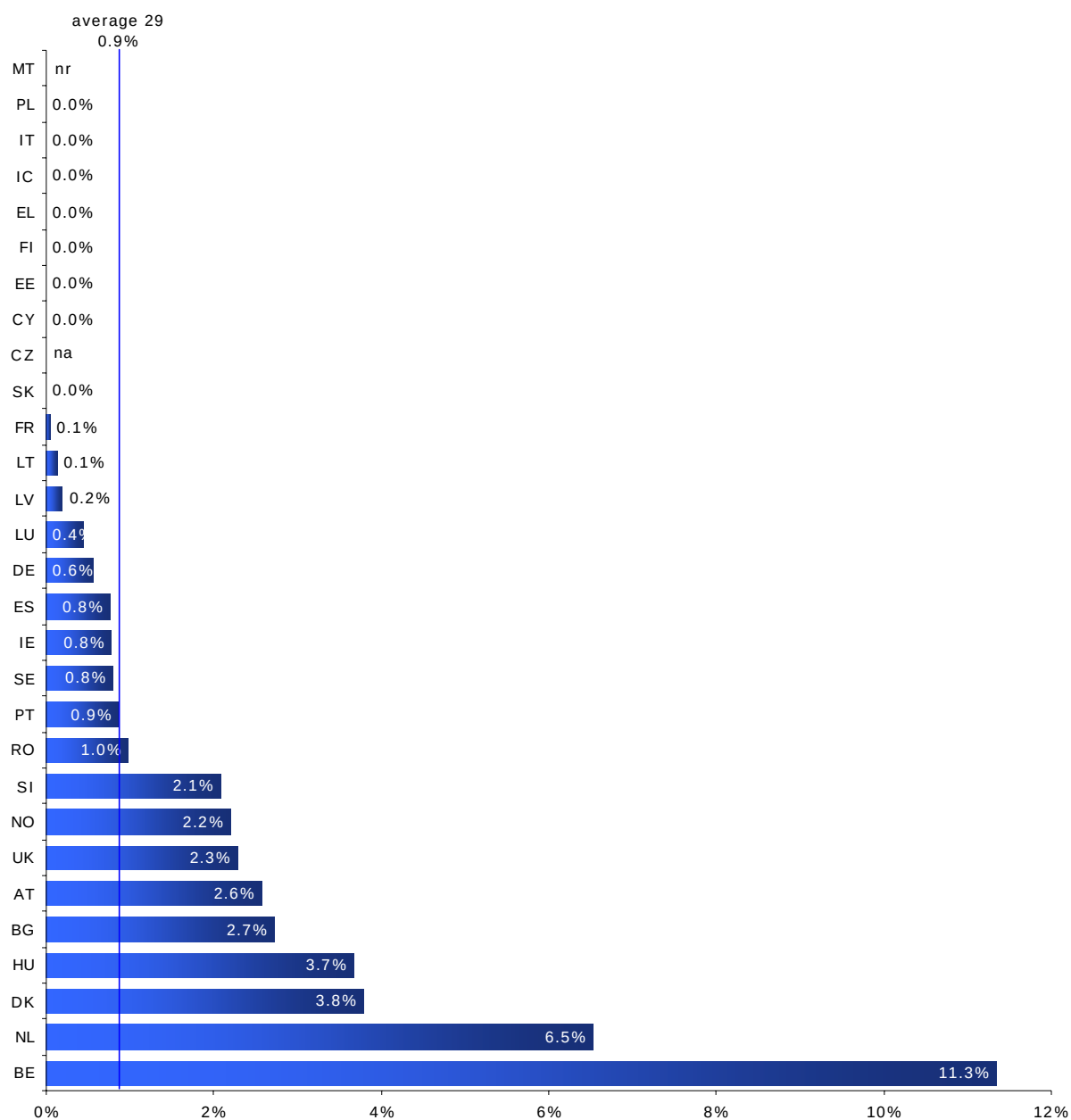


In terms of penetration, figures ranged from 0% in Greece and Italy, where cable is not available, to 13.4% in the Netherlands at the end of 2008, with a weighted average for the 27 countries of 3.5%, i.e. well below DSL penetration rates.

Table 11: National cable modem penetration at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 3.5%  | 3.5%      | 3.5%  | 3.5%      | 3.4%  | 3.5%      |

Figure 18: Cable modem penetration in rural areas at the end of 2008



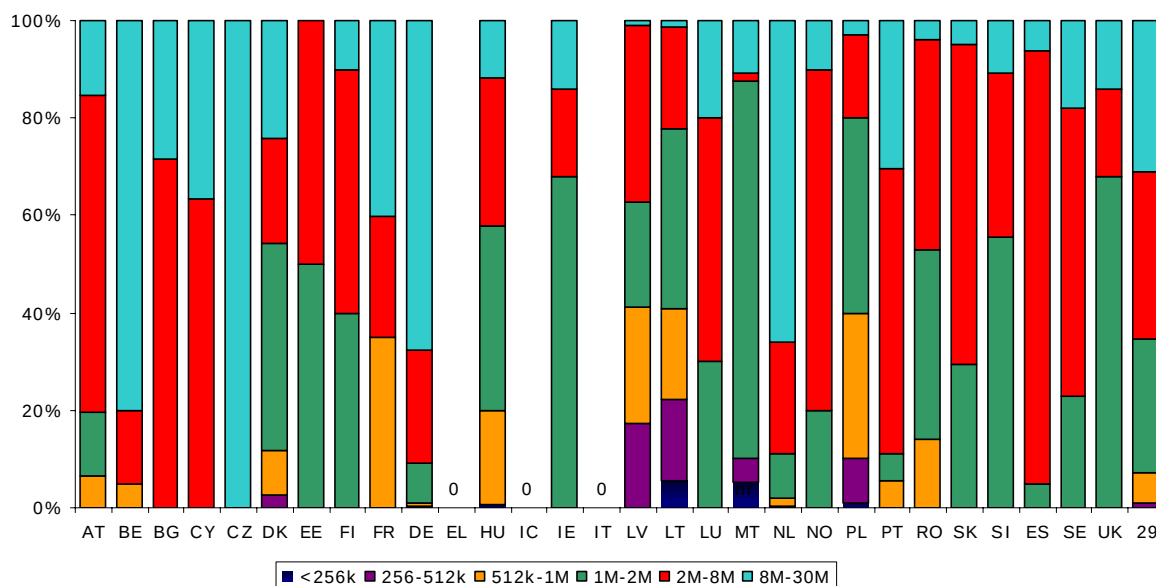
Cable modem penetration in rural areas is very low, with a European average of 0.9%, with only Belgium and the Netherlands reporting significant penetration in rural areas.

Table 12: Cable modem penetration in rural areas at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 0.9%  | 0.9%      | 0.8%  | 0.8%      | 0.8%  | 0.9%      |

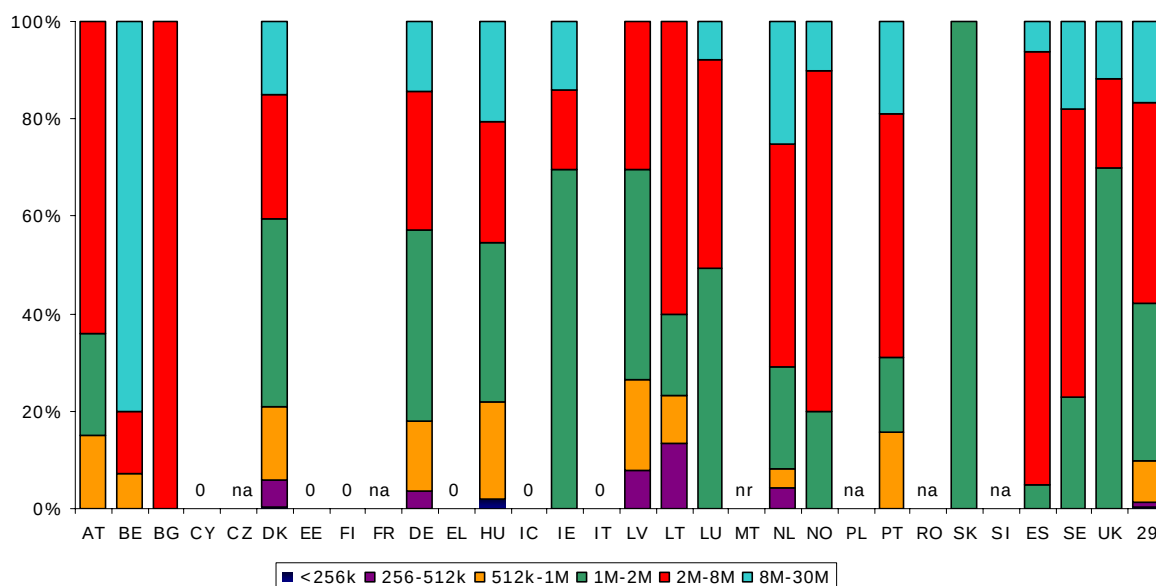
## Cable modem download rate segmentation

Figure 19: Breakdown of cable modem subscriber bases by download rates, at the end of 2008



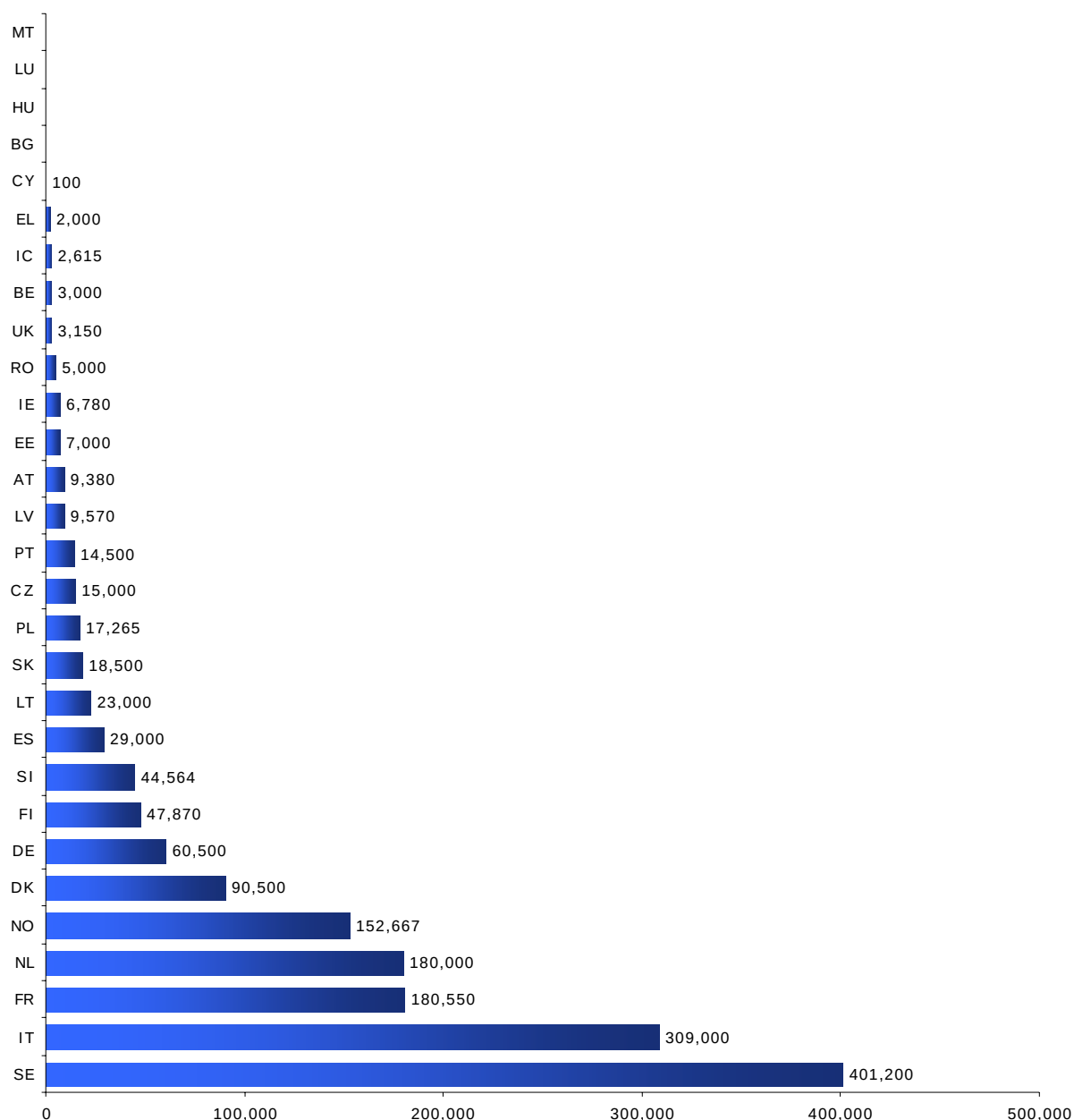
On average, 65.5% of cable modem customers subscribed to offers with download rates of over 2 Mbps (59.3% at the end of 2007). More significantly, 31.1% subscribe to download rates of over 8 Mbps, which is just 10 points more than at the end of 2007. In 10 countries (Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Germany, the Netherlands, Norway, Portugal and Spain), connections with download speeds over 2 Mbps account for 80% or more of total cable modem connections. On average, cable modem connections offer slightly higher download rates than DSL, and disparities between national and rural levels are minimal (only significant in the highest speed ranges).

Figure 20: Breakdown of rural cable modem subscriber bases by download rates, at the end of 2008



### 3.1.4. FTTH subscribers

Figure 21: Number of FTTH/FTTB subscribers, at the end of 2008



The number of FTTH/FTTB subscribers was just over 1.6 million at the end of 2008 in the 29 countries covered – up from 1 million at the end of 2007. 75% of the installed base is concentrated in five countries (Sweden, Italy, France, the Netherlands and Norway).

### 3.1.5. Satellite solutions

- IDATE estimates that there were still close to 10 million households in Europe that were not covered by a terrestrial broadband solution in 2008.
- After having emerged in North America and Asia, satellite broadband in the Ka band was introduced in Europe in mid-2007 and has since proven a popular solution for accompanying wide-reaching government plans to reduce the digital divide.
- The revival of the satellite broadband market has been enabled by a massive drop in the price of terminals, combined with the introduction of the Ka band which has helped bring down the price of bandwidth considerably.
- However, the broadband satellite consumer market is still only nascent in Europe and operators are in the process of establishing their positions.

**Table 13: Positioning strategies available to a satellite operator**

|                                                        | Zone 1<br>Well developed<br>broadband market                                                                                                                   | Zone 2<br>Catching up steadily                                                                                                                                                                                                     | Zone 3<br>Still lagging behind                                                                                                                                                                                          |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                        | Western Europe                                                                                                                                                 | Baltic states, Portugal, Slovenia                                                                                                                                                                                                  | Eastern Europe (except Baltic states, Slovenia), Greece                                                                                                                                                                 |
| <b>Most suitable initial strategic positioning</b>     | Reduction of the digital divide<br>Partnership with a DTH platform                                                                                             | Reduction of the digital divide<br>Partnership with a DTH platform                                                                                                                                                                 | Internet pure player<br>Partnership with a DTH platform                                                                                                                                                                 |
| <b>Most suitable longer term strategic positioning</b> | Reduction of the digital divide<br>Partnership with a DTH platform                                                                                             | Reduction of the digital divide<br>Partnership with a DTH platform                                                                                                                                                                 | Reduction of the digital divide<br>Partnership with a DTH platform                                                                                                                                                      |
| <b>Potential target market for satellite</b>           | <b>++</b><br><b>3.9 million households</b> not covered by a broadband network at the end of 2008<br>But wireless network rollouts expected in the coming years | <b>+</b><br><b>0.5 million households</b> not covered by a broadband network at the end of 2008<br>But wireless network rollouts expected, PC penetration rate limited but rising rapidly, and lower GDP per capita than in zone 1 | <b>+++</b><br><b>5.3 million households</b> not covered by a broadband network at the end of 2008<br>But wireless network rollouts expected, PC penetration rate limited but rising rapidly, and average GDP per capita |

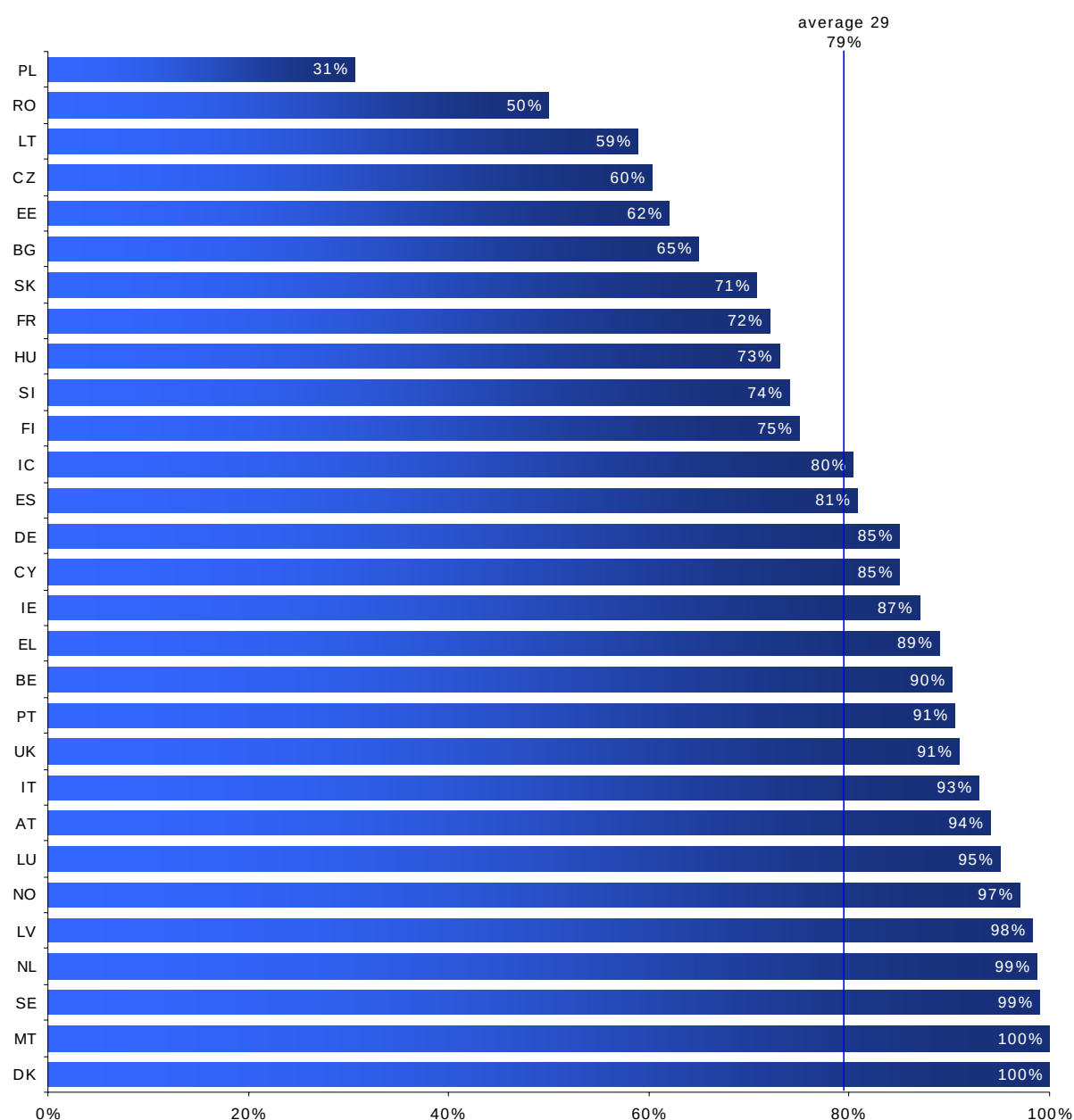
Source: IDATE



### 3.1.6. 3G coverage and take-up

#### 3G population coverage

Figure 22: National 3G (UMTS) population coverage at the end of 2008



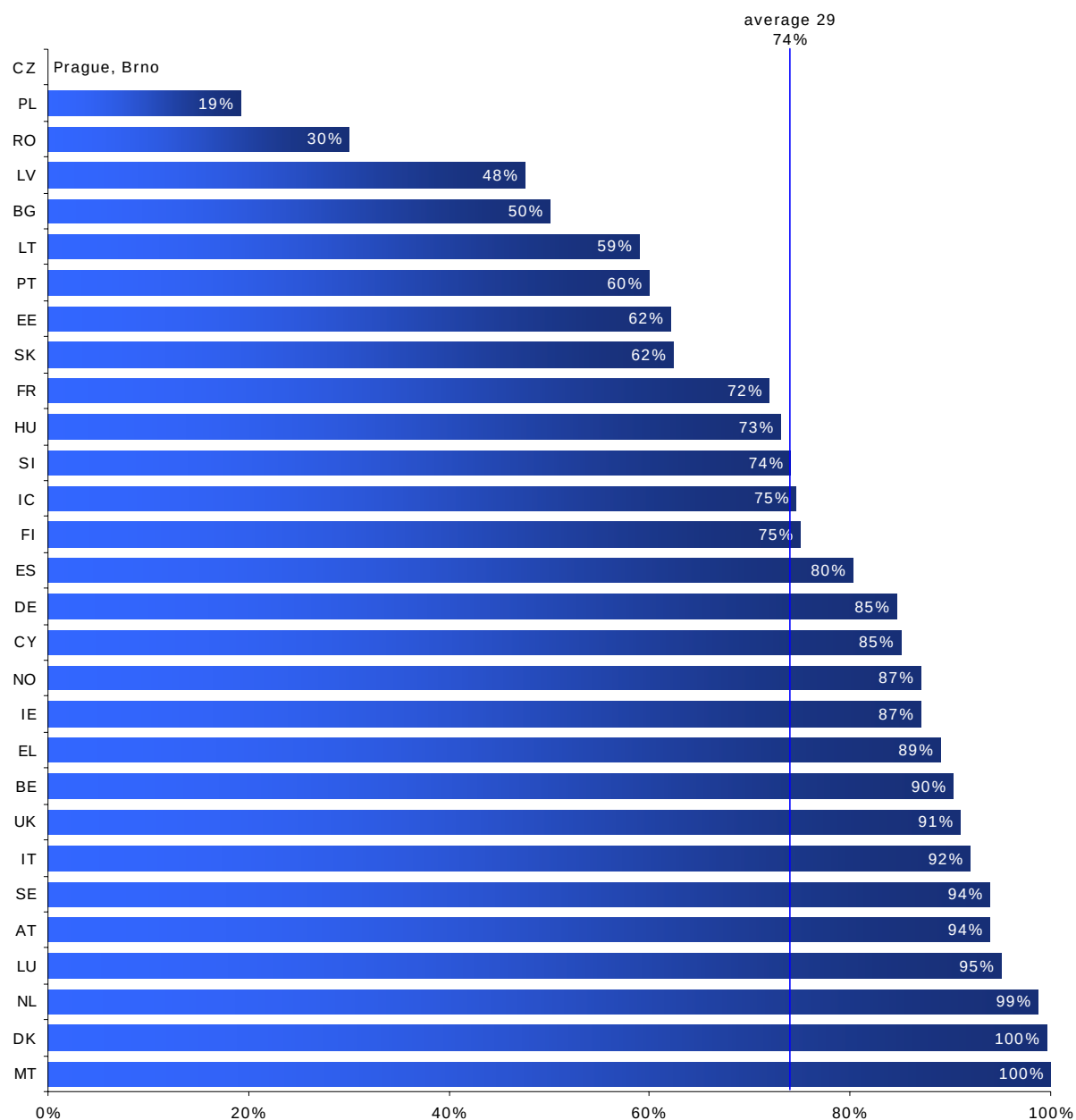
At the end of 2008, 3G deployment was underway in all countries, with an average population coverage of 86%. The above figure refers to UMTS coverage with speeds of 384 Kbps and upwards. In numerous countries, operators have also upgraded their networks to 3.5G (HSDPA notably) to offer higher speeds (1.5 Mbps+). See below for details.

Table 14: 3G coverage at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 86%   | 86%       | 80%   | 81%       | 79%   | 79%       |

### 3G+ population coverage

Figure 23: National 3G+ (HSDPA) population coverage at the end of 2008



On the whole, 3G+ coverage is by now close to 3G coverage levels, especially in Western European countries (85% on average). However, there are still significant gaps between 3G and 3G+ coverage in Portugal, Norway and a number of Eastern European countries (the Czech Republic, Poland, Latvia, Romania and Bulgaria).

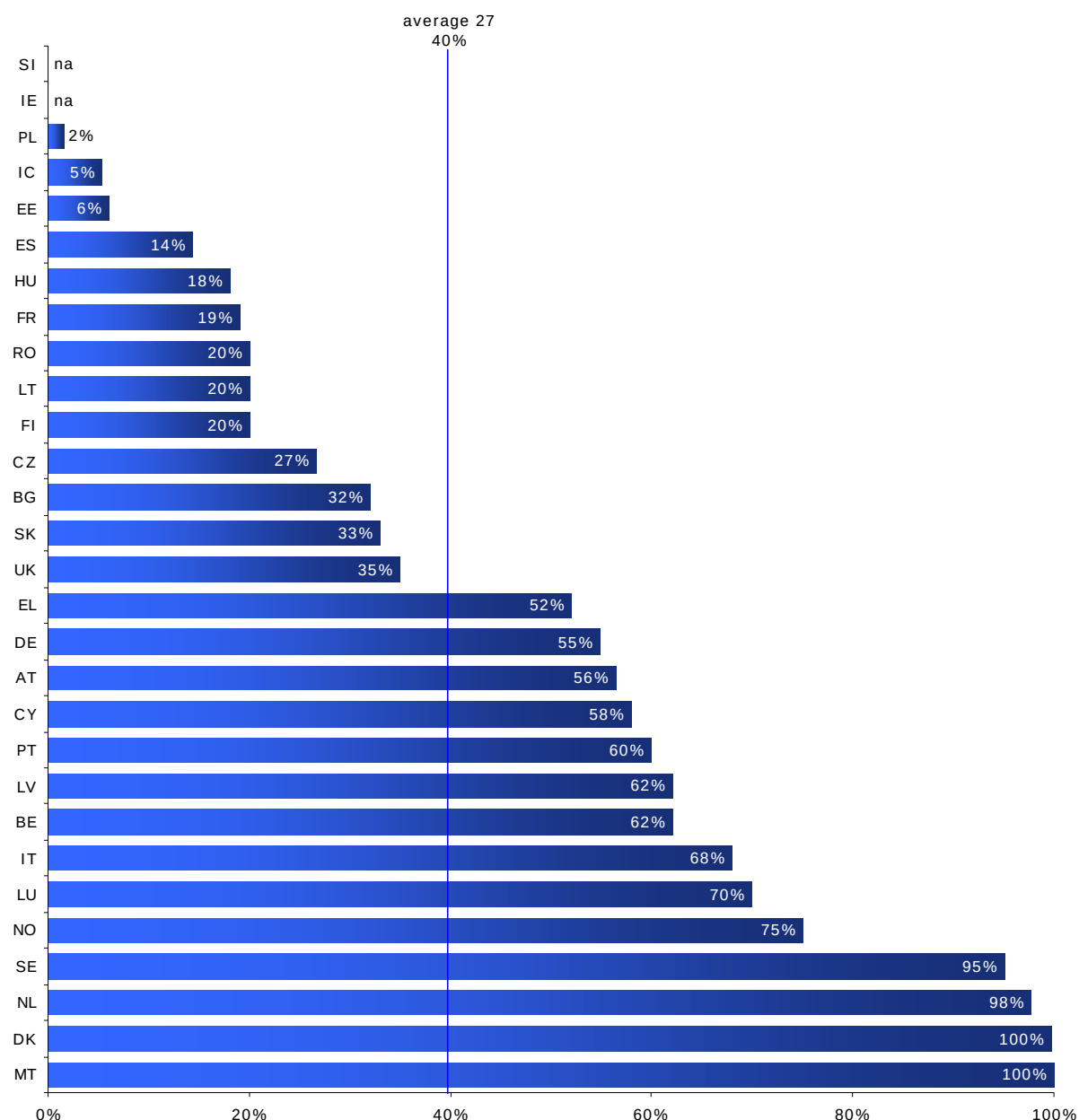
Table 15: 3G+ coverage at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 85%   | 85%       | 77%   | 77%       | 74%   | 74%       |

\* Average calculation excludes countries where figures are not available.

## Territorial 3G coverage

Figure 24: National territorial 3G (UMTS) coverage at the end of 2008



Territorial coverage for 3G (UMTS) is lower than population coverage due to the fact that the first rollouts were performed in densely populated areas (large towns, dense suburban areas) and, except in a few countries, rural areas are still largely underserved. In average, UMTS territory coverage was close to 40% at the end of 2008. 3G networks were largely upgraded to HSDPA: however, there are still significant gaps in some countries between UMTS and HSDPA coverage levels, notably in a few Nordic countries (Sweden, Norway). Average for HSDPA coverage is 27%.

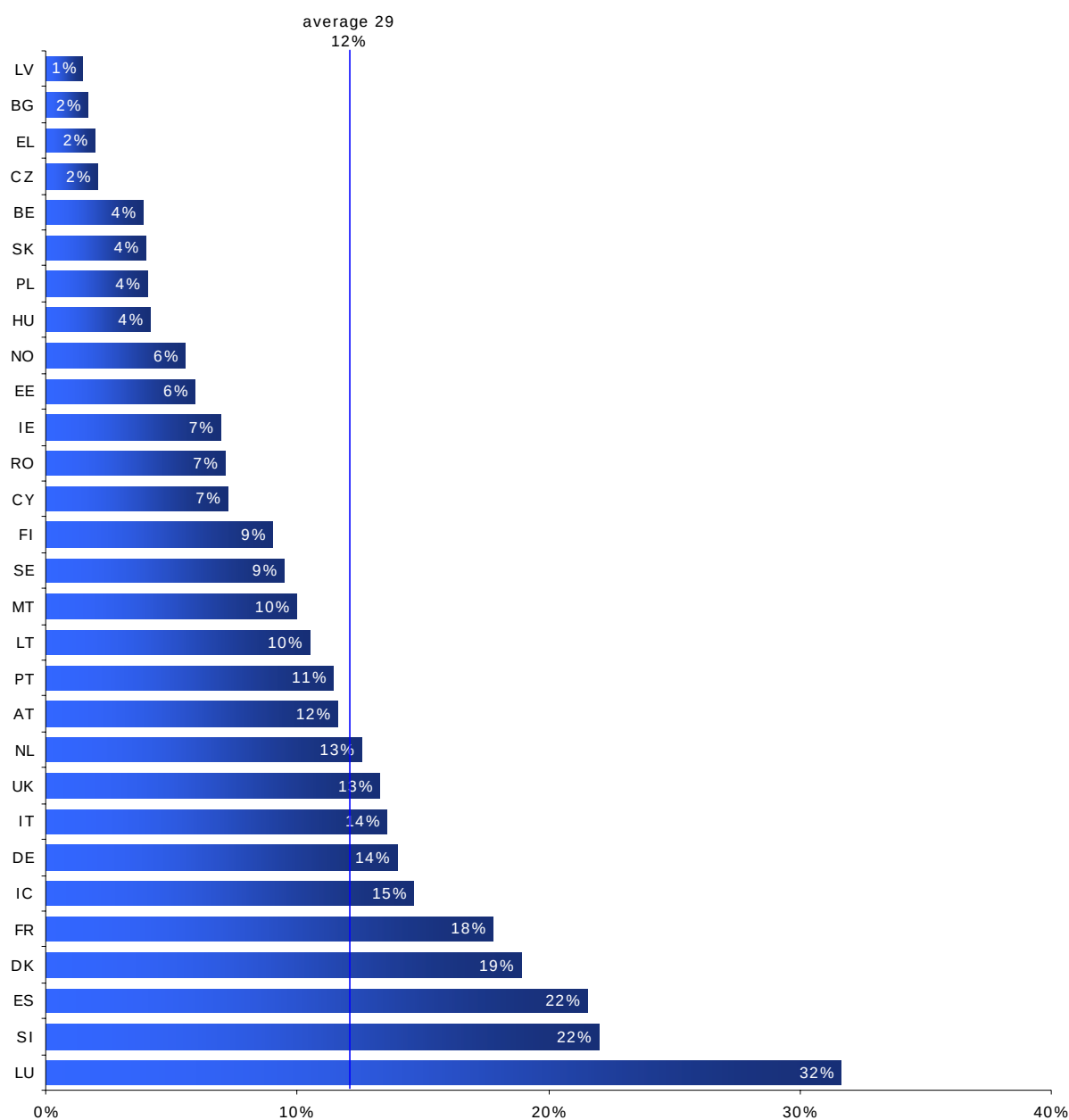
Table 16: 3G coverage at the end of 2008 (as a % of the territories)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 44%   | 46%       | 39%   | 41%       | 38%   | 40%       |

\* Average calculation excludes countries where figures are not available.

## 3G penetration

Figure 25: National 3G (UMTS) penetration at the end of 2008



There were 62.2 million 3G active users at the end of 2008 in the 29 countries covered, which represents a 12.3% penetration rate. Take-up is slightly more advanced in Western countries (EU-15 + 2).

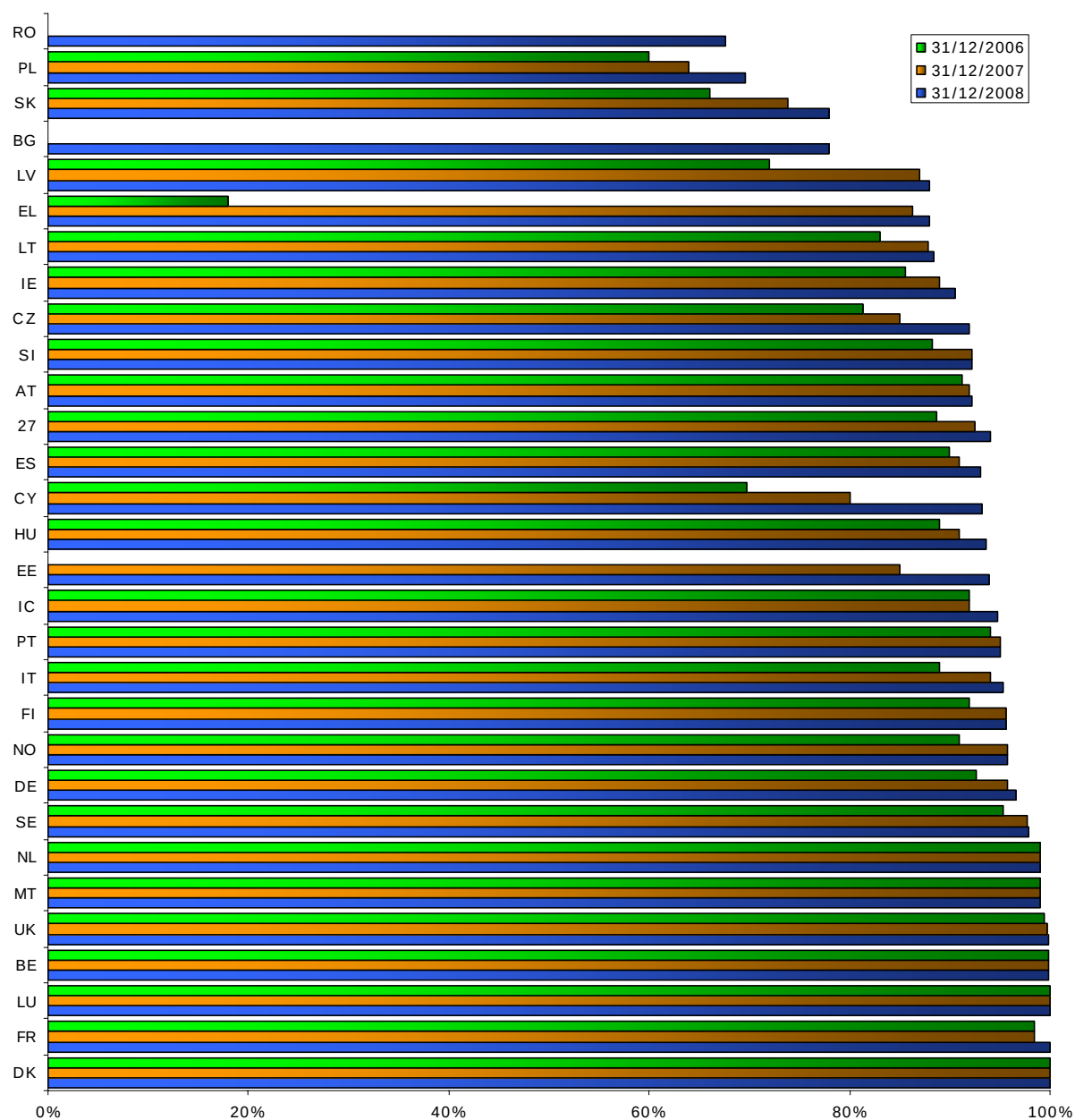
Table 17: 3G penetration at the end of 2008 (as a % of the population)

| EU-15 | EU-15 + 2 | EU-25 | EU-25 + 2 | EU-27 | EU-27 + 2 |
|-------|-----------|-------|-----------|-------|-----------|
| 14.4% | 14.3%     | 12.8% | 12.7%     | 12.4% | 12.3%     |

## 3.2. EU-25 + Norway & Iceland, from year-end 2006 to year-end 2008

### 3.2.1. Coverage

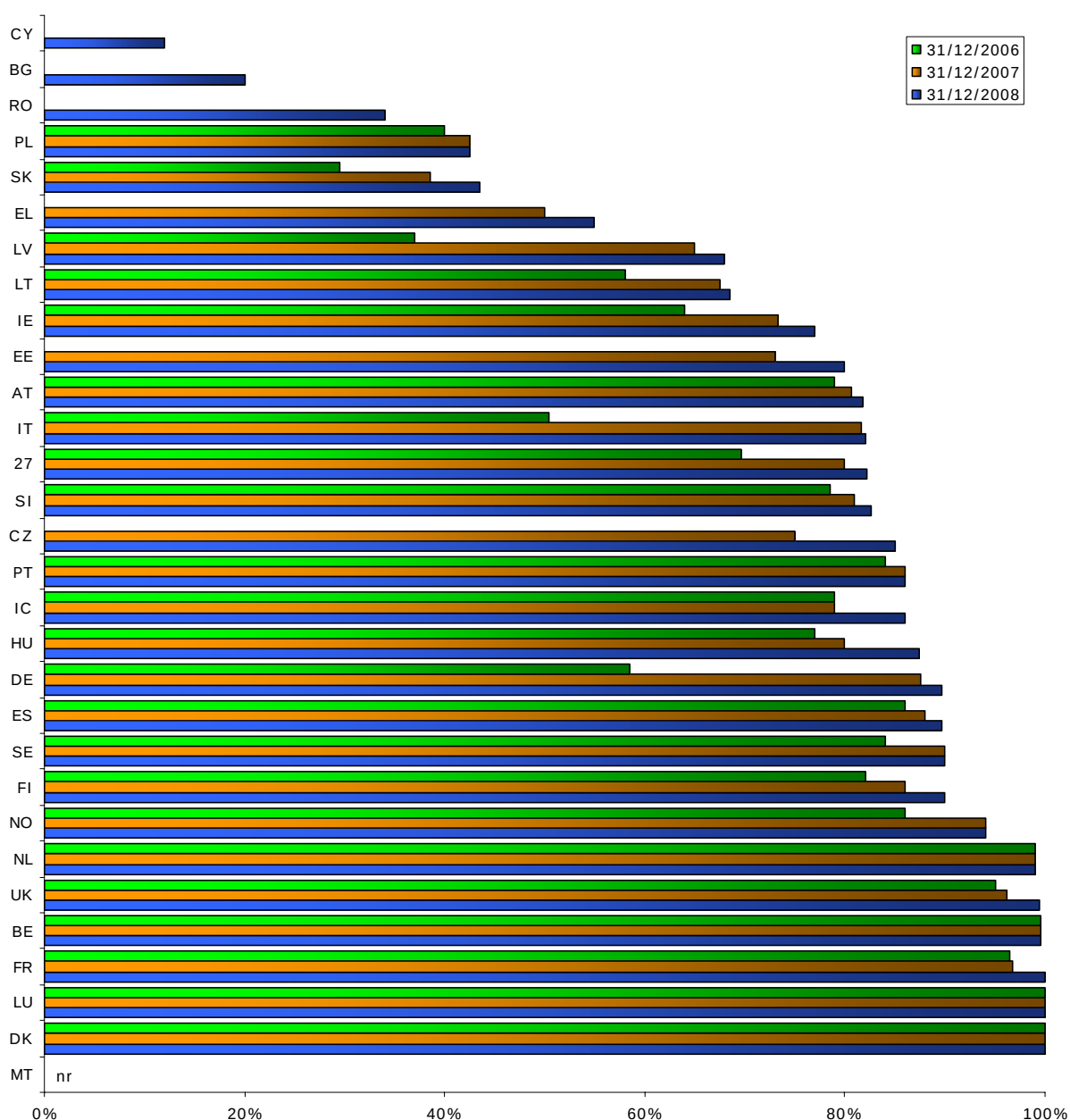
Figure 26: National DSL coverage



Average DSL coverage in the EU-25 + 2\* was close to 94% at the end of 2008. DSL coverage now exceed 90% in most countries (22) and, in 2008, increased substantially in Poland and Slovakia, which are still however lagging behind, along with Romania and Bulgaria), while real strides were also made in Cyprus and, to some extent, in Spain.

\* Comparisons are produced for the EU-25 + 2 since figures for Romania and Bulgaria were not collected for previous years

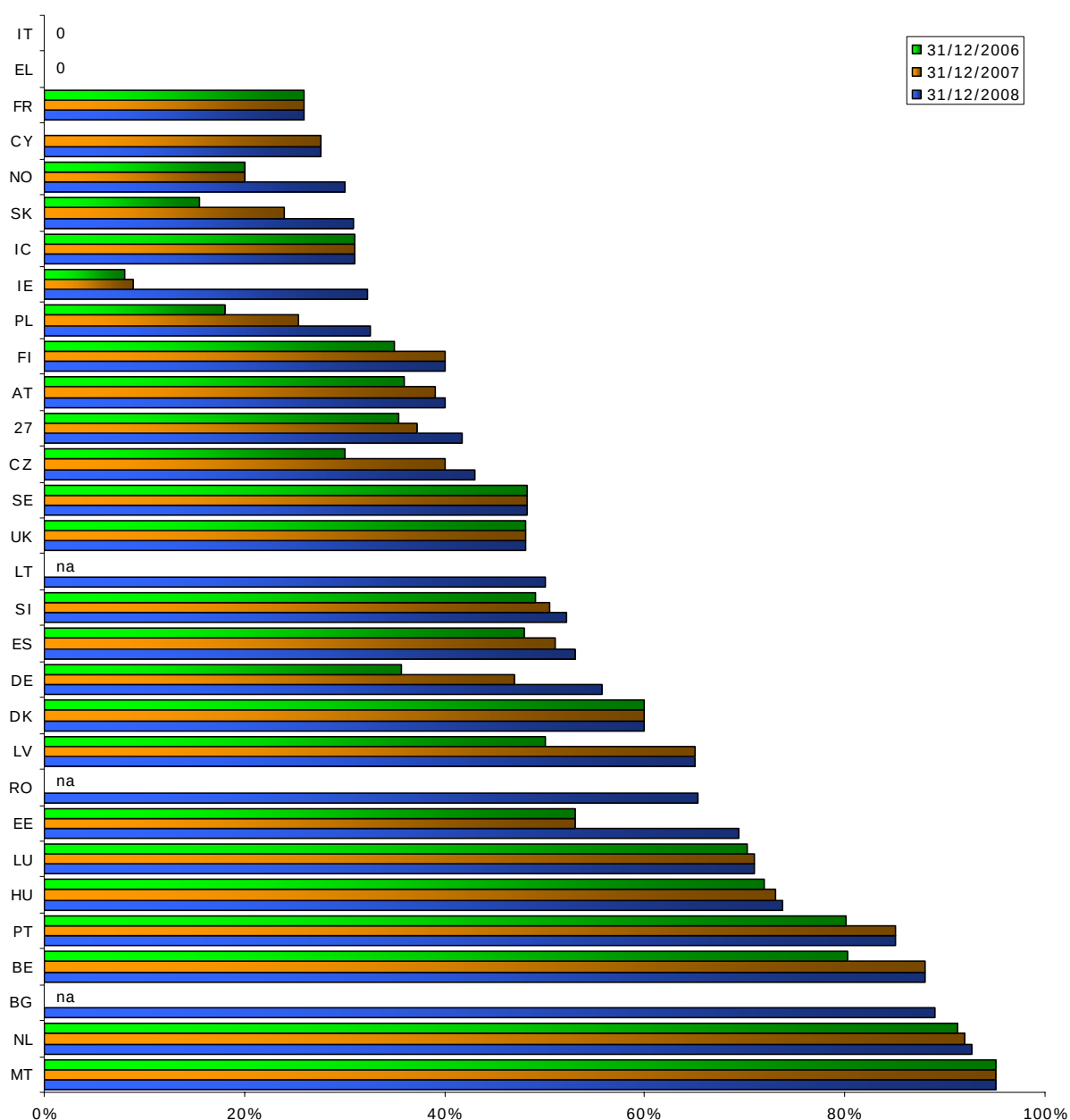
Figure 27: Rural DSL coverage



Regarding DSL coverage in rural areas, significant progress has been made in all countries, even if it is still low in some new Member States and in Greece. Progress has been especially good in recent years in Slovakia, Greece, Estonia, the Czech Republic, Iceland and Hungary. The average for the EU-25 + 2 was just over 82% at the end of 2008 (+12.6 points compared to the end of 2007) which nevertheless remains 11 points below national coverage levels.

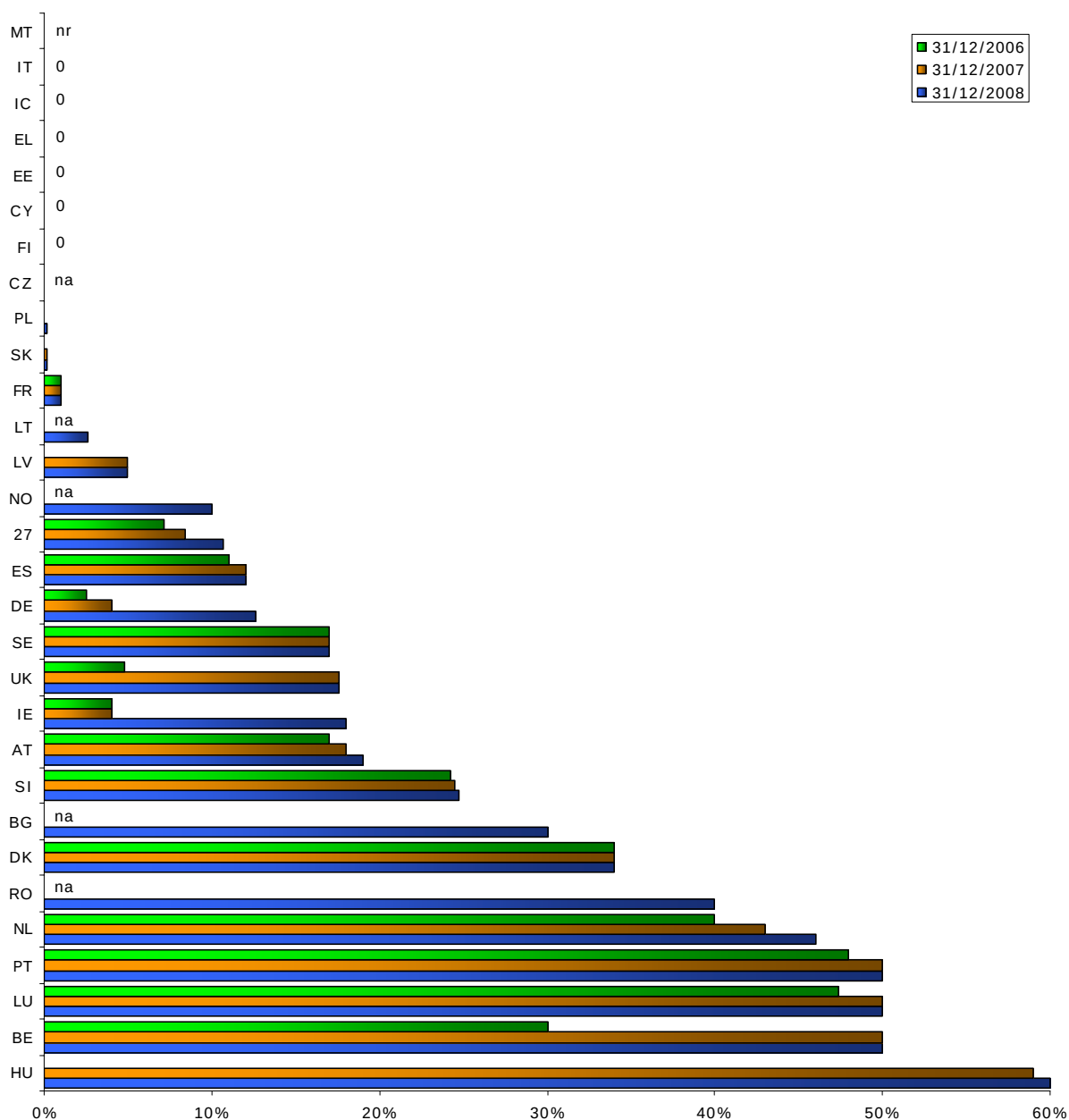
\* Average calculation is weighted based on the rural population in the different countries.

Figure 28: National cable modem coverage



Average cable modem coverage in the EU-25 + 2 was close to 42% at the end of 2008, up from 35% at the end of 2006. The situation still differs widely from country to country: from Greece and Italy where cable is not available at all, to the Netherlands and Malta where cable modem is now available to over 90% of the population.

Figure 29: Rural cable modem coverage



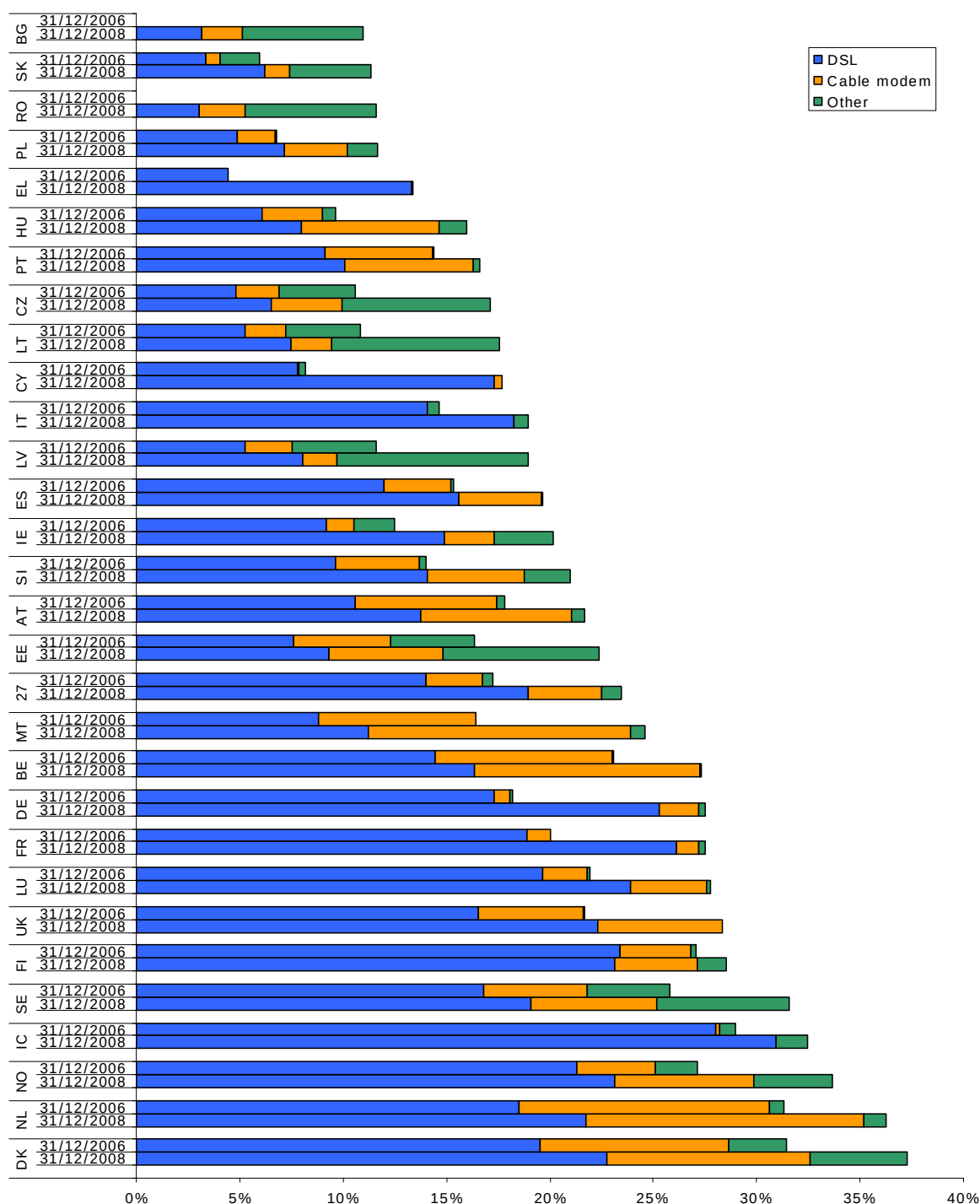
Average cable modem coverage in rural areas is still low compared to national coverage levels: less than 11% compared to 42% for national coverage. Even in countries where cable is well developed, such as the Netherlands, Belgium and Portugal, cable modem access is only available to between 40% and 50% of the population in rural areas.

\* Average calculation is weighted based on the rural population in the different countries.



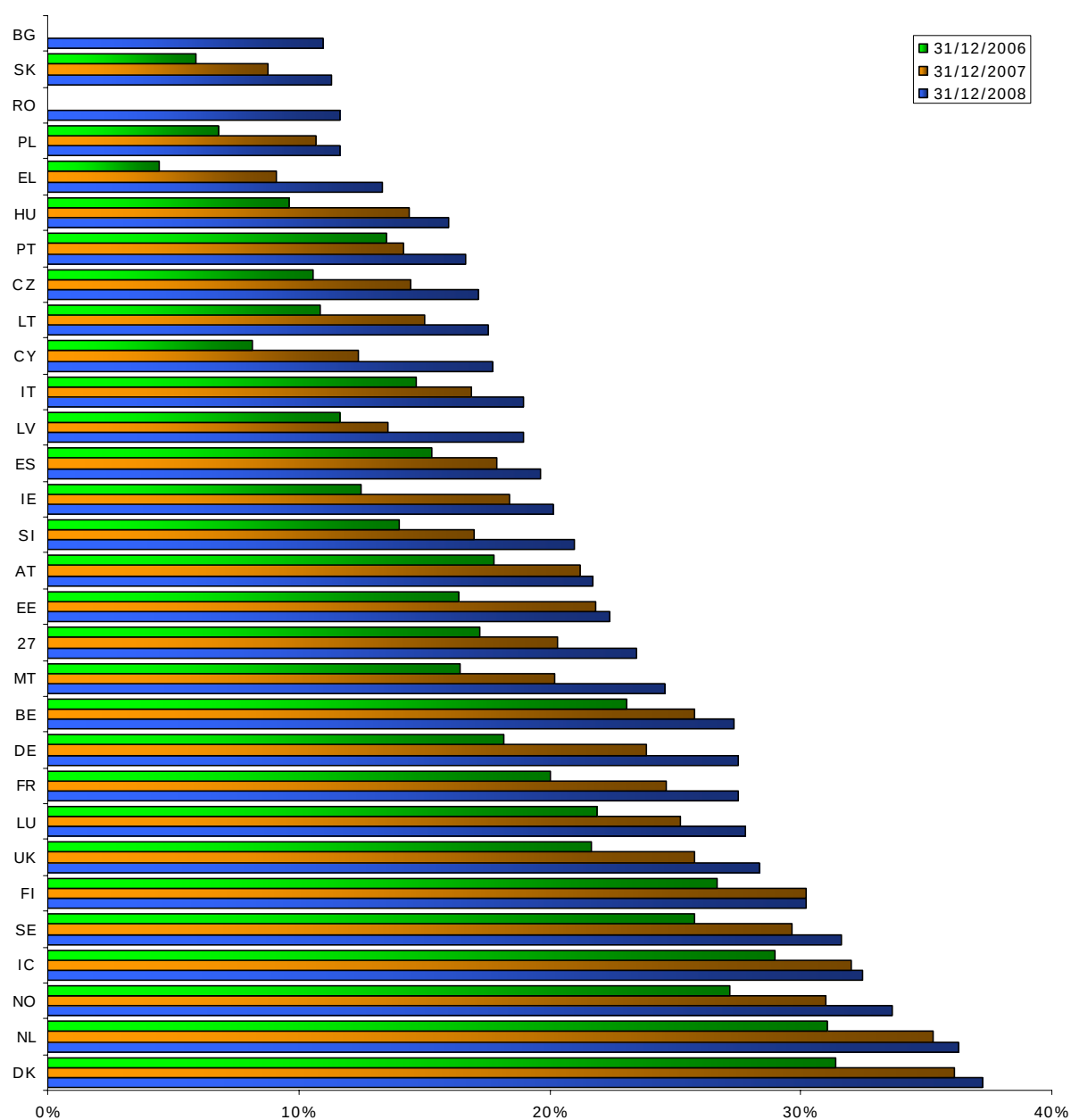
### 3.2.2. Penetration

Figure 30: Broadband penetration by technology, 2006 and 2008



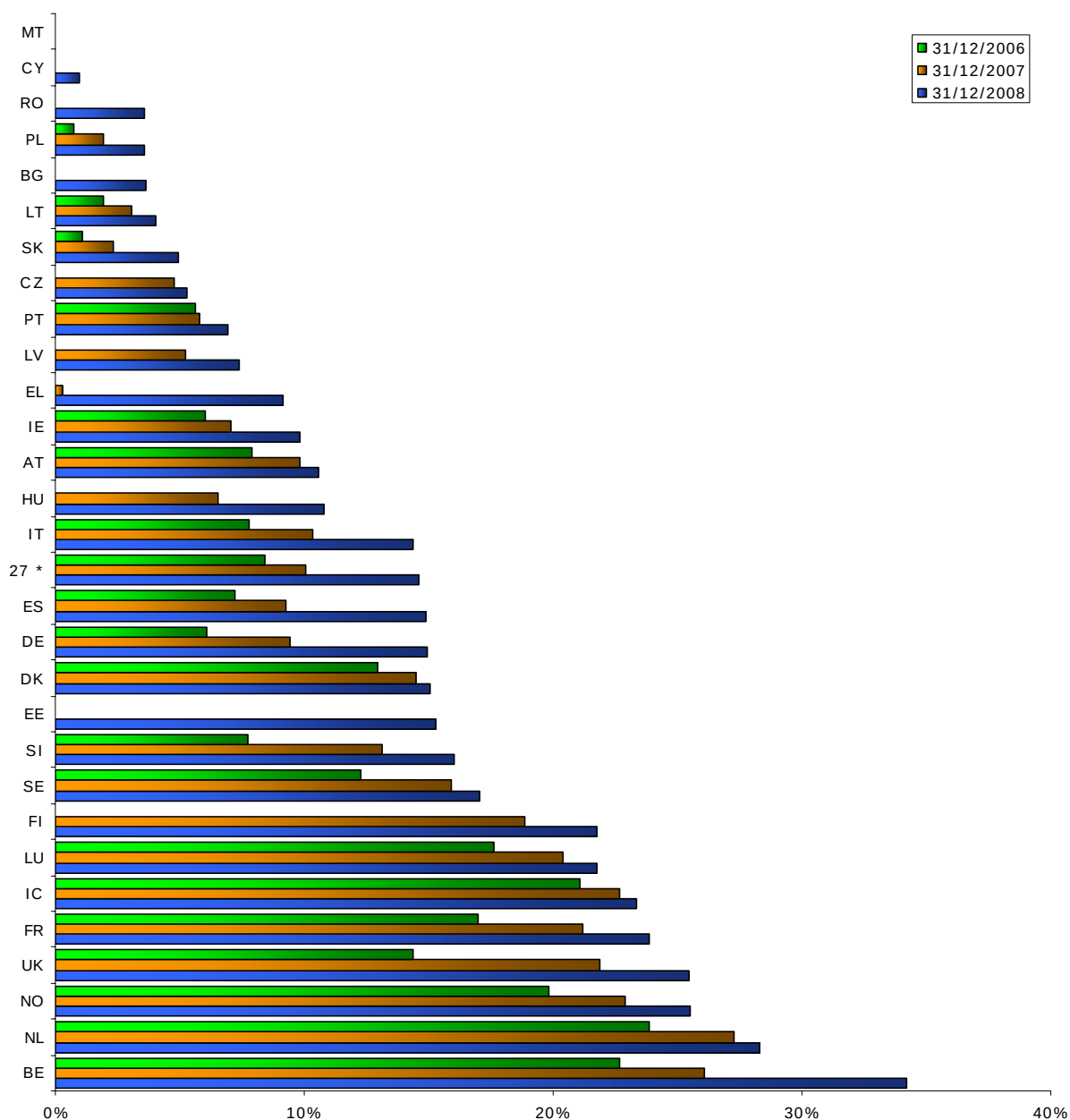
DSL is by far the dominant fixed broadband technology, accounting for just over 80% of broadband connections, on average, in the EU-25 + 2. It leads the way in all Western European countries, but varies in certain Eastern and Central European nations, such as Romania, the Czech Republic, Latvia and Lithuania, where local networks (LAN/RLAN) had been widely deployed to deliver broadband access at a time when ADSL was not available.

Figure 31: National broadband penetration, 2006 to 2008



The Netherlands and Denmark rank number one overall in terms of broadband penetration, with a penetration rate over 36% for both at the end of 2008. Bulgaria, Slovakia, Romania and Poland remain the least advanced markets in the region with a broadband penetration rate of between 11% and 12% at the end of 2008.

Figure 32: Rural broadband penetration (DSL + cable modem), 2006 to 2008

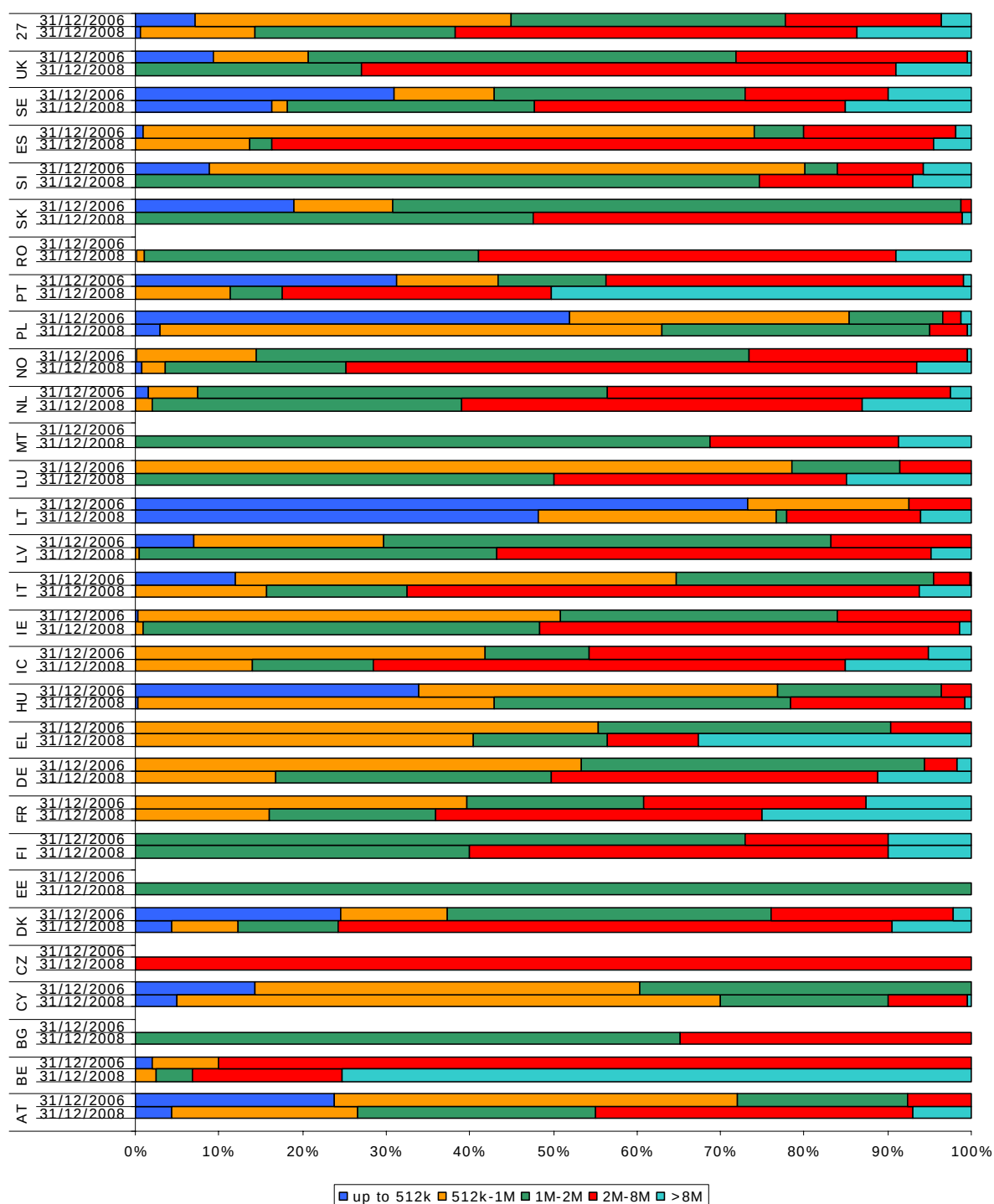


\* Average calculation is weighted based on the rural population in the different countries

Broadband penetration in rural areas is generally far lower than at the national level (nearly 15% on average in rural areas, compared to 23.5% at the national level), due primarily to lower coverage rates in those areas.

### 3.2.3. Download rates

Figure 33: National DSL download rate segmentation (Dec. 2006-Dec. 2008)



\* calculated on the basis of countries for which detailed information is available

On average, the proportion of DSL customers subscribing to a service with a download speed of over 2 Mbps increased by 40 points between the end of 2006 and the end of 2008: going from 22% to nearly 62%.

This trend can be observed, albeit to varying degrees, in all countries. Progress was very significant in Spain (+64 points in the "over 2 Mbps" range, to 84%), Slovakia (+51 points to 52%), Italy (+63 points to 67%) and Denmark (+52 points to 76%).

Figure 34: National DSL download rate segmentation (Dec. 2008)

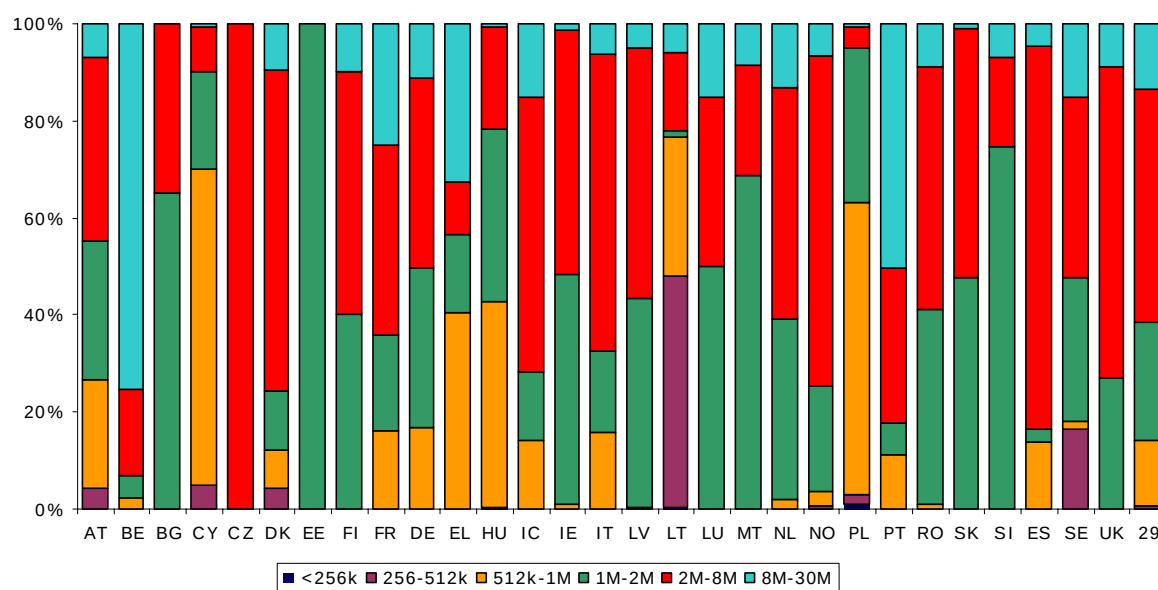
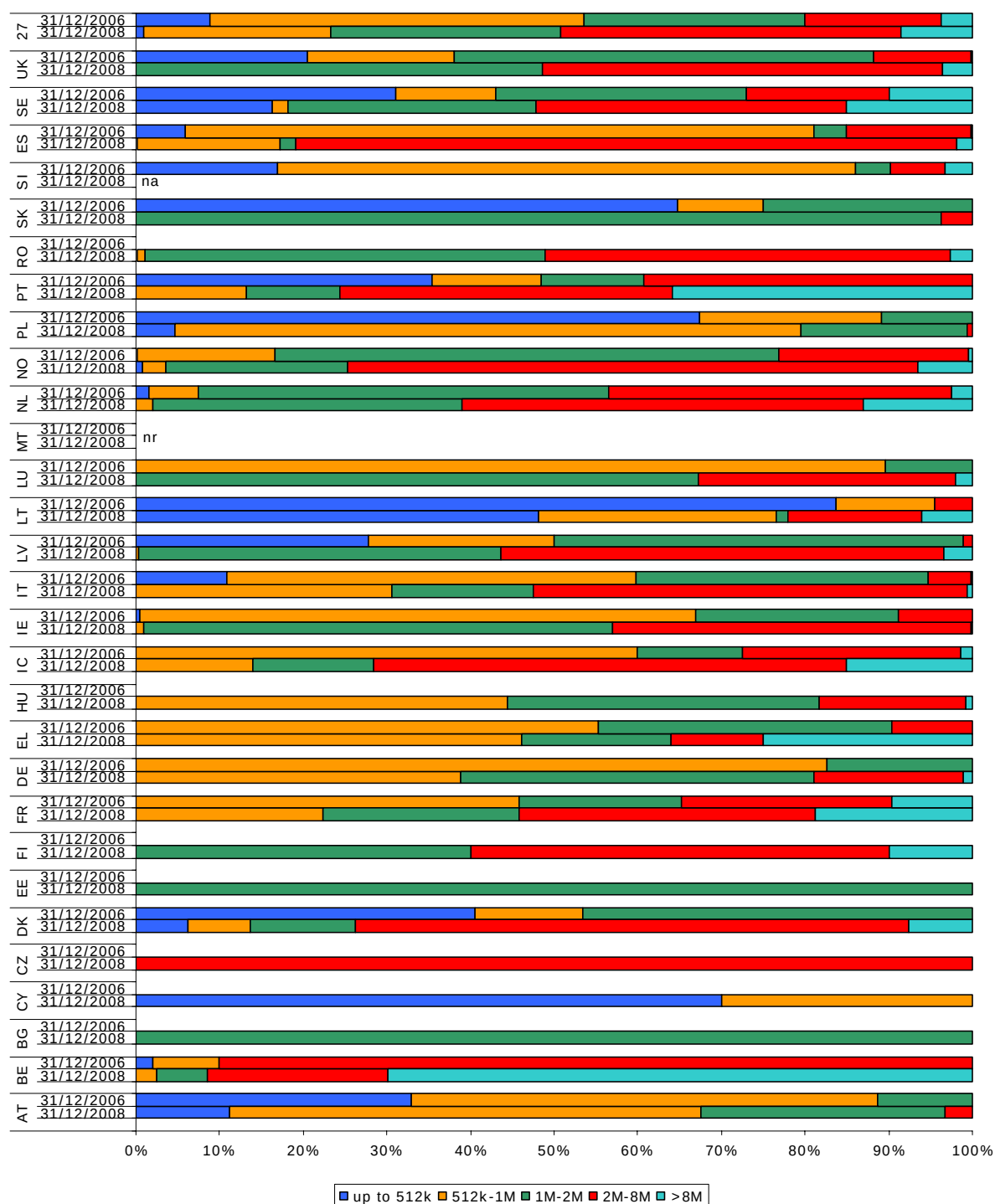


Figure 35: Rural DSL download rate segmentation (Dec. 2006-Dec. 2008)



\* calculated on the basis of countries for which detailed information is available

On average, the proportion of DSL subscribers in rural areas with download speeds over 2 Mbps increased by 31 points between the end of 2006 and the end of 2008, from 20% to just over 49%.

Progress has been especially strong in Denmark (+74 points, from 0% in the "over 2 Mbps" range at the end of 2006), Spain (+66 points to 81%), Latvia (+55 points to 56%), Norway (+52 points to 75%) and, to a somewhat lesser degree, in Italy (+47 points to 53%).

Figure 36: Rural DSL download rate segmentation (Dec. 2008)

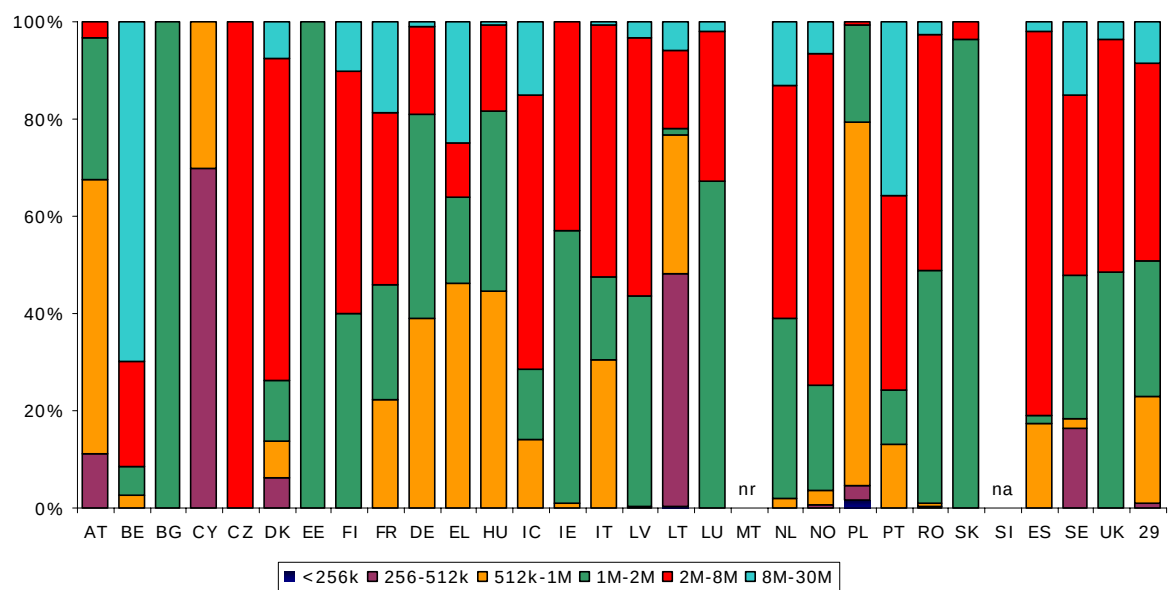
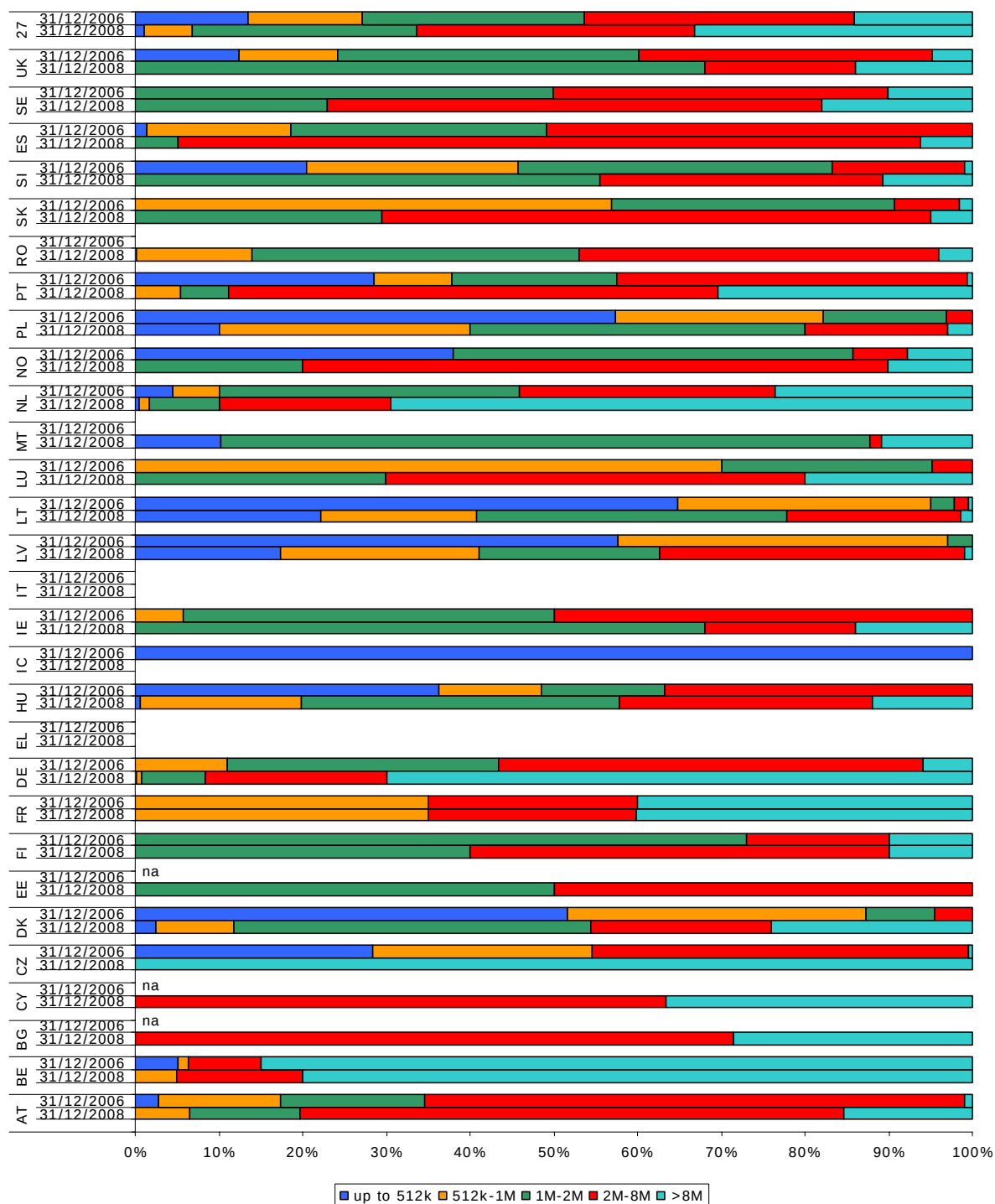


Figure 37: National cable modem download rate segmentation (Dec. 2006-Dec. 2008)



\* calculated on the basis of countries for which detailed information is available

On average, the proportion of cable modem subscribers with download speeds over 2 Mbps increased by 20 points between the end of 2006 and the end of 2008: from 46% to 66%.

Very strong growth occurred during that time in Spain (+44 points in the "over 2 Mbps" range, to 95%), Slovakia (+61 points to 71%), Portugal (+46 points to 89%), Norway (+66 points to 80%), Luxembourg (+65 points to 70%) and the Czech Republic (+55 points to 100%).



Figure 38: National cable modem download rate segmentation (Dec. 2008)

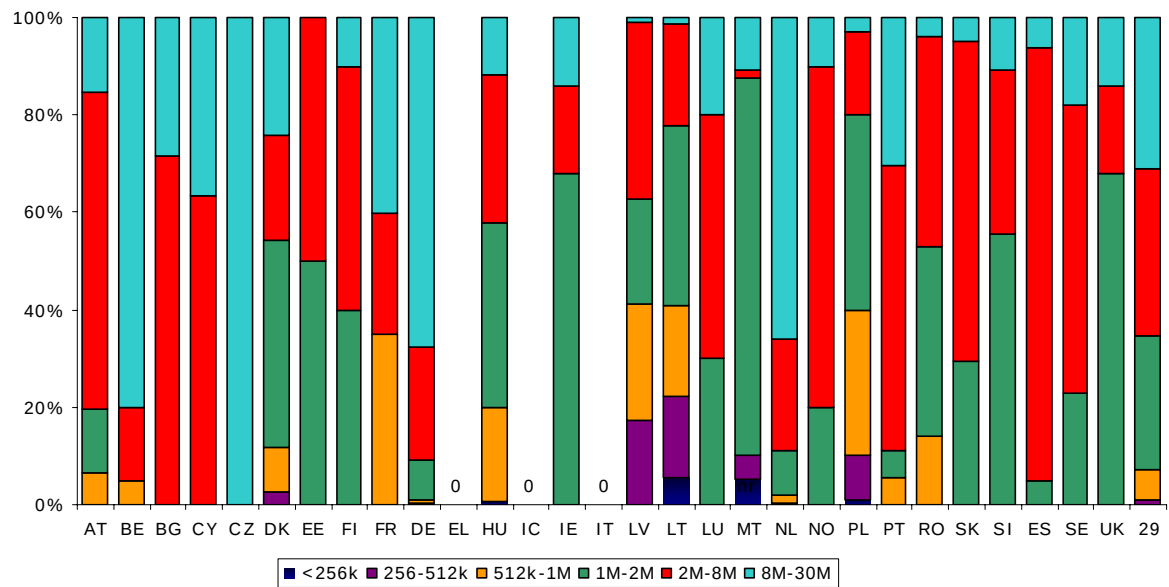
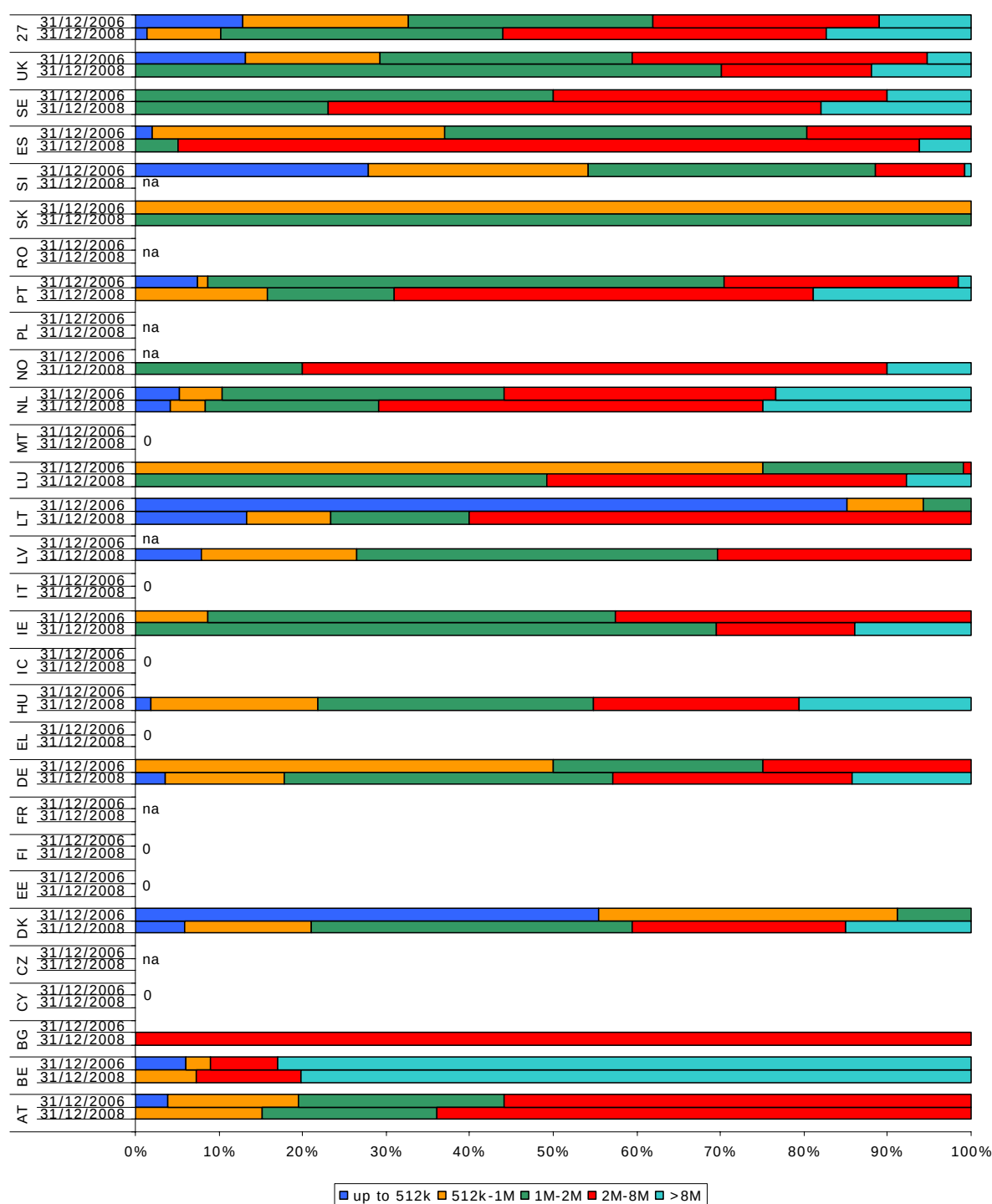


Figure 39: Cable modem download rate segmentation for rural areas (Dec. 2006-Dec. 2008)

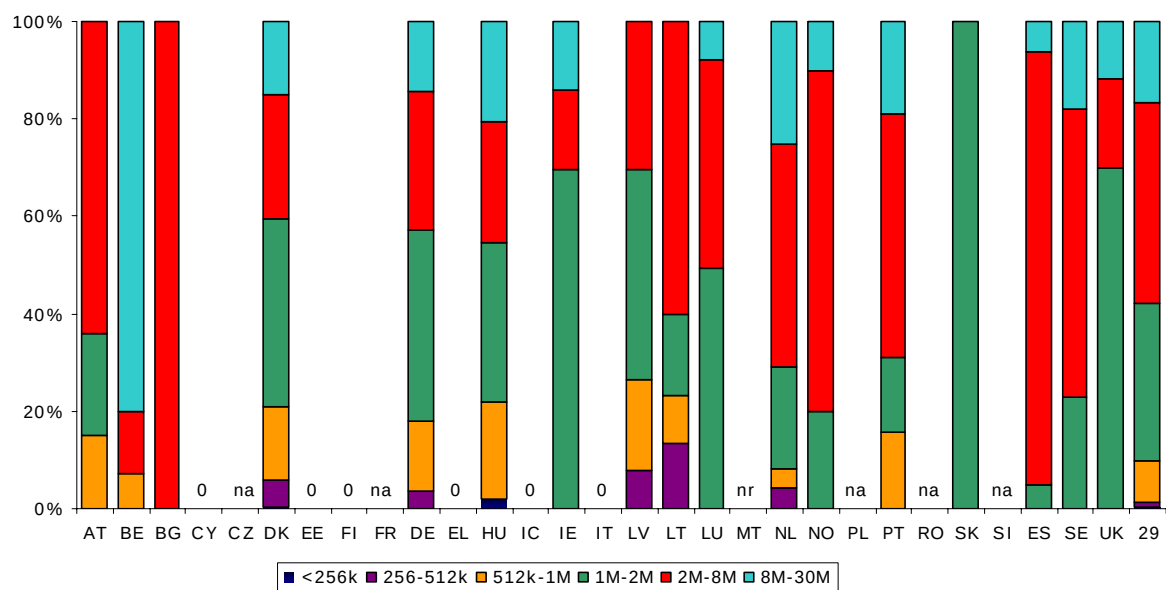


\* calculated on the basis of countries for which detailed information is available

On average, the proportion of cable modem subscribers with download speeds over 2 Mbps increased by 18 points between the end of 2006 and the end of 2008: from 38% to 56%.

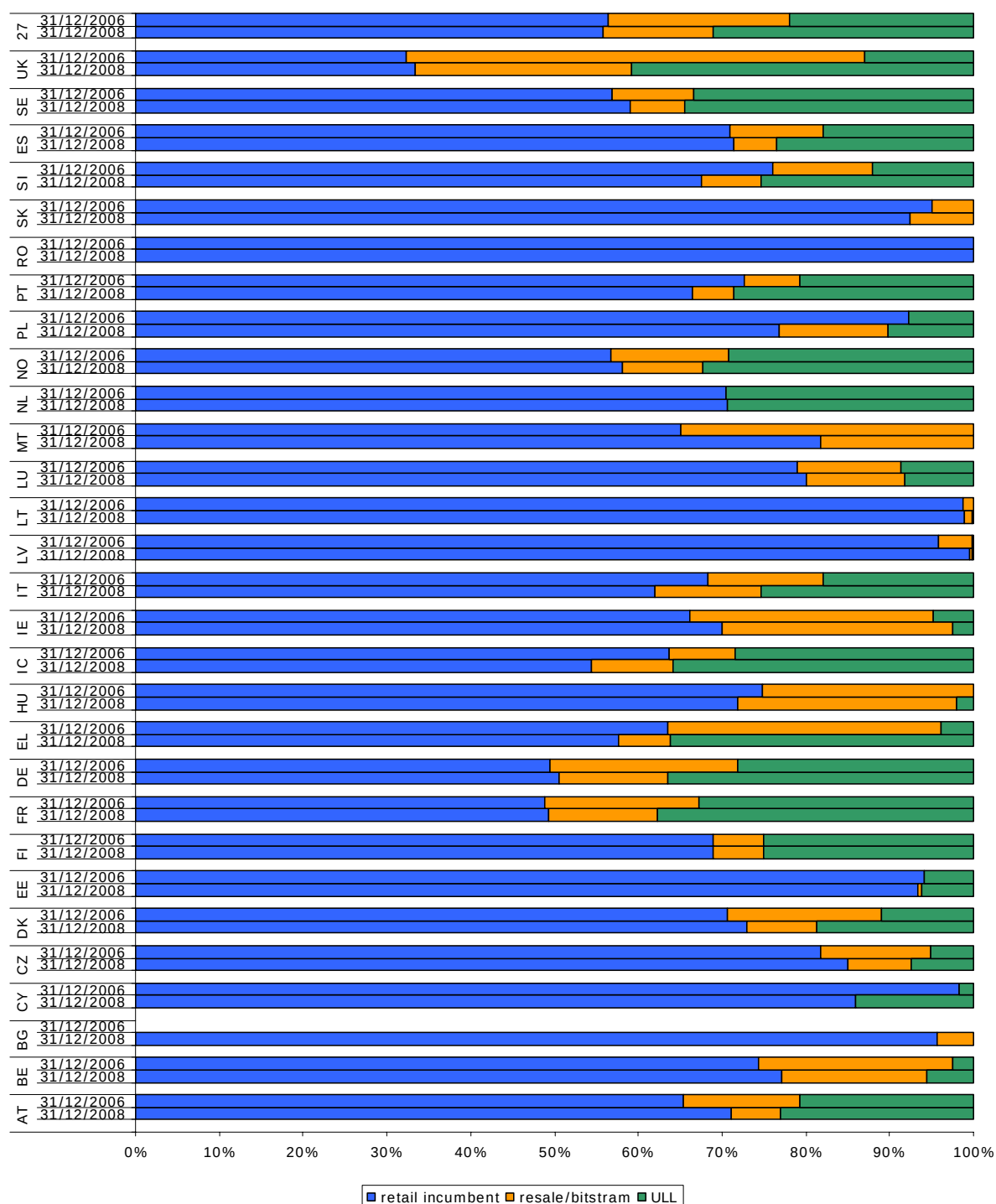
Very significant progress was made in Spain (+75 points in the "over 2 Mbps" range, to 95%), Slovakia (+61 points to 71%), Portugal (+46 points to 89%), Norway (+66 points to 80%), Luxembourg (+50 points to 51%) and Latvia (+60 points, from 0% to 60%).

Figure 40: Cable modem download rate segmentation for rural areas (Dec. 2008)



### 3.2.4. Origin of DSL connections

Figure 41: National DSL market share (31 Dec. 2006-31 Dec. 2008)



Overall, the percentage of retail DSL lines supplied by incumbent carriers has decreased slightly over the past two years in the EU-27: from 56.4% to 55.9%, which nevertheless marks a slower rate of decrease for the incumbents' market share, which had dropped from 60.4% to 56.4% between 2005 and 2006.

LLU (local loop unbundling) increased by more than 9 points – from 22% at the end of 2006 to 31% at the end of 2008 – with spectacular progress having been made in the UK: from 13% to 41%.

Figure 42: National DSL market share as of 31 December 2008

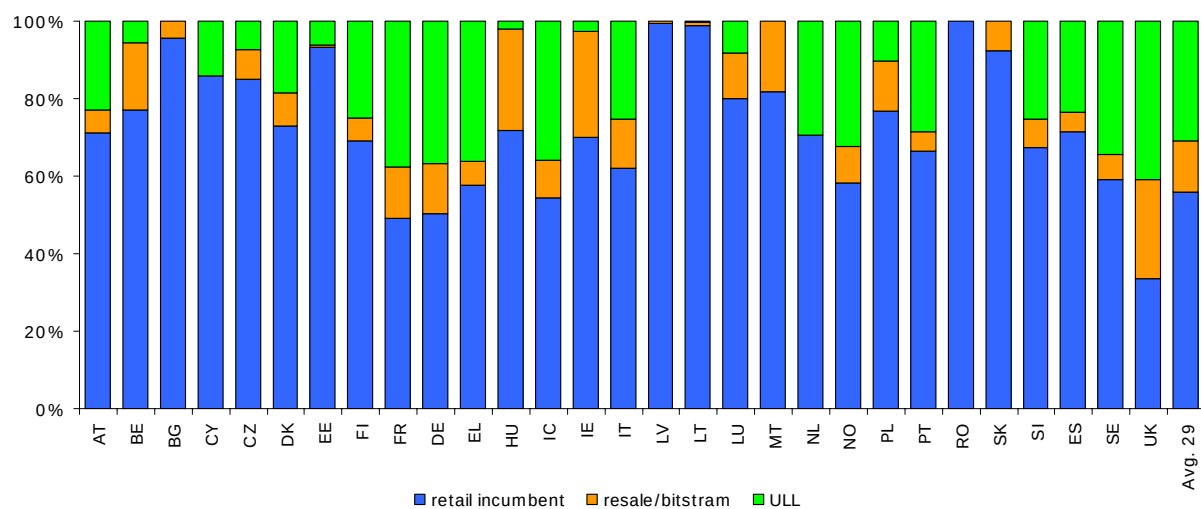
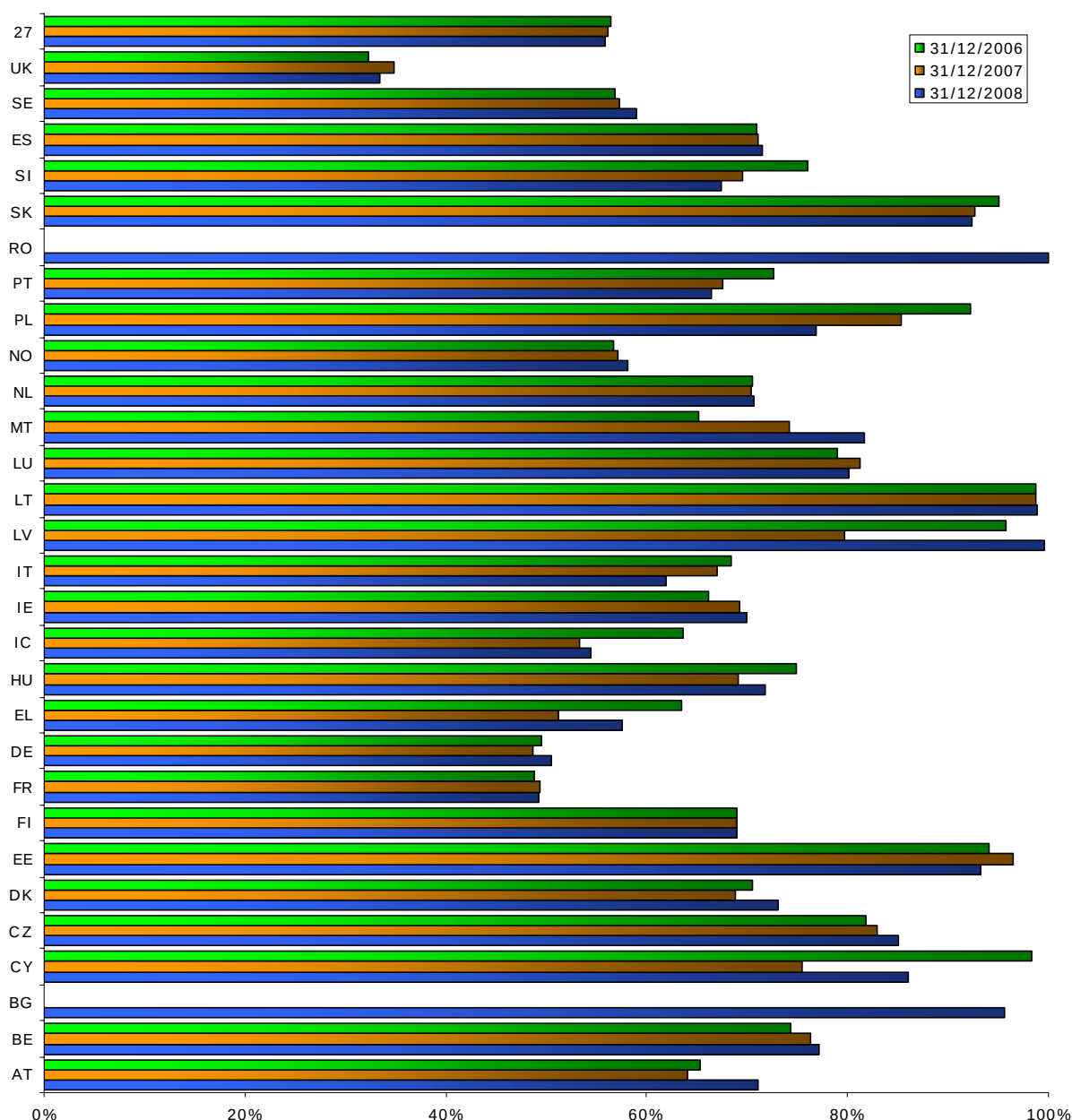


Figure 43: Incumbent carriers' national DSL market share



In some countries, the incumbent carrier gained back market share between the end of 2006 and the end of 2008: in Malta (from 65% at the end of 2006 to 82% at the end of 2008), Austria (from 65% to 71%), Ireland (from 66% to 70%) and in Belgium, Denmark, Norway and Sweden (2-3 points more at the end of 2008). But the incumbent continued to lose ground in Cyprus (where its market share shrank from 98% at the end of 2006 to 86% at the end of 2008), Greece (from 64% to 58%), Iceland (from 64% to 55%), Italy (from 68% to 62%), Poland (from 92% to 77%), Portugal (from 73% to 66%) and Slovenia (from 76% to 67%).

## 4. Country profiles

### 4.1. Austria

#### 4.1.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 2,897,326  | 2,110,877     | 3,341,563  | 8,349,766 |
| Share of total population | 34.7%      | 25.3%         | 40.0%      | 100.0%    |

#### 4.1.2. General broadband data

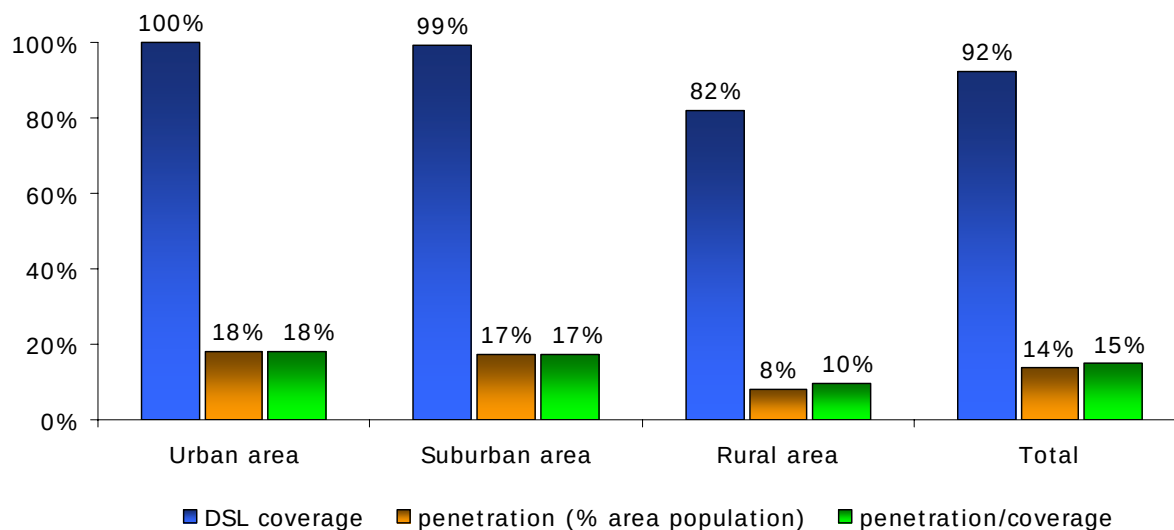
|                                                  | 12/04   | 12/05     | 12/06     | 12/07     | 12/08             |
|--------------------------------------------------|---------|-----------|-----------|-----------|-------------------|
| DSL coverage (% of population)                   | 86%     | 86%       | 91%       | 92%       | 92%               |
| DSL subscribers                                  | 442,200 | 684,600   | 874,000   | 1,040,000 | 1,149,800         |
| DSL penetration (% of population)                | 5.4%    | 8.3%      | 10.6%     | 12.9%     | 13.8%             |
| Cable modem coverage (% population)              | 31%     | 31%       | 36%       | 39%       | 40%               |
| Cable modem subscribers                          | 340,000 | 471,681   | 565,000   | 605,000   | 610,000           |
| Cable modem penetration (% population)           | 4.1%    | 5.7%      | 6.8%      | 7.5%      | 7.3% <sup>1</sup> |
| FTTx subscribers                                 | 1,100   | 2,200     | 3,000     | 5,000     | 9,380             |
| PLC subscribers                                  | 4,200   | 5,000     | 5,300     | 5,800     | 4,800             |
| WLL subscribers                                  | 7,100   | 14,900    | 20,100    | 45,000    | 37,100            |
| Satellite subscribers                            | 2,400   | 3,000     | 3,000     | 1,000     | 1,000             |
| Total                                            | 797,000 | 1,181,381 | 1,470,400 | 1,701,800 | 1,812,080         |
| Total fixed broadband penetration (% population) | 9.8%    | 14.7%     | 17.8%     | 21.2%     | 21.7%             |
| Mobile broadband subscribers                     |         |           |           |           | 969,500           |
| Mobile broadband penetration (% population)      |         |           |           |           | 11.6%             |

<sup>1</sup> population base revised in 2008

Coverage at the national level for both DSL and cable modem increased only slightly in 2008. Austria's fixed broadband subscriber base increased from 1.7 million to more than 1.8 million in 2008, and fixed penetration peaked at 21.7%. With more than 100,000 new subscribers, DSL remains the leading technology. It accounted for more than 63% of fixed broadband connections at the end of 2008, compared to a third of all connections accounted for cable. Austria's fixed broadband penetration is just below the EU-27 average, but mobile broadband is rapidly gaining ground. With almost 970,000 active users, the mobile Internet is now the second most widely used broadband technology after DSL. Other technologies remain relatively marginal except for WLL, although its user base has shrunk to 37,100 (from 45,000 in 2008).

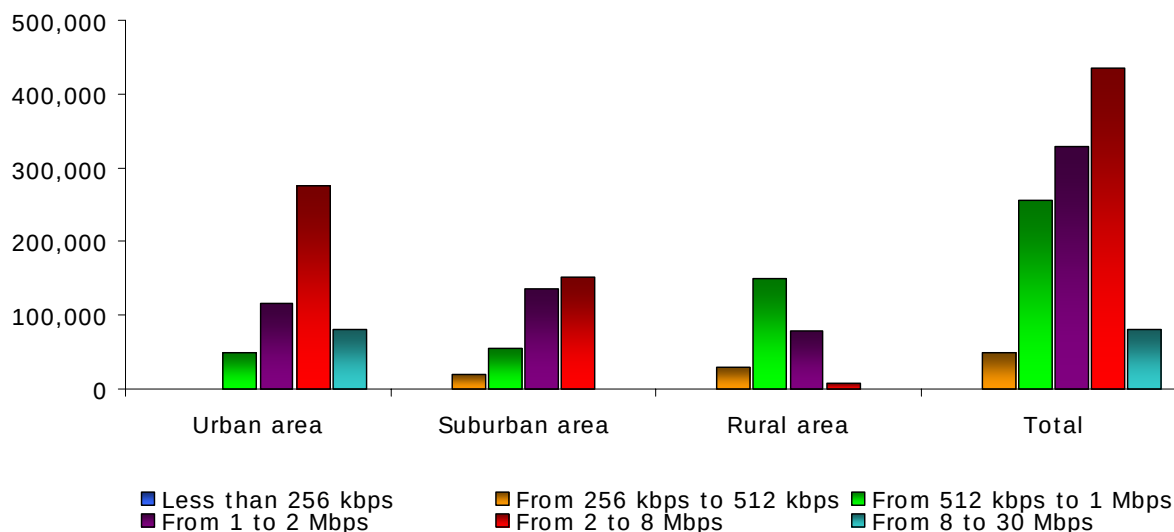
### 4.1.3. DSL coverage and take-up

#### Coverage and penetration



DSL coverage is relatively complete in urban and suburban areas, but there are still white spots (i.e. dead zones) in rural areas, which account for 40% of the population. DSL penetration increased from 12.9% in 2007 to 13.8% in 2008.

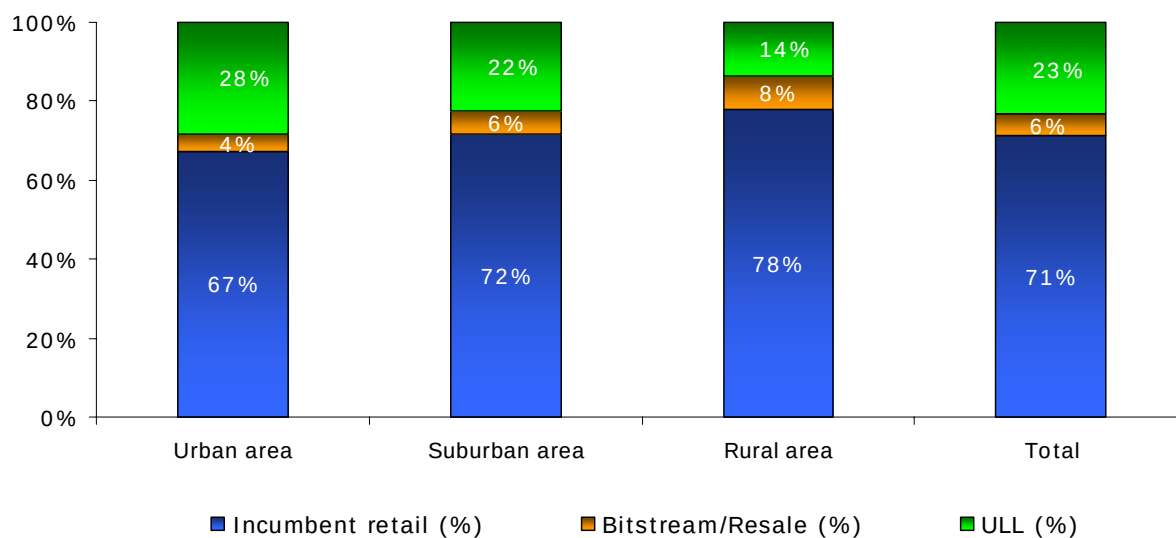
#### Number of DSL connections by download rate



Download connections up to 1 Mbps are of declining importance but still represent more than a fourth of all DSL connections. As more providers offer faster connections at reasonable prices, more and more people are upgrading, the result being that connections running at more than 2 Mbps now account for 45% of the market.



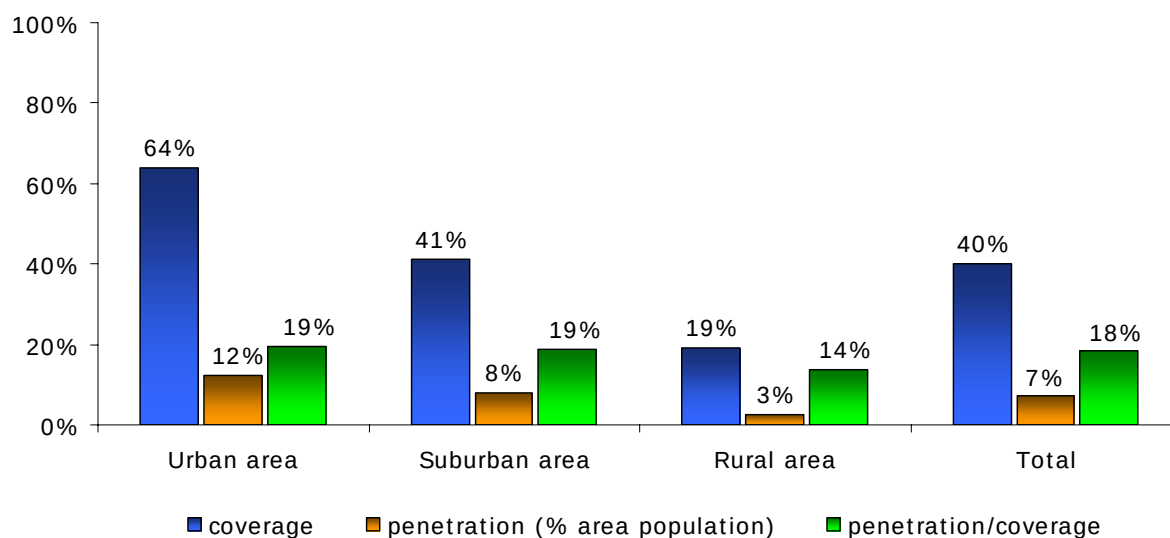
### Percentage of DSL connections by type of provider



Austria's incumbent telco, Telekom Austria, was able to increase its market share to 71% of the total DSL subscriber base at the end 2008. The proportion of connections based on wholesale offers has continued to decrease and now totals only 5.8%, compared to 8.2% in 2007, while the percentage of connections based on local loop unbundling (LLU) has also decreased to 23% of the market – down from 27.8% in 2007.

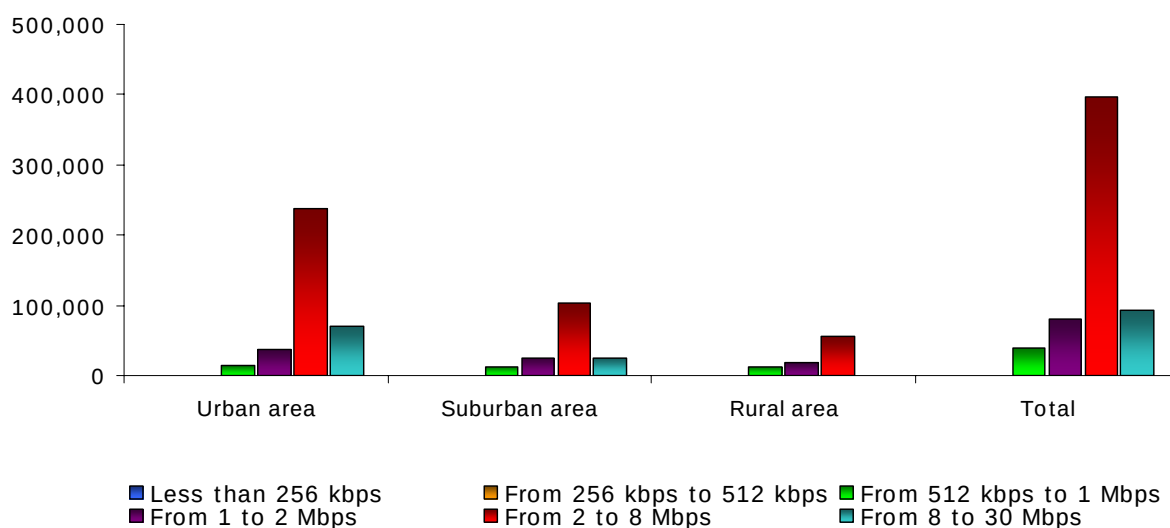
#### 4.1.4. Cable modem coverage and take-up

##### Coverage and penetration



The decline in cable modem growth continued on through from 2006 and 2007 to 2008. Even though DSL growth rates are also down, broadband cable was unable to keep pace with the rise of DSL. Most of Austria's more than 200 local cable operators provide broadband Internet access, the predominant one being UPC.

##### Number of cable modem connections by download rate



Cable modem services in Austria offer significantly higher download rates than DSL services. More than 80% of the country's cable modem customers subscribe to offers with download rates of more than 2 Mbps.

## 4.1.5. Other fixed broadband access technologies

### FTTx

FTTx is still marginal in Austria. There is nevertheless a vast fibre backbone already in place in many of the country's biggest cities, such as Vienna, Graz and Innsbruck, and a few smaller optical fibre networks supplying homes in Vienna and Ried im Innkreis. At the end of 2008, around 6,000 households in Austria were accessing the Internet via FTTH.

Incumbent carrier Telekom Austria is currently in the process of preparing its FTTH rollout, while the country's leading cable operator, UPC, has also announced the launch of a fibre solution running at up to 100 Mbps by June 2009.

### PLC

The only remaining provider of commercial powerline services in Austria is Linz AG, a regional company serving the Linz region. The other operators have stopped marketing their PLC services. At the end of 2008, Linz AG had a customer base of roughly 5,800 (2007: 4,800) and covered 85,000 households.

### WLL/WiMAX

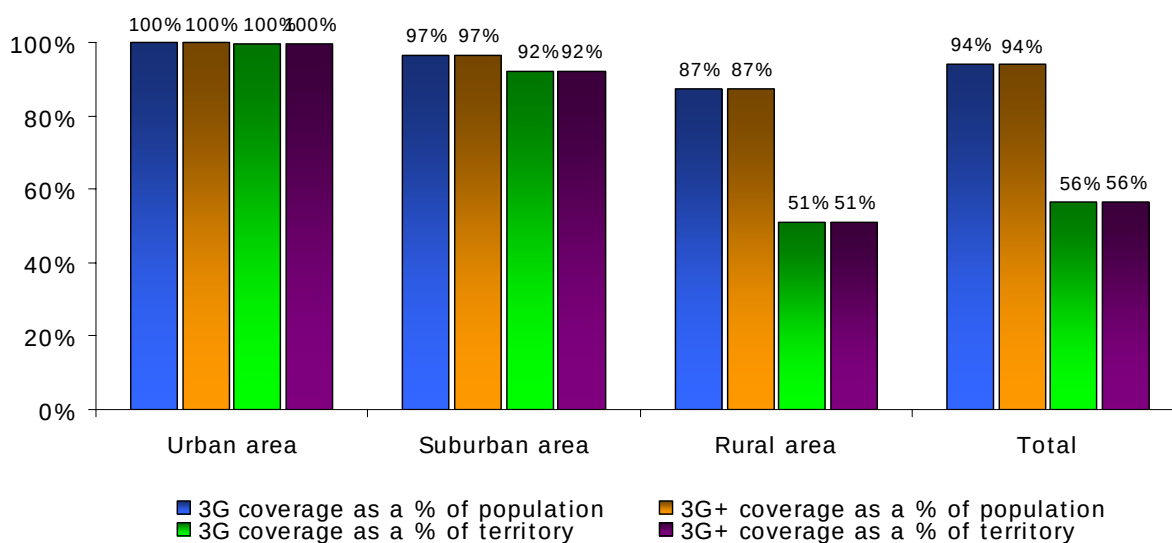
By the end of 2008, the number of fixed wireless connections had declined to 37,100 from 45,000 at the end of 2008. Telekom Austria has stopped any further investments in WiMAX and will be focusing its future innovative efforts on UMTS, HSDPA and landline access.

### Satellite

Internet via satellite is marketed by several players in Austria, of which SES Astra is the largest provider. The total number of satellite subscribers is holding steady at around 1,000.

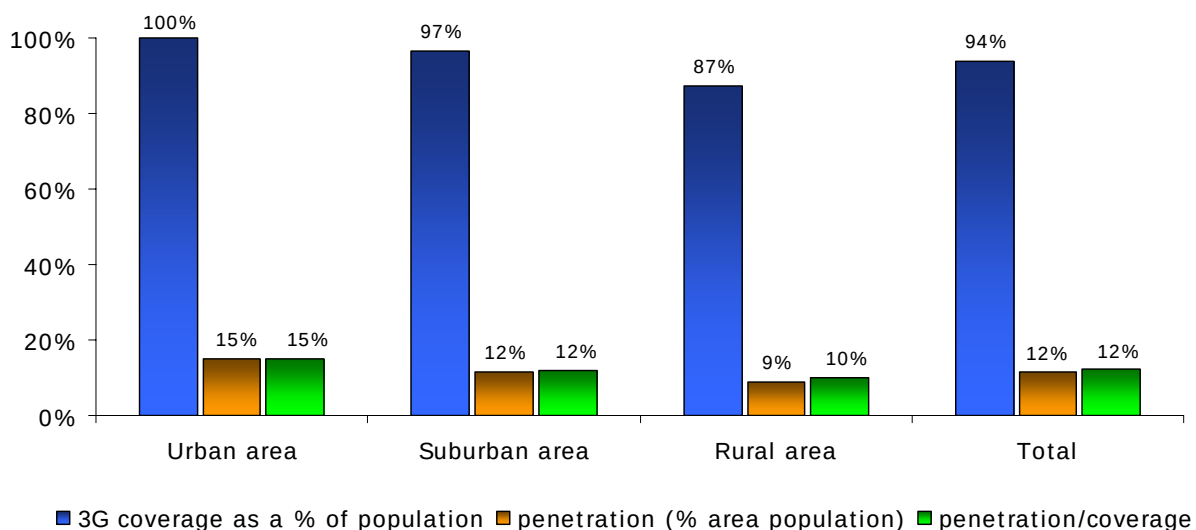
## 4.1.6. Mobile broadband coverage and take-up

### Coverage by technology



94% of Austria's population and more than 50% of Austria's territory are covered by the 3G+ network which has been fully upgraded to HSDPA.

### Penetration



At the end of 2008, the Austrian National Regulatory Authority (RTR) announced that there were approximately 970,000 active mobile internet users (subscribers who consume at least 250Mb/month, including data). This figure has risen by almost 60% since the year before. Particularly noteworthy is the fact that more than three quarters (75.8%) of all mobile Internet customers use only this connection and do not have fixed broadband access. Mobile internet is now the second most popular form of broadband access in Austria after DSL, and is by far the fastest growing technology.

## 4.2. Belgium

### 4.2.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 6,113,580  | 4,082,163     | 460,554    | 10,656,297 |
| Share of total population | 57.4%      | 38.3%         | 4.3%       | 100.0%     |

### 4.2.2. General broadband data

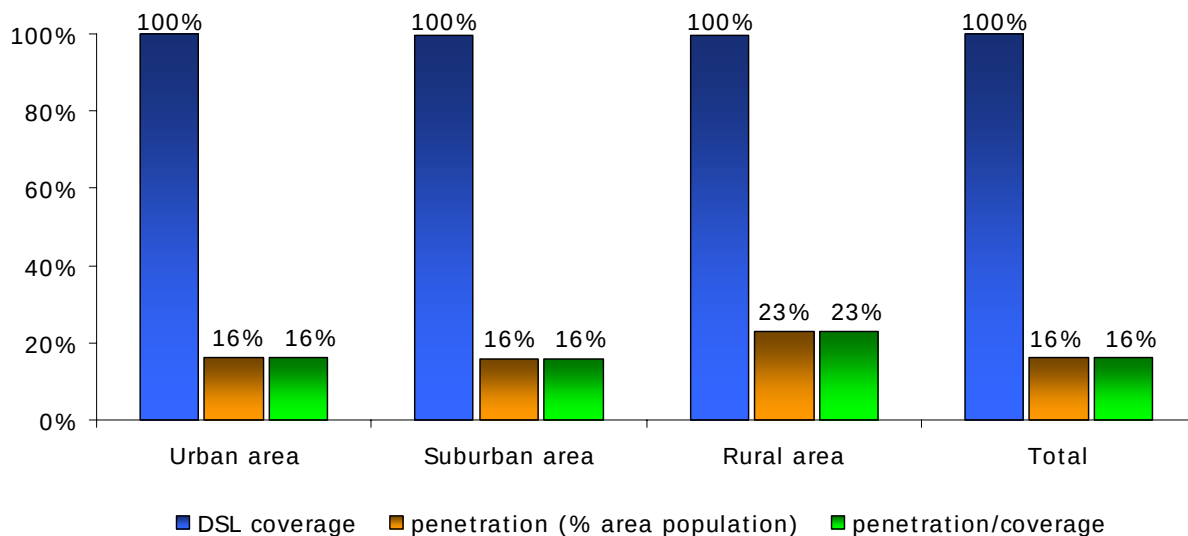
|                                                  | 12/04     | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 100%      | 100%      | 100%      | 100%      | 100%      |
| DSL subscribers                                  | 1,011,007 | 1,294,362 | 1,516,885 | 1,620,222 | 1,742,544 |
| DSL penetration (% of population)                | 9.7%      | 12.4%     | 14.4%     | 15.4%     | 16.4%     |
| Cable modem coverage (% population)              | 80%       | 80%       | 80%       | 88%       | 88%       |
| Cable modem subscribers                          | 690,000   | 699,300   | 900,000   | 1,071,107 | 1,160,000 |
| Cable modem penetration (% population)           | 6.6%      | 6.7%      | 8.6%      | 10.2%     | 10.9%     |
| FTTx subscribers                                 | 0         | 0         | 0         | 56        | 3,000     |
| PLC subscribers                                  | 0         | 0         | 0         | 0         | 0         |
| WLL subscribers                                  | -         | 3,597     | 5,500     | 14,313    | 8,600     |
| Satellite subscribers                            | 0         | 0         | 0         | 0         | 0         |
| Total                                            | 1,701,007 | 1,997,259 | 2,422,385 | 2,705,698 | 2,914,144 |
| Total fixed broadband penetration (% population) | 16.3%     | 19.1%     | 23.0%     | 25.7%     | 27.3%     |
| Mobile broadband subscribers                     |           |           |           |           | 414,038   |
| Mobile broadband penetration (% population)      |           |           |           |           | 3.9%      |

Coverage, for both ADSL and cable modem, has been very high for several years and changed very little between 2007 and 2008. Fixed broadband penetration in Belgium continued to increase in 2008, up to 27.3%. At the end of the year, it ranked 11<sup>th</sup> amongst European countries, just below France and Germany. The number of broadband customers grew by just over 200,000 in 2008, with 60% of new subscribers signing for DSL, and the remainder for broadband cable access. The ADSL subscriber base is now increasing at the same pace as cable modem, whereas in 2007, cable modem was enjoying stronger growth. As cable is available in most areas of Belgium, we estimate that close to 90% of the population have a real choice between at least two alternative broadband access technologies.

In the mobile market, 3G networks are now available to most people in Belgium (90% population coverage at the end of 2008) but mobile broadband usage is still only fledgling, with estimates pointing to just over 400,000 subscribers (6% of the total mobile subscriber base) actually using 3G data services.

### 4.2.3. DSL coverage and take-up

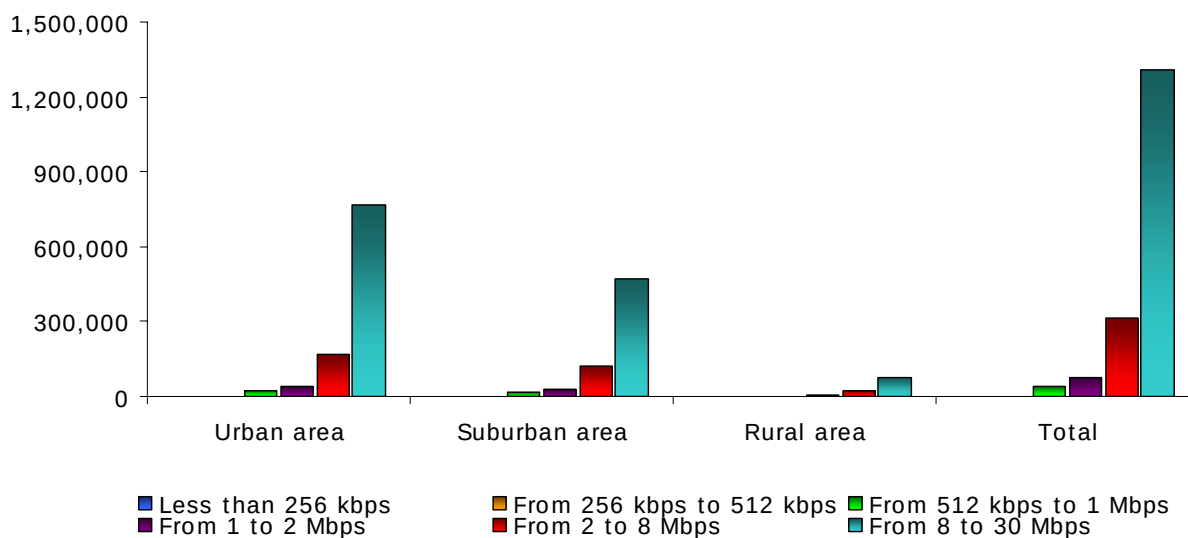
#### Coverage and penetration



While coverage is very broad, DSL take-up has grown at a relatively slow pace over the past two years (+6.8 % in 2007, then +7.5% in 2008), with only 225,000 new subscribers during this 24-month period (compared to close to 300,000 new subscribers in 2005 and 200,000 in 2006).

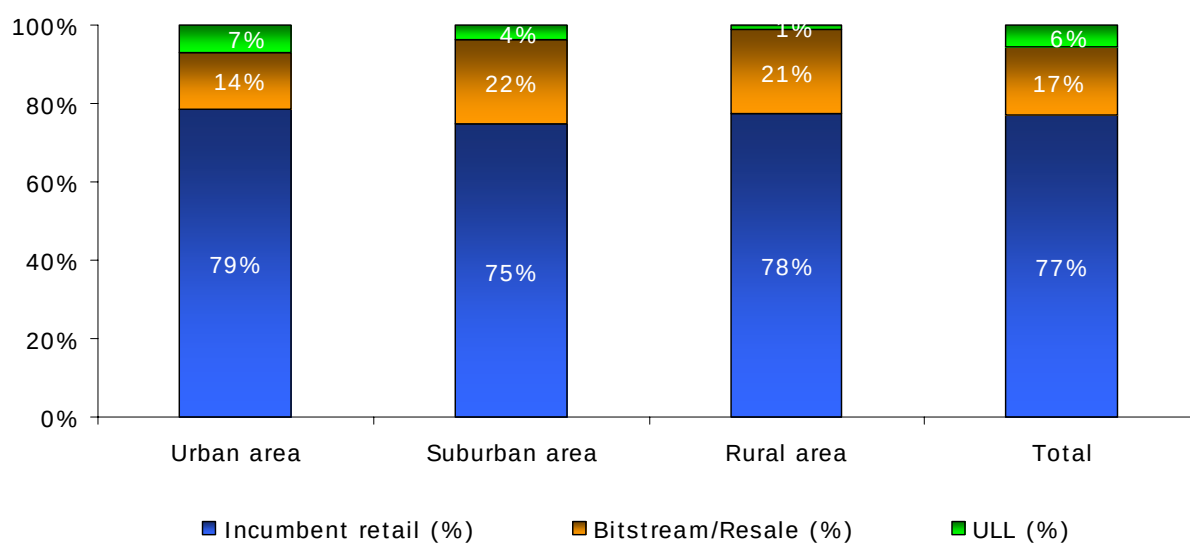
ADSL penetration is still a bit higher in rural areas due to the fact that cable modem is still not available in some (albeit fewer) parts of those territories, especially in the rural areas of Walloon.

#### Number of DSL connections by download rate



Most ADSL offers now include a service delivering a downstream speed of 12 Mbps. Some alternative operators launched "light" offers (downstream speed of 512 Kbps) in early 2004. Belgacom also launched an ADSL Light offer (maximum download speed of 512 Kbps) in May 2004, then upgraded to 1 Mbps (now known as ADSL Budget) and to 4 Mbps (new ADSL Light). These offers enjoyed only limited success however, as most users subscribe to the offers running at 12 Mbps (e.g. Belgacom ADSL Go) or more, via ADSL2+ (e.g. Belgacom ADSL Plus with 18 Mbps download speed) and VDSL.

### Percentage of DSL connections by type of provider

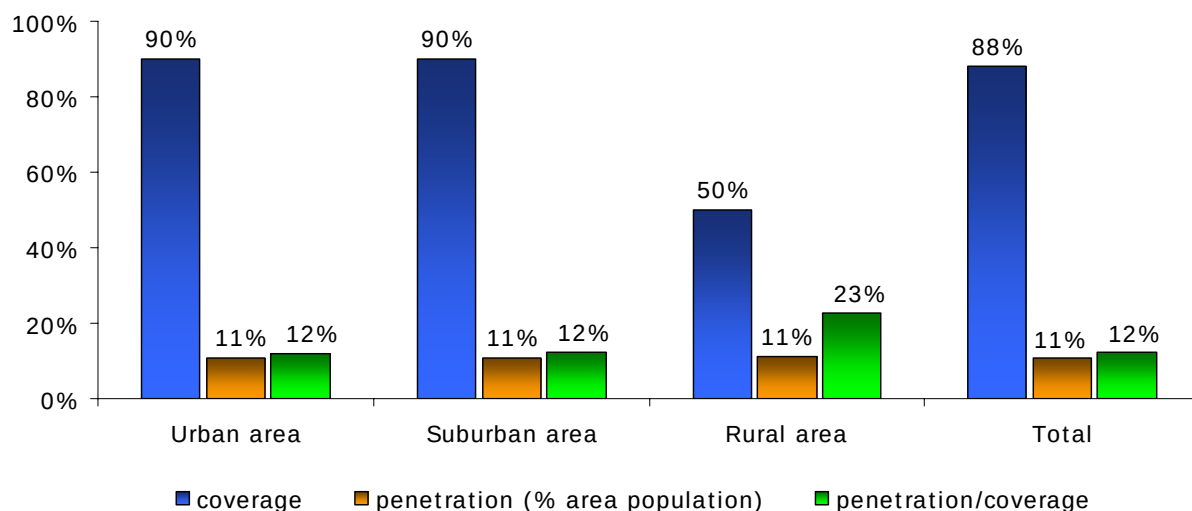


Unbundling is still little used in Belgium, accounting for only 5.5% of DSL connections at the end of 2008 (96,318 LLU). The number of DSL connections supplied through bitstream and resale offers decreased again in 2008 (-23,000, i.e. a market share that has shrunk from 20.1% to 17.4%).

Meanwhile, incumbent carrier Belgacom's share of the retail DSL market rose by nearly one point to 77.1% (partly due to the purchase of Scarlet Telecom in November 2008).

## 4.2.4. Cable modem coverage and take-up

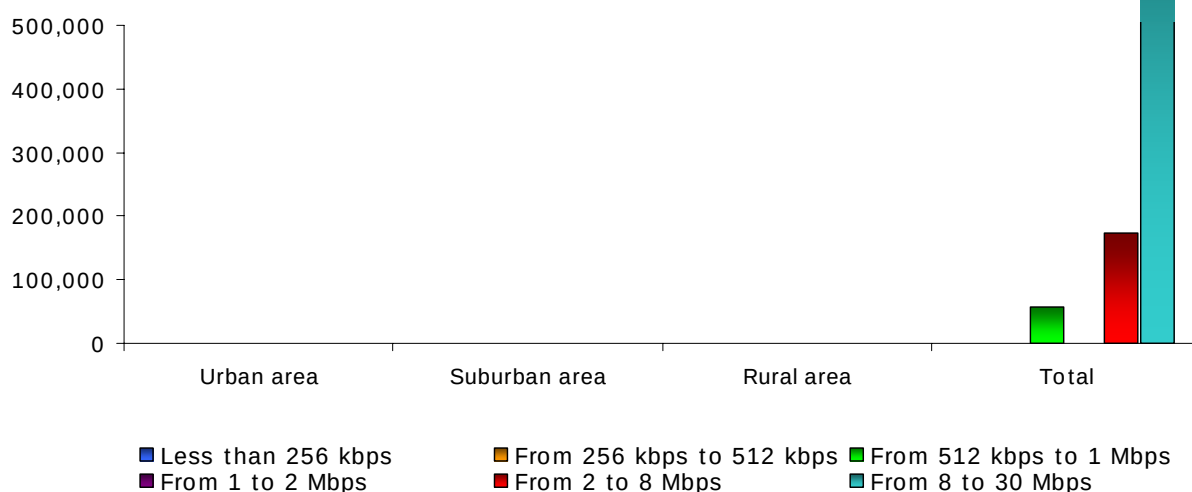
### Coverage and penetration



Cable modem coverage remained stable in 2008, with the customer base increasing by 90,000 new subscribers.

In late 2006, Telenet and UPC Belgium, which were both subsidiaries of Liberty Global, merged. Telenet also purchased 4 municipal 'Interkabel' networks in 2008. Other major cable operators are Numericable Belgium (formerly Coditel) and Brutele.

### Number of cable modem connections by download rate



Although "light" offers (with download rates at 1 Mbps) were introduced in the cable market following the launch of DSL "light" offers, basic offers now deliver access at 3 Mbps to 6 Mbps while most cable modem users subscribe to download rate offers of 15 Mbps to 25 Mbps.



## 4.2.5. Other broadband access technologies

### Wi-Fi

Belgacom and Telenet have been active in Wi-Fi services since 2003.

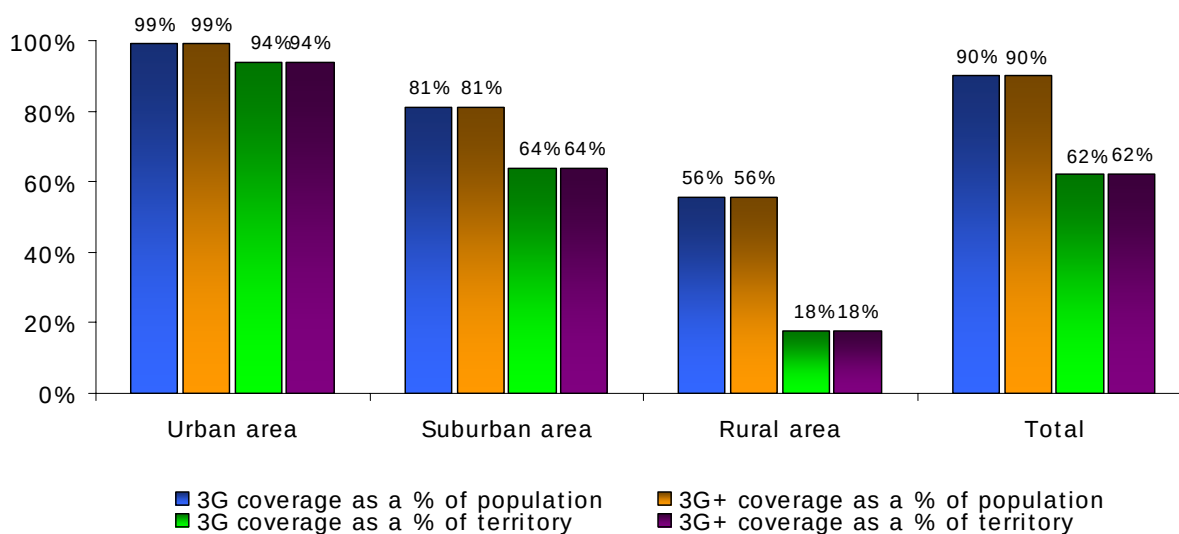
Belgacom provides Wi-Fi services via several hundred hotspots in airports, train stations, hotels, restaurants, museums and parks. Telenet, which took over Sinfilo, signed a deal with Belgian railways and with Mobistar to allow their customers to utilise its Wi-Fi network. It now operates more than 1,000 hotspots across the country.

### WLL/WiMAX

There were over 8,600 WLL subscribers in Belgium at the end of 2008. In April 2004, Clearwire Belgium and Mac Telecom were awarded licences to operate in the 3.4-3.6 GHz frequency band, while the MET (Walloon region) has a licence to operate in the 24.5-26.5 GHz frequency band, but only in the city of Charleroi.

## 4.2.6. Mobile broadband coverage and take up

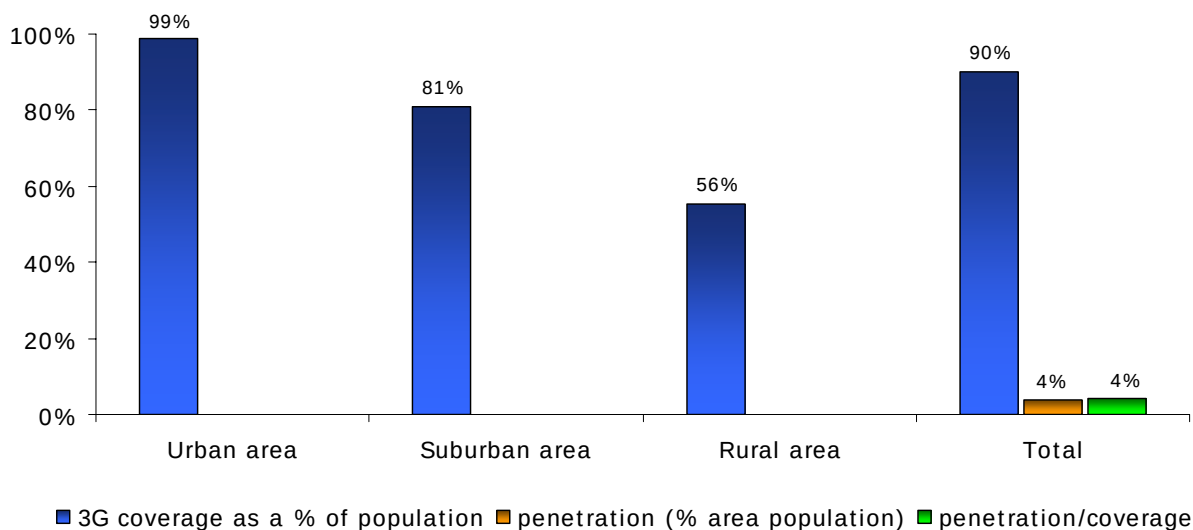
### Coverage by technology



The UMTS network has been fully upgraded to HSDPA.

90% of Belgium's population and 62% of the territory are covered by the 3G+ network.

### Penetration



The three Belgian cellular operators were awarded 3G licences in 2001 but only the two largest, Proximus (Belgacom) and Mobistar, were marketing 3G services at the end of 2008 – with BASE due to enter the market in 2009. Assuming a market share of 67% for Proximus, the number of actual 3G subscribers is estimated to be just over 414,000.

## 4.3. Bulgaria

### 4.3.1. Population

|                           | Urban area | Suburban area | Rural area | National |
|---------------------------|------------|---------------|------------|----------|
| Inhabitants               | 6,100,000  | -             | 1,100,000  | 7,200,00 |
| Share of total population | 84.7%      | -             | 15.3%      | 100.0%   |

### 4.3.2. General broadband data

|                                                  | 12/04  | 12/05   | 12/06   | 12/07   | 12/08   |
|--------------------------------------------------|--------|---------|---------|---------|---------|
| DSL coverage (% of population)                   | na     | na      | na      | na      | 78%     |
| DSL subscribers                                  | 10,000 | 40,000  | 93,000  | 163,756 | 230,000 |
| DSL penetration (% of population)                | 0.1%   | 0.5%    | 1.2%    | 2.2%    | 3.2%    |
| Cable modem coverage (% population)              | na     | na      | na      | na      | 89%     |
| Cable modem subscribers                          | 43,900 | 101,700 | 163,000 | 150,000 | 140,000 |
| Cable modem penetration (% population)           | 0.6%   | 1.3%    | 2.1%    | 1.3%    | 1.9%    |
| FTTx subscribers                                 | na     | na      | na      | 384,000 | 420,000 |
| PLC subscribers                                  | na     | na      | na      | 500     | na      |
| WLL subscribers                                  | na     | na      | na      | 1,584   | na      |
| Satellite subscribers                            | 0      | 0       | 0       | 0       | 100     |
| Total                                            | 53,900 | 141,700 | 256,000 | 700,040 | 790,100 |
| Total fixed broadband penetration (% population) | 0.7%   | 1.8%    | 3.3%    | 9.6%    | 11.0%   |
| Mobile broadband subscribers                     |        |         |         |         | 120,000 |
| Mobile broadband penetration (% population)      |        |         |         |         | 1.7%    |

DSL coverage is still low compared to other countries, while cable modem appears to be more widely available (see explanations below). Broadband take-up in Bulgaria started with the rollout of LAN ISPs in the beginning of 2000s. This approach allowed a great many local ISPs and alternative operators to build high-quality networks step by step. Almost all independent LAN ISPs have since been acquired, merged and turned into large, high quality ISPs.

Internet access via cable was introduced a little later on, chiefly as part of an expansion by the country's well-developed network of cable television providers. Already by 2004 more than 53% of the population had access to cable television in their homes.

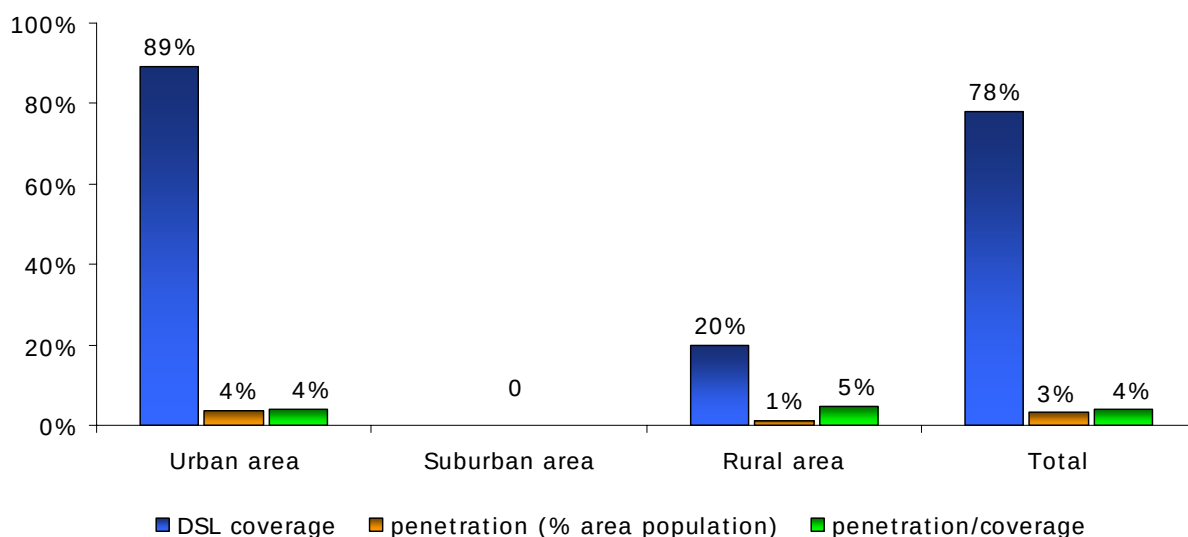
The incumbent operator, BTC, introduced ADSL quite late compared to other EU countries, partly because the lines were not digitised until later and partly to avoid having to provide last mile access to alternative operators. This explains why ADSL accounted for less than 30% of fixed broadband connections at the end of 2008.

LAN/RLAN are still very competitive markets, with 357 and 102 providers, respectively, competing for market share at the beginning of 2008.

The last two and half years have been very positive ones for the country's ISPs, and especially for mobile operators, thanks to the rollout of the mobile internet which has benefitted from a large base of laptop computers and successful advertising campaigns.

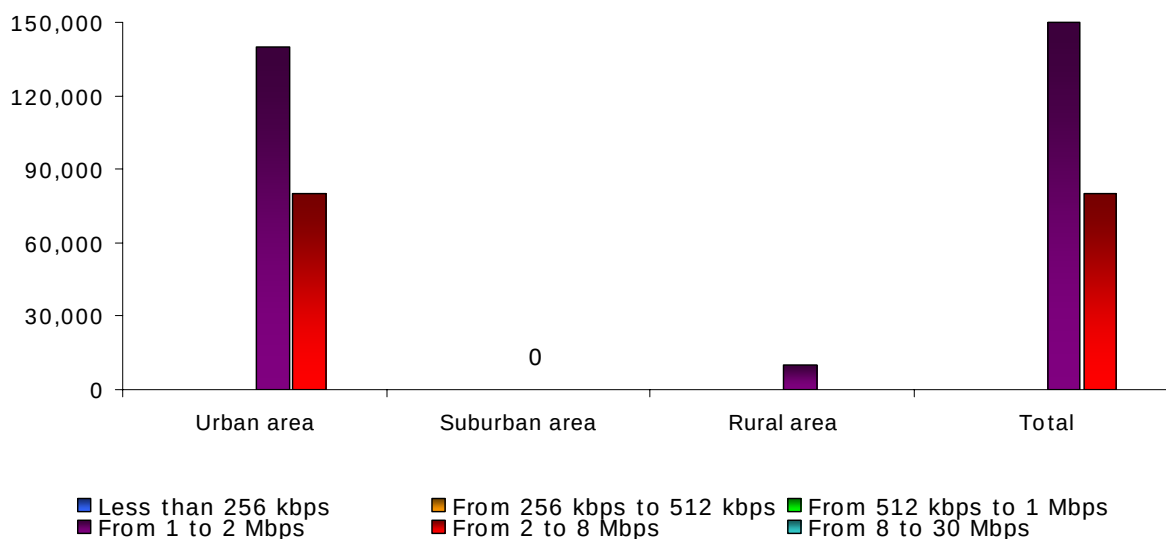
### 4.3.3. DSL coverage and take-up

#### Coverage and penetration



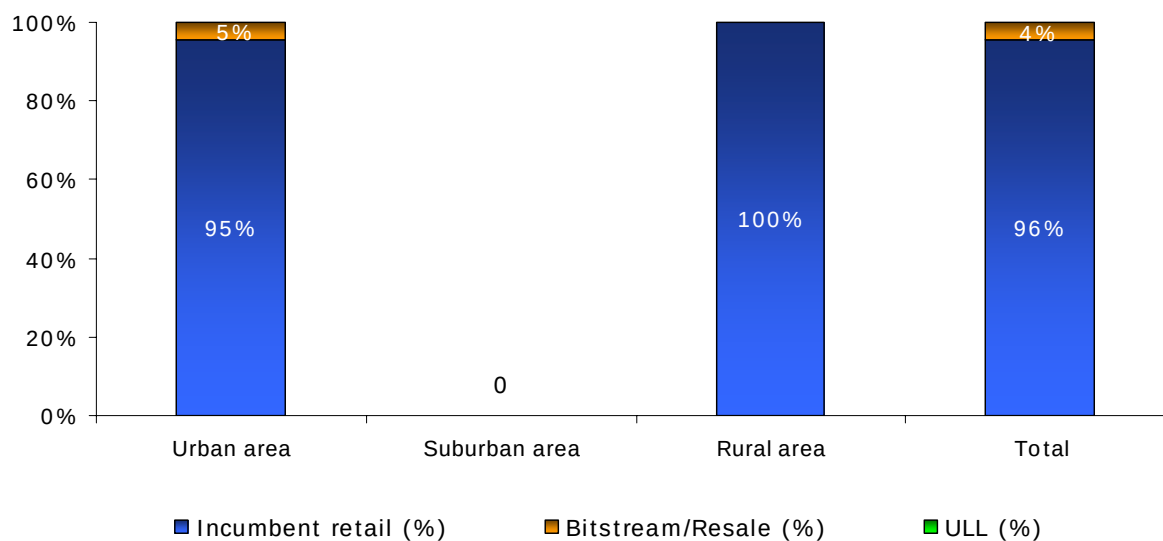
DSL coverage in Bulgaria totals 78%, with only 20% of the country's rural population currently covered. The still sizeable disparities in coverage levels that existed in urban areas in 2006 – the Pazardzik region had only 32% coverage, for instance, compared to close to 100% in Sofia – are steadily being eradicated.

#### Number of DSL connections by download rate



ADSL download speeds vary from 2 to 12 Mbps. Most of the ADSL lines are located in urban/suburban areas, with just 4% installed in rural areas. There are two major reasons for this: population density and the availability of low-cost competitive services.

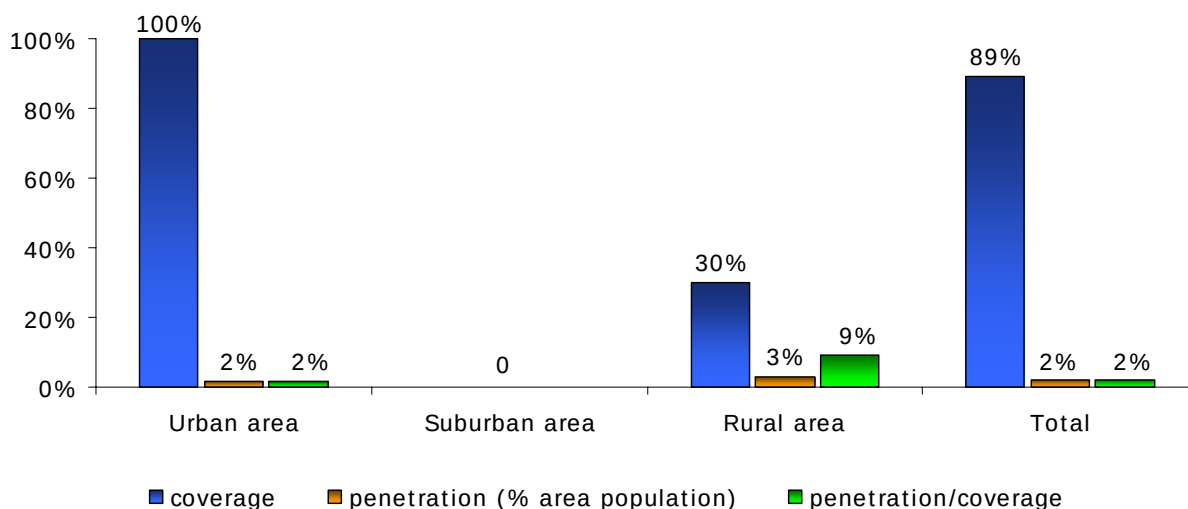
### Percentage of DSL connections by type of provider



Though officially in place, local loop unbundling is employed very little. Only 4% of ADSL connections are provided by alternative operators, in fact, mainly because of low margins available to resellers. Orbitel launched ADSL service (marketed as ODSL) in June 2008. A few other companies have signed contracts with BTC for bit stream, but did not offer yet (and will not in the future) ADSL over the incumbent's network. It is doubtful that ODSL will survive in the market and most probably its provision will be ceased soon, since the alternative networks, including fiber-to-the-building or even fiber-to-the home offer better quality for the same or lower price.

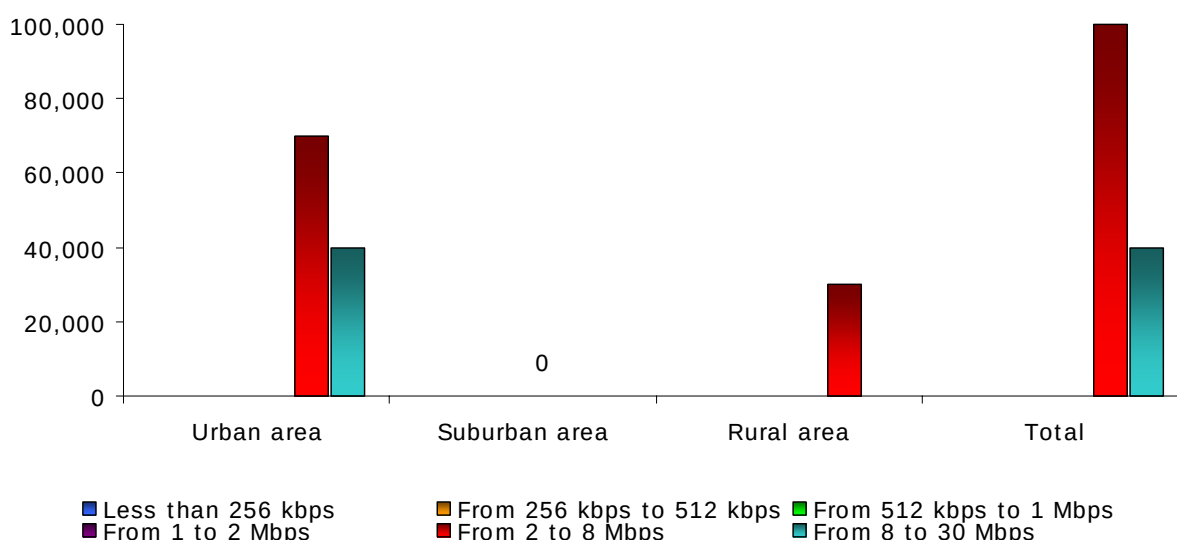
### 4.3.4. Cable modem coverage and take-up

#### Coverage and penetration



Cable television grew faster than LAN ISPs and practically all people in cities/towns or urban areas can access CATV. The growth model of cable TV and LAN ISPs were very similar. Both relied on some breaches of IPR and other regulations to break-even faster and then to legalise their businesses. The cable TV market has concentrated, as it happened in the LAN market. A series of mergers and acquisitions of large national and local players led to almost oligopolistic markets. Yet, this made easier for cable TV operators to provide and compete on the internet access market. Although in rural areas CATV coverage rate is over 30%, networks cannot always provide Internet services. There are a few cases where triple or double play services have been offered through three different cables.

#### Number of cable modem connections by download rate



Around 70% of cable connections are below 8 Mbps, but the minimum speed on offer is 2 Mbps.

### 4.3.5. Other broadband access technologies

#### LAN/RLAN

Both from the actual penetration statistics but also from the coverage maps of different technologies, it is obvious that LAN/RLAN access is the leading technology for broadband access in Bulgaria in terms of coverage and speed. The speeds vary from 30Mbps to 100 Mbps. Yet, the major concern is service quality, since these high-speeds are not always guaranteed. Also, due to power supply problems, the switches often burn and even sometime end-users' LAN cards. LAN networks are quite easy and cost-effective to build, but not that easy to maintain. Additional problems arise from the fact that quite often the operators do not comply with the regulation that all cables should be under the surface, exposing them to various risks. Typically LAN users in large towns are real broadband users, while in smaller towns, a lot of users prefer limited packages (with limited speed) due to economic reasons.

#### Wi-Fi

As with most EU countries, there is no commercial Wi-Fi access provider in Bulgaria, but there were more and more free Wi-Fi hotspots available (ad-funded and via innovative sharing schemes) in 2007 and 2008. Because no licence is required to supply Wi-Fi access, it is very difficult to produce a coverage map, but a great many restaurants and cafés in all of the country's towns and cities offer free Wi-Fi.

#### WLL/WiMAX

WiMAX technology is still not widely used and is mainly confined to businesses. One of the stumbling blocks to increased penetration is the lack of money to invest in these technologies, especially during the current financial crisis.

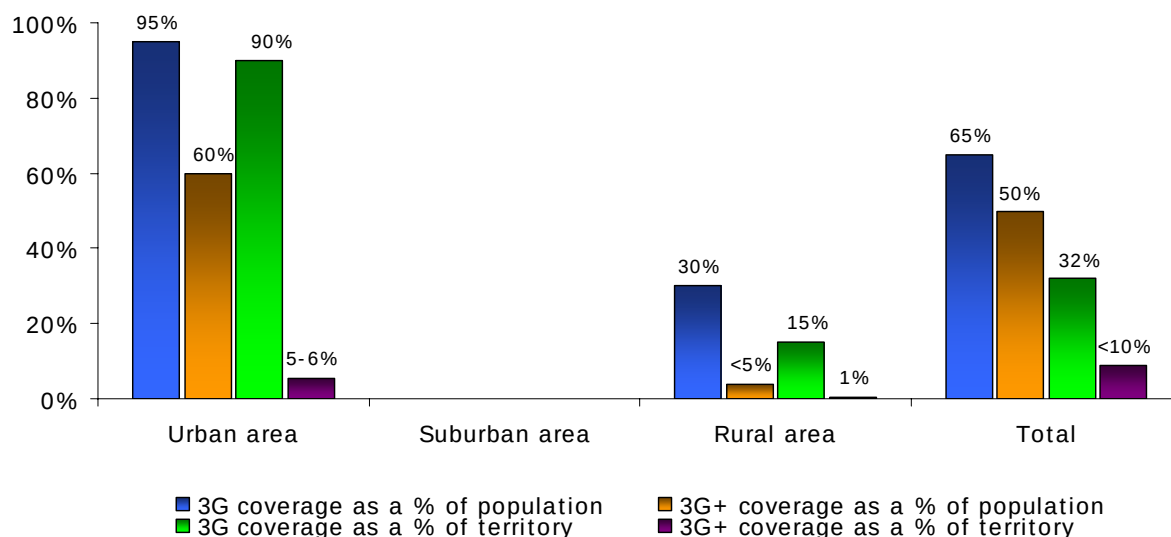
#### Satellite

VSAT access is provided by Transat. One very positive aspect is the ability to provide access virtually nationwide, but there is a delay of 250 ms (single loop) which prevents it from being used for certain Internet applications, added to which the price of the service is too high for residential customers, so it is employed primarily by businesses and government services only.

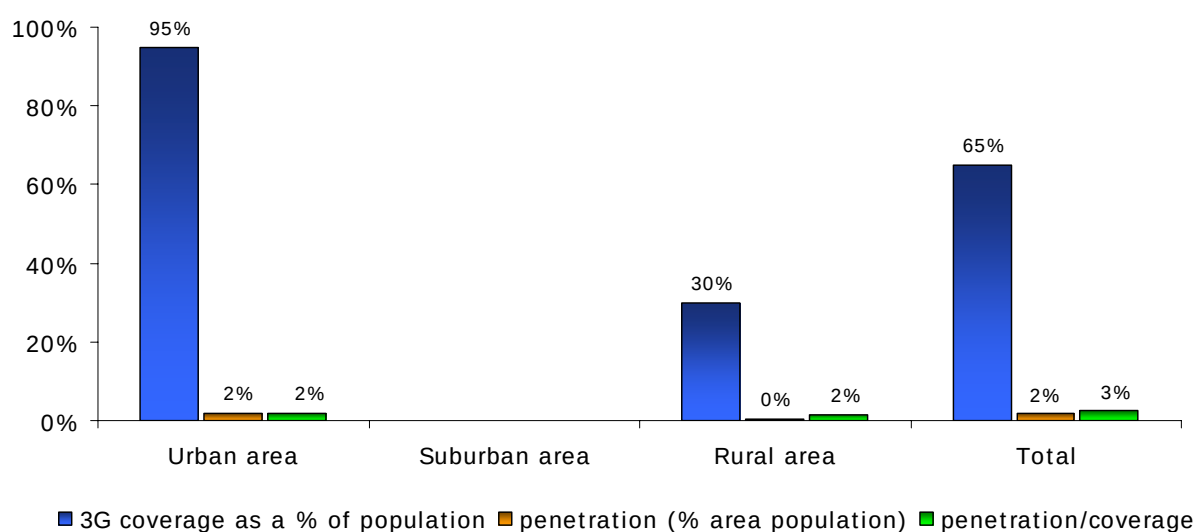
### 4.3.6. Mobile broadband coverage and take up

Mobile internet access is provided by all three mobile operators in Bulgaria: Mtel, Globul and Vivatel. Very little of the country is currently covered by 3G+, but the growing number of subscribers suggests that this will likely change.

#### Coverage by technology



#### Penetration



Penetration is still very low, in the range of 1% to 3%.



## 4.4. Cyprus

### 4.4.1. Population

|                           | Urban area | Suburban area | Rural area | National |
|---------------------------|------------|---------------|------------|----------|
| Inhabitants               | 542,900    | 205,000       | 37,500     | 785,400  |
| Share of total population | 69.1%      | 26.1%         | 4.8%       | 100.0%   |

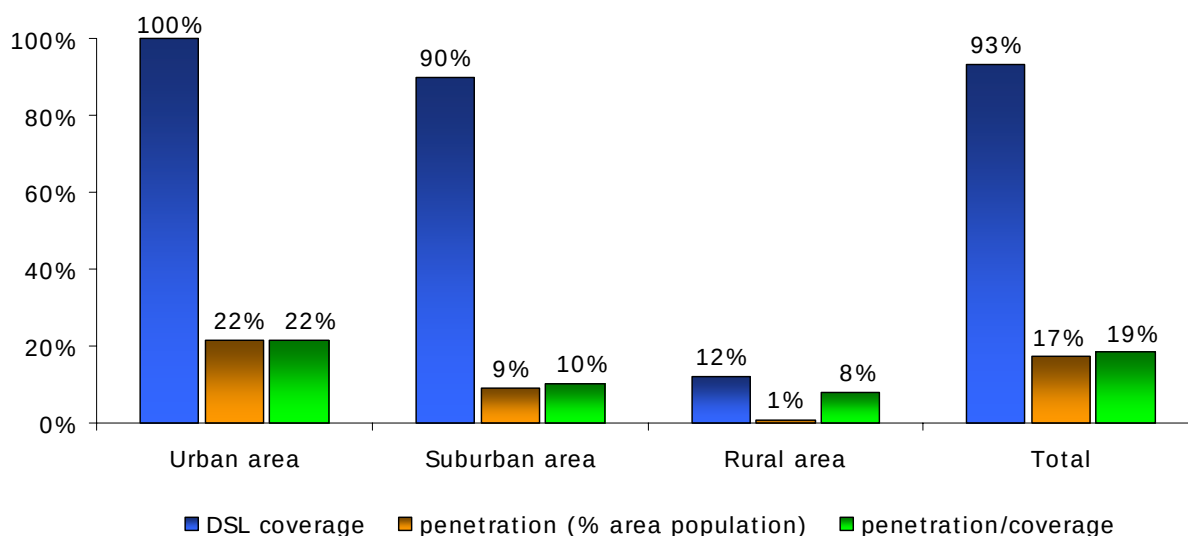
### 4.4.2. General broadband data

|                                                  | 12/04  | 12/05  | 12/06  | 12/07  | 12/08   |
|--------------------------------------------------|--------|--------|--------|--------|---------|
| DSL coverage (% of population)                   | -      | 70%    | 70%    | 80%    | 93%     |
| DSL subscribers                                  | 15,760 | 43,500 | 60,934 | 96,335 | 136,300 |
| DSL penetration (% of population)                | 2.0%   | 5.6%   | 7.8%   | 12.3%  | 17.3%   |
| Cable modem coverage (% population)              | 0%     | 0%     | -      | 28%    | 28%     |
| Cable modem subscribers                          | 0      | 0      | 314    | 718    | 2,757   |
| Cable modem penetration (% population)           | 0.0%   | 0.0%   | 0.0%   | 0.1%   | 0.4%    |
| FTTx subscribers                                 | 0      | 0      | -      | 100    | 100     |
| PLC subscribers                                  | 0      | 0      | -      | -      | -       |
| WLL subscribers                                  | 0      | 0      | -      | -      | -       |
| Satellite subscribers                            | 0      | 0      | 0      | 50     | 300     |
| Total                                            | 15,760 | 43,500 | 63,702 | 97,153 | 139,260 |
| Total fixed broadband penetration (% population) | 2.0%   | 5.6%   | 8.1%   | 12.4%  | 17.7%   |
| Mobile broadband subscribers                     |        |        |        |        | 57,000  |
| Mobile broadband penetration (% population)      |        |        |        |        | 7.3%    |

Broadband penetration enjoyed strong growth in 2008 (+5.3 points). DSL coverage, by far the leading technology, was recently expanded to some rural areas.

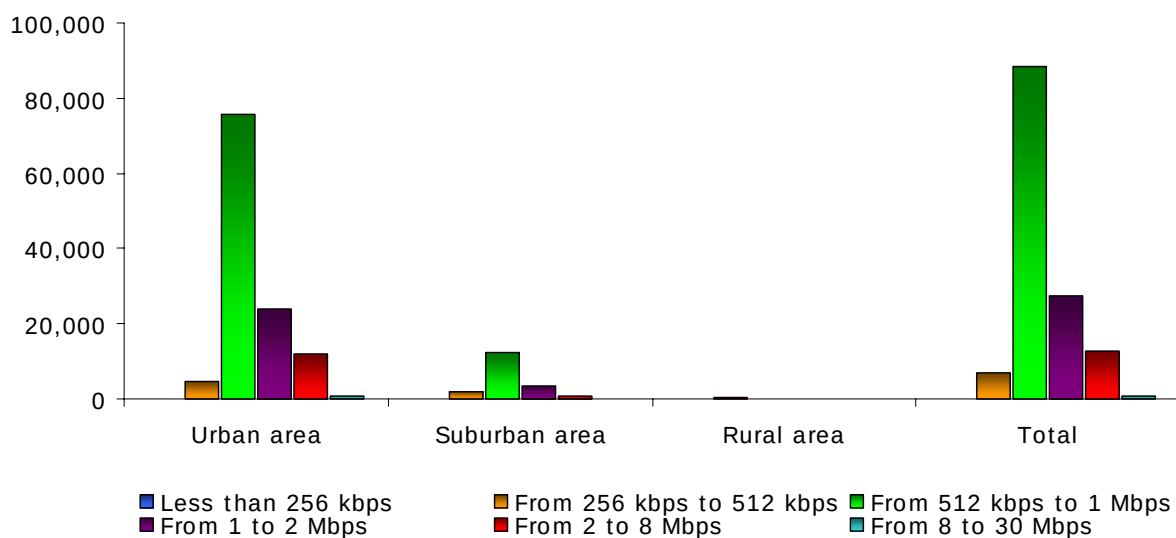
### 4.4.3. DSL coverage and take-up

#### Coverage and penetration

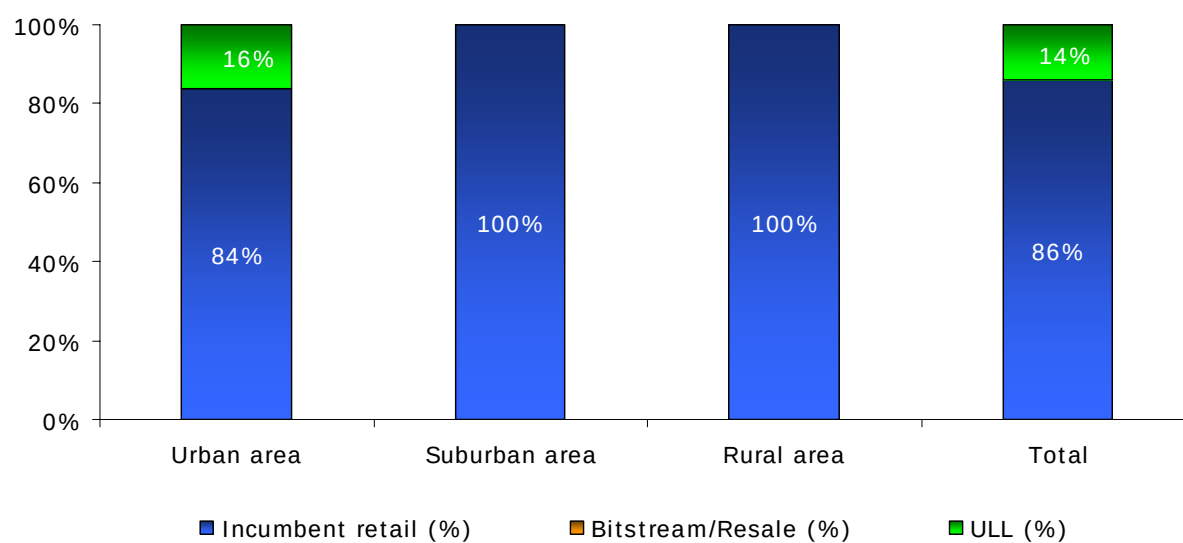


Broadband penetration in Cyprus rose significantly in 2008 (+41% compared to the end of 2007) but remains below the European average.

#### Number of DSL connections by download rate



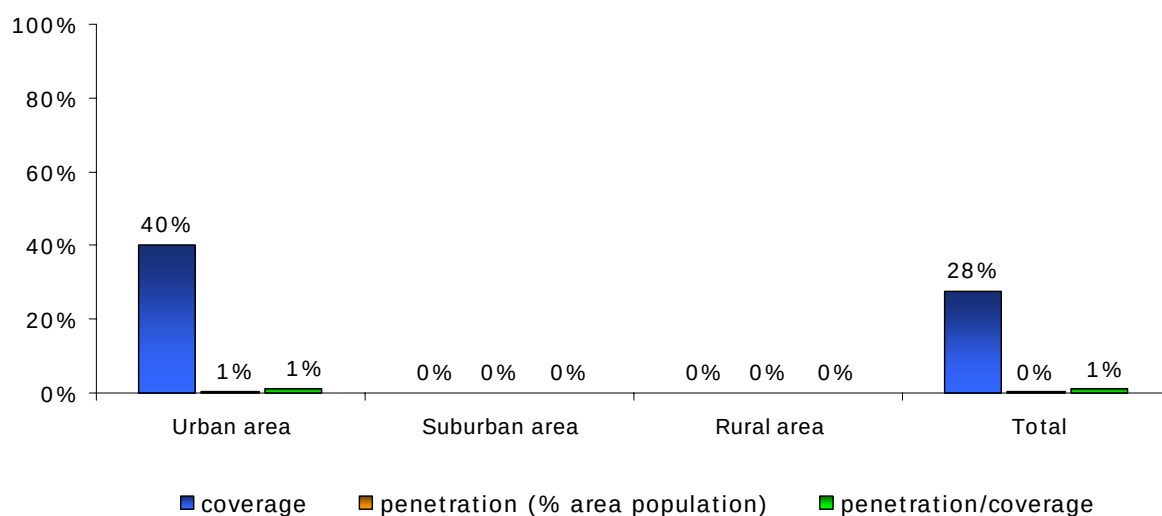
DSL download speeds are still quite low, with most connections supplying only 1 Mbps.

**Percentage of DSL connections by type of provider**

Unbundling is available only in urban areas and used mainly by Cyta's main competitor, Primetel.

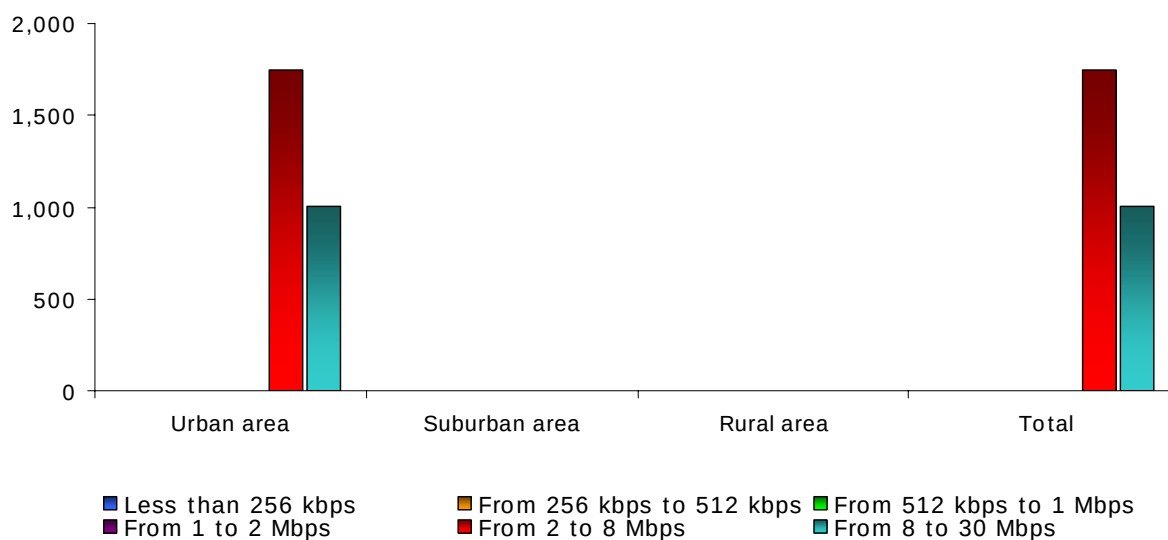
#### 4.4.4. Cable modem coverage and take-up

##### Coverage and penetration



Cablenet launched Internet access services in 2006, but progress was very slow and cable modem connections accounted for only 2% of the broadband subscriber base in Cyprus at the end of 2008.

##### Number of cable modem connections by download rate



Cable modem connection speeds are significantly higher than DSL speeds.

### 4.4.5. Other broadband access technologies

#### FTTH

In 2007, Cyta initiated a pilot project based on both GPON and E-P2P technologies, covering 100 homes. So far, there have been no commercial developments.

#### WLL/WiMAX

Hotspots have been deployed in only a few public spaces such as cafes and airports, providing time restricted services to users who can subscribe through their mobile phones, using a texting-based registration procedure. There are no plans for nationwide development. At least five ISPs provide Wi-Fi services: Ayza.net, NetHouse, Rflex, Cytanet and Thunderworx.

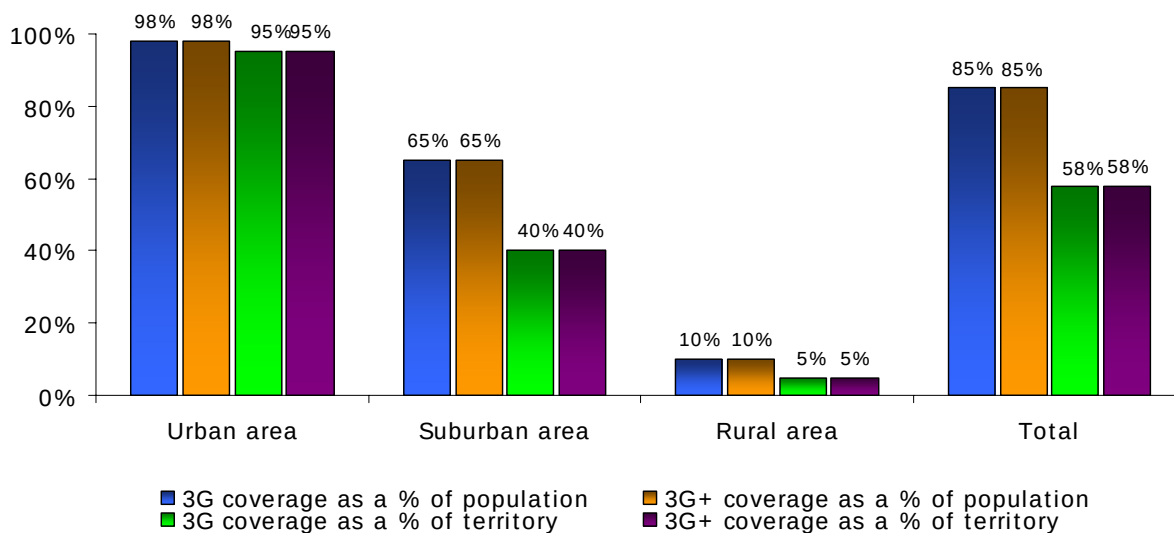
#### Satellite

In addition to WLL, satellite can also provide broadband access in Cyprus. There were around 300 broadband satellite connections at the end of 2008, most of them supplied by alternative operator GloTech, a subsidiary of US satellite operator Hughes, which provides Internet connections with downlink speeds up to 4 Mbps. The price of the service is quite high, however.

In March 2009, the Ministry of Communications & Works for the Republic of Cyprus Republic announced that all villages without broadband Internet access would be covered by satellite Internet access in combination with Wi-Fi.

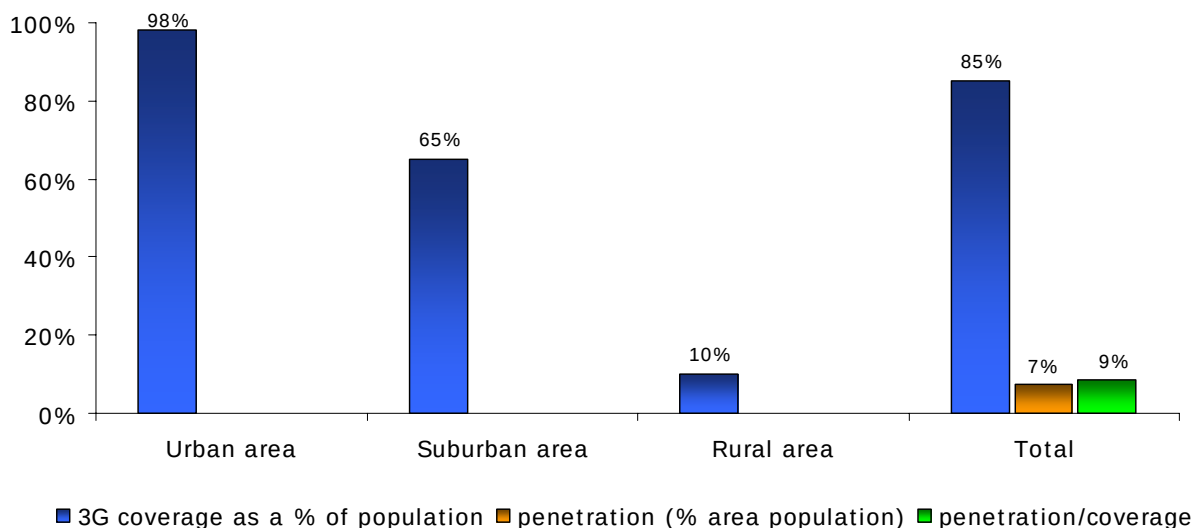
#### 4.4.6. Mobile broadband coverage and take-up

##### Coverage by technology



Following the launch of 3G services by its competitor, MTN, at the end of 2004, Cytamobile stepped up its rollout programme: its 3G network now covers 85% of the population and was entirely upgraded to HSDPA.

##### Penetration



There were 57,000 3G subscribers in Cyprus at the end of 2008, which represented just over 7% of the total mobile subscriber base.

## 4.5. The Czech Republic

### 4.5.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 2,229,586  | 5,013,953     | 3,224,003  | 10,467,542 |
| Share of total population | 21.3%      | 47.9%         | 30.8%      | 100.0%     |

### 4.5.2. General broadband data

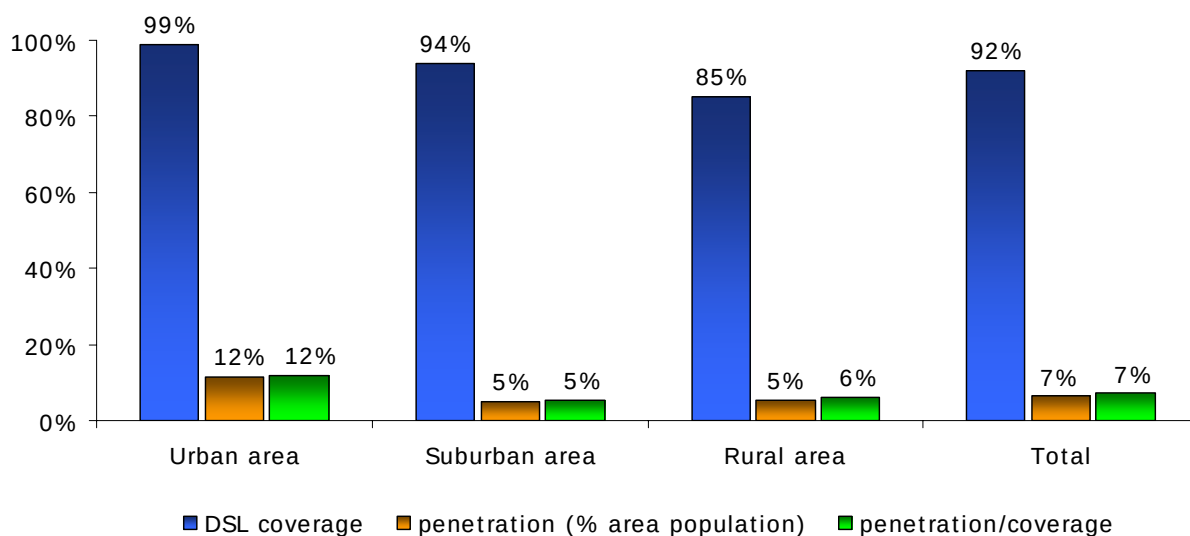
|                                                  | 12/04   | 12/05   | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|---------|---------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | -       | 75%     | 81%       | 85%       | 92%       |
| DSL subscribers                                  | 105,000 | 279,853 | 494,570   | 613,200   | 680,600   |
| DSL penetration (% of population)                | 1.0%    | 2.7%    | 4.8%      | 5.9%      | 6.5%      |
| Cable modem coverage (% population)              | 7%      | 24%     | 30%       | 30%       | 43%       |
| Cable modem subscribers                          | 60,000  | 132,944 | 216,000   | 309,000   | 360,000   |
| Cable modem penetration (% population)           | 0.6%    | 1.3%    | 2.1%      | 3.0%      | 3.4%      |
| FTTx subscribers                                 | 0       | 17,049  | 24,000    | 55,000    | 100,000   |
| PLC subscribers                                  | 0       | 0       | 50        | 200       | 200       |
| WLL subscribers                                  | 150,000 | 208,873 | 350,000   | 520,000   | 650,000   |
| Satellite subscribers                            | -       | 4,000   | 4,000     | 4,000     | 4,000     |
| Total                                            | 315,000 | 642,719 | 1,088,620 | 1,501,400 | 1,794,800 |
| Total fixed broadband penetration (% population) | 3.1%    | 6.3%    | 10.6%     | 14.5%     | 17.1%     |
| Mobile broadband subscribers                     |         |         |           |           | 217,000   |
| Mobile broadband penetration (% population)      |         |         |           |           | 2.1%      |

Both DSL and cable modem coverage levels have increased steadily over the past few years; progress was significant again in 2008, especially for DSL in rural areas. There were 2,000,000 broadband subscribers in the Czech Republic in 2008, including mobile broadband. Even though the number of subscribers to all types of connection is still growing, the user base for traditional access technologies, namely DSL and cable, is tending to grow at a lesser pace than for wireless technologies (Wi-Fi, mobile broadband).

As concerns broadband penetration, the highest rates are to be found in Prague and the Hradec Králové region (48% and 39% of households, respectively). On the other end of the spectrum, with the lowest broadband coverage levels is north-western Bohemia, in the regions of Karlovy Vary, Ústí nad Labem and Liberec (25%, 23% and 25% respectively).

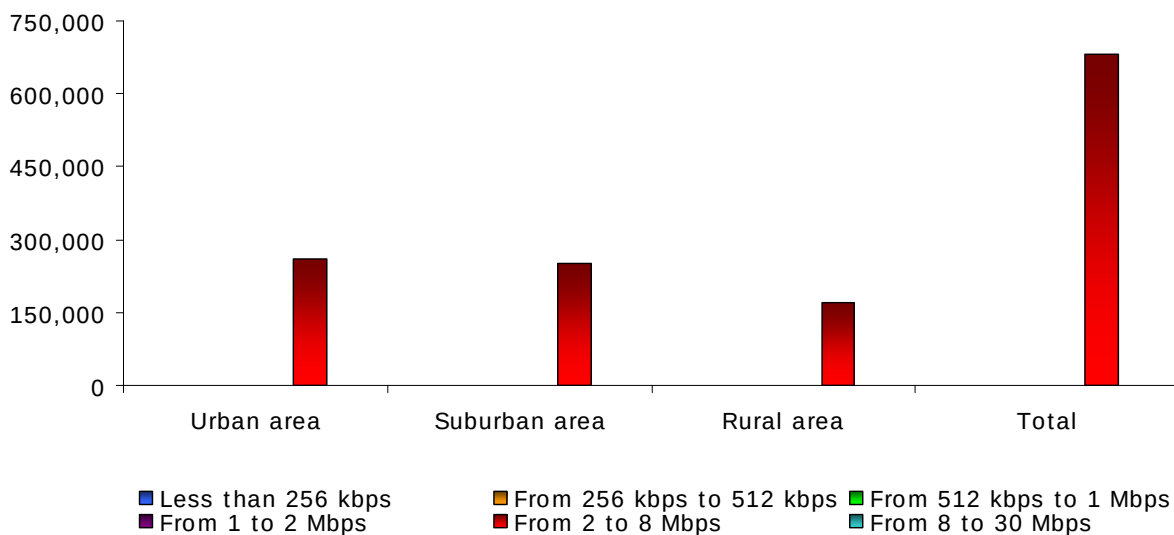
### 4.5.3. DSL coverage and take-up

#### Coverage and penetration



In 2008, there were 680,600 DSL subscribers – DSL being available to 92% of the population. 38% of all DSL subscribers live in urban areas, 37% in suburban areas and 25% in rural areas.

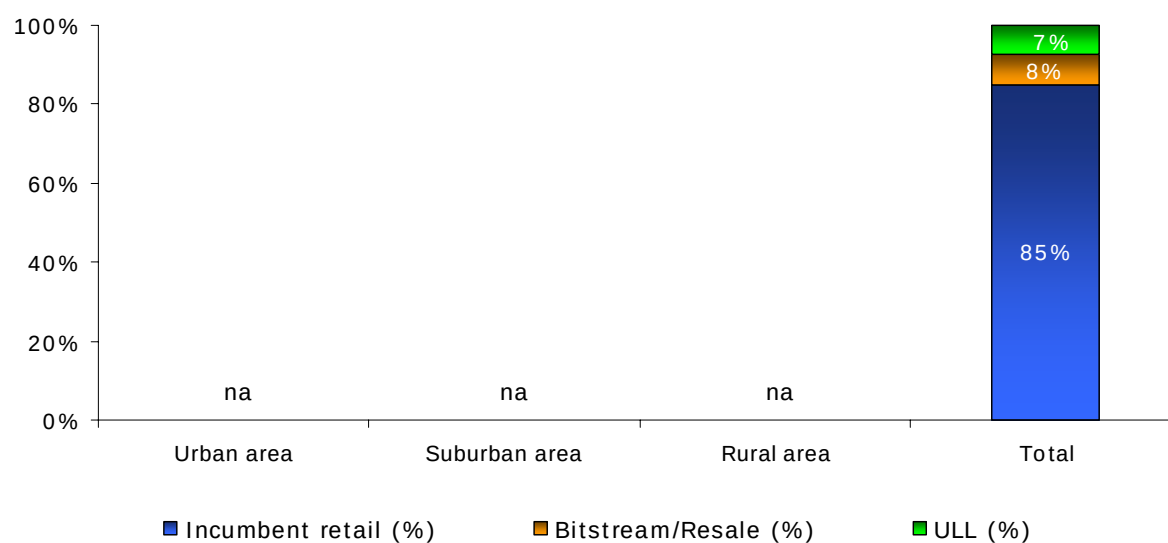
#### Number of DSL connections by download rate



Because none of the leading operators was able to provide detailed data (see methodological notes), we could not establish a distinction between connections with download speeds at 8 Mbps (basic advertised speed) and connections with higher download speeds (16 Mbps, 20 Mbps).



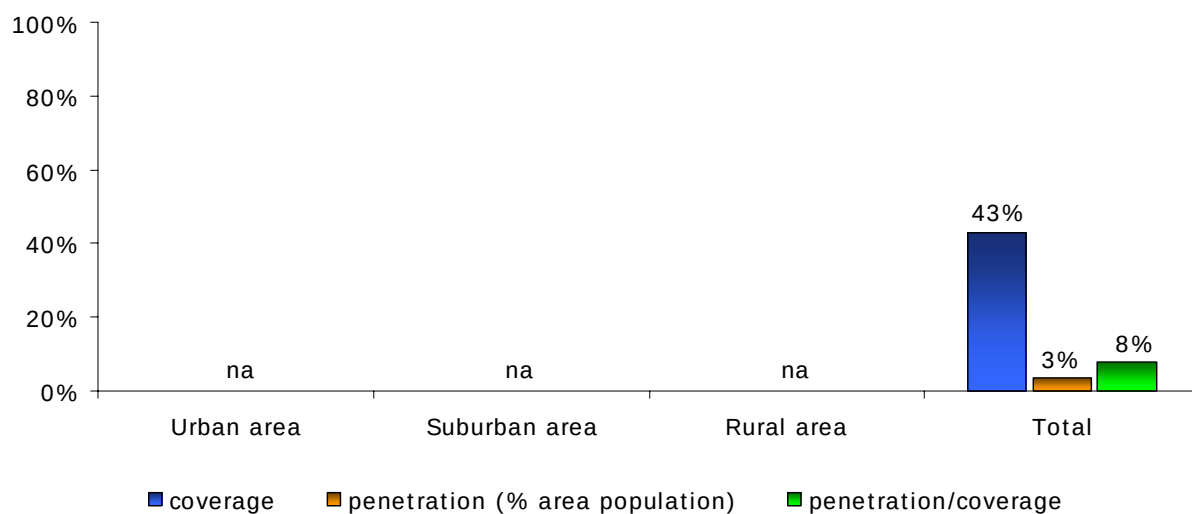
## Number of DSL connections by type of provider



85% of DSL connections are sold directly by the incumbent carrier, Telefónica O<sub>2</sub>, with the remainder of the market being shared almost equally between bitstream/resale and unbundled lines.

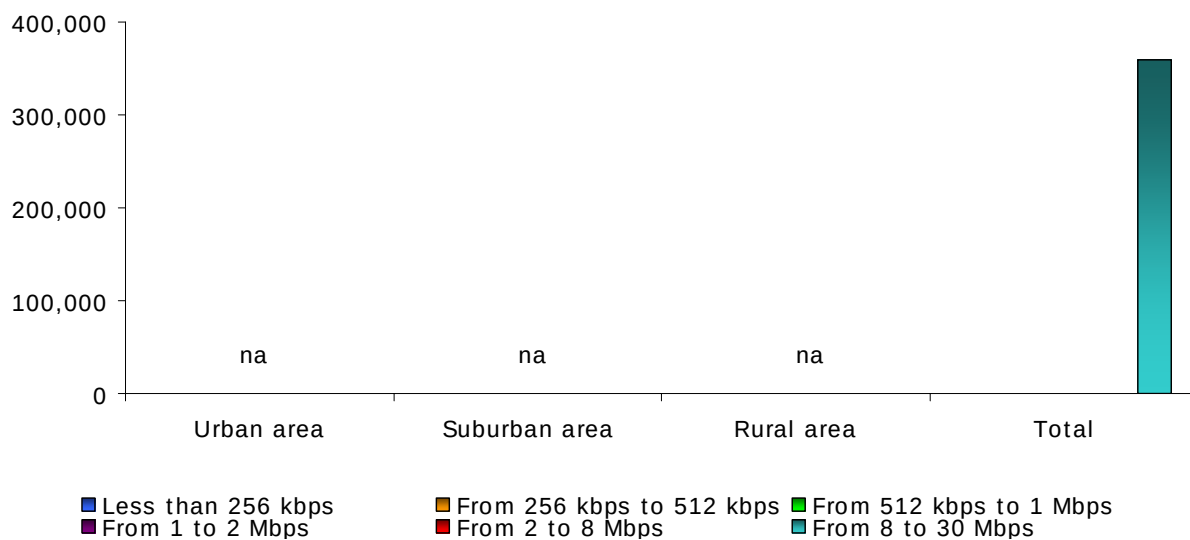
#### 4.5.4. Cable modem coverage and take-up

##### Coverage and penetration



At the end of 2008, there were 360,000 cable modem subscribers in the Czech Republic. The number one player in the country's broadband cable market is UPC, with an 87% market share. According to an estimate by UPC, around 43% of population have access to cable modem technology.

##### Number of cable modem connections by download rate



The basic download speed offered by UPC is 10 Mbps.

### 4.5.5. Other broadband access technologies

#### **FTTx**

As of 31 December 2008, 100,000 subscribers were accessing the Internet via FTTx technology – the majority of them being businesses. Companies in the market are T-Systems PragoNet, Casablanca INT, ČD Telematika, Dial Telecom or Trioptimum.

#### **Wi-Fi**

It is very difficult to analyse Wi-Fi market as it is highly fragmented and rather difficult to obtain relevant data. A rough estimate indicates around 650,000 subscribers.

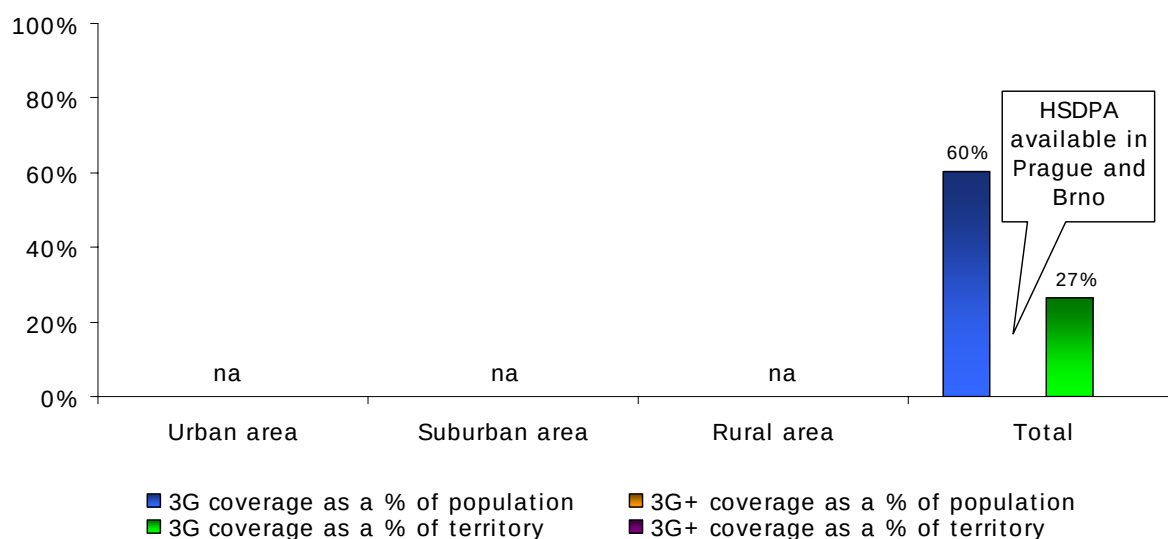
According to the Czech Telecommunication Office, 63% of Wi-Fi subscribers have connection speeds below 2 Mbps (i.e. 410,000 subscribers) and 37% are equipped with access rates above 2 Mbps (i.e. 240,000 subscribers).

#### **Satellite**

This form of broadband Internet access does not play an important role in the residential market. Because of its high price, it is used primarily by medium-size and big businesses, and by companies in those regions where no other solution is available. Due to the meagre popularity of this technology, the subscriber base has remain unchanged over recent years (4,000).

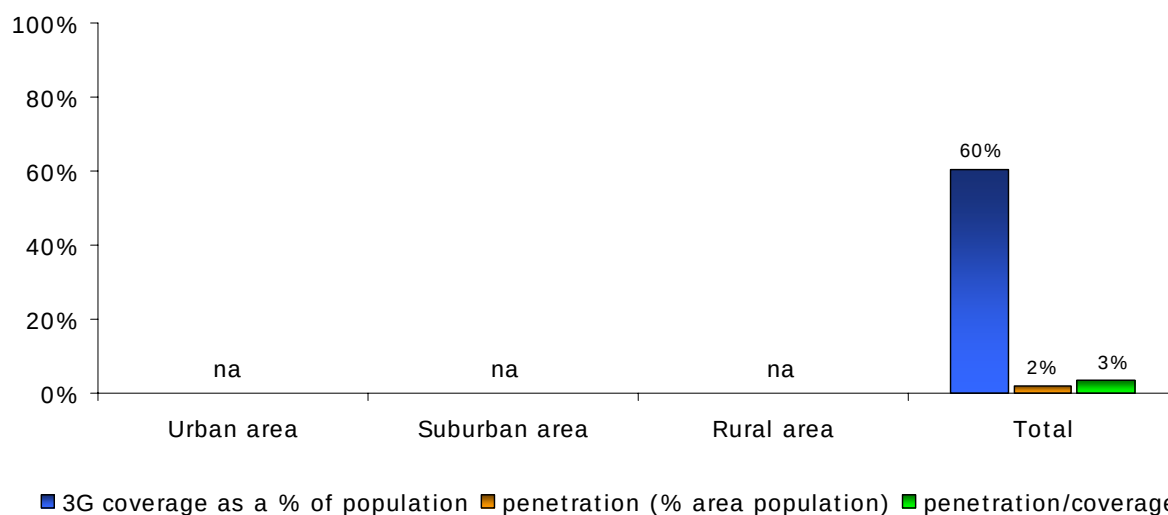
## 4.5.6. Mobile broadband coverage and take-up

### Coverage by technology



T-mobile Czech Republic covers 26.63% of the Czech territory and 60.3% of the population with its mobile broadband network. The coverage rates for other operators are not available, but we presume that T-Mobile CR data are indicative of the overall situation. The carrier has also upgraded a portion of its 3G network, in Prague and Brno, to HSDPA.

### Penetration



Four operators market mobile broadband access in the Czech Republic, and have a combined base of 217,000 subscribers. The largest market share belongs to Telefónica O<sub>2</sub> which uses UMTS and CDMA (1xEV-DO) technologies. T-mobile is the number two player, followed by Vodafone. The number four player is U:fon which is preparing a large-scale 3G network rollout.

## 4.6. Denmark

### 4.6.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,659,164  | 2,157,463     | 1,659,164  | 5,475,791 |
| Share of total population | 30,3%      | 39,4%         | 30,3%      | 100,0%    |

### 4.6.2. General broadband data

|                                                  | 12/04     | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 95%       | 100%      | 100%      | 100%      | 100%      |
| DSL subscribers                                  | 633,459   | 836,785   | 1,063,227 | 1,207,200 | 1,246,737 |
| DSL penetration (% of population)                | 11.7%     | 15.5%     | 19.5%     | 22.0%     | 22.8%     |
| Cable modem coverage (% population)              | 60%       | 60%       | 60%       | 60%       | 60%       |
| Cable modem subscribers                          | 343,664   | 462,441   | 496,227   | 542,281   | 538,861   |
| Cable modem penetration (% population)           | 6.4%      | 8.6%      | 9.1%      | 9.9%      | 9.8%      |
| FTTx subscribers                                 | 85,000    | 117,028   | 131,230   | 205,678   | 232,437*  |
| PLC subscribers                                  | 0         | 92        | 99        | 96        | 0         |
| WLL subscribers                                  | 3,019     | 15,184    | 20,124    | 23,016    | 22,487**  |
| Satellite subscribers                            | 0         | 111       | 149       | 5         | 0         |
| Total                                            | 1,065,142 | 1,431,641 | 1,711,056 | 1,978,276 | 2,040,522 |
| Total fixed broadband penetration (% population) | 19.7%     | 26.5%     | 31.4%     | 36.1%     | 37.3%     |
| Mobile broadband subscribers                     |           |           |           |           | 1,034,000 |
| Mobile broadband penetration (% population)      |           |           |           |           | 18.9%     |

\* including 109,609 LAN subscribers (mainly FTTB + Ethernet)

\*\* including 4,174 Wi-Fi subscribers and 16,882 WiMAX subscribers

DSL coverage has been complete for several years, while cable modem coverage has reached a peak at 60% (close to cable TV coverage). With over 2 million subscribers and a density of 37.3% at the end of 2008, the Danish fixed broadband market remains one of the most advanced markets in the world.

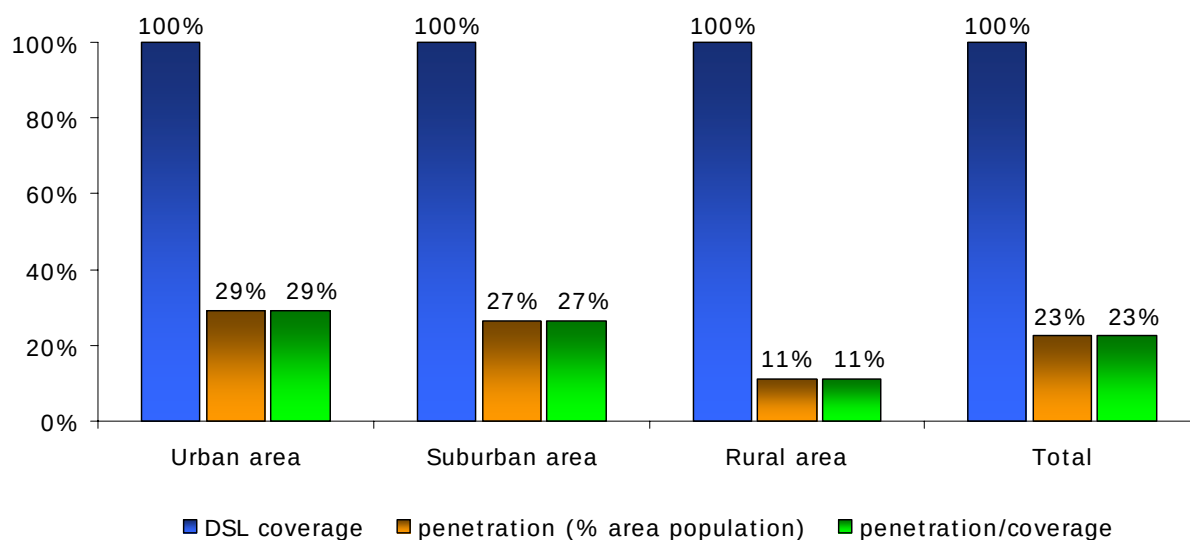
DSL accounts for more than half of the fixed broadband connections and incumbent carrier, TDC, still has a 73% share of this segment. All local exchanges are DSL-equipped, but eligibility is still slightly lower due to technical constraints (distance, quality of the copper pair, etc.). TDC is also active in the cable segment through its subsidiary, TDC Kabel TV.

Despite a roughly 10% increase in the number of FTTx connections, the fixed broadband connection market appears to have reached its peak. We are, however, seeing tremendous growth in mobile broadband connections, with penetration levels having reached 18.9%, and forecasts indicating that mobile connections will replace a portion of existing fixed connections in the future.

Incumbent TDC's chief competitors are Fullrate (owned by TDC), Telia Denmark and Tele2 (DSL), Telia Stofa and Arrownet (cable) and several WiMAX operators (Danske Telecom, mobile operator Sonofon and Bulter Networks).

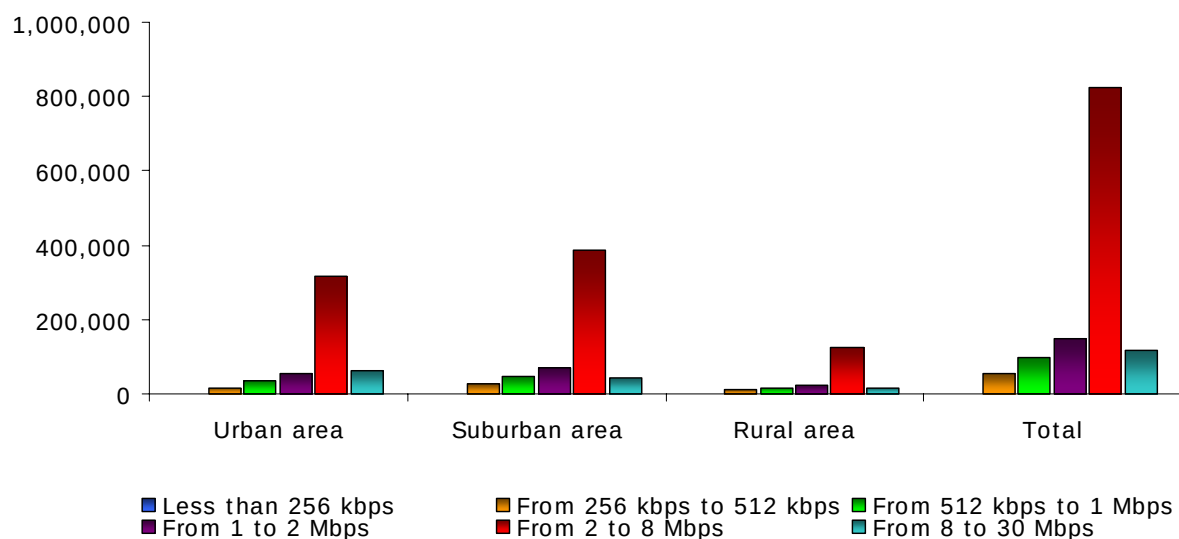
### 4.6.3. DSL coverage and take-up

#### Coverage and penetration



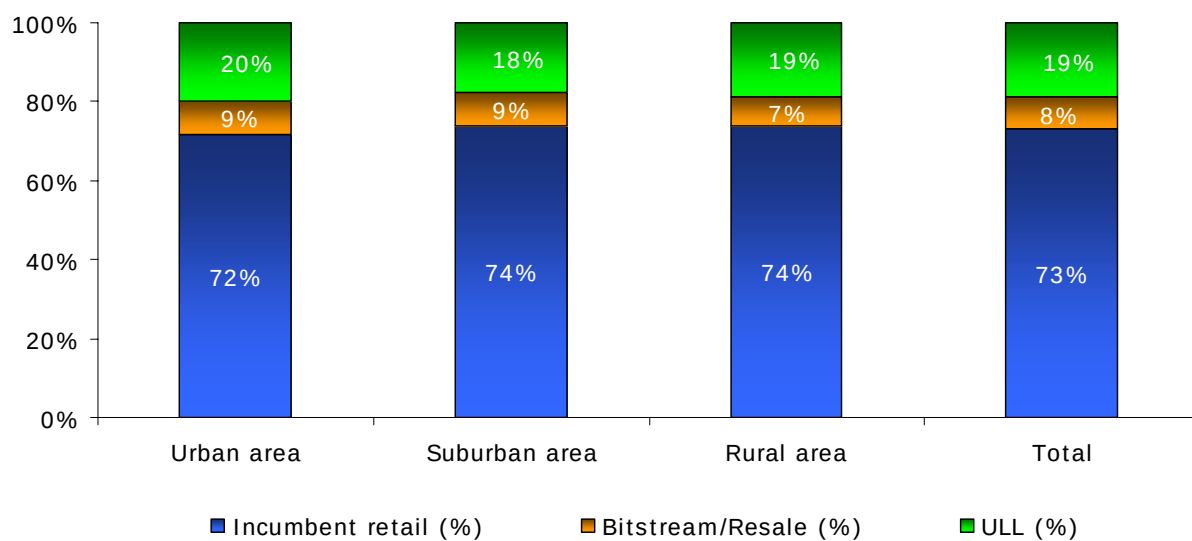
DSL coverage is now deemed complete in all parts of Denmark. All local exchanges have been DSL-capable for several years, and almost all subscribers (more than 99% of the population) are covered with DSL services. Take-up nevertheless remains far higher in urban and suburban areas than in rural areas. The total number of subscribers remained stable during 2008.

#### Number of DSL connections by download rate



Download speeds have increased considerably, and most connections are now in the 2 to 8 Mbps range.

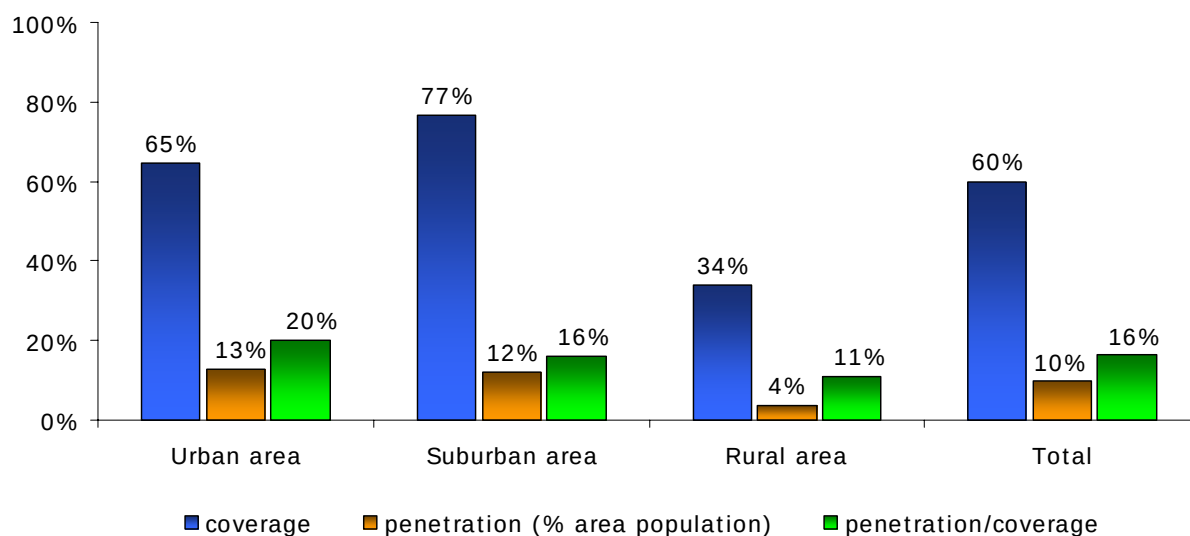
### Number of DSL connections by type of provider



The incumbent remains strong, enjoying a 73% share of the DSL access market.

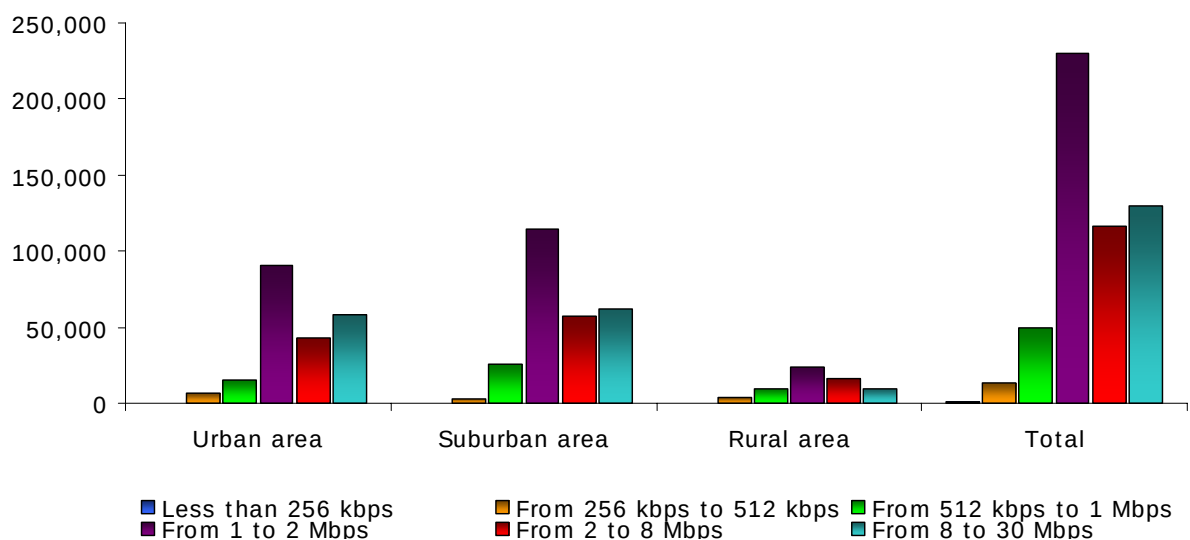
## 4.6.4. Cable modem coverage and take-up

### Coverage and penetration



As with the number of DSL connections, the number of broadband cable subscribers remained unchanged from 2007 to 2008.

### Number of cable modem connections by download rate



Following a rapid increase in the speed of the solutions offered by cable modem operators, connections with download speeds of 2 Mbps and more now account for the vast majority of cable modem connections (close to 90%).



## 4.6.5. Other broadband access technologies

### FTTx

FTTH, Fibre-to-the-Premises and FTTC/LAN networks continue to grow rapidly in Denmark.

|                  | 12/03  | 12/04  | 12/05   | 12/06   | 12/07   | 12/08   |
|------------------|--------|--------|---------|---------|---------|---------|
| FTTx subscribers | 42,400 | 85,000 | 117,028 | 131,230 | 205,678 | 232,437 |

### Wi-Fi

Wi-Fi has been relatively successful in Denmark. In addition to established operators such as TDC, the market is now populated by new entrants such as Danske Telecom. The number of Wi-Fi subscribers has declined from 6,095 at the end 2007 to 4,174 at the end 2008.

### WLL/WiMAX

Overall state of WLL/WiMAX in Denmark:

|                                                       | 12/04        | 12/05        | 12/06        | 12/07        | 12/08        |
|-------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|
| WLL coverage                                          |              |              |              |              |              |
| <i>Percentage of the population covered (3.5 GHz)</i> | close to 90% | close to 90% | close to 90% | close to 90% | close to 90% |
| WLL subscribers                                       | 3,674        | 3,761        | 3,761        | 3,793        | 4,174        |
| WiMAX                                                 | -            | 2,495        | 12,272       | 13,109       | 16,882       |

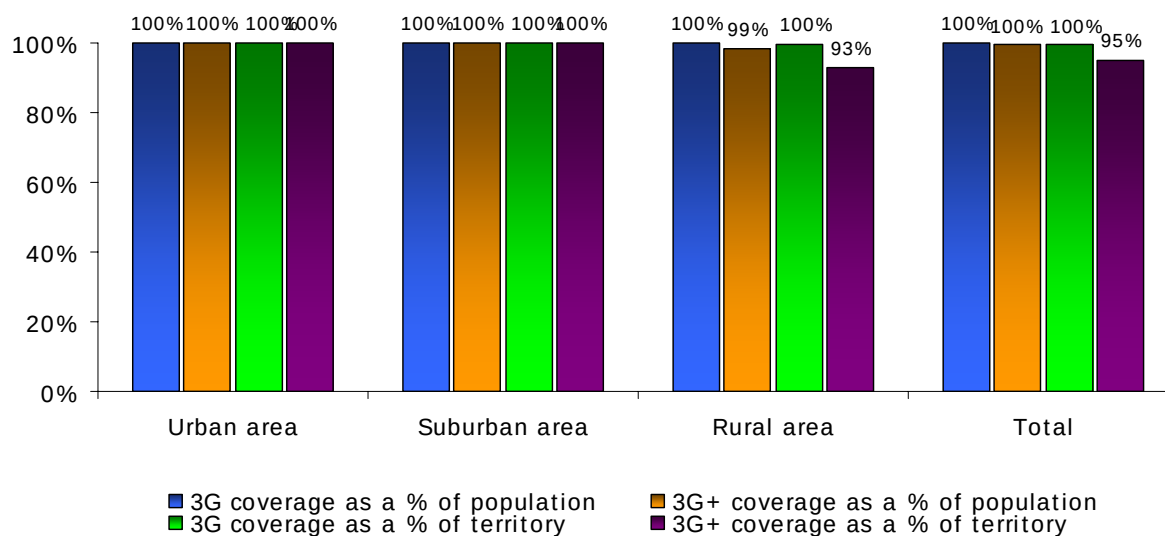
- WiMAX is concentrated in two regions in Jutland. The leading operator is Danske Telecom. A new operator, ELRO, was awarded a license in June 2007, and now has a market share of 20.2%.

### Satellite

The number of Internet via satellite subscriptions in Denmark dropped from 149 at the end of 2006 to only 5 at the end of 2007, and the service is now defunct.

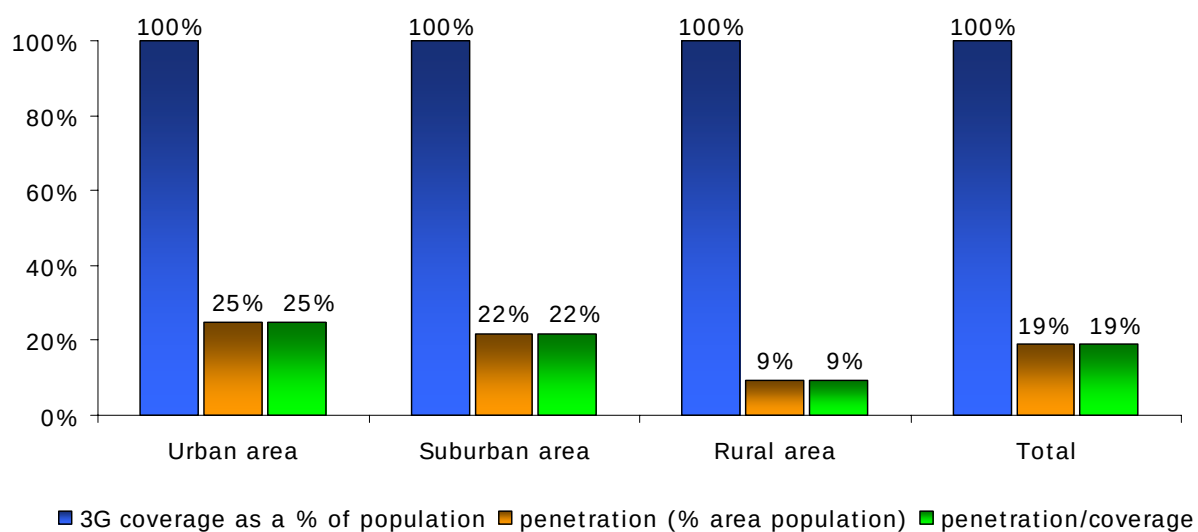
## 4.6.6. Mobile broadband coverage and take-up

### Coverage by technology



3G/3G+ coverage is near complete in Denmark, with only 1.5% of the population, or 7% of the territory in rural areas not covered by 3G+.

### Penetration



In addition to cellular telephony, there has been a dramatic growth in mobile data-only subscriptions. Following a growth of 45% in second half of 2008, the number of subscribers passed the one million market. "3" is the leading operator with a market share of 46.4%. The other major operators are TDC, Sonofon and Telia.

## 4.7. Estonia

### 4.7.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 930,796    | 0             | 409,619    | 1,340,415 |
| Share of total population | 69.4%      | 0.0%          | 30.6%      | 100.0%    |

### 4.7.2. General broadband data

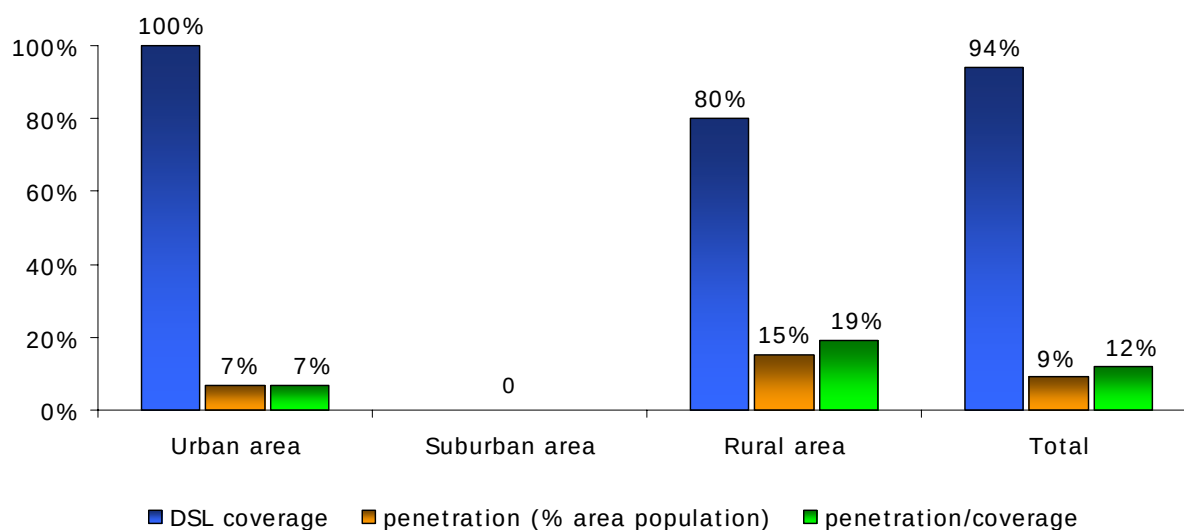
|                                                  | 12/04   | 12/05   | 12/06   | 12/07   | 12/08   |
|--------------------------------------------------|---------|---------|---------|---------|---------|
| DSL coverage (% of population)                   | -       | -       | -       | 85%     | 94%     |
| DSL subscribers                                  | 70,000  | 85,000  | 102,000 | 117,000 | 125,000 |
| DSL penetration (% of population)                | 5.2%    | 6.3%    | 7.6%    | 8.7%    | 9.3%    |
| Cable modem coverage (% population)              | -       | 53%     | 53%     | 53%     | 69%     |
| Cable modem subscribers                          | 45,000  | 53,000  | 63,000  | 71,000  | 74,000  |
| Cable modem penetration (% population)           | 3.3%    | 3.9%    | 4.7%    | 5.3%    | 5.5%    |
| FTTx/LAN subscribers                             | 8,000   | 30,000  | 40,000  | 50,000  | 66,000  |
| PLC subscribers                                  | 0       | 0       | 0       | 0       | 0       |
| WLL subscribers                                  | 4,000   | 8,000   | 15,000  | 25,000  | 35,000  |
| Satellite subscribers                            | 0       | 0       | 0       | 0       | na      |
| Total                                            | 127,000 | 176,000 | 220,000 | 263,000 | 300,000 |
| Total fixed broadband penetration (% population) | 9.4%    | 13.1%   | 16.4%   | 19.6%   | 22.4%   |
| Mobile broadband subscribers                     |         |         |         |         | 80,000  |
| Mobile broadband penetration (% population)      |         |         |         |         | 6.0%    |

Both DSL and cable modem coverage levels increased significantly in 2008. The number of broadband customers increased by 14% in 2008 (vs. +20% in 2007). There were 84 providers competing for market share in the country's data communications market at the end of 2008, with Elion Ettevõtte AS, AS Starman and AS STV leading the way. Competition in the broadband market is chiefly between companies that control their own infrastructure. Among the leading players, Elion supplies chiefly ADSL access while cable companies Starman and STV supply broadband cable access – and these three providers combined account for 82% of the country's broadband customers.

Most end users subscribe to service bundles that include a broadband Internet connection, (mobile) telephone services and/or cable TV. At end of 2008, 62% of end users were subscribing to at least a double play package.

### 4.7.3. DSL coverage and take-up

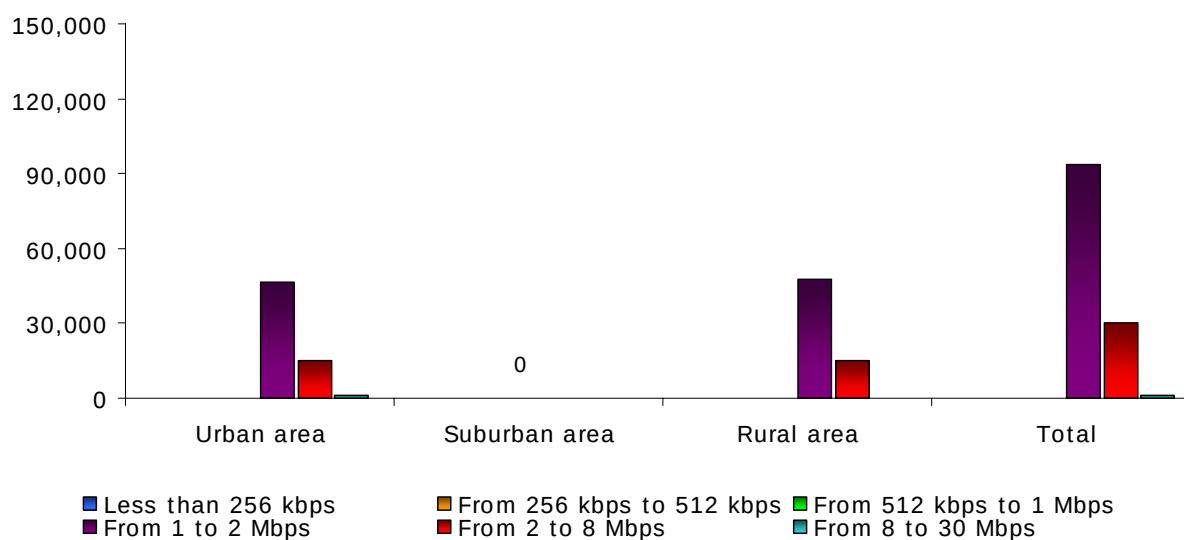
#### Coverage and penetration



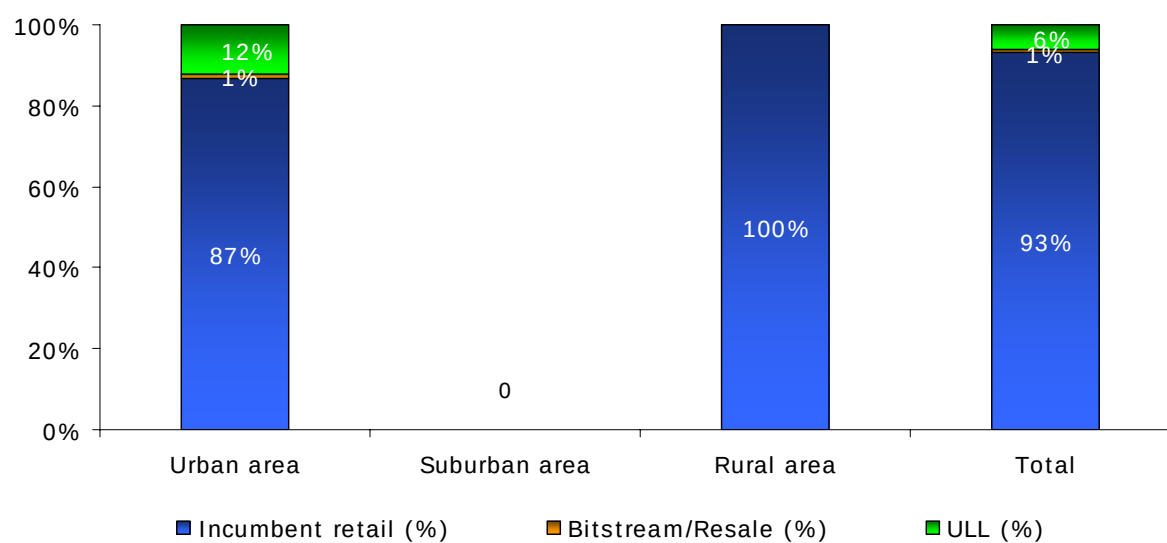
Broadband data services were provided mainly via the telephone network and cable distribution networks. The number of ADSL customer increased by 7% compared to 2007, after having increased by around 15% the year before.

It is estimated that 100% of urban areas and 80% of rural areas are covered with ADSL technologies. The distribution of actual subscribers is estimated to be split 50-50 between urban and rural areas.

#### Number of DSL connections by download rate



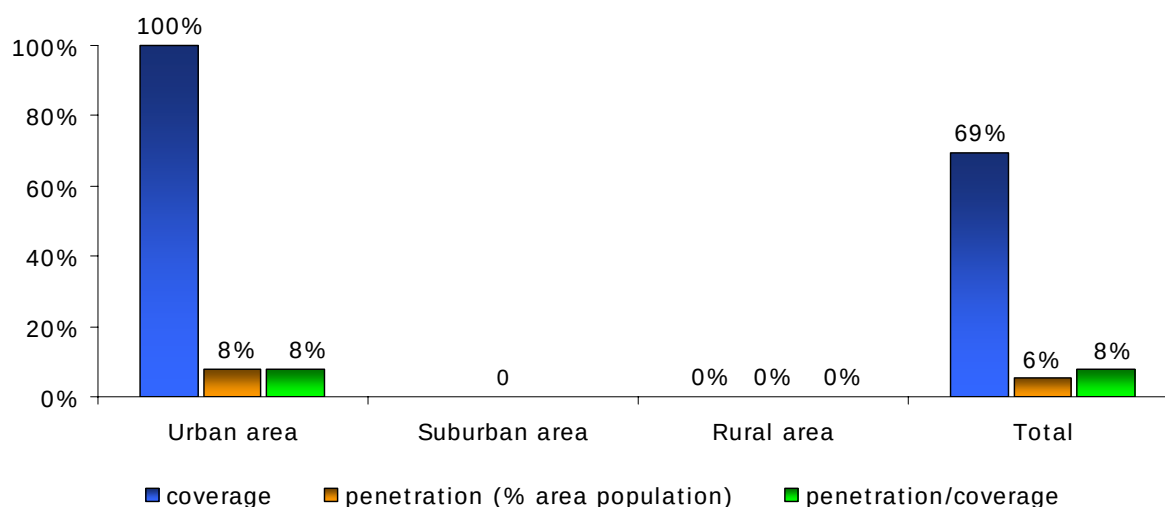
Detailed data on DSL connections by download rate are not available from the providers, but it is estimated that some 75% of the connections fall into the category of 512 kbps to 2 Mbps, nearly 25% into the category of 2-10 Mbps, and 1% above 10 Mbps.

**Number of DSL connections by type of provider**

As of 2008, only 7,700 Elion local lines were unbundled lines. In 2008, Elion and Elisa began offering wholesale bitstream access to other companies, attracting 180 customers by year end.

#### 4.7.4. Cable modem coverage and take-up

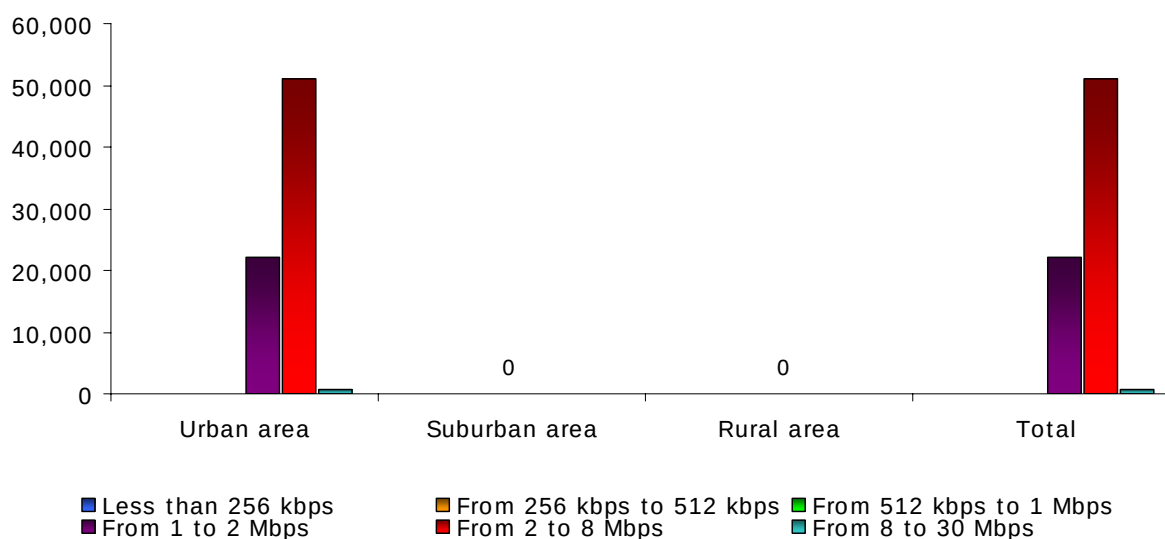
##### Coverage and penetration



The broadband cable subscriber base grew by 4% over the previous year, compared to roughly 13% growth in 2007.

Figures indicate that cable networks in urban areas are capable of delivering broadband access, while the networks in rural areas are not.

##### Number of cable modem connections by download rate



Detailed data on cable modem connections by download rate is not available from the providers, but it is estimated that around 30% of the connections fall in the category of 512 kbps to 2 Mbps, around 70% into the category of 2-10 Mbps, and less than 1% deliver access at a speed of over 10 Mbps.

### 4.7.5. Other broadband access technologies

#### **FTTx**

The number of customers subscribing to an optical fibre access solution rose by 32% in 2008, compared to a 25% increase in 2007.

#### **WLL**

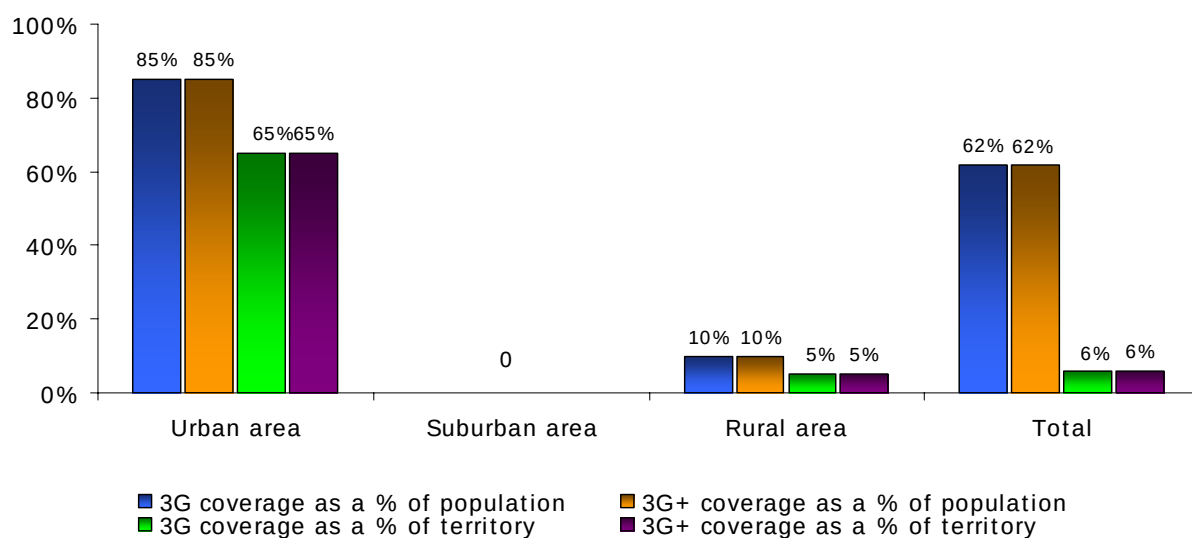
The highest rate of growth for any technology was experienced by WLL access, whose customer base grew by 38% in 2008. Elisa, in partnership with Levira AS, began operating a nationwide WiMAX network that year. It is still the least popular form of Internet access, accounting for only 11% of the total user base.

#### **Satellite**

There are no companies in Estonia that own a satellite network. Elisa does resell satellite services, but no detailed data are available, and estimates indicate a very small share of the broadband access market for satellite-based solutions.

## 4.7.6. Mobile broadband coverage and take-up

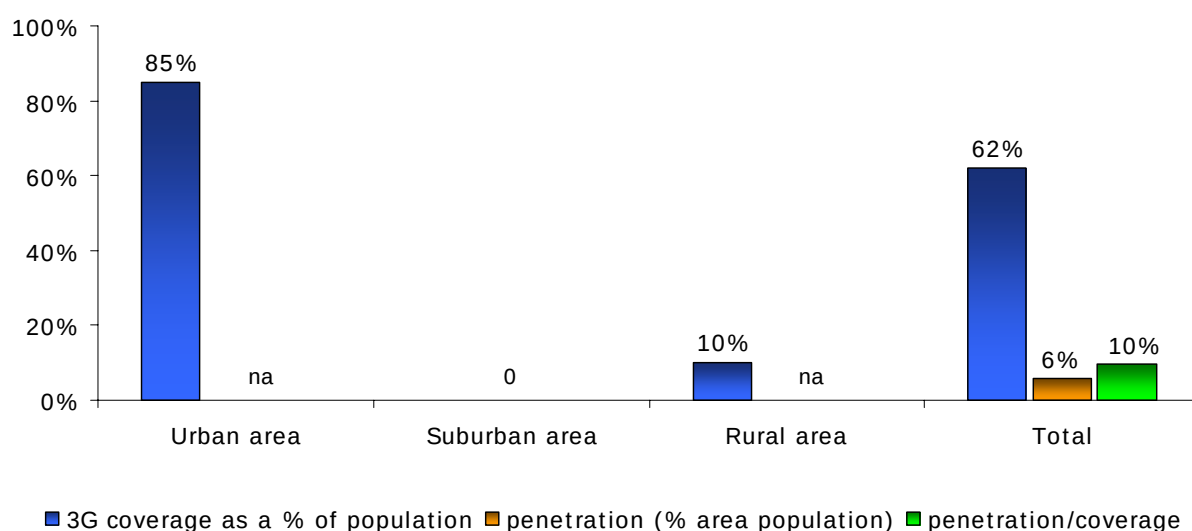
### Coverage by technology



EMT, AS Tele2 and Elisa were awarded 10-year UMTS licences in the summer of 2003. EMT was the first to run trials on its 3G network, back in September 2003, but waited until late October 2005 to launch commercial 3G services in the Tallinn area. As of 2008, all the network operators (Elisa, EMT and Tele2) were operating 3G+ networks and supplying 3G+ broadband connections.

Of the population living in urban areas, 90% are estimated to be covered with 3G+ access, and 5% of those living in rural areas, putting the national average at 60-65%. From a territorial perspective, 90% of urban areas are covered and 10% of rural areas, which puts national territorial coverage at between 5% and 10%.

### Penetration



The number of actual users is estimated to be 80,000.



## 4.8. Finland

### 4.8.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,869,197  | 1,668,923     | 1,788,194  | 5,326,314 |
| Share of total population | 35.1%      | 31.3%         | 33.6%      | 100.0%    |

### 4.8.2. General broadband data

|                                                  | 12/04   | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|---------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 89%     | 90%       | 92%       | 96%       | 96%       |
| DSL subscribers                                  | 658,700 | 1,018,700 | 1,161,100 | 1,270,500 | 1,231,000 |
| DSL penetration (% of population)                | 12.7%   | 19.5%     | 23.4%     | 25.4%     | 23.1%     |
| Cable modem coverage (% population)              | 32%     | 33%       | 35%       | 40%       | 40%       |
| Cable modem subscribers                          | 112,400 | 148,900   | 181,100   | 209,600   | 214,800   |
| Cable modem penetration (% population)           | 2.2%    | 2.8%      | 3.4%      | 4.0%      | 4.0%      |
| FTTx/LAN subscribers*                            | na      | na        | 72,900    | 114,000   | 134,900   |
| PLC subscribers                                  | 900     | 800       | 800       | 1,000     | na        |
| WLL subscribers                                  | 3,300   | 3,500     | 4,900     | 15,300    | 26,100    |
| Satellite subscribers                            | 120     | 0         | 0         | 0         | 0         |
| Total                                            | 775,420 | 1,171,900 | 1,420,800 | 1,610,400 | 1,607,100 |
| Total fixed broadband penetration (% population) | 14.7%   | 22.3%     | 26.7%     | 30.2%     | 30.2%     |
| Mobile broadband subscribers                     |         |           |           | 143,100   | 479,700   |
| Mobile broadband penetration (% population)      |         |           |           |           | 9.0%      |

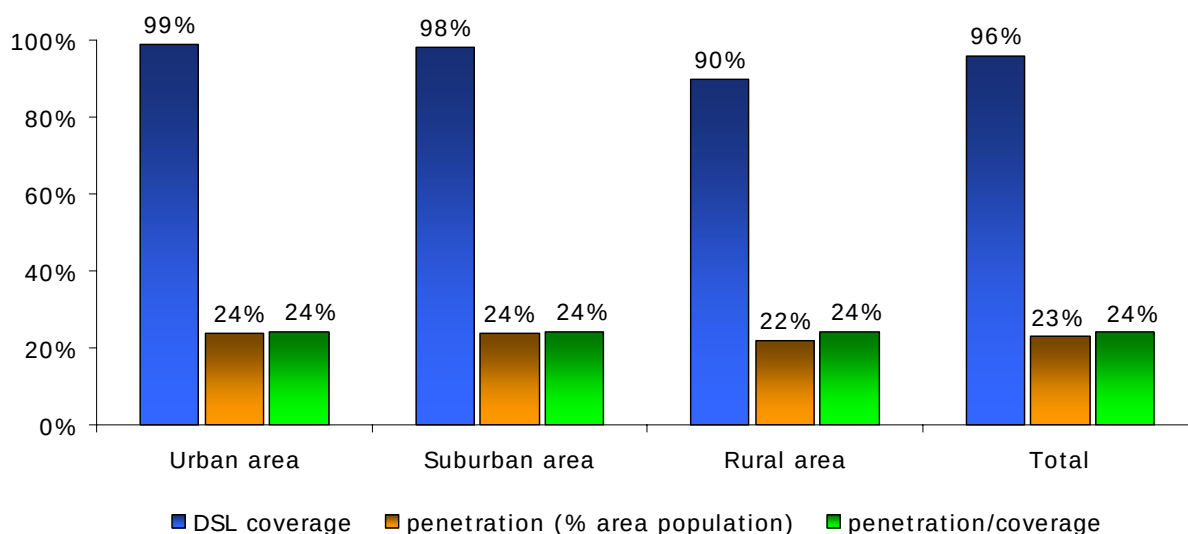
\* stated as "real estate and housing company subscriptions" in the Ficora reports

The strong development of broadband in Finland is due chiefly to the early introduction of broadband technologies and competition enablers (xDSL in 1994, unbundling in 1997), along with continuous public support. But while coverage may be high (although figures neither DSL or cable modem made any progress in 2008), download speeds remain relatively low. The National Broadband Strategy, launched in 2004, aimed to have more than 90% of all Internet connections over broadband by the end of 2007, with average download speeds of 8 Mbps. In reality, Ficora reports that the average download speed was only just above 2 Mbps at the end of 2008. This is in marked contrast to the other Nordic countries where average download speeds are much higher. At the end of 2008, the Finnish government launched a new Broadband Programme whose aim was to provide everyone in Finland with a broadband connection running at 1 Mbps by the end of 2010 as a universal service. In autumn 2009, the government ultimately decided that a 1 Mbps connection would become a universal service as early as mid-2010, and that connection at a minimum 100 Mbps, depending on demand, would be so by the end of 2015.

The Finnish market continues to be dominated by DSL, which is available to 96% of the population and accounts for more than 80% of total broadband connections. Elisa, Finnet and TeliaSonera Finland, the three "incumbent" operators, provide DSL services through their own lines, but alternative DSL operators could control more than 30% of the market, despite claims that wholesale offers are too expensive. Cable modem is far less advanced, although there are more than 50 cable TV operators in Finland, including Telia Sonera and Elisa.

### 4.8.3. DSL coverage and take-up

#### Coverage and penetration

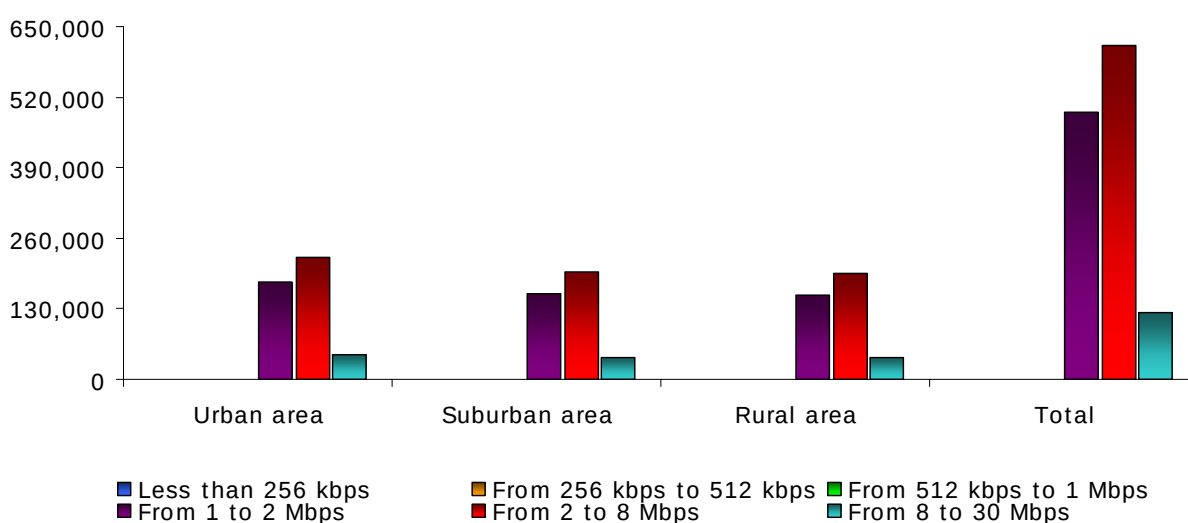


DSL coverage in urban areas totals close to 100%. Municipalities have provided partial funding to extend coverage in rural areas, where coverage has now risen above 90%. Nationwide, the coverage remains around 96%. According to Ficora, this figure is not likely to increase in the foreseeable future.

The number of DSL connections appears to have fallen significantly from 2007 to 2008. In truth, the number of DSL subscriptions has remained relatively stable. The reason for the apparent large decline is that Ficora no longer counts real estate and housing company subscriptions as DSL. While most of these subscriptions are probably based on DSL, they could, in practice, be based on any technology. Ficora has therefore chosen to exclude them from their DSL statistics and list them as a separate category.

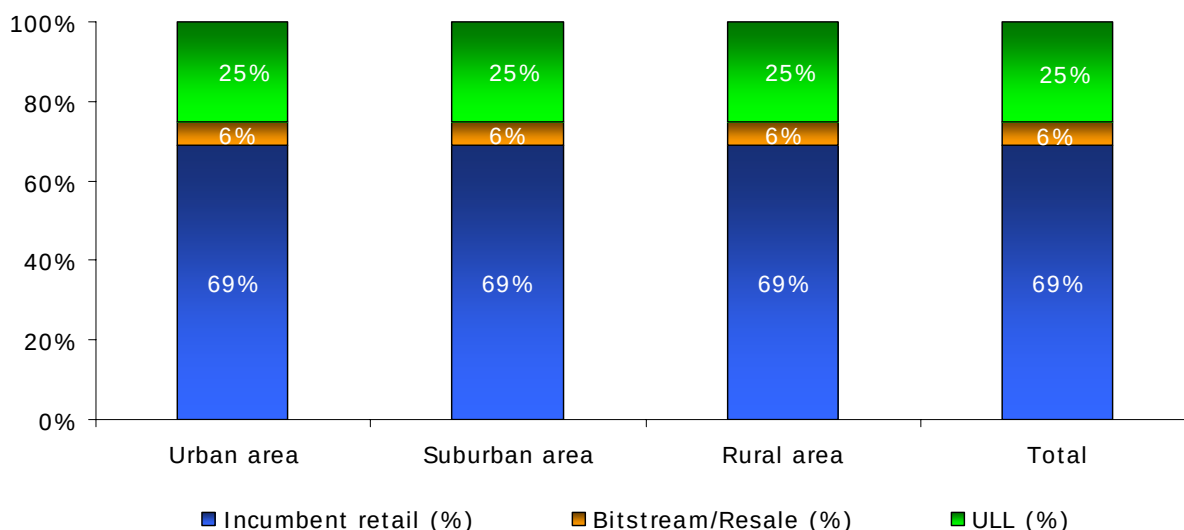
Either way, as in the other Nordic countries, DSL subscription growth has flattened, and even dropped slightly in some instances.

#### Number of DSL connections by download rate



Because no data are available from operators, we have had to rely on figures from national regulatory authority, Ficora, which reports that 40% of all broadband subscriptions (DSL and cable) had a download rate of below 2 Mbps. According to the regulator, broadband connections of 10 Mbps or faster accounted for about 10% of the total base. Because DSL dominates the market, these figures are probably reasonably accurate.

### Percentage of DSL connections by type of provider

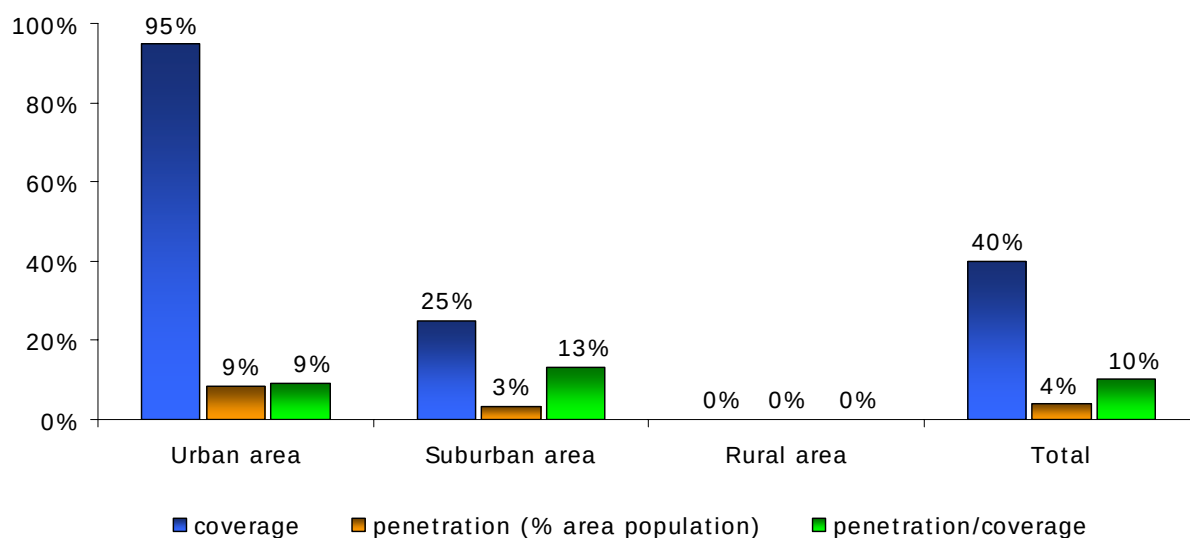


It should be noted that there are several “incumbents” in the Finnish market. There are dozens of local telcos, each of which can be classified as an incumbent in its own traditional operating area. Distinguishing the incumbent from alternative providers is therefore by no means cut and dried.

For practical purposes, Elisa, Finnet and TeliaSonera Finland are considered Finland's three incumbents. The above distinction is based on a discussion with Ficora, and there has been no significant change in the situation since last year.

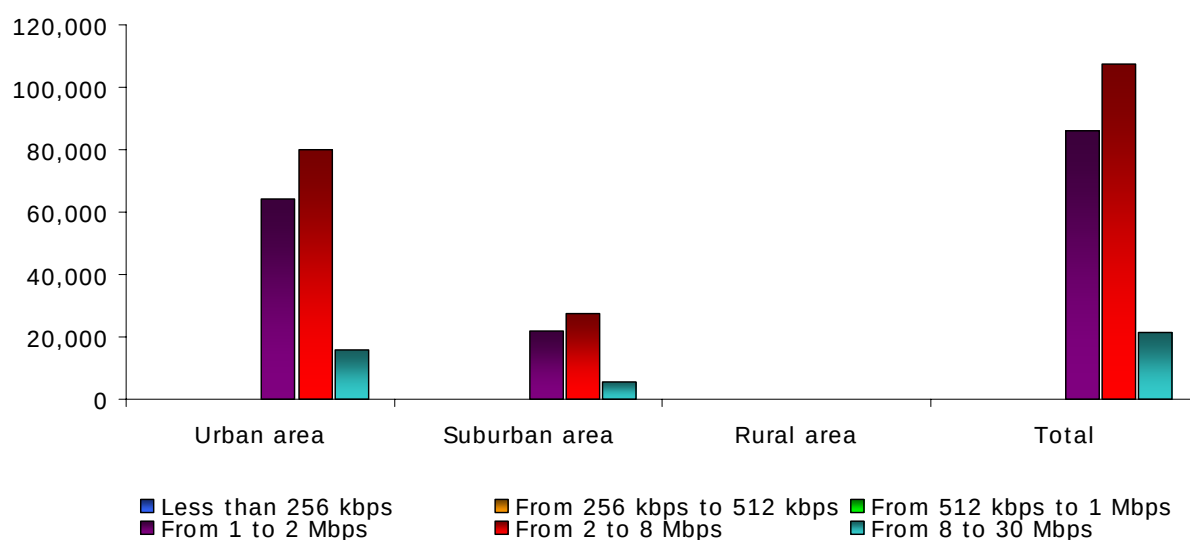
#### 4.8.4. Cable modem coverage and take-up

##### Coverage and penetration



Approximately 40% of the Finnish population is passed for cable modem, which is available primarily in urban areas. According to Ficora, the coverage level is not expected to increase in the foreseeable future.

##### Number of cable modem connections by download rate



As no data are available from operators, we have had to rely on national figures from national regulatory authority, Ficora (see comments in the DSL section).

## 4.8.5. Other broadband access technologies

### Satellite and PLC

Satellite Internet access and PLC do not play a significant role in the Finnish broadband market. The number of PLC subscriptions in Finland remained stable around 900 through 2005, 2006 and into 2007. Since then, Ficora has no longer recorded the number of PLC subscriptions as a unique category. The technology is marginal and (for all intents and purposes) the number of subscriptions equals zero.

### Wi-Fi

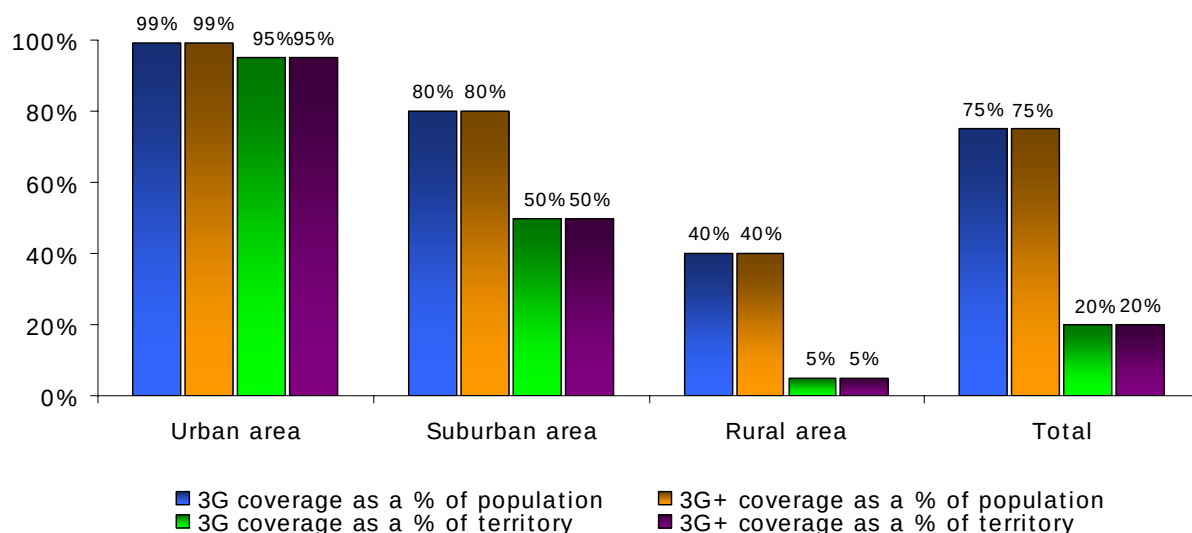
The exact number of hotspots is not known, but there were 2,800 WLAN broadband connections in use at the end of Q1 2007. This includes the hotspots as well as "normal, dedicated" subscriptions using WLAN technology (although these are probably quite rare).

### WLL/WiMAX

Among the main "incumbents" (Sonera, DNA, Elisa, Finnet), only DNA appears to market WiMAX as a broadband product, and even then only in areas where DSL is not available. The total number of subscriptions nearly doubled, going from 15,300 in 2007 to 26,100 in 2008.

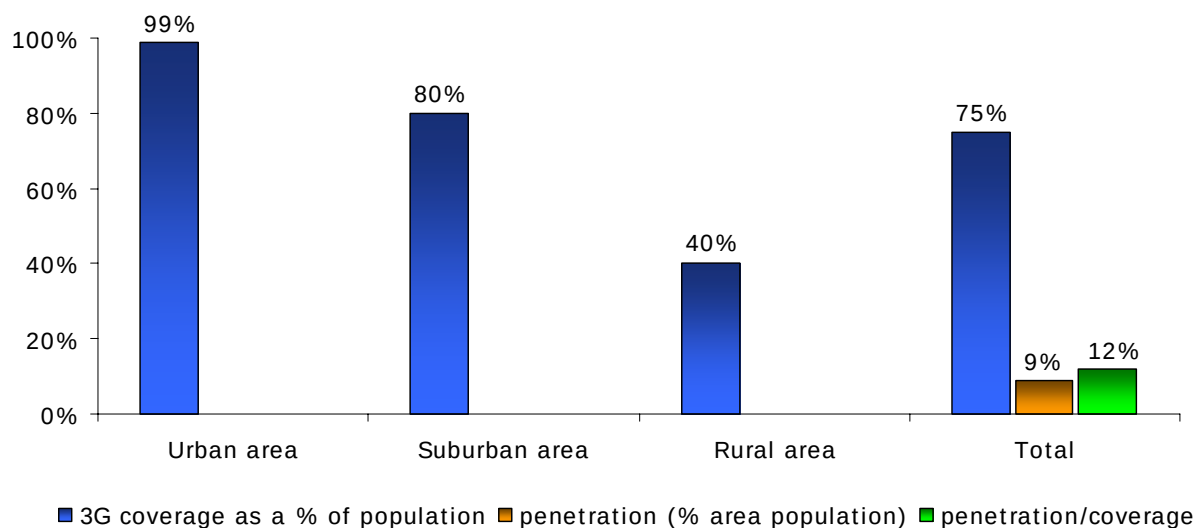
## 4.8.6. Mobile broadband coverage and take-up

### Coverage by technology



The country's 3G operators cover largely the same areas, and it is estimated that 75% of the population and 20% of the territory was covered by 3G at the end of 2008. Urban areas enjoy very high coverage (95%-100%), while rural areas are more sparsely covered, with very little coverage outside inhabited areas.

### Penetration



While most handsets are 3G-capable, Ficora reports 479,700 actual users at the end of 2008.

## 4.9. France

### 4.9.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 34,411,889 | 15,385,711    | 14,505,400 | 64,303,000 |
| Share of total population | 53.4%      | 23.9%         | 22.7%      | 100.0%     |

### 4.9.2. General broadband data

|                                                  | 12/04     | 12/05     | 12/06      | 12/07      | 12/08      |
|--------------------------------------------------|-----------|-----------|------------|------------|------------|
| DSL coverage (% of the population)               | 91%       | 96%       | 98%        | 99%        | 100%       |
| DSL subscribers                                  | 6,245,795 | 8,777,215 | 11,877,557 | 14,800,000 | 16,804,000 |
| DSL penetration (% of the population)            | 10.1%     | 14.1%     | 18.9%      | 23.5%      | 26.1%      |
| Cable modem coverage (% population)              | 26%       | 26%       | 26%        | 26%        | 26%        |
| Cable modem subscribers                          | 496,568   | 566,400   | 700,000    | 703,500    | 700,650    |
| Cable modem penetration (% population)           | 0.8%      | 0.9%      | 1.1%       | 1.1%       | 1.1%       |
| FTTx subscribers                                 | 500       | 6,800     | 14,000     | 43,500     | 180,550    |
| PLC subscribers                                  | 0         | 0         | <800       | <800       | <800       |
| WLL subscribers                                  | 1,200     | 1,200     | 1,200      | 1,200      | 4,000      |
| Satellite subscribers                            | 1,000     | 1,000     | 1,000      | 1,000      | 1,000      |
| Total                                            | 6,745,063 | 9,352,615 | 12,594,557 | 15,550,000 | 17,691,000 |
| Total fixed broadband penetration (% population) | 11.0%     | 15.0%     | 20.0%      | 24.6%      | 27.5%      |
| Mobile broadband subscribers                     |           |           |            | 5,879,000  | 11,439,000 |
| Mobile broadband penetration (% population)      |           |           |            | 9.1%       | 17.8%      |

DSL coverage is now complete, while cable networks are upgrading to FTTx (mainly FTTB). The total number of fixed broadband subscribers in France increased by 13.8% in 2008 (2.1 million new broadband connections in one year) with penetration reaching 27.5% at year-end.

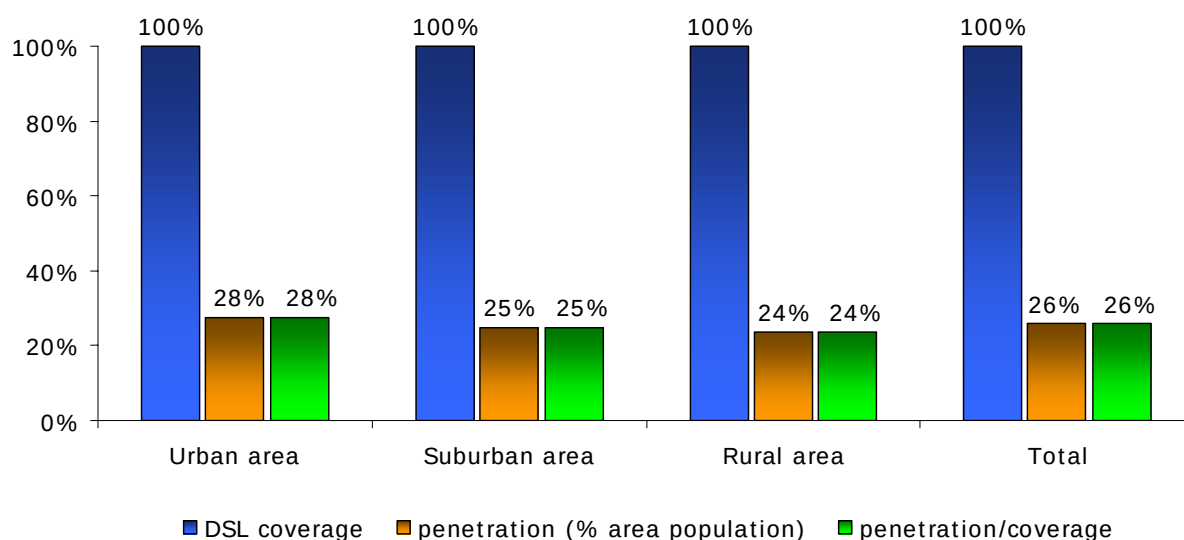
DSL is still by far the leading broadband access technology, accounting for 95% of total fixed connections. Competition is driven by LLU. ADSL2+ technology is widespread and most users have access to triple play bundles that include IPTV. After consolidation, the DSL market is now concentrated in the hands of three operators: Orange (France Telecom), SFR (formerly neuf cegetel) and Iliad/Free. The cable modem segment is stagnating.

FTTH/B developed substantially in 2008, and France is now one of Europe's leading markets with over 180,000 subscribers at the end of that year.

Mobile broadband subscribers have also increased significantly: one out of every five mobile subscribers is now using 3G services.

### 4.9.3. DSL coverage and take-up

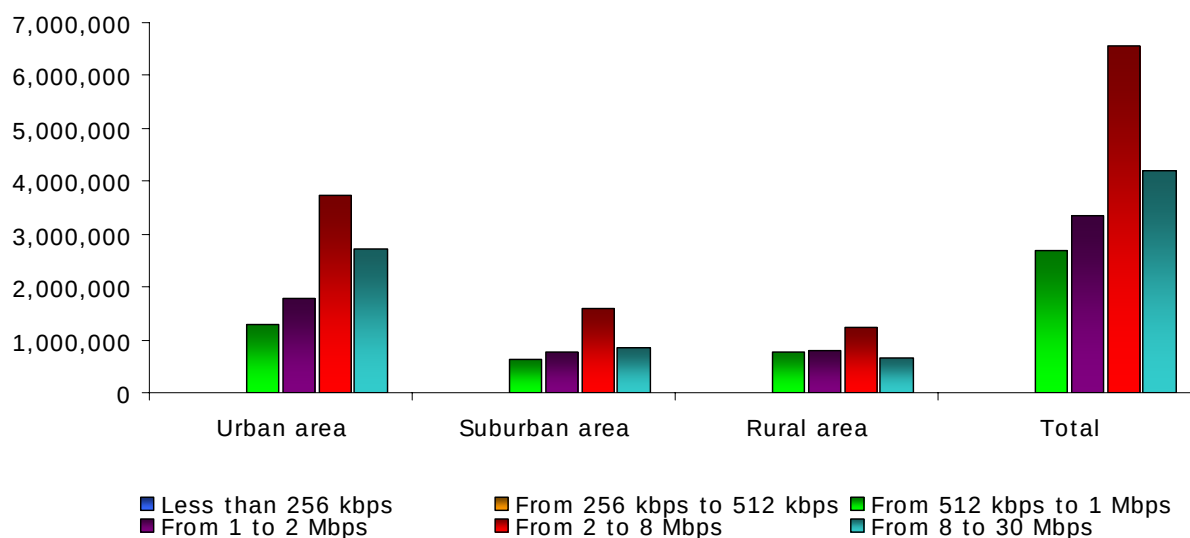
#### Coverage and penetration



At the end of 2008, all France Telecom local exchanges were DSL-equipped. However, FT indicates that, due to technical constraints, ADSL can be delivered only to 99% of units depending on those local exchanges, except in certain big cities (Paris, Lyon and Marseille).

Two million new DSL subscribers entered the broadband market in 2008.

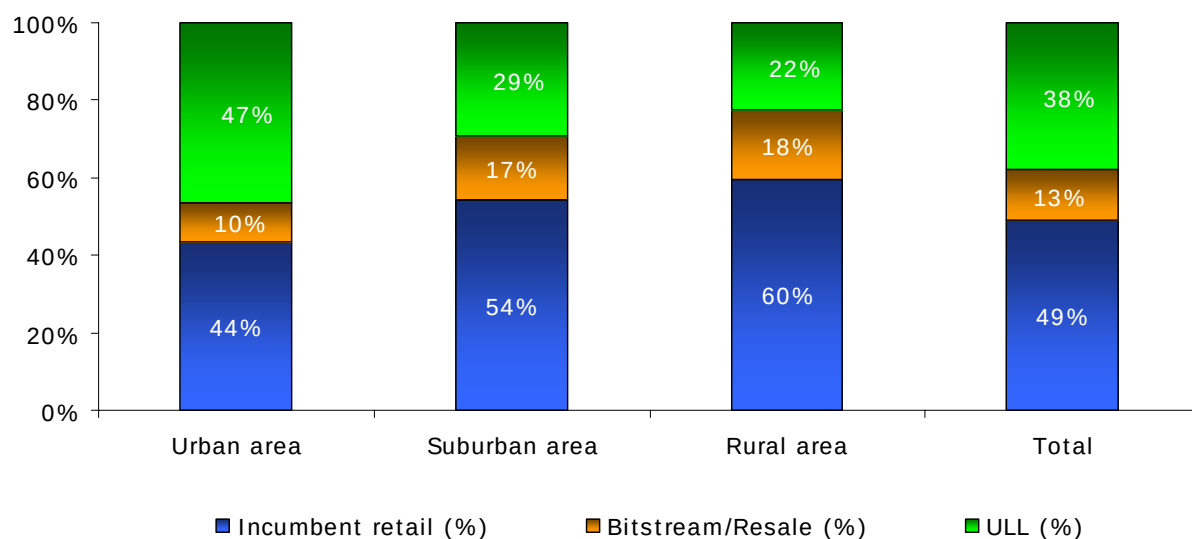
#### Number of DSL connections by download rate



The French ADSL market is characterised by a high proportion of connections with download rates over 8 Mbps, supported by ADSL2+ technology. We estimate that 4.2 million connections (or 25% of total DSL connections) were in this category at the end of 2008.



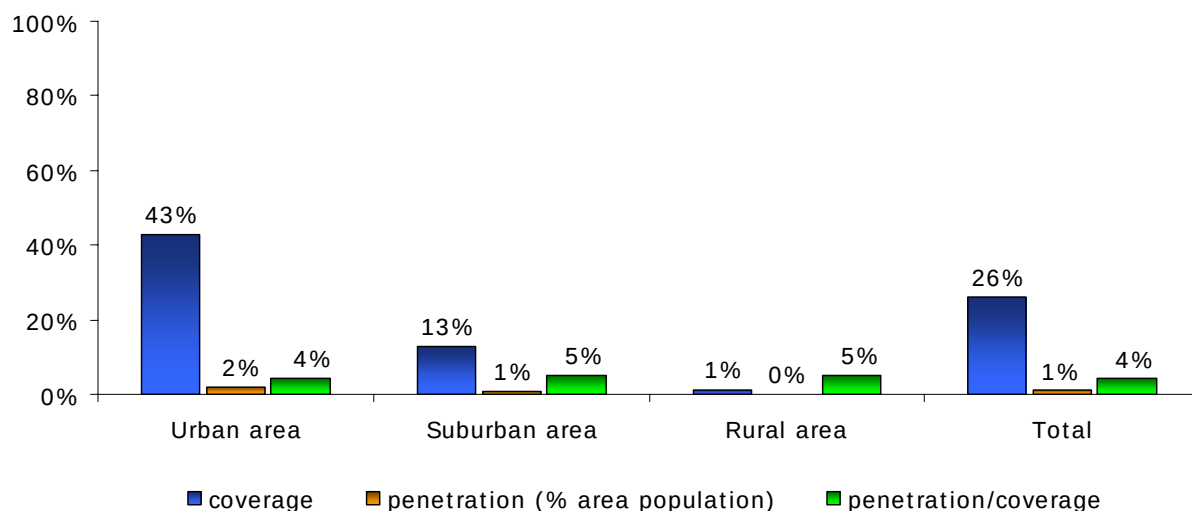
### Percentage of DSL connections by type of provider



Half of all DSL connections are marketed directly by Orange (formerly Wanadoo), France Telecom's ISP subsidiary. Competitive offers are based mainly on unbundled lines. LLU's share of the DSL market has increased from 35% at the end of 2007 to nearly 38% at the end of last year, with 78% of those lines being fully unbundled – up from 70% at the end of 2007. The use of naked DSL (also called "naked bitstream" by French regulator ARCEP which groups it with other bitstream connections) has also grown significantly, and now accounts for more than half of the bitstream/resale group.

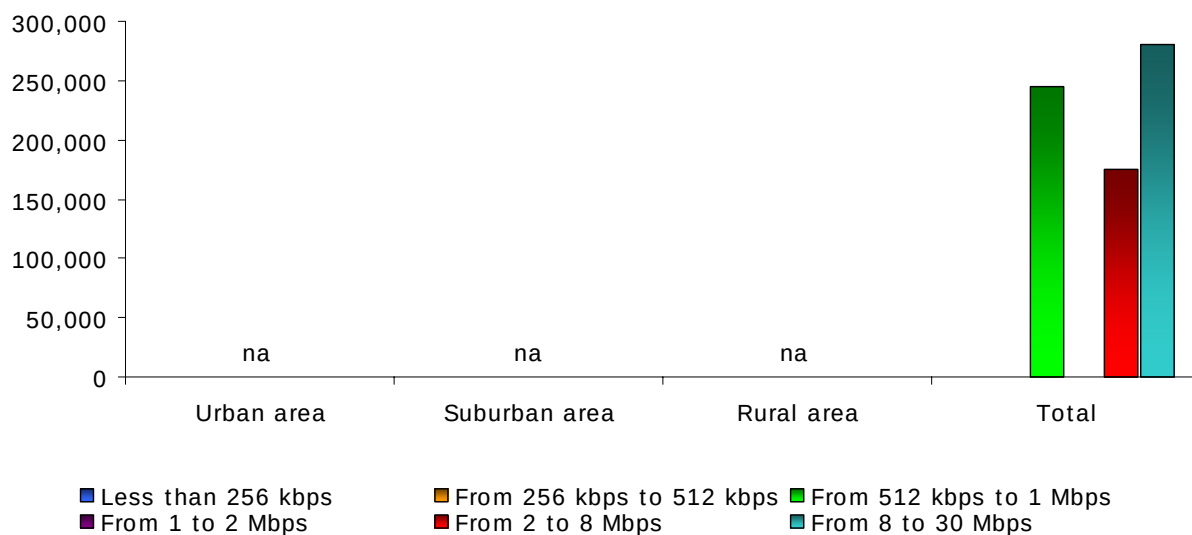
## 4.9.4. Cable modem coverage and take-up

### Coverage and penetration



26% of the French population is covered by cable modem technology. There have been no new deployments in recent times. Numericable, which now owns close to 100% of country's cable networks, is currently investing in FTTB technology.

### Number of cable modem connections by download rate



Two-thirds of broadband cable connections in France deliver download rates of over 8 Mbps.

## 4.9.5. Other broadband access technologies

### FTTx

All four of France's active broadband providers announced FTTH/B rollout plans in 2006-2007, but progress was slow until this past year and changes in the market could be swift. The number of FTTH/B subscribers increased from 43,500 at the end of 2007 to over 180,000 at the end of 2008. Market developments are being driven by cable operator, Numericable, which has upgraded half of its homes passed to FTTLA or FTTB, and currently controls two-thirds of the FTTx subscriber base (120,000 subscribers at end 2008).

At the end of 2008, France Telecom was reporting 500,000 homes passed for FTTH while SFR/neuf cegetel and Iliad/Free had 250,000 and 300,000 homes passed, respectively, and a combined total of 60,000 subscribers.

### PLC

In April 2005, PLC access went beyond the experimental stage in France but, for now, its development as an alternative to ADSL is being hampered by EDF, owner of the country's electricity network, which has not been authorised to market Internet access.

The development of indoor powerline carrier systems is allowed, provided they do not create any interference with existing systems.

Sipperec, a public syndicate covering several cities around Paris, is the only public body still involved in deploying PLC for outdoor access in France, through a contract with Mecerlec Telecom.

### Wi-Fi

Hotspots have been widely deployed in public areas (hotels, airports, railway stations, conference centres, etc.), providing wireless access to the Net for a specific clientele, the bulk of which are travelling business people. There are now around 40,000 hotspots in France.

Wireless community networks (SFR/neuf and Free) are also increasing as ISPs are working to expand their wireless coverage turning their customers' IP boxes into Wi-Fi hotspots (for those customers who agree, with only part of the bandwidth made available to other subscribers).

### WLL/WiMAX

Regional WiMAX licences were awarded in 2006 (two operators in each region). The main beneficiaries of these licences were Bolloré Telecom, Altitude Wireless and HDDR (a TDF-led consortium).

Following the acquisition of 8 of the 11 WiMAX licenses held by HDDR (a subsidiary of TDF), Bolloré can be considered a national operator, covering 20 out of 22 regions. The other national operator is Iliad/Free which took over Altitude Telecom's nationwide WiMAX licence in September 2005.

However, according to national regulator, ARCEP, only 675 stations were installed at the end of 2008; this is less than 20% of the initial target (3,562). The number of WiMAX subscribers at the end of 2008 is estimated at 4,000.

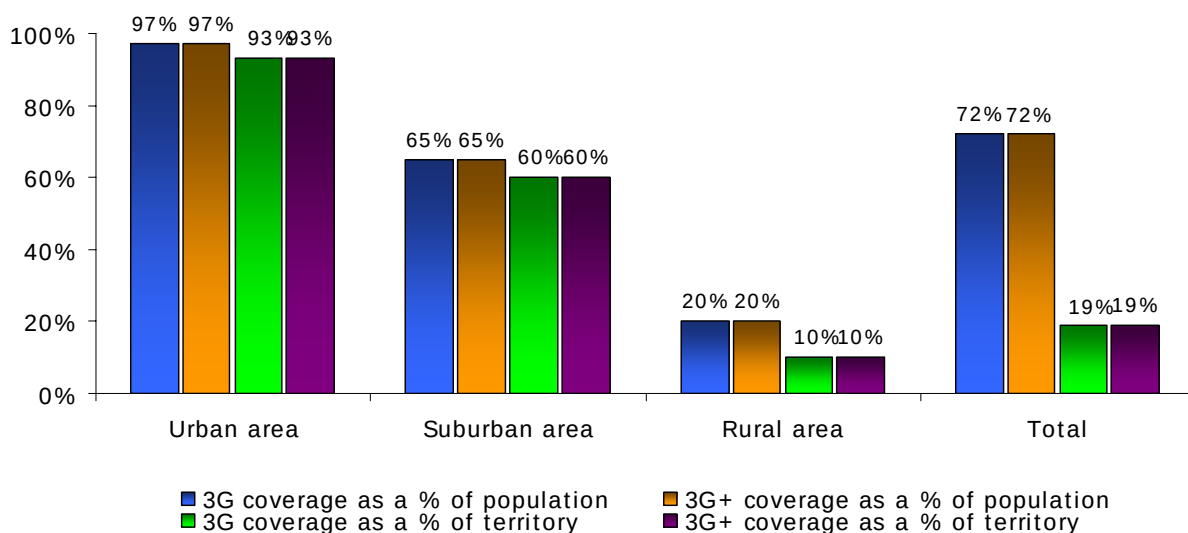
### Satellite

Several two-way offers are now available in France, targeting SMEs in rural areas. We estimate that there were around 1,000 satellite subscribers in France at the end of 2008.

At the beginning of 2009, three suppliers also announced they were launching broadband access via satellite to cover dead zones: Orange, through its subsidiary Nordnet (based on SES Astra), Numeo and Sat2Way (based on Eutelsat satellites).

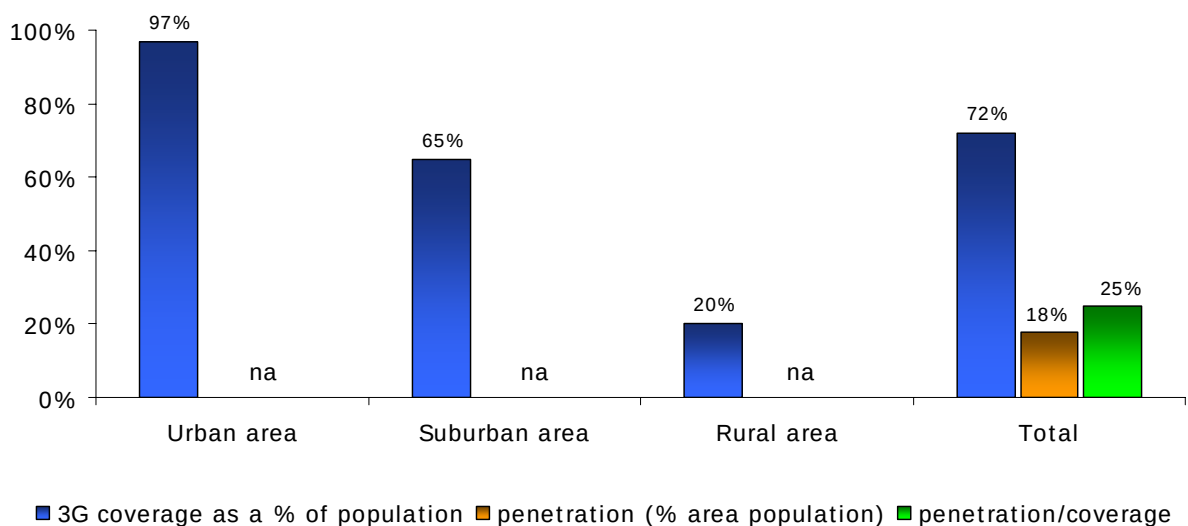
## 4.9.6. Mobile broadband coverage and take-up

### Coverage by technology



SFR and Orange cover around 72% of population with 3G. Both operators have completely upgraded their 3G networks to HSPA.

### Penetration



There were 11.4 million active 3G customers at the end of 2008. According to a survey conducted in August 2008, 15% of mobile customers were using their mobile phones to send/receive emails and/or surf the Internet.

## 4.10. Germany

### 4.10.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 40,411,451 | 29,395,511    | 12,507,944 | 82,314,906 |
| Share of total population | 49.1%      | 35.7%         | 15.2%      | 100.0%     |

### 4.10.2. General broadband data

|                                                  | 12/04     | 12/05      | 12/06      | 12/07      | 12/08      |
|--------------------------------------------------|-----------|------------|------------|------------|------------|
| DSL coverage (% of population)                   | 91%       | 92%        | 93%        | 96%        | 97%        |
| DSL subscribers                                  | 6,720,000 | 10,380,000 | 14,300,000 | 18,500,000 | 20,720,000 |
| DSL penetration (% of population)                | 8.1%      | 12.6%      | 17.3%      | 22.5%      | 25.2%      |
| Cable modem coverage (% population)              | 10%       | 15%        | 36%        | 47%        | 56%        |
| Cable modem subscribers                          | 145,000   | 240,000    | 600,000    | 985,000    | 1,600,000  |
| Cable modem penetration (% population)           | 0.2%      | 0.3%       | 0.7%       | 1.2%       | 1.9%       |
| FTTx subscribers                                 | 150       | 150        | 20,000     | 108,000    | 280,000    |
| PLC subscribers                                  | 9,000     | 9,600      | 9,500      | 9,500      | 10,000     |
| WLL subscribers                                  | 1,000     | 0          | 0          | 0          | 80,000     |
| Satellite subscribers                            | 41,000    | 57,000     | 56,000     | 36,500     | 31,000     |
| Total                                            | 6,916,150 | 10,686,750 | 14,985,500 | 19,639,000 | 22,721,000 |
| Total fixed broadband penetration (% population) | 8.4%      | 13.0%      | 17.8%      | 23.9%      | 27.6%      |
| Mobile broadband subscribers                     |           |            |            |            | 11,500,000 |
| Mobile broadband penetration (% population)      |           |            |            |            | 14.0%      |

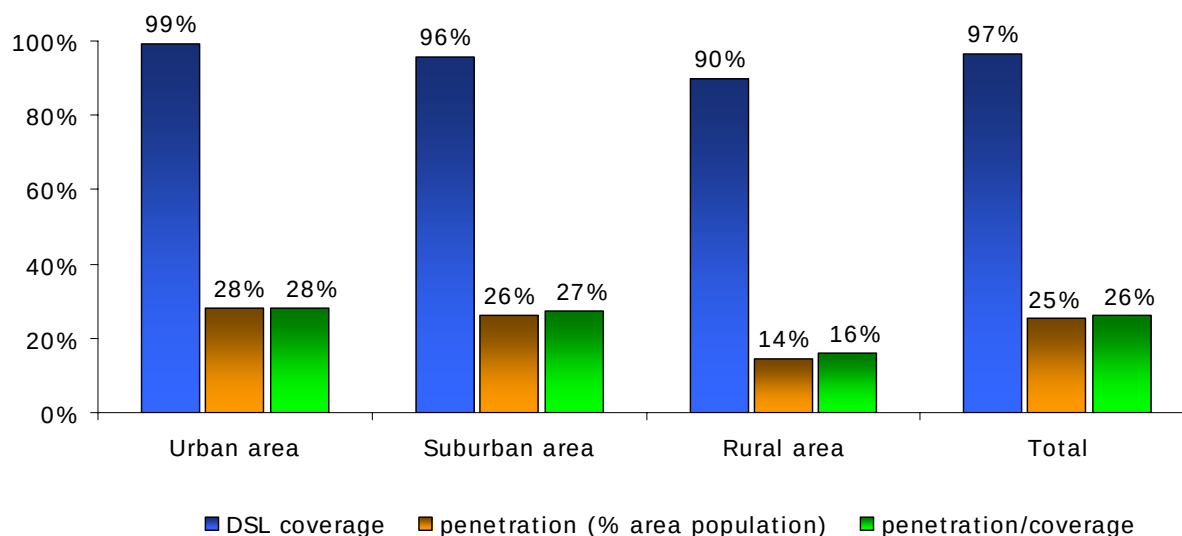
Both DSL and cable modem coverage levels are high, thanks to regular progress over the past few years -especially in rural areas for DSL and at national level for cable modem. Fixed broadband penetration in Germany continued to grow significantly and is now at 27.6% (compared to 23.9% in 2008).

ADSL remains by far the dominant technology (92% of all fixed broadband connections at the end of 2008). Though broadband cable penetration grew by another 60%, to 1.6 million (after a 65% growth to 985,000 in 2007), cable modem is still relatively marginal. The fact that the German cable infrastructure is run by large level 3 operators, and more than 4,000 smaller level 4 operators, has hampered the development of the country's cable Internet market over recent years. Cable operators are competing to gain market share with high bandwidth offers.

FTTx – here FTTN+VDSL – made significant progress in 2007 and 2008 as German incumbent Deutsche Telekom, which began to deploy FTTN+VDSL in mid-2006, continued expanding its network throughout various urban areas. Additionally, several smaller operators such as NetCologne, M-Net and EWE TEL have expanded their FTTH networks. On top of that, various WiMAX/WLL networks have been installed in urban as well as suburban and rural areas that could not connect to other fixed line technologies.

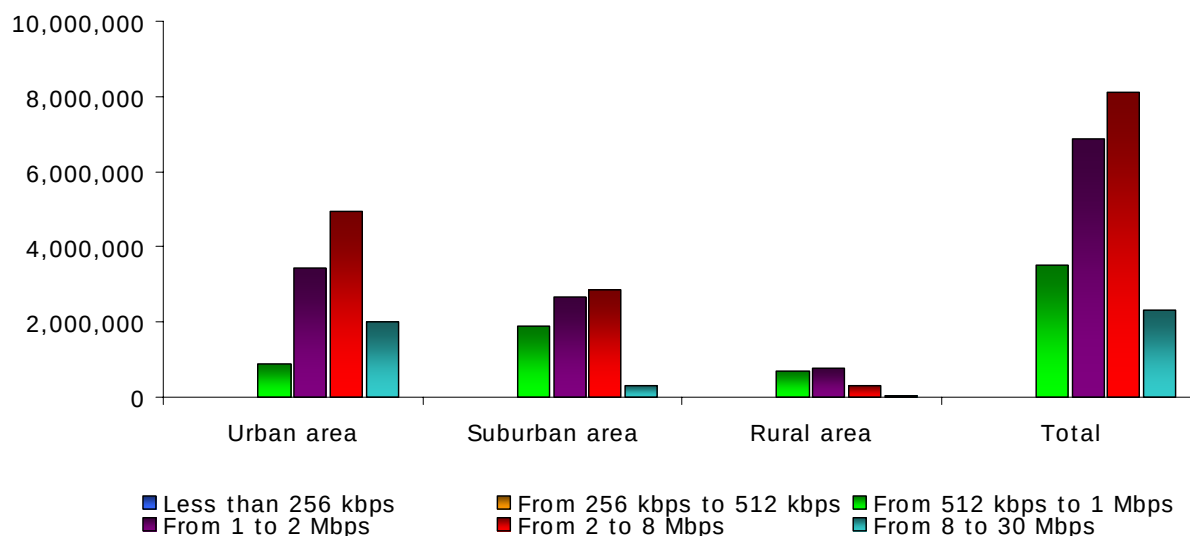
### 4.10.3. DSL coverage and take-up

#### Coverage and penetration



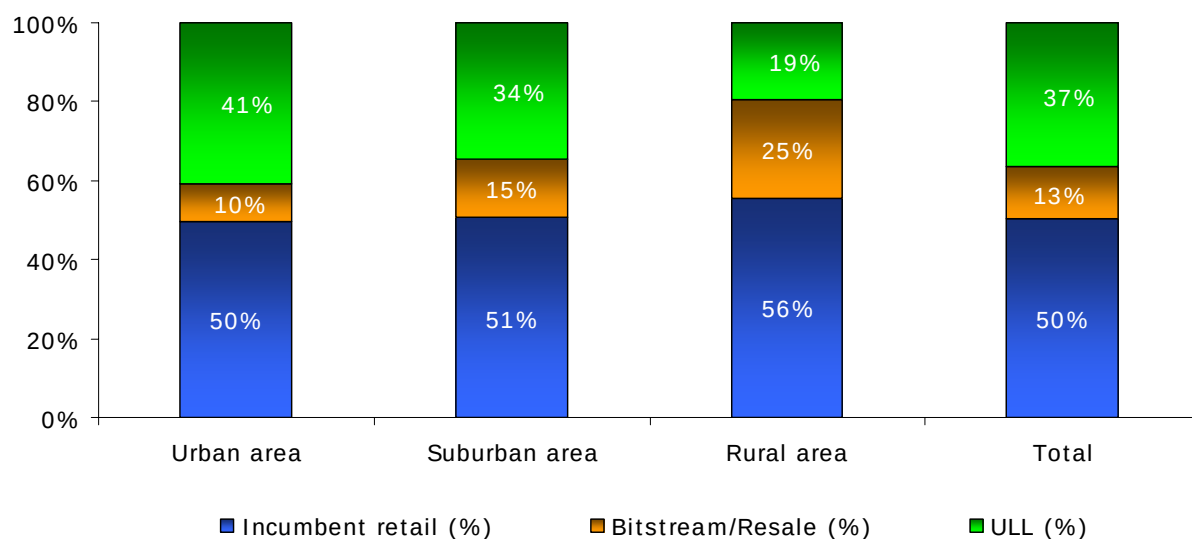
In Germany, most local exchanges are DSL equipped, but DSL coverage is still higher in urban areas. Total DSL coverage in December 2008 is estimated at 96.6%.

#### Number of DSL connections by download rate



In 2008, more and more providers began to market faster connections at lower prices and users upgraded their connections. Around 50% of all DSL connections are now equipped with download speeds higher than 2 Mbps, and 11% deliver speeds above 8 Mbps.

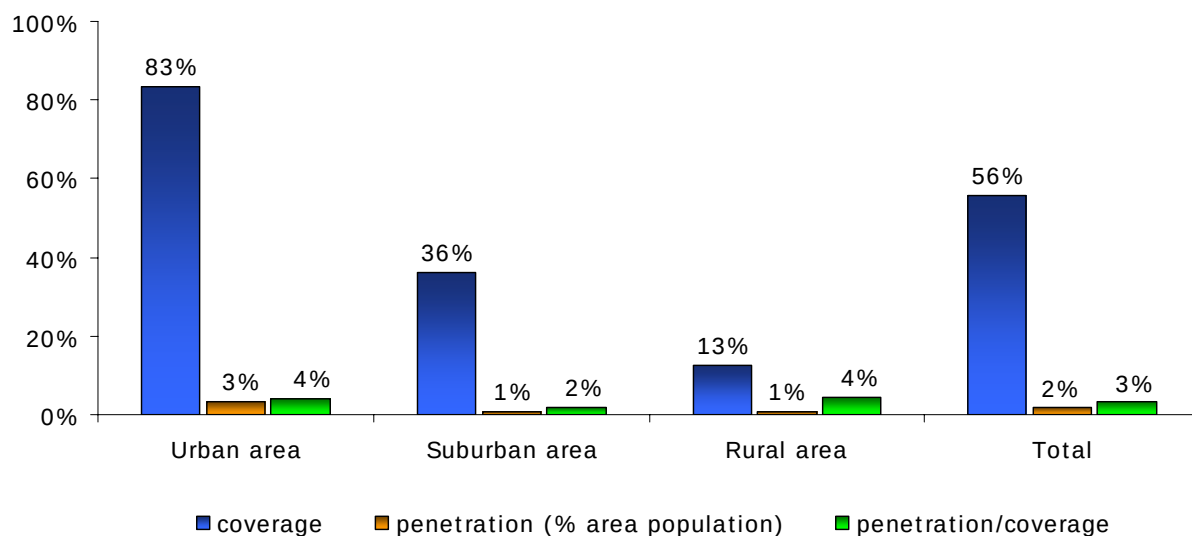
### Percentage of DSL connections by type of provider



The incumbent carrier, Deutsche Telekom, was able to re-gain market share for its retail lines and now accounts for 50.5% of all DSL, vs. 48.6% in 2007. Resale offers' share of the market decreased significantly, from 18.9% in 2007 to 13.0%. LLU now accounts for 36.5% of all DSL connections, up from 32.4% in 2007.

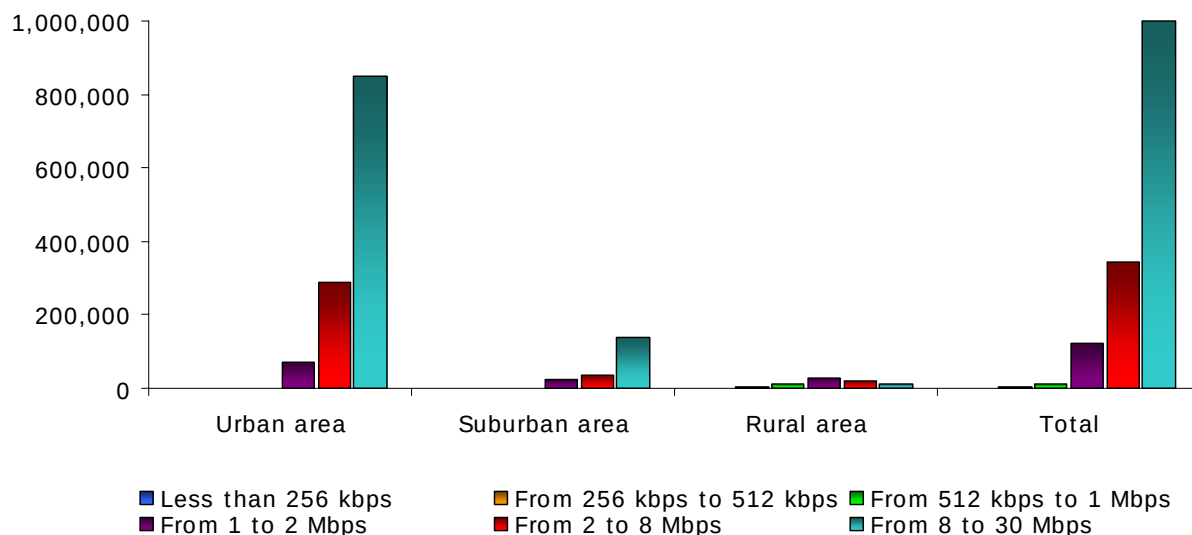
#### 4.10.4. Cable modem coverage and take-up

##### Coverage and penetration



The penetration rate for cable modem services in Germany is still relatively low (1.9%), despite considerable growth over the last several years. Upgrades to the cable network have been primarily in urban and suburban areas, and only in selected rural areas close to large cities. In most of these regions that are covered by cable, DSL was available long before cable modem services were launched, contributing significantly to the low broadband cable penetration rates.

##### Number of cable modem connections by download rate



Cable modem subscribers use significantly higher download rates than DSL subscribers. About 90% of them were subscribing to offers with download speeds of more than 2 Mbps, and 70% to offers delivering access rates of over 8 Mbps.



### 4.10.5. Other broadband access technologies

#### FTTx

Since October 2006, incumbent carrier, Deutsche Telekom, has been rolling out its FTTN+VDSL network in Germany's major cities. By the end of 2008, more than 50 of the country's largest cities were covered. Deutsche Telekom offers download rates of 25 or 50 Mbps, but its FTTN+VDSL broadband access was being marketed only as part of a bundle with its IPTV service.

Thanks to companies like NetCologne, M-Net and EWE TEL, smaller FTTH networks are appearing and access speeds of up to 300 Mbps are available. There were approximately 280,000 FTTx subscribers across Germany at the end of 2008.

#### PLC

The already minimal development of PLC in Germany is stagnating. According to Germany's NRA, the "Bundesnetzagentur", there were 10,000 PLC-based Internet subscribers in the country at the end of 2008, which is almost the same number as in 2007 and 2006.

#### Wi-Fi

In 2008, the number of PWLAN hotspots remained stable at around 10,000.

Most commercial (there are also a few non-commercial) PWLAN hotspots are located in urban areas, especially in hotels, cafés, airports and on university campuses.

#### WLL/WiMAX

In December 2006, five companies, including Clearwire, Deutscher Breitband Dienst GmbH and Inquam were awarded broadband wireless access licenses at auction. Each of them will have to cover at least 15% of the region it is responsible for by the end of 2009. At the end of 2008, several local WiMAX networks were available in cities such as Berlin, Dresden, Hannover and Leipzig, as well as some suburban and rural areas, e.g. in eastern Bavaria. By the end of 2008, there about 80,000 WLL/WiMAX subscribers in Germany.

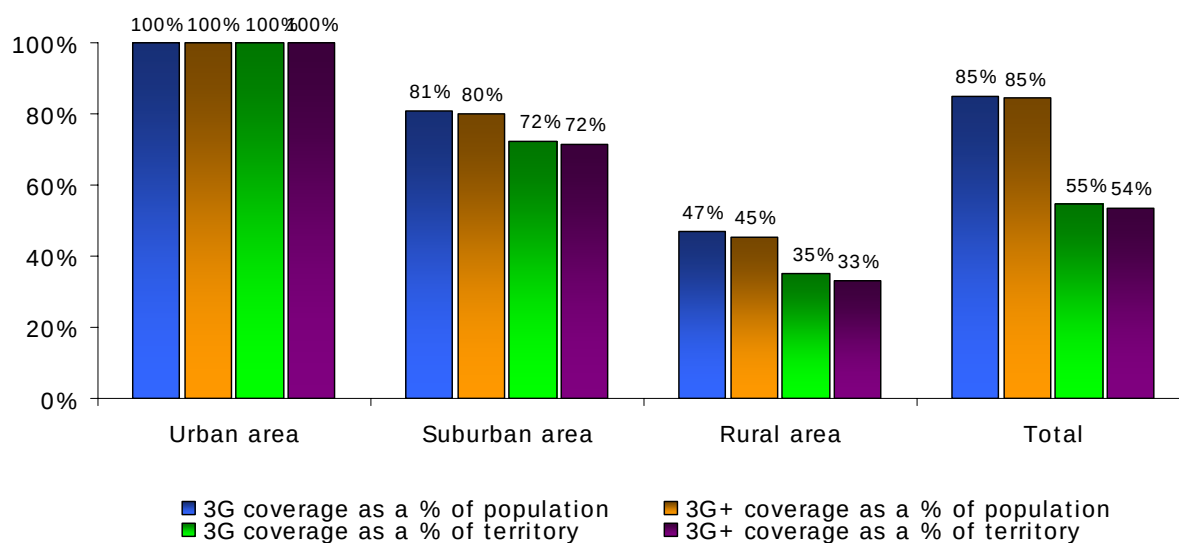
The first trials have also been performed on the use of digital dividend spectrum (i.e. frequencies made available by the switch to digital broadcasting). The German Federal Council enacted a reallocation of broadcasting frequencies to broadband Internet access. Depending on the outcome of the frequency allocation process, rural areas will be supplied with broadband Internet sometime between 2010 and 2011.

#### Satellite

Due to its high costs, satellite Internet remains a solution used only in areas that are not covered by DSL or cable. As the number of white spots is decreasing, the number of satellite Internet subscribers has declined over the past year – down to an estimated 31,000 at the end of 2008, compared to 36,500 in the year before.

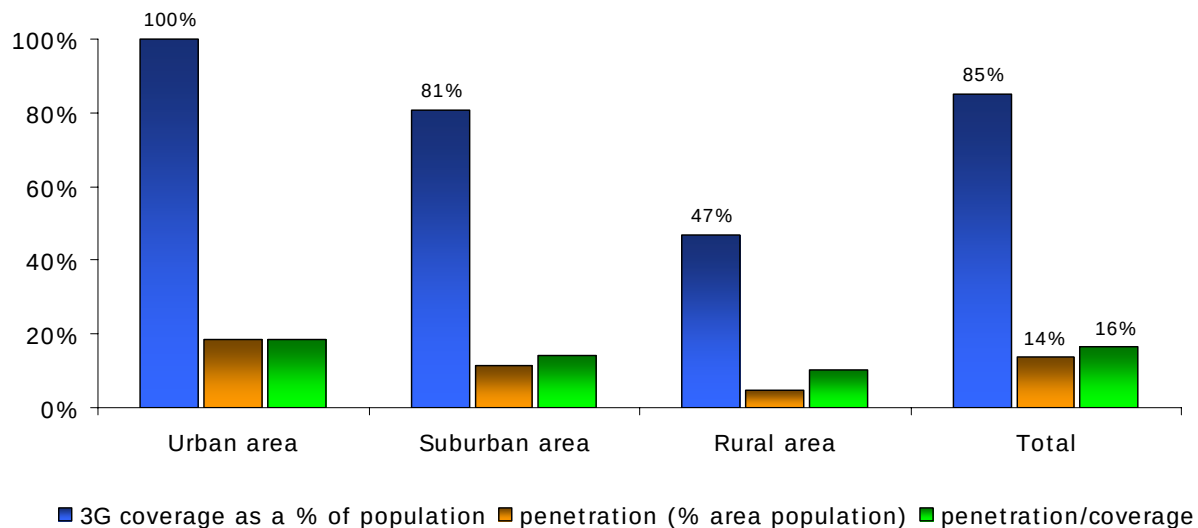
## 4.10.6. Mobile broadband coverage and take-up

### Coverage by technology



3G coverage has reached about 85% of the German population and 55% of the German territory, and most of the German UMTS networks has been upgraded to HSDPA.

### Penetration



By the end of 2008, the number of active mobile Internet users was approximately 11.5 million.

## 4.11. Greece

### 4.11.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 6,870,125  | 1,914,625     | 2,477,750  | 11,262,500 |
| Share of total population | 61.0%      | 17.0%         | 22.0%      | 100.0%     |

### 4.11.2. General broadband data

|                                                  | 12/04  | 12/05   | 12/06   | 12/07     | 12/08     |
|--------------------------------------------------|--------|---------|---------|-----------|-----------|
| DSL coverage (% of population)                   | 9%     | 12%     | 18%*    | 86%       | 88%       |
| DSL subscribers                                  | 46,547 | 158,000 | 485,793 | 1,016,076 | 1,500,354 |
| DSL penetration (% of population)                | 0.4%   | 1.4%    | 4.4%    | 9.1%      | 13.3%     |
| Cable modem coverage (% population)              | 0%     | 0%      | 0%      | 0%        | 0%        |
| Cable modem subscribers                          | 0      | 0       | 0       | 0         | 0         |
| Cable modem penetration (% population)           | 0.0%   | 0.0%    | 0.0%    | 0.0%      | 0.0%      |
| FTTx subscribers                                 | 0      | 220     | 474     | 594       | 2,000     |
| PLC subscribers                                  | 0      | 0       | 0       | 0         | 0         |
| WLL subscribers                                  | 0      | 419     | 648     | 1,231     | 2,000     |
| Satellite subscribers                            | 0      | 0       | 350     | 520       | 386       |
| Total                                            | 48,547 | 158,639 | 487,265 | 1,018,421 | 1,504,740 |
| Total fixed broadband penetration (% population) | 0.4%   | 1.5%    | 4.4%    | 9.1%      | 13.4%     |
| Mobile broadband subscribers                     |        |         |         |           | 221,738   |
| Mobile broadband penetration (% population)      |        |         |         |           | 2.0%      |

\* installed capacity (ADSL ports) as a % of total fixed lines

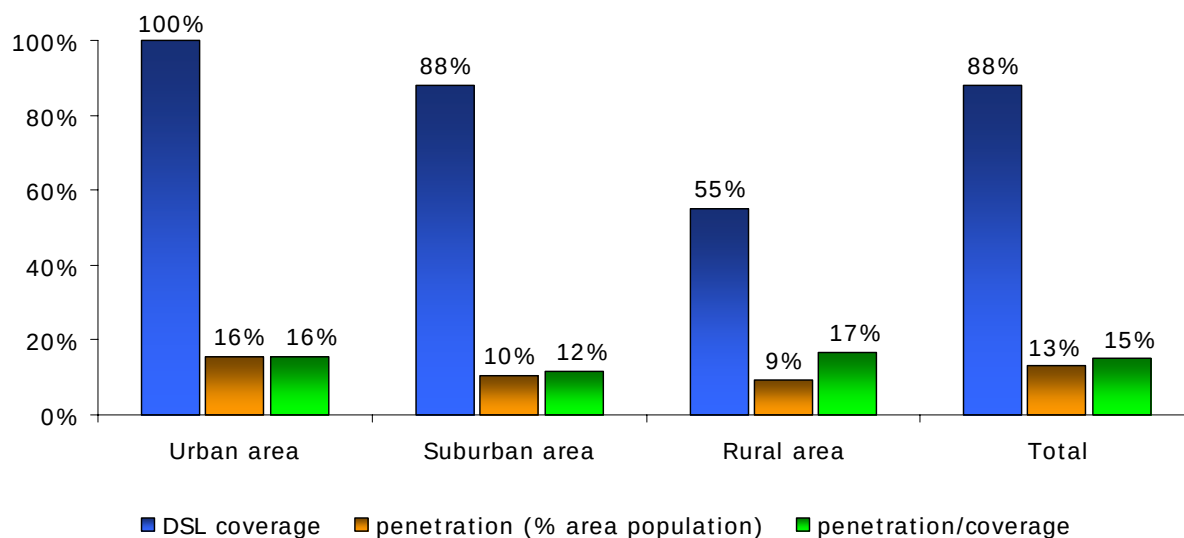
DSL coverage still lags behind the EU average. Broadband penetration continued to rise significantly, from 9.1% in 2007 to 13.4% at the end of 2008. Greece is still lagging behind most EU Member States, however, and the market's consolidation in 2008 (fixed/mobile alliances, reduction of the number of players) has not yet altered the situation in any radical way.

Germany's incumbent carrier, Deutsche Telekom, acquired a 25% plus one share stake in the Greek incumbent, OTE, thereby taking majority control.

The urban/rural disparities are expected to shrink over the coming years. The development of digital services for citizens, the provision of broadband service packages (double-play and triple-play bundles) all indicate that Greece now offers the same services as any other EU Member State.

### 4.11.3. DSL coverage and take-up

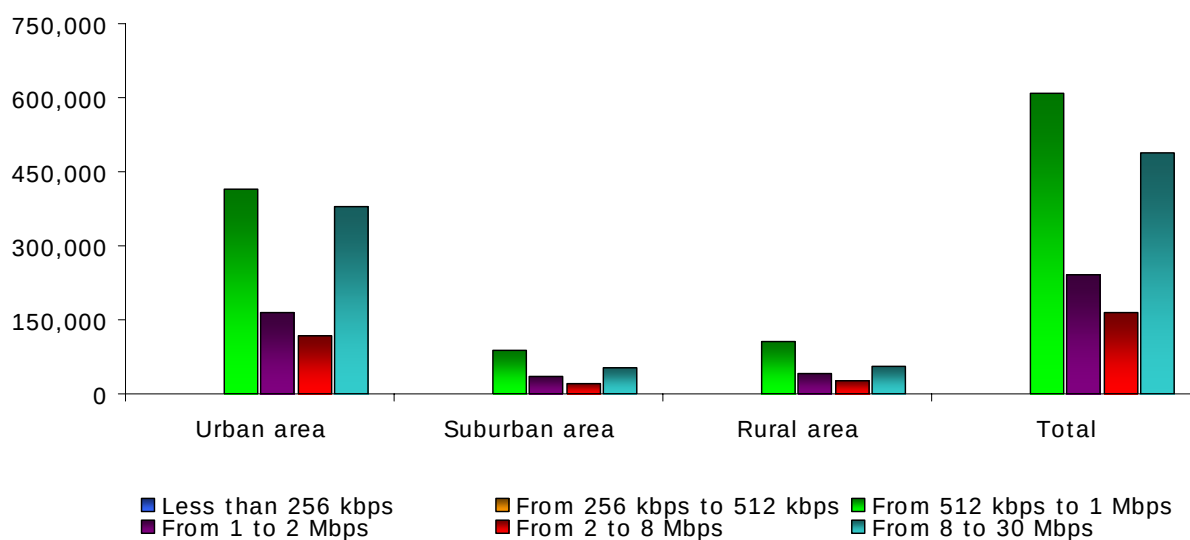
#### Coverage and penetration



There were more than 1.5 million DSL connections in Greece at the end of 2008, most of them (1 million) in urban areas where incumbent carrier, OTE, and alternative operators have concentrated their investments.

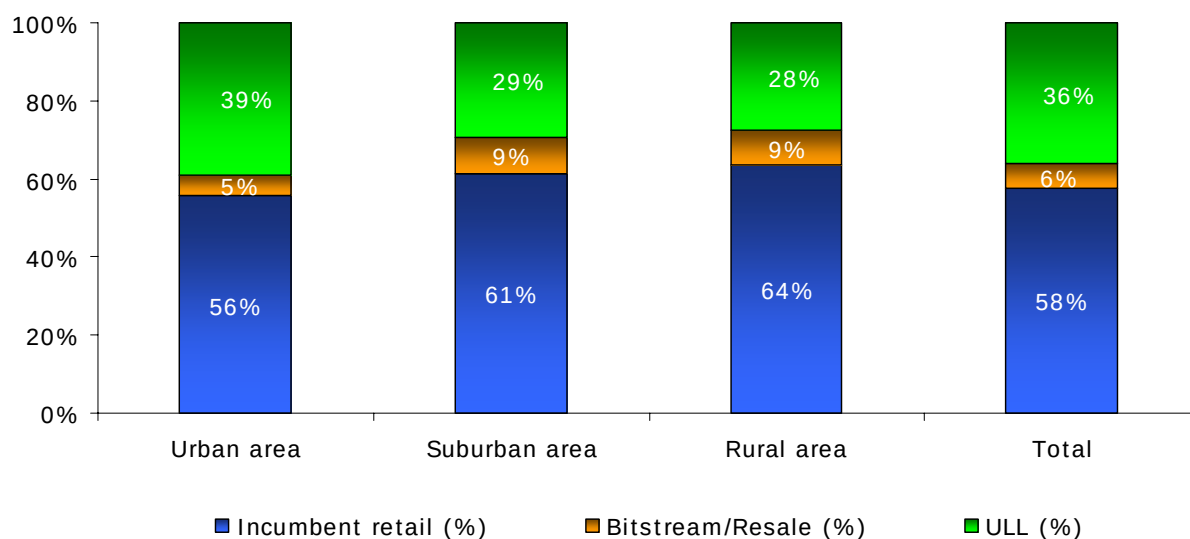
Coverage increased only slightly in 2008, up to 88%.

#### Number of DSL connections by download rate



Broadband speeds of more than 8 Mbps represent one third of the total base.

### Percentage of DSL connections by type of provider



Alternative operators continued to expand their networks, building mainly on local loop unbundling (both full LLU and shared access) which represents around 36% of the total broadband access lines.

The number of DSL marketed by alternative operators via bitstream solutions has been more than cut in half since 2007.

The percentage of DSL operated by the incumbent or its ISP subsidiary is over 50%.

At the end of December of 2008, OTE was providing physical collocation in Greece through 152 local exchanges.

#### 4.11.4. Other broadband access technologies

The other broadband access technologies play a marginal role.

##### **Cable**

Cable modem is not available in Greece.

##### **FTTx**

FTTH is not developed. FTTB is developed on a very small scale only.

In 2008, the Transport and Communication Ministry announced an FTTH network rollout project, for an investment estimated at €2.1 billion. The project consists of fibre network deployments in the capital, Athens, and in 50 other cities, including the islands.

##### **Wi-Fi**

Wi-Fi hotspots have not been widely deployed in Greece. Some hotels, cafés and restaurants do Wi-Fi access, and the city of Athens operates free Wi-Fi hotspots. The country's Digital Planning Secretary is planning to expand the number of hotspots in large cities and towns.

##### **WLL/WiMAX**

At the end of 2000, national regulator EETT held an auction for Fixed Wireless Access (FWA) systems operating in the 3.5 GHz and 25 GHz bands. Three licenses in the 3.5 GHz band were initially awarded, with the remaining unassigned spectrum (2×14 MHz) granted in a separate award process in 2006.

The licences were awarded to Craig Wireless, OTE, Cosmoline and Wind.

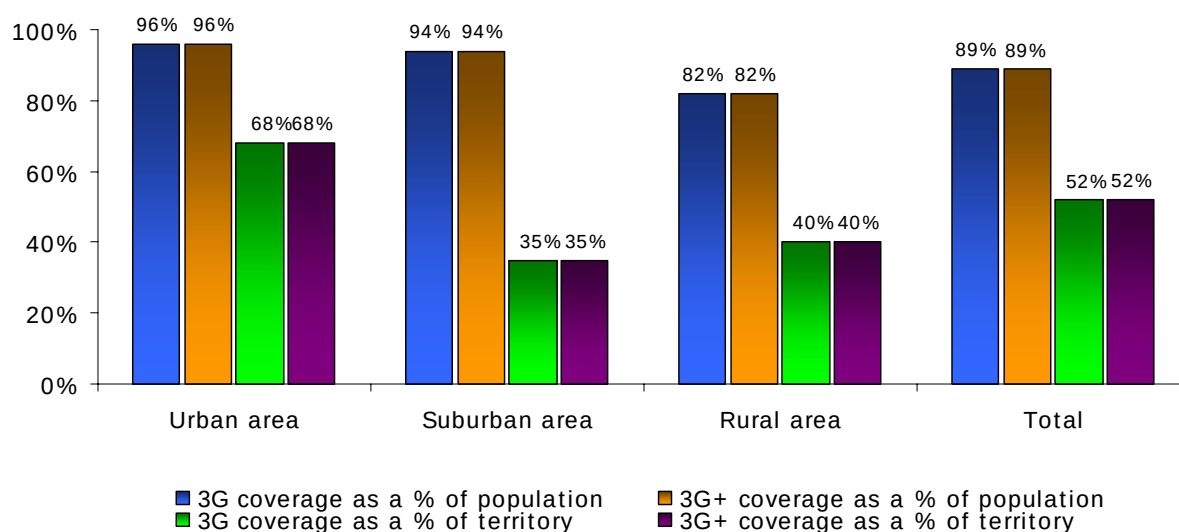
Craig Wireless Hellas has signed a partnership agreement with Net One. Under the terms of the contract, Craig will provide Net One subscribers with access to its WiMAX network in the Athens and Thessaloniki regions. In April 2008, Net One merged with Algonet; a further merger with On Telecom in Greece is subject to final negotiations. Craig Wireless's network in Greece comprises two NOCs connecting base stations in Athens and Thessaloniki which, together, they cover around 25 percent of the Greek population. The network currently provides fixed and roaming wireless broadband access to residential users, businesses and government departments.

##### **Satellite**

There were nearly 390 satellite customers at the end of 2008.

### 4.11.5. Mobile broadband coverage and take-up

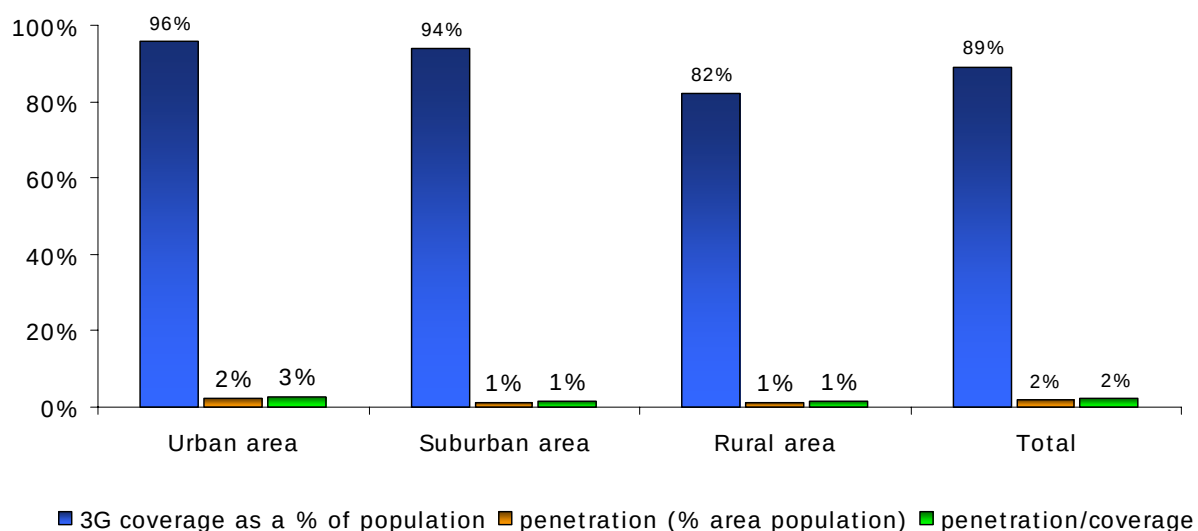
#### Coverage by technology



The EETT has awarded rights of use for radio frequencies to GSM/DCS technology in the 900 and 1800 MHz bands, UMTS technology in the 2.1 GHz band and for Fixed Wireless Access systems in 3.5 and 25 GHz bands.

The three individual licences for the development of 3<sup>rd</sup> generation mobile telephony networks were awarded in 2001 to Vodafone, Wind and Cosmote.

#### Penetration



The Greek mobile telephony market has developed considerably over the past several years, both in terms of SIM card numbers and network traffic.

Mobile broadband has begun being used, increasing its share of the base by nearly 2% by the end of 2008.

## 4.12. Hungary

### 4.12.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 3,400,924  | 3,343,606     | 3,300,871  | 10,045,401 |
| Share of total population | 33.9%      | 33.3%         | 32.9%      | 100.0%     |

### 4.12.2. General broadband data

|                                                  | 12/04   | 12/05   | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|---------|---------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 70%     | 85%     | 89%       | 93%       | 94%       |
| DSL subscribers                                  | 235,969 | 372,523 | 597,331   | 739,028   | 800,404   |
| DSL penetration (% of population)                | 2.3%    | 3.7%    | 5.9%      | 7.4%      | 8.0%      |
| Cable modem coverage (% population)              | -       | 66%     | 72%       | 73%       | 74%       |
| Cable modem subscribers                          | 135,803 | 191,997 | 374,647   | 563,593   | 668,414   |
| Cable modem penetration (% population)           | 1.3%    | 1.9%    | 3.7%      | 5.6%      | 6.6%      |
| FTTx subscribers                                 | -       | 1,000   | 11,021    | 26,425    | 53,712    |
| PLC subscribers                                  | 0       | 0       | 0         | 1         | 1         |
| WLL subscribers                                  | -       | 24,019  | 59,058    | 125,000   | 83,374    |
| Satellite subscribers                            | -       | -       | -         | 8         | 710       |
| Total                                            | 371,772 | 589,539 | 1,042,057 | 1,428,591 | 1,606,615 |
| Total fixed broadband penetration (% population) | 3.7%    | 5.9%    | 10.4%     | 14.2%     | 16.0%     |
| Mobile broadband subscribers                     |         | 560     | 50,000    | 257,365   | 414,558   |
| Mobile broadband penetration (% population)      |         | 0.0%    | 0.5%      | 2.5%      | 4.1%      |

Coverage for both DSL and cable modem is relatively high but increased only slowly in 2008. The number of fixed broadband subscribers increased to over 1.6 million by the end of 2008. Growth slowed down in the last year, with less than 180,000 new subscribers (compared to close to 400,000 in 2007), and the overall penetration rate increased only slightly, from 14.2% to 16% in one year.

DSL still accounts for 50% of fixed broadband connections, but cable modem and FTTx subscriber bases are growing more rapidly (+130,000 new connections in 2008 for both technologies combined vs. +60,000 for DSL).

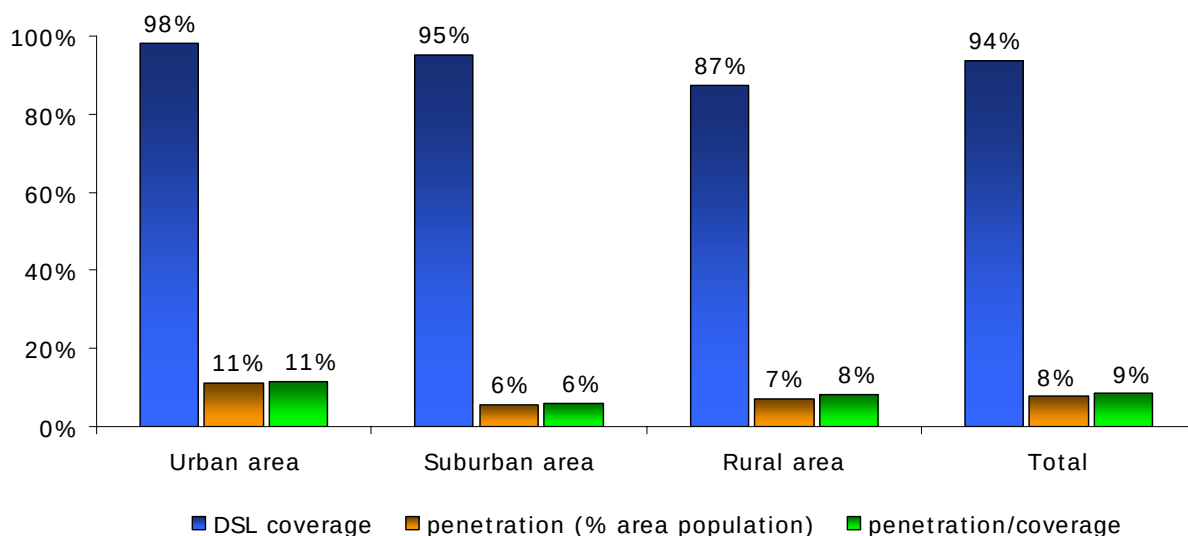
After increasing rapidly between 2005 and 2007, WLL connections decreased in 2008 – mainly because of the progress made in wireline technology coverage in rural areas. On the other hand, broadband satellite technology has developed significantly, even if the subscriber base still accounts for only a fraction of broadband connections (0.05% of fixed broadband connections), and most of the customers are businesses (finance, insurance, retail, logistics).

Mobile broadband has been a particularly dynamic segment over the past two years, increasing its share of total broadband connections from less than 5% at the end of 2006 to more than 20% at the end of 2008.



### 4.12.3. DSL coverage and take-up

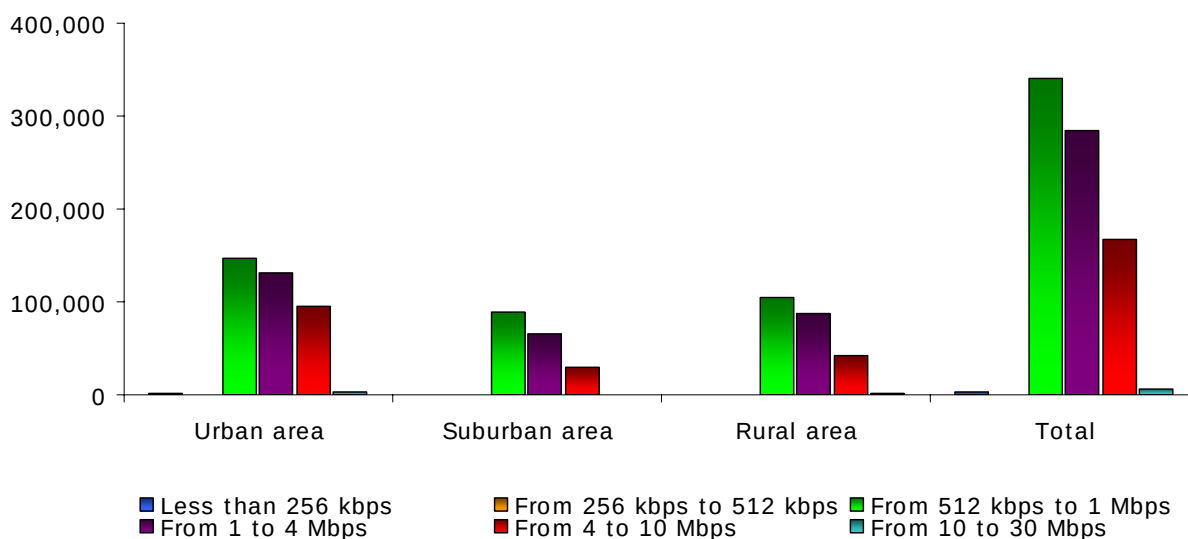
#### Coverage and penetration



There has been very little change in coverage levels compared to the 2007, with close to 100 more towns and villages newly covered in 2008, most of them in rural areas. DSL was available in 2,550 of the country's 3,152 towns and villages at the end of 2008.

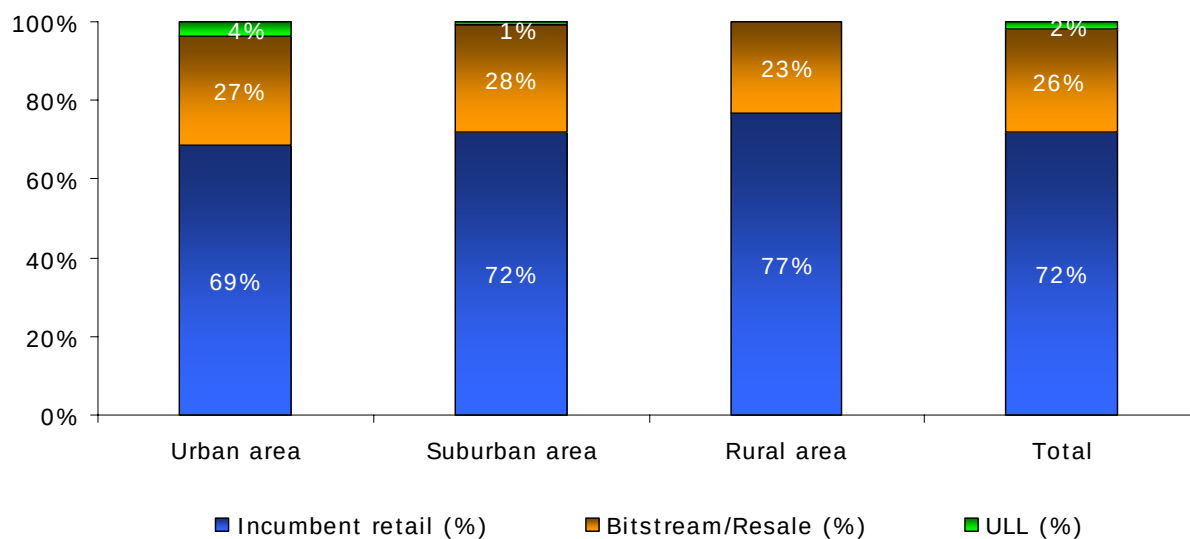
DSL has lost part of its appeal, especially in suburban areas where cable modem and mobile technologies have spread rapidly.

#### Number of DSL connections by download rate



There was a slight change in download rates compared to 2007 situation. The fastest services, running at 2 to 8 Mbps, are available chiefly in urban areas.

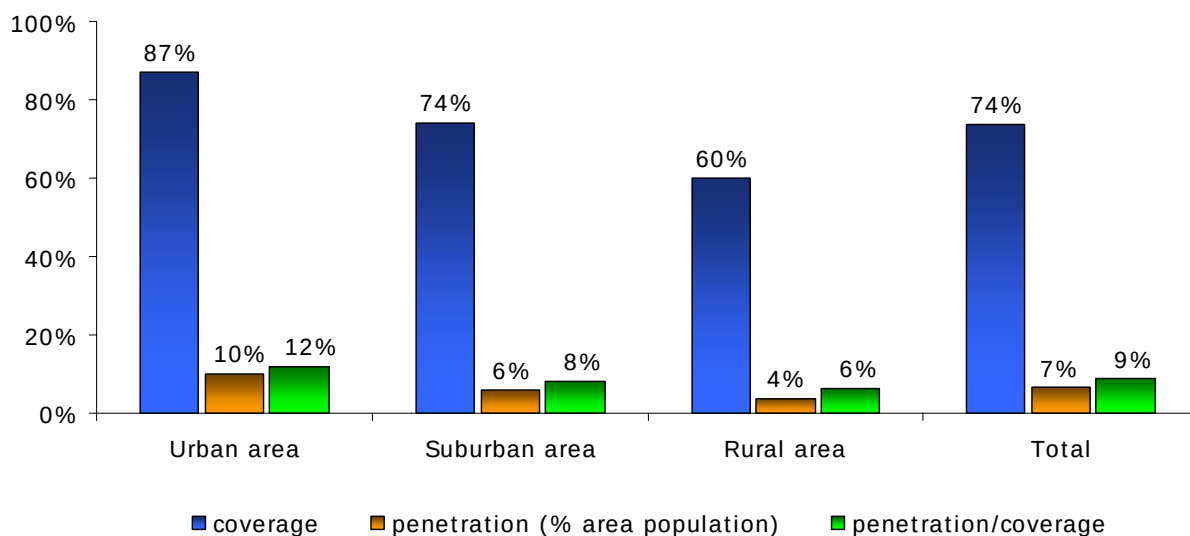
### Percentage of DSL connections by type of provider



The incumbent ISP continued to dominate the DSL access market, boasting a very healthy 71.9% share in 2008, although alternative providers are making some inroads in urban areas. Of particular note is the fact that over 90% of unbundled lines (14,446 out of 15,614) are located in urban areas, mainly in Budapest.

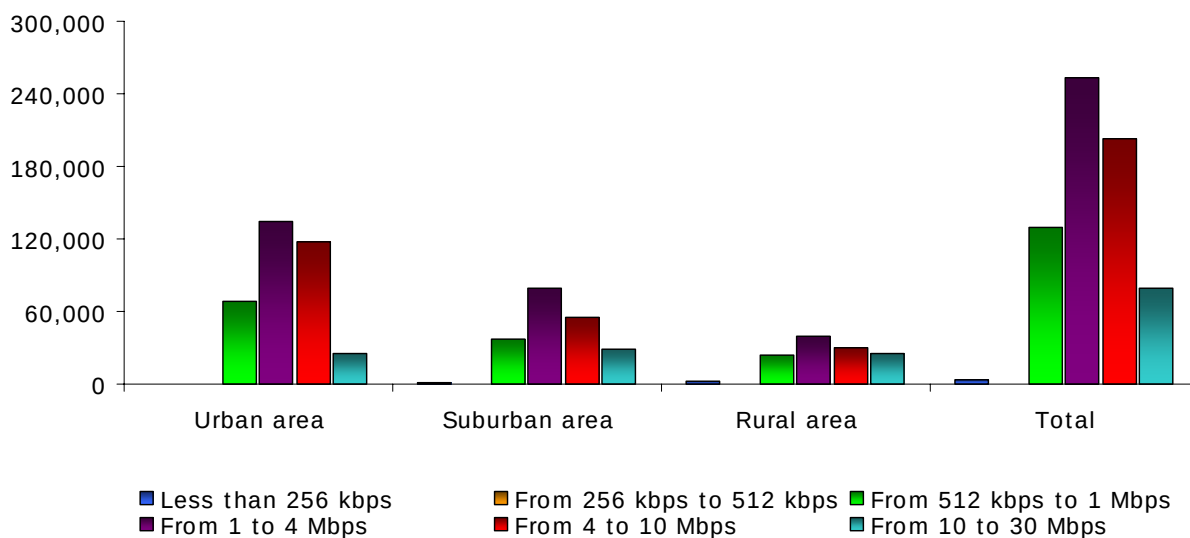
#### 4.12.4. Cable modem coverage and take-up

##### Coverage and penetration



Although cable modem coverage has increased only slightly over the past 2 years (from 72% at the end of 2006 to 74% at the end of 2008), it has spurred the development of double-play and triple-play bundles which have become very popular. The cable modem subscriber base has also grown much more rapidly than the DSL base (+78% in two years vs. +34% for DSL).

##### Number of cable modem connections by download rate



Cable modem download speeds are generally higher than DSL speeds, especially in rural areas where high speeds (over 8 Mbps) account for almost 25% of cable modem subscriptions.

### 4.12.5. Other broadband access technologies

#### **FTTH**

The number of FTTx subscribers doubled in 2008 to reach 54,000 at the end of the year, all types of fibre architecture combined.

The newest major challenge in the fixed broadband market is the announced investment by the country's dominant fixed telecom services provider, T-Co, whose three-year programme is to provide approximately 780,000 households with fibre-to-the-home access by 2011. The first phase of this rollout plan was launched in 2008 (€40 million invested).

#### **Wi-Fi/WiMAX**

The number of hotspots increased in 2008, as did the areas covered, most of which are located in cities. The number of connected institutions, tourist spots and restaurants/cafés is high, due to users' growing demand for wireless access.

#### **WLL**

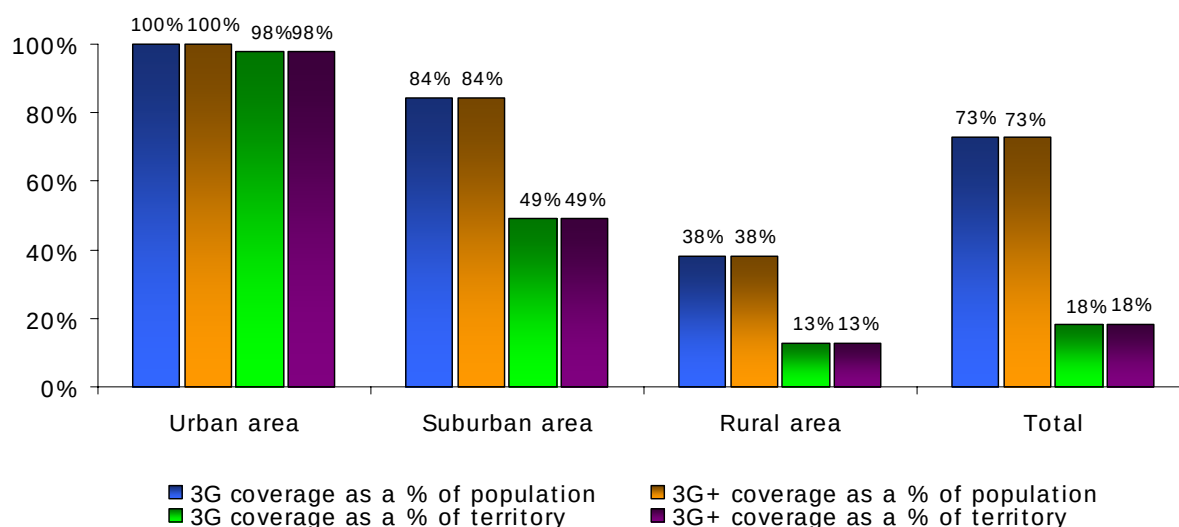
The decrease in the WLL market can be attributed to technical/technological reasons. Some of the semi-temporary WLL networks were made redundant by other fixed networks, and chiefly DSL which covered 2,500 towns and cities by the end of 2008, including 100 new villages during the year. But WLL networks are still an attractive solution for serving remote hamlets and very sparsely populated rural areas.

#### **Satellite**

The satellite market has made real strides but, given that it started from virtually nothing, its 710 customers have very little impact on the broadband market as a whole. The increase in subscribers is due to the swift expansion of retail chains in rural areas.

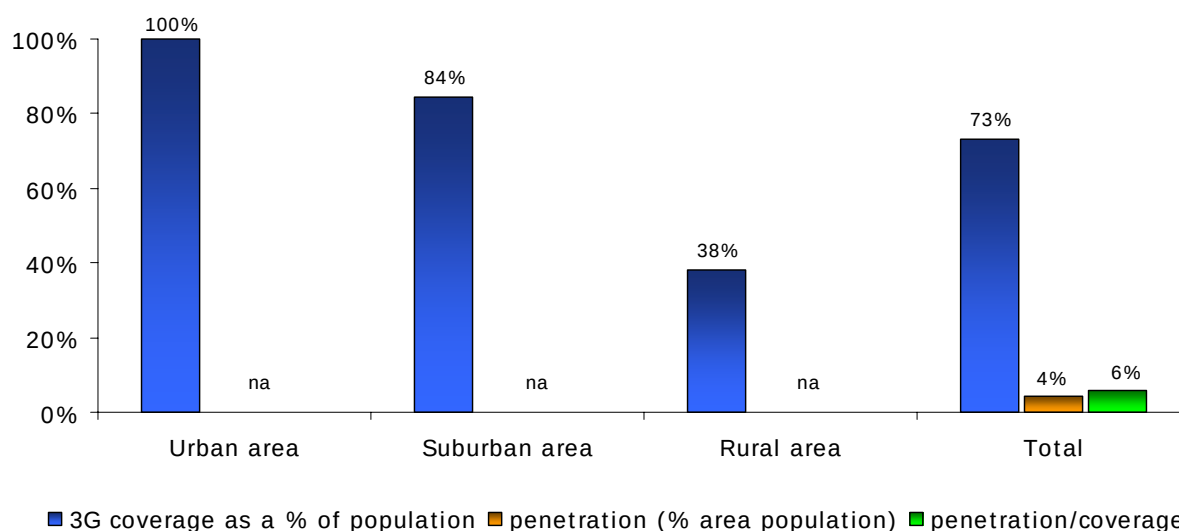
## 4.12.6. Mobile broadband coverage and take-up

### Coverage by technology



At the end of 2008, 73% of the population and 18.1% of the territory were covered by 3G and 3G+, chiefly in urban and suburban areas: 43 out of 44 urban areas, 168 out of 342 suburban areas and 358 villages were covered by 3G networks.

### Penetration



There were 355,000 mobile broadband subscribers (2.5G and 3G technologies) in Hungary at the end of June 2008, and 494,300 at the end of the year, but the number of active users was only 414,558. "Active users" refers to subscribers who have generated data traffic in the past three months. The number of 3G customers increased from 247,400 at the end of June to 365,400 by 31 December 2008.

## 4.13.Iceland

### 4.13.1. Population

|                           | Urban area | Suburban area | Rural area | National |
|---------------------------|------------|---------------|------------|----------|
| Inhabitants               | 201,000    | -             | 118,368    | 319,368  |
| Share of total population | 62.9%      | 0.0%          | 37.1%      | 100.0%   |

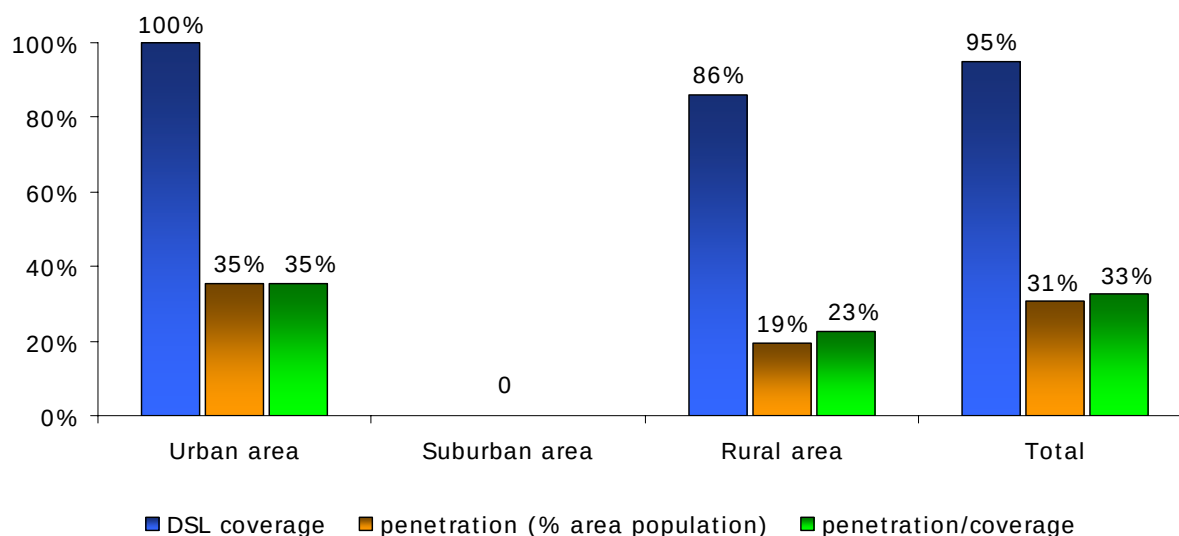
### 4.13.2. General broadband data

|                                                  | 12/04  | 12/05  | 12/06  | 12/07  | 12/08   |
|--------------------------------------------------|--------|--------|--------|--------|---------|
| DSL coverage (% of population)                   | 92%    | 92%    | 92%    | 92%    | 95%     |
| DSL subscribers                                  | 50,612 | 75,897 | 84,350 | 94,630 | 98,762  |
| DSL penetration (% of population)                | 17.2%  | 25.9%  | 28.1%  | 30.8%  | 30.9%   |
| Cable modem coverage (% population)              | 31%    | 31%    | 31%    | 31%    | 31%     |
| Cable modem subscribers                          | 670    | 432    | 500    | 500    | 0       |
| Cable modem penetration (% population)           | 0,2%   | 0,1%   | 0.2%   | 0.2%   | 0.0%    |
| FTTx subscribers                                 | 92     | 204    | 500    | 1,218  | 2,615   |
| PLC subscribers                                  | 1,020  | -      | -      | -      | -       |
| WLL subscribers                                  | 795    | 1,380  | 1,500  | 2,017  | 2,252   |
| Satellite subscribers                            | 75     | 104    | 150    | 72     | 68      |
| Total                                            | 53,264 | 78,017 | 87,000 | 98,437 | 103,697 |
| Total fixed broadband penetration (% population) | 18.1%  | 26.6%  | 29.0%  | 32.0%  | 32.5%   |
| Mobile broadband subscribers                     |        |        |        |        | 46,742  |
| Mobile broadband penetration (% population)      |        |        |        |        | 14.6%   |

Broadband penetration is very high in Iceland, due chiefly to the increase in DSL take-up. The cable modem service had been marginal and is now completely shut down. The penetration rate (32.5% at the end of 2008) is one of the highest in the European region. This is due to the fact that Iceland is geographically isolated and that broadband access is an economical way (even if prices are high compared to other European countries) for communicating with people overseas, especially for corporate users. The market for DSL seems to have reached saturation, and future growth is expected to be in the area of mobile broadband access.

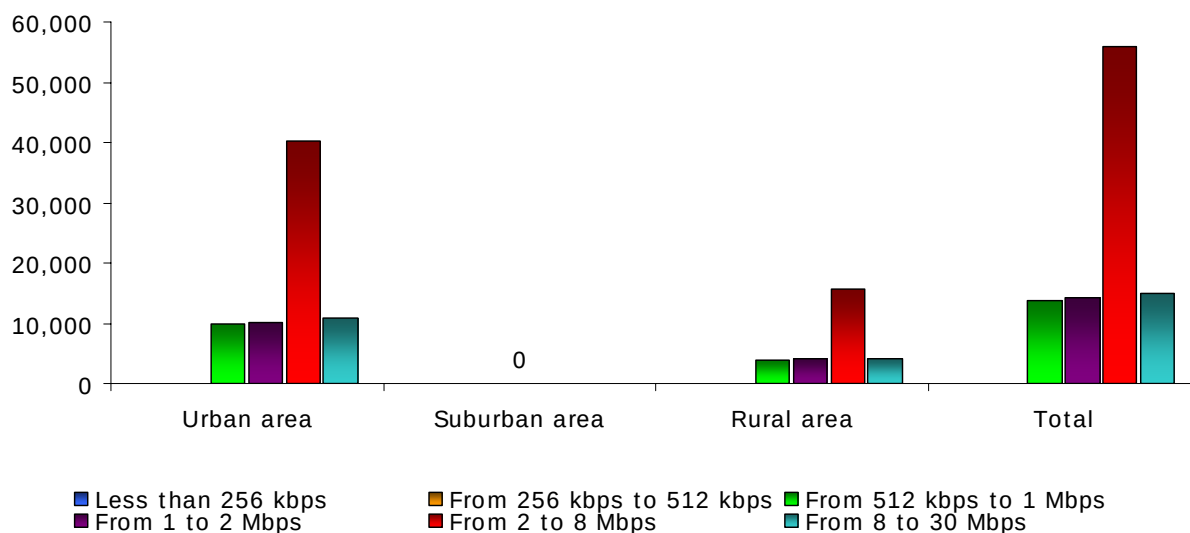
### 4.13.3. DSL coverage and take-up

#### Coverage and penetration



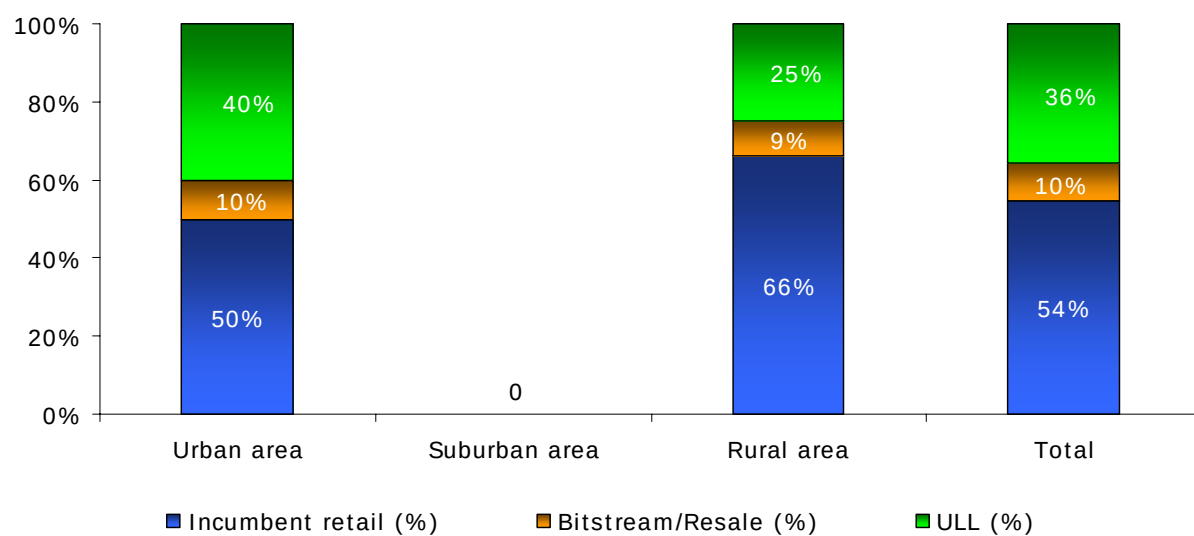
Coverage has been 100% in the Reykjavik area for some years, and is increasing regularly on the rest of the island (coastal areas).

#### Number of DSL connections by download rate



Over 70% of DSL users subscribe to offers with download rates of over 2 Mbps.

### Percentage of DSL connections by type of provider



Unbundling is well developed in Iceland, notably in urban areas where customer density is high.



#### 4.13.4. Cable modem coverage and take-up

Cable modem services were terminated in 2008.

#### 4.13.5. Other broadband access technologies

##### **FTTx**

A subsidiary of Reykjavik Energy, Lina.net, markets FTTH services, along with the incumbent telco, Siminn, and og Vodafone – both of which market optical fibre access (only FTTB or FTTC for Siminn). The number of connections increased by over 140% in 2007 and more than doubled in 2008, but penetration remains relatively low, accounting for only 2.5% of the market (2,615 subscribers).

##### **PLC**

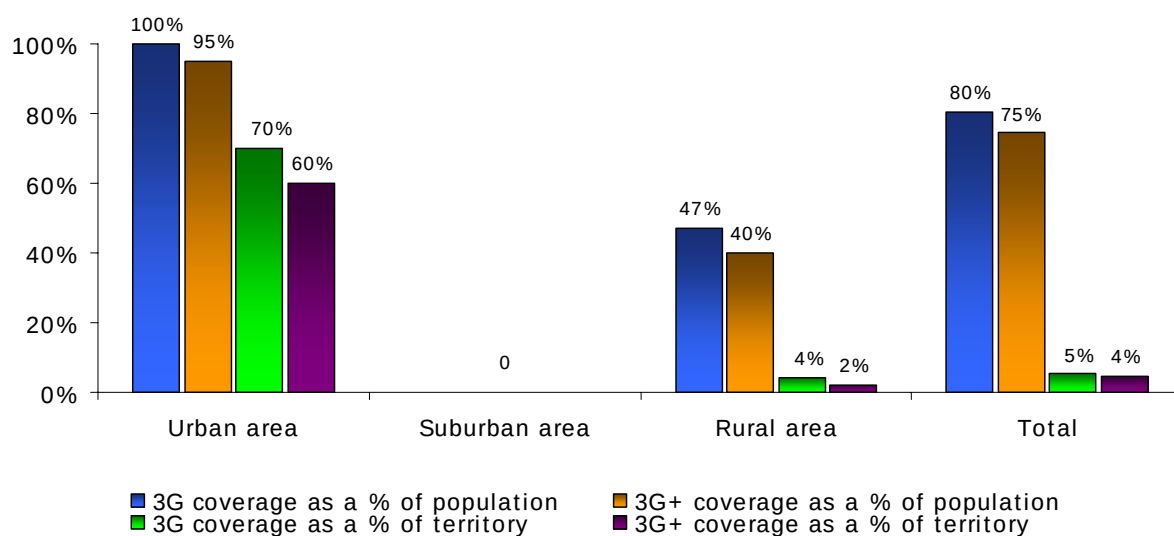
PLC services were offered by Reykjavik Energy, which has the capability to provide broadband access (coverage) to roughly 30,000 of the approximately 70,000 households in Reykjavik. There were 1,020 subscribers at the end of 2004, but the service has since been terminated.

##### **Wi-Fi**

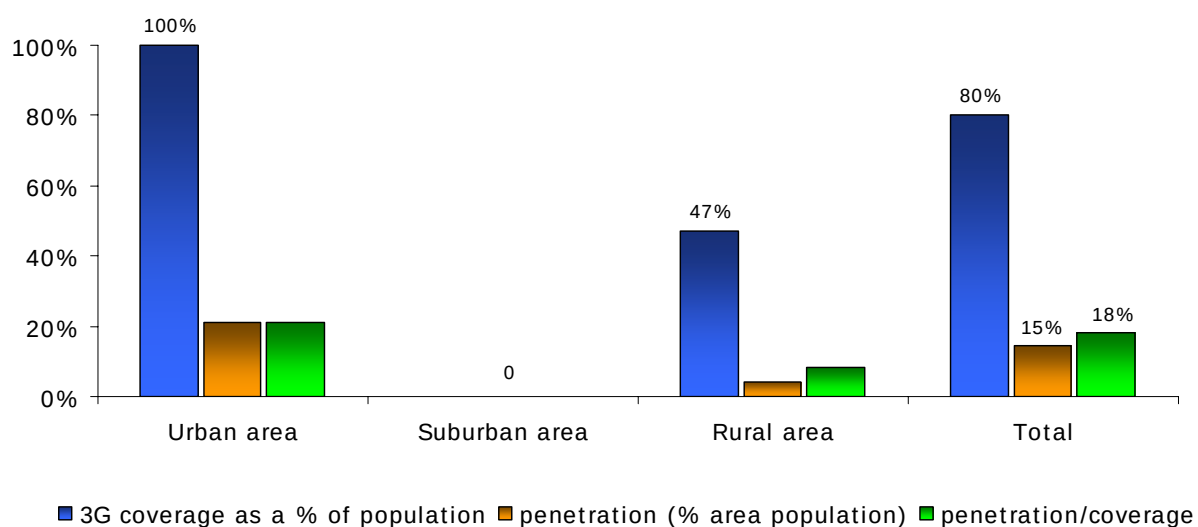
Siminn, og Vodafone and a few small operators offer Wi-Fi access at different hotspots.

### 4.13.6. Mobile broadband coverage and take-up

#### Coverage by technology



#### Penetration



Mobile broadband services were introduced in the autumn 2007. The number of 3G subscribers actively using only data services totalled 8,042 at the end of 2008, while the number of 3G subscribers using either voice and data or data only was 46,742.

## 4.14.Ireland

### 4.14.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,883,814  | 791,556       | 1,746,730  | 4,422,100 |
| Share of total population | 42.6%      | 17.9%         | 39.5%      | 100.0%    |

### 4.14.2. General broadband data

|                                                  | 12/04   | 12/05   | 12/06   | 12/07   | 12/08   |
|--------------------------------------------------|---------|---------|---------|---------|---------|
| DSL coverage (% of population)                   | 71%     | 82%     | 86%     | 89%     | 90%     |
| DSL subscribers                                  | 115,583 | 202,246 | 389,245 | 555,727 | 660,025 |
| DSL penetration (% of population)                | 2.7%    | 4.9%    | 9.2%    | 13.4%   | 14.9%   |
| Cable modem coverage (% population)              | 5%      | 11%     | 18%     | 27%     | 32%     |
| Cable modem subscribers                          | 8,045   | 25,000  | 55,320  | 82,500  | 104,133 |
| Cable modem penetration (% population)           | 0.0%    | 0.6%    | 1.3%    | 2.0%    | 2.4%    |
| FTTx subscribers                                 | 0       | 450     | na      | 3,967   | 6,780   |
| PLC subscribers                                  | -       | -       | -       | -       | -       |
| WLL subscribers                                  | 11,000  | 40,000  | 75,000  | 118,400 | 118,497 |
| Satellite subscribers                            | -       | 2,950   | 4,000   | 4,247   | 1,911   |
| Total                                            | 134,628 | 270,646 | 528,165 | 764,841 | 891,346 |
| Total fixed broadband penetration (% population) | 3.3%    | 6.6%    | 12.5%   | 18.4%   | 20.2%   |
| Mobile broadband subscribers                     |         |         |         |         | 308,909 |
| Mobile broadband penetration (% population)      |         |         |         |         | 7.0%    |

Nota: figures in *italics* are estimates.

Broadband via DSL take-up continued to increase in 2008, albeit at a lower rate than in 2007, while coverage also increased only slightly. The retail division of incumbent carrier Eircom has captured nearly three-quarters of the DSL subscriber growth (75,000 of the 105,000 new customers) with the remaining ones shared by the incumbent's wholesale offers and alternative operators' LLU-based services. Eircom has also increased the speed of its customers' services, from 2 to 3 Mbps and from 3 to 7.6 Mbps.

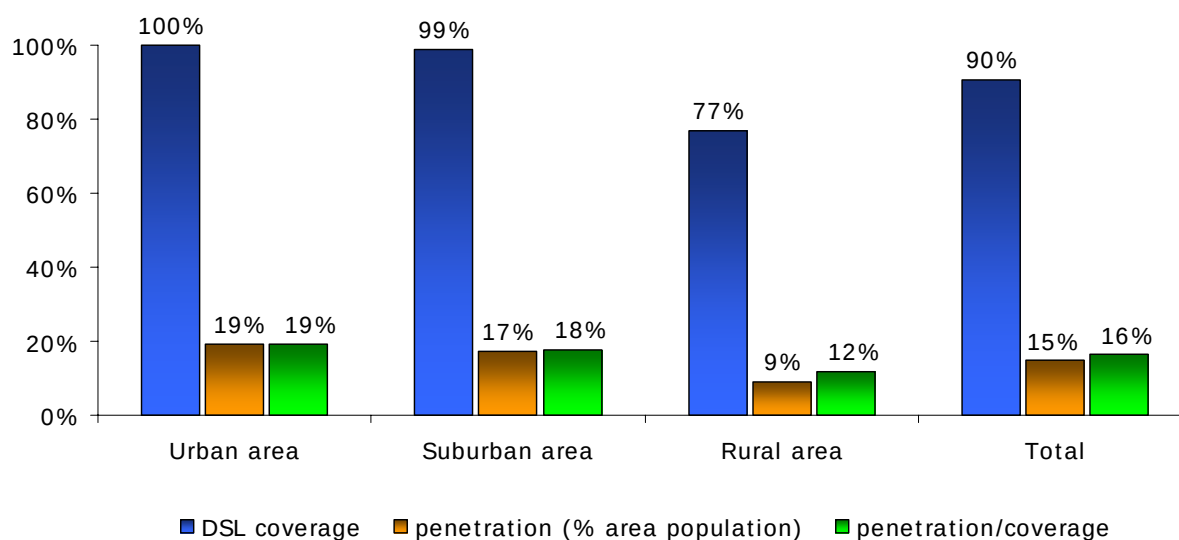
The distribution of the Irish population has long been a challenge for delivering broadband access. The National Broadband Scheme was launched in 2007, with goal of eliminating the digital divide affecting the rural population. 3 Hutchinson was awarded the contract late in the year, and network rollouts were due to take place in 2009.

Prior to the deployment of the National Broadband Scheme, the Department of Communications, Energy and Natural Resources estimates that, through a combination of different available fixed and mobile technologies, 60% of Irish households had broadband access at the end of 2008.

The programme is expected to further boost the growth of wireless connectivity in Ireland, which already has a substantial base of 308,905 subscribers.

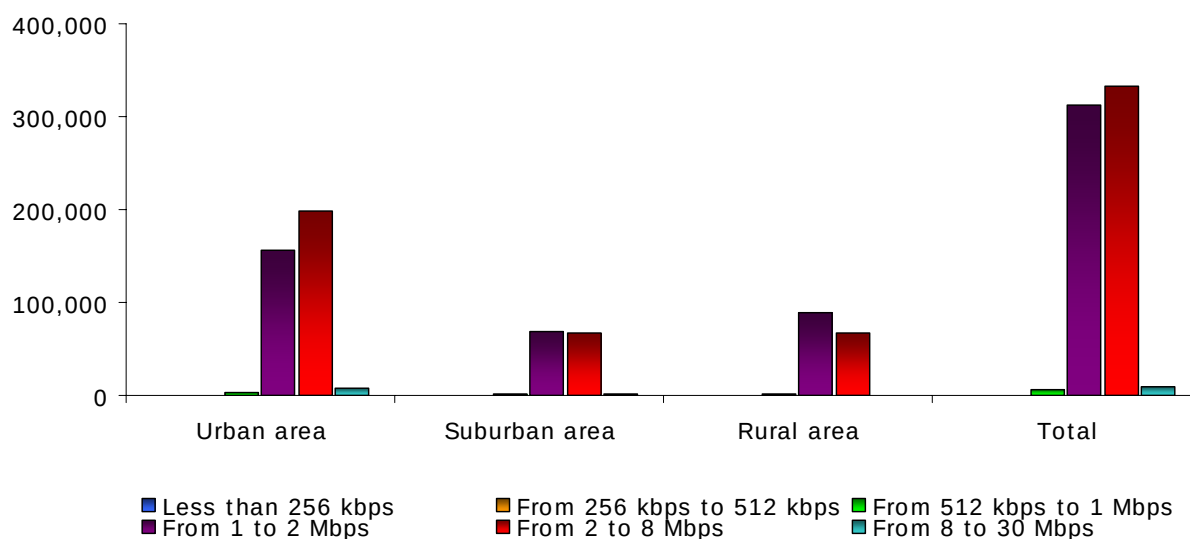
### 4.14.3. DSL coverage and take-up

#### Coverage and penetration



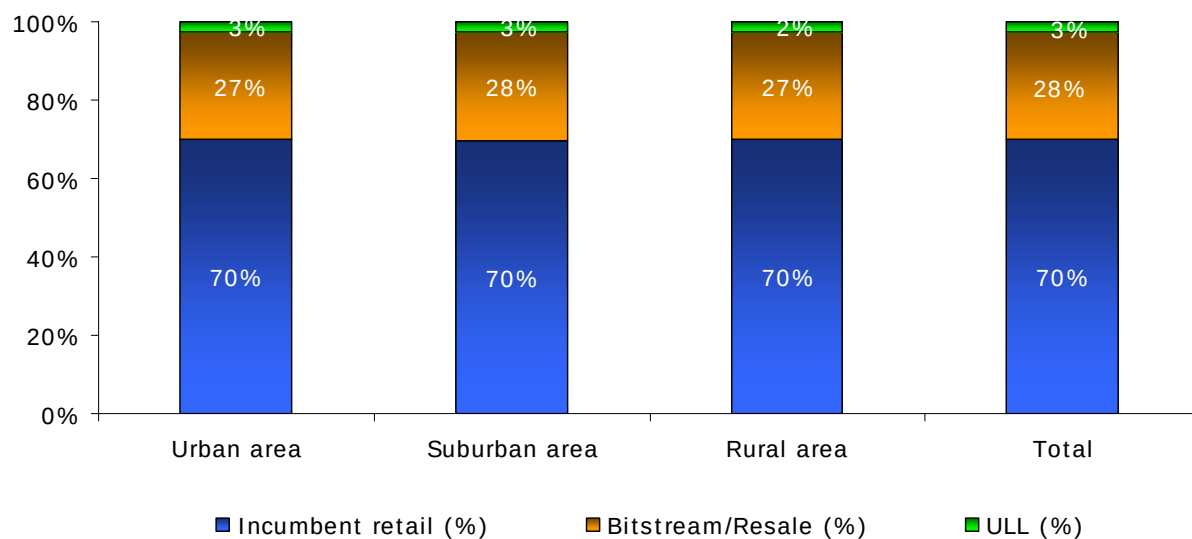
Eircom has pursued its DSL extension programme with 630,000 subscribers. The expansion also affected coverage, with an additional 117 exchanges becoming DSL-enabled in 2008. Rural areas benefitted the most from the additional rollouts, with coverage increasing to 77% – 4% more than in 2007.

#### Number of DSL connections by download rate



Eircom's bandwidth upgrades have naturally meant an increase in average access rates, with over half (54%) of the subscriber base now connected to a service running at over 3 Mbps. This is a substantial rise compared to the previous year when only 13.1% were connected at a speed of between 2 and 8 Mbps.

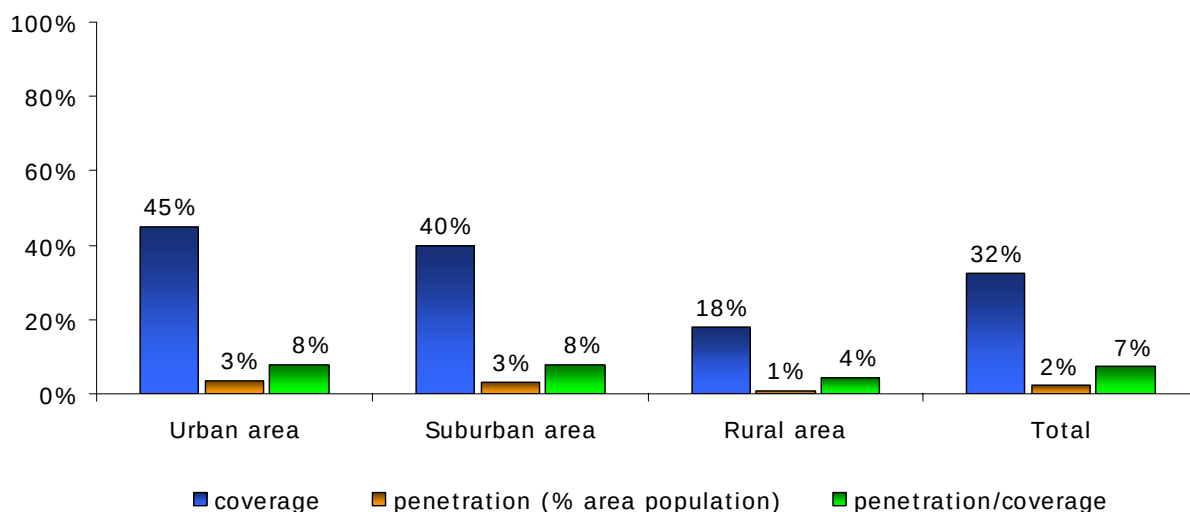
### Percentage of DSL connections by type of provider



Eircom has maintained its market dominance, boasting a 70% share of DSL connections via its retail division and a 28% share via bitstream. The 3% of the market served by unbundling has remained more or less unchanged since the previous year.

#### 4.14.4. Cable modem coverage and take-up

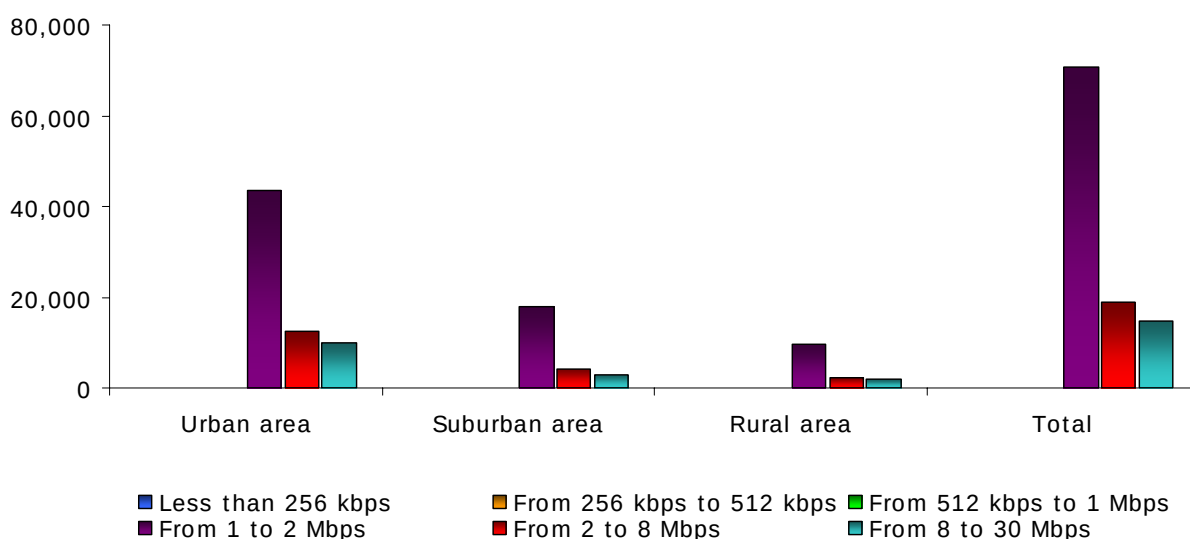
##### Coverage and penetration



Unfortunately, as with previous years, a breakdown by location and access speed is not available. The data have thus been extrapolated based on estimates from other operators and trends in Ireland.

UPC, which is the brand that is now promoted in Ireland as the European division of Liberty Global, has increased its foothold substantially, by over 100,000 subscribers. To achieve this, the company launched an initiative, bundling its access services with a TV package, which it is testing in certain areas in partnership with rival provider, Digiweb. Overall, when compared to the end of 2007, the net additions at the end of 2008 represented an increase of 26%, despite which cable has not increased its share of the broadband base, which is holding steady at 11%.

##### Number of cable modem connections by download rate



### 4.14.5. Other broadband access technologies

#### **WLL/WiMAX**

Wireless broadband remained stable between 2007 and 2008, after having more than doubled the previous year. Take-up decreased for two quarters in a row: after increasing from 118,000 customers in Q4 2007 to 122,000 in Q1 2008, the base shrank over the next six months to 118,000 in the last quarter of the year.

The number of Wi-Fi hotspots operated by the country's three leading providers, Bitbuzz, Eircom and BT, increased by 14% in 2008 to a total 1,429.

#### **Satellite**

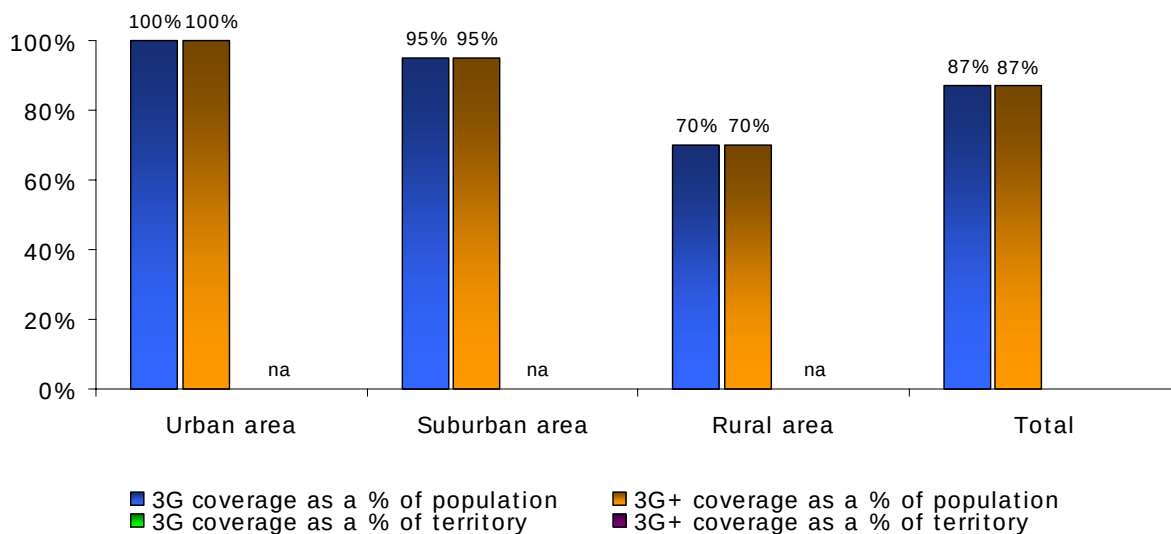
The satellite offering remained modest, and there was no noticeable increase in subscribers compared to previous year. As part of the National Broadband Scheme, satellite technology will be used to complement the deployment of 3G infrastructure in very remote areas.

#### **FTTx**

Optical fibre and satellite combined represent only 8,691 subscribers, a very small increase from the 8,300 in 2007. The scheduled investment by the National Development Plan for financing a Metropolitan Area Network (MAN) has been postponed following a cost-effectiveness assessment performed the previous year.

#### 4.14.6. Mobile broadband coverage and take-up

##### Coverage by technology



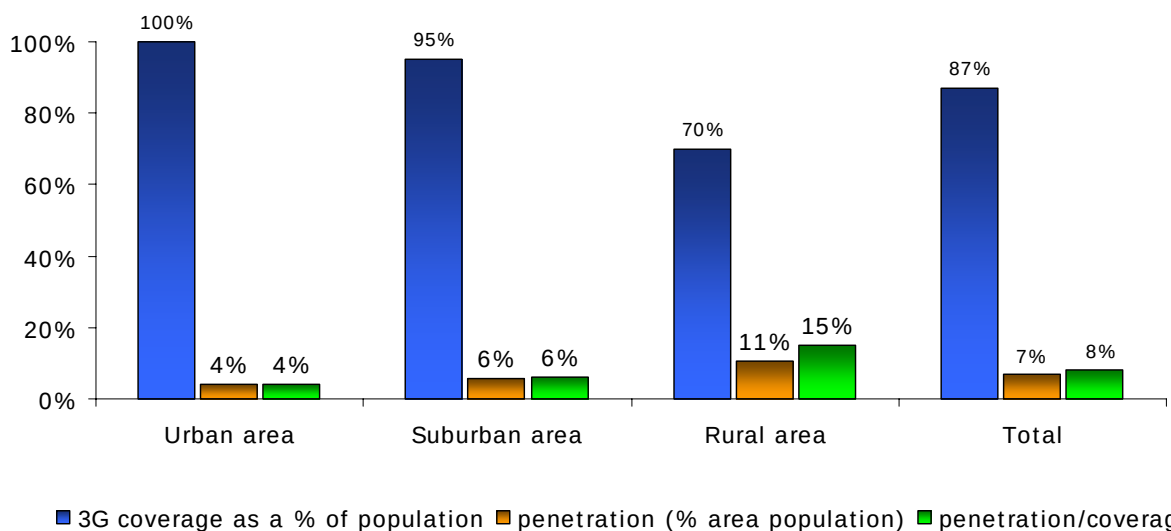
Although total coverage and subscription figures are available, detailed coverage and subscription for each area have not been documented and so have been estimated in the above and below charts.

3G coverage has been a strong focus in Ireland, with the National Broadband Scheme awarded to 3 Hutchinson. The company is planning on a rollout spanning 21 months, with the first services becoming available in spring 2009. The coverage provided will be chiefly 3G access, along with a satellite complement in 8% of the country.

Based on an announcement from 3, users should expect to have access to a peak download speed of between 1.2 Mbps and 5 Mbps (at the cell's centre).

The services will be packaged, so prices will be comparable to a fixed line subscription. The expected price for the service to be launched in 2009 will be in line with current offerings, with plans to include bandwidth upgrades with no price increase as faster technologies become available.

##### Penetration



By the end of 2008, the number of active mobile Internet users was approximately 308,905.



## 4.15. Italy

### 4.15.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 30,259,624 | 21,972,832    | 7,386,834  | 59,619,290 |
| Share of total population | 50.8%      | 36.9%         | 12.4%      | 100.0%     |

### 4.15.2. General broadband data

|                                                  | 12/04     | 12/05     | 12/06     | 12/07      | 12/08      |
|--------------------------------------------------|-----------|-----------|-----------|------------|------------|
| DSL coverage (% of population)                   | 83%       | 86%       | 89%       | 94%        | 95%        |
| DSL subscribers                                  | 4,400,000 | 6,500,000 | 8,200,000 | 9,700,000  | 10,900,000 |
| DSL penetration (% of population)                | 7.6%      | 11.1%     | 14.0%     | 16.4%      | 18.3%      |
| Cable modem coverage (% population)              | 0%        | 0%        | 0%        | 0%         | 0%         |
| Cable modem subscribers                          | 0         | 0         | 0         | 0          | 0          |
| Cable modem penetration (% population)           | 0.0%      | 0.0%      | 0.0%      | 0.0%       | 0.0%       |
| FTTx subscribers                                 | 184,000   | 206,000   | 229,000   | 268,000    | 309,000    |
| PLC subscribers                                  | 0         | 0         | 0         | 0          | 0          |
| WLL subscribers                                  | 400       | 800       | 1,400     | 2,000      | 3,000      |
| Satellite subscribers                            | 109,000   | 128,000   | 106,000   | 89,000     | 81,303     |
| Total                                            | 4,693,400 | 6,834,800 | 8,536,400 | 10,059,000 | 11,293,303 |
| Total fixed broadband penetration (% population) | 8.1%      | 11.7%     | 14.5%     | 17.0%      | 18.9%      |
| Mobile broadband subscribers                     |           |           |           |            | 8,100,000  |
| Mobile broadband penetration (% population)      |           |           |           |            | 13.6%      |

At the end of 2008, there were close to 11 million broadband Internet connections in Italy, a 12% increase over the previous year. Due to the lack of cable networks and limited FTTH coverage, DSL is by far the main broadband access technology, despite still incomplete coverage, especially in rural areas.

Broadband access has had a service's typical lifecycle in its introduction and development phases, and is now continuing to grow, but at a lesser pace.

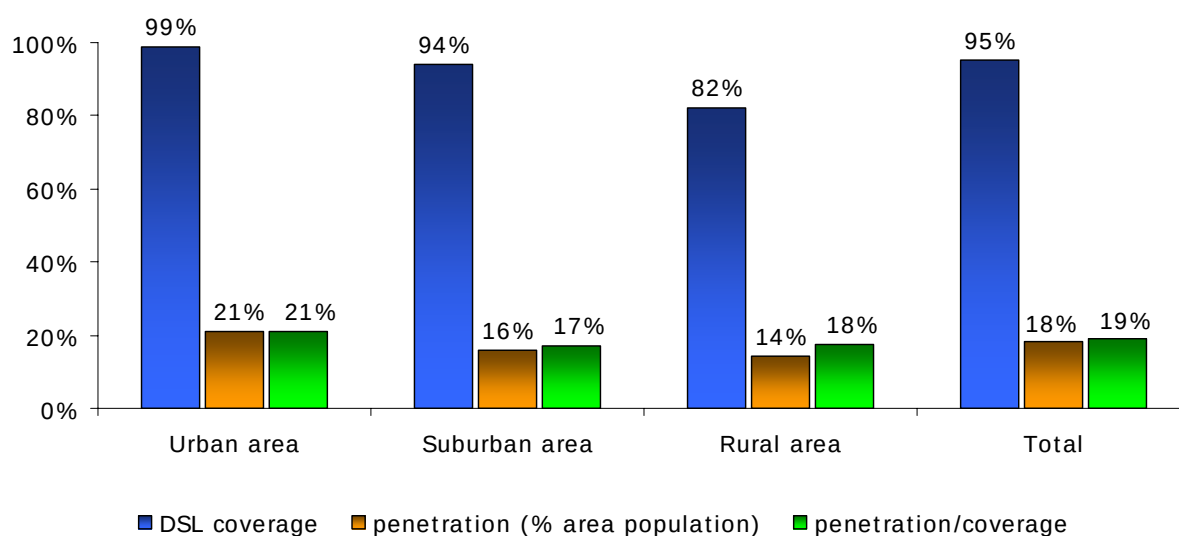
We are seeing more bundling of complementary services (Voice over IP + Internet access), based on the xDSL network. FTTH subscriber numbers have increased very little as no new large-scale rollouts have been planned.

At the end of 2008 there were three IPTV providers in Italy: FastWeb, Telecom Italia and Wind/Infostrada, with a combined customer base of around 550,000 users, of which more than 300,000 subscribe to FastWeb TV, around 200,000 subscribed to Alice Home TV (Telecom Italia) and the remaining to Wind/Infostrada TV.

FastWeb was the first vendor in Italy to launch IPTV, back in 2001. The service is now available to all of its customers connected via FTTH or unbundled ADSL, but not to those connected to ADSL via bitstream/resale solutions. Telecom Italia began trials in 2004-2005, and launched its IPTV service in 258 cities in 2006.

### 4.15.3. DSL coverage and take-up

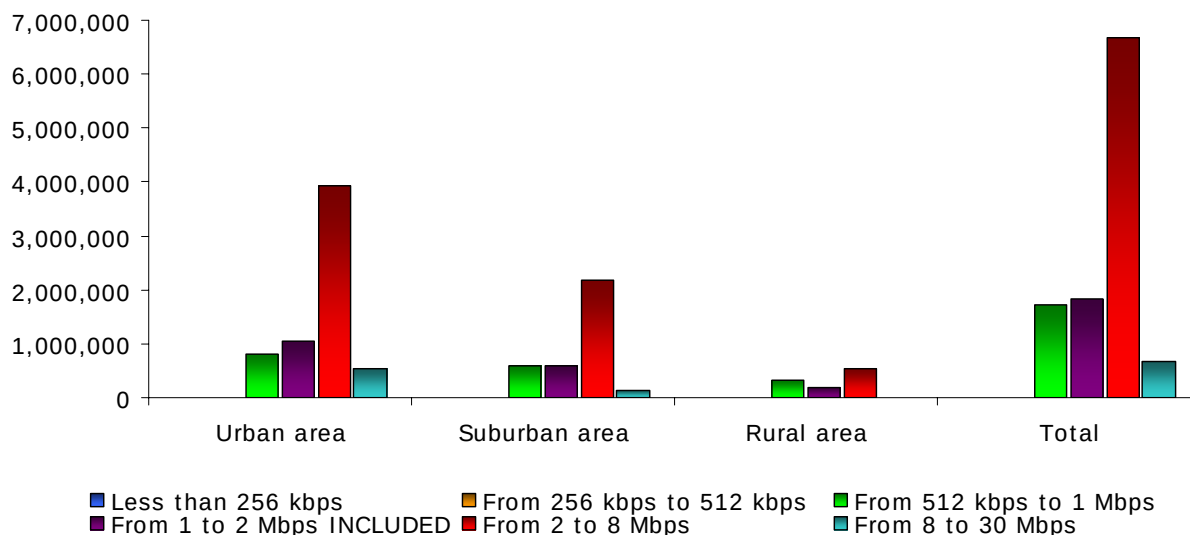
#### Coverage and penetration



According to Telecom Italia, at the end of 2008 there were about 8,400, central offices equipped with DSLAMs, covering 95.3% of the total population.

Coverage in rural areas rose by more than 5 points in 2008, from 75% at the end of 2007, and total coverage increased by one point, up to 95%.

#### Number of DSL connections by download rate



Continuous bandwidth increases, enabled by technological developments, together with the introduction of new services and increased demand, have created a virtuous circle between demand and bandwidth availability.

At the end of 2008, it can be estimated that about 60% of active connections were delivering a download rate of between 2 and 8 Mbps, and a further 6% were in the range of 8 to 30 Mbps. It can therefore be said that the majority of connections are at speeds equal to or higher than 2 Mbps.

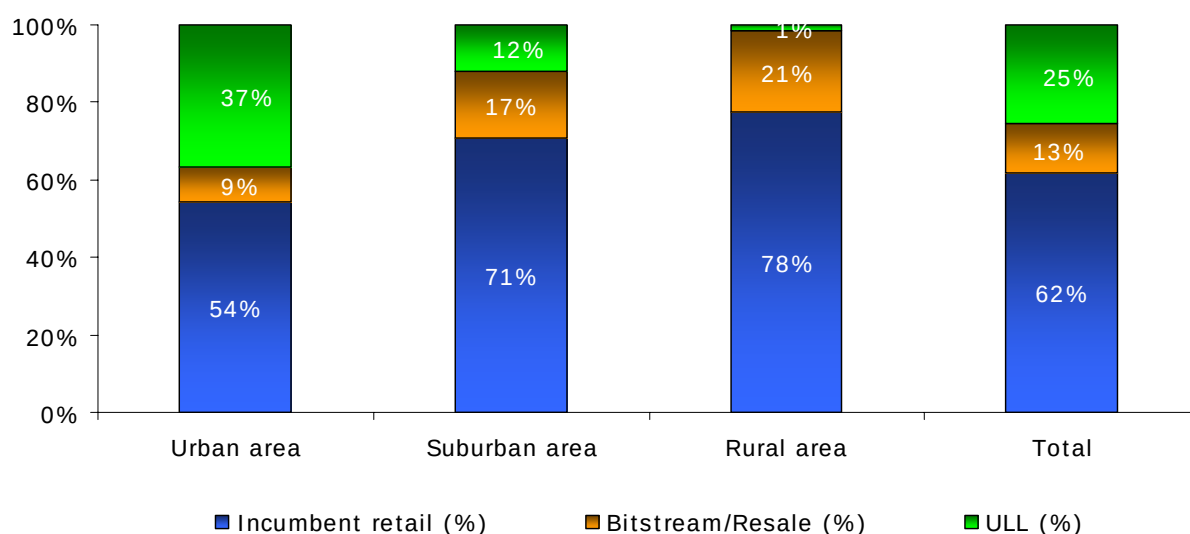
Only a small percentage of subscribers (less than 10%) have opted for premium connections at 20 Mbps, however, even though the services are available to more than half of the population.

Over the past year, all Italian telecom carriers enhanced their ADSL and ADSL2+ offerings with various downstream rates (from 7 Mbps to 20 Mbps).

The leading market players are:

- the incumbent, Telecom Italia, offering services at 7 Mbps and 20 Mbps;
- FastWeb, the country's 4<sup>th</sup> largest telco, which markets an FTTH offer at 20 Mbps and an ADSL offer at 10 Mbps;
- Infostrada (Wind), offering services running at 7 and 20 Mbps.

### Percentage of DSL connections by type of provider



At the end of 2008, with 6.7 million ADSL, Telecom Italia had a roughly 62% share of the DSL retail market, 4 points less than the previous year.

LLU and shared access lines are the fastest growing markets: with 2,766,000 units, their share increased from 22% to 25% in the past year.

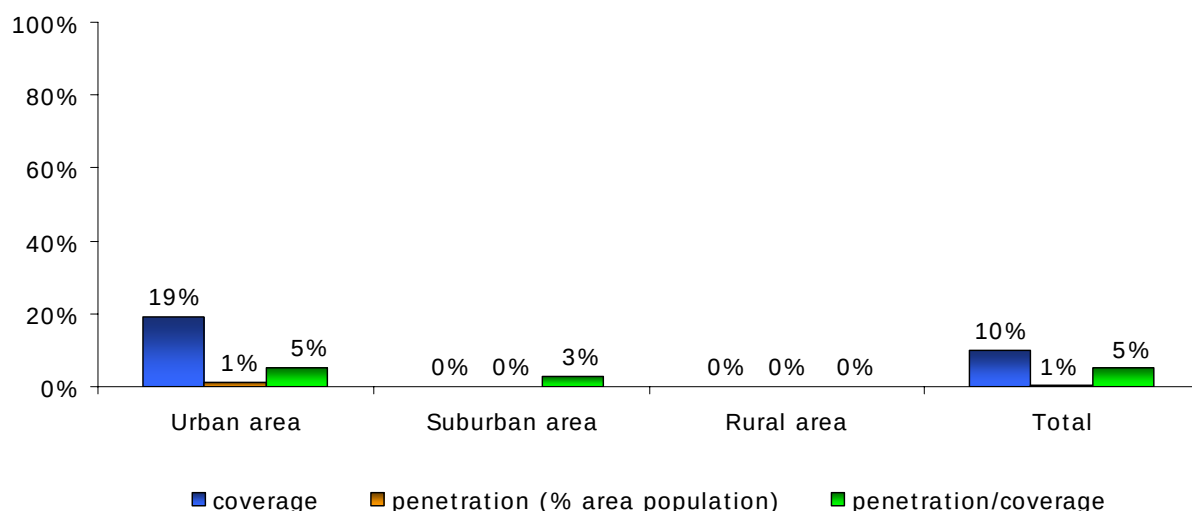
Competition is still growing: in 2002 the top two alternative providers together accounted for only 13% of the retail market, whereas now LLU-based competition accounts for 25% of total broadband lines.

The third component in the xDSL market, i.e. xDSL resold by OLO/ISPs, is decreasing in relevance. There has been a negligible increase: from a 12% market share at the end of 2007 to 12.7% at the end of 2008, for a base of 1.38 million active customers.

After a first stage based on wholesale offerings, starting in 2004/2005, full unbundling and shared access have therefore increased significantly – a development made possible by broader LLU coverage for several major market players, along with the steady development of bundled solutions.

#### 4.15.4. FTTH coverage and take-up

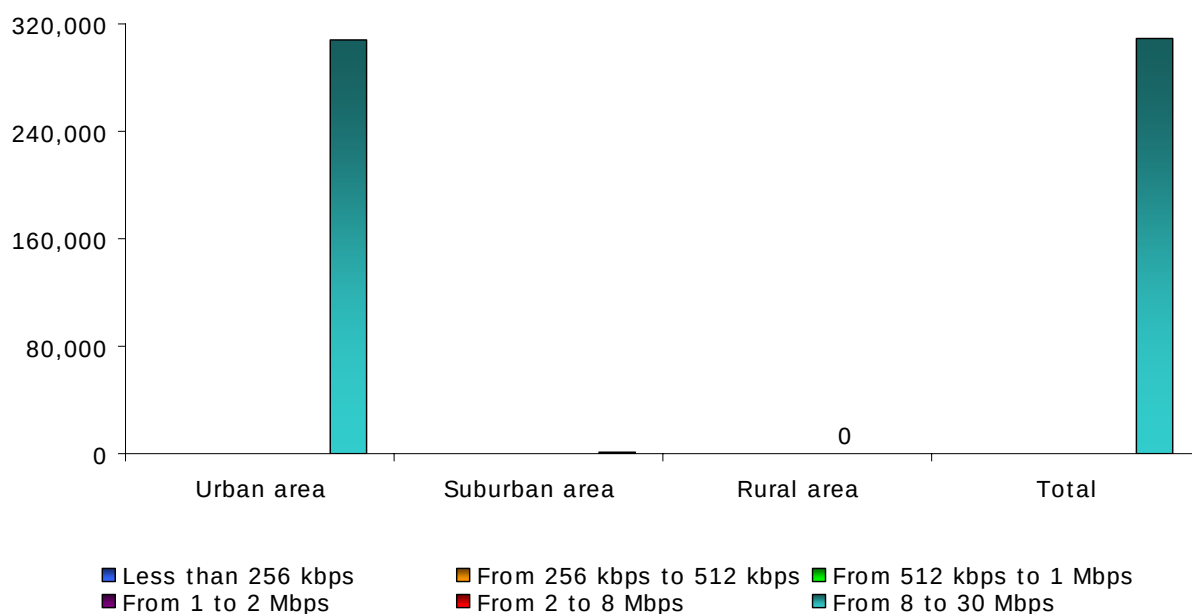
##### Coverage and penetration



FastWeb sells its FTTH services to both businesses and households, while Colt Telecom, BT Albacom, Wind and Telecom Italia market their services to a very small group of businesses and corporate customers.

FastWeb reports that FTTH is available in more than 30 cities: primarily in Milan (and in 17 outlying municipalities), Rome (and in two suburbs), Naples, Turin, Geneva, Bologna (and 6 outlying municipalities) and Bari.

##### Number of FTTH connections by download rate



All FTTH access services sold in the last year can reach a speed of at least 10 Mbps.

### 4.15.5. Other broadband access technologies

#### Wi-Fi

According to the 14<sup>th</sup> Progress Report on the Single European Electronic Communications Market, at the end of 2008 there were 4,844 active Wi-Fi hotspots in Italy. The best equipped region was Lombardy, followed by Lazio, Emilia-Romagna and Tuscany.

According to a survey carried out by Between, at the end of 2008 there were around 130 WISP (Wireless Internet Service Provider) who offered Wi-Fi/Hiperlan services, covering approximately 15% of the Italian population, but with large regional disparities: northern Italian regions have a much higher level of coverage than southern regions.

#### WLL/WiMAX

WLL services are based on the 24.5 GHz and 27.5-29.5 GHz frequencies, also known as LMDS in Italy. These services were liberalised in 2002 in a public auction held by the Ministry of Communications, where licences were awarded to 13 network operators.

At the end of 2008, it can be estimated that the situation is roughly the same as it was at the end of 2006, with a base of roughly 1,000 WLL business customers in north-eastern Italy.

In October 2007, the Ministry of Communications held an auction for 35 WiMAX licenses in the 3.4-3.6 GHz frequency bands.

At the end of February 2008, the procedure ended and the licenses for 21 regions and 14 macro-regions were awarded to 11 operators. Four of them are “big” Telcos with a national presence and seven are local operators. Some of these operators have begun their rollouts, but none cover more than 5% of the population. All are required to develop significant local coverage, especially in digital divide areas (coverage obligations linked to frequency allocation).

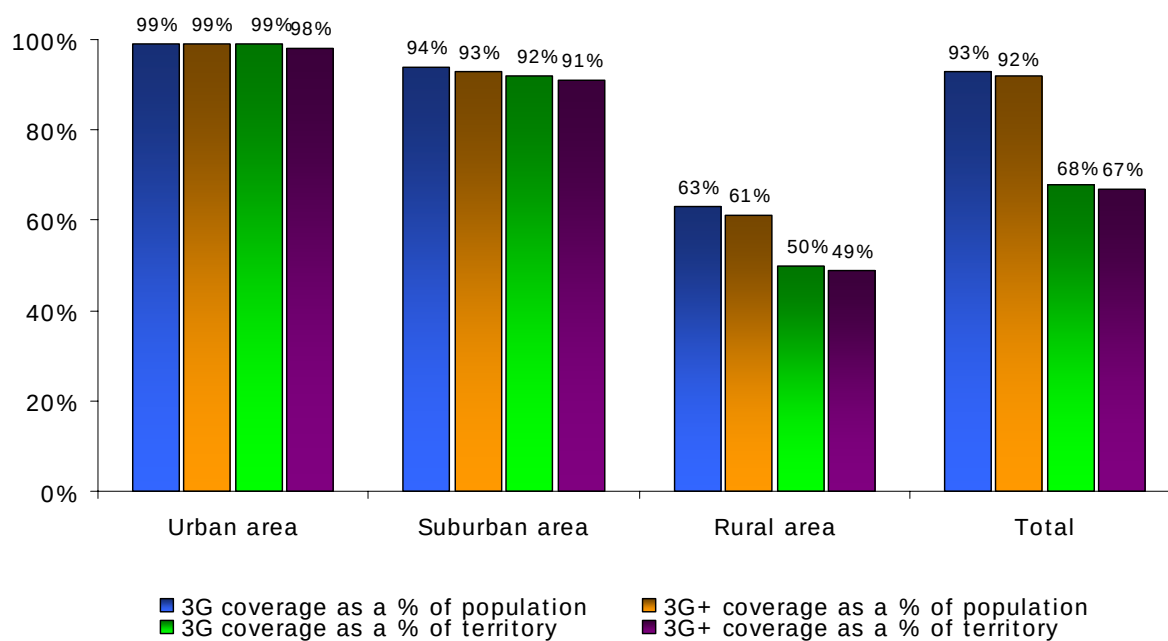
#### Satellite

Two-way satellite Internet access in Italy is supplied primarily by ISP Netsystem.com (also in partnership with Telecom Italia).

At the end of December 2008, there were 81,303 satellite Internet subscribers in Italy.

## 4.15.6. Mobile broadband coverage and take-up

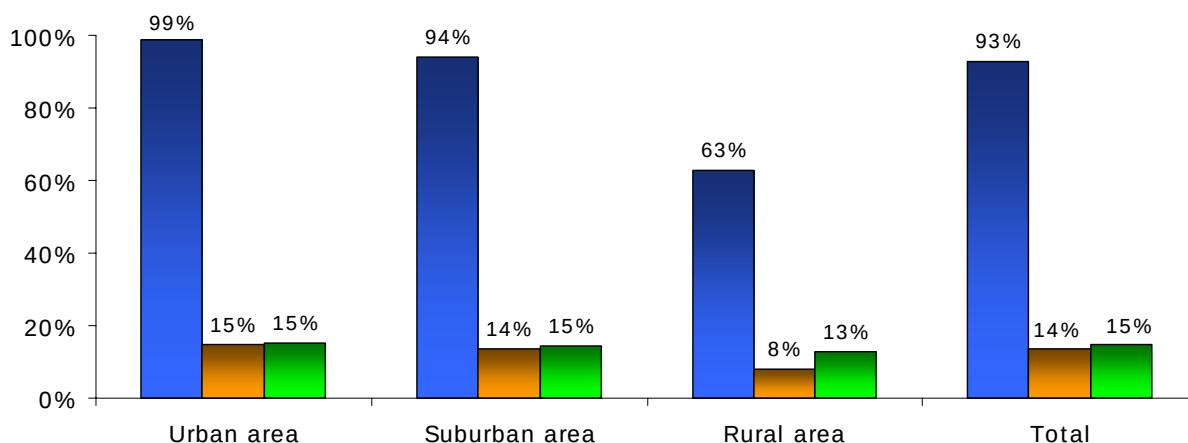
### Coverage by technology



Mobile broadband coverage in Italy reaches over 90% of the total population, albeit with a huge difference between rural and urban areas of around 30 percentage points<sup>3</sup>.

<sup>3</sup> Coverage was calculated based on the lists of covered municipalities published on operators' websites. Each municipality where an operator is present is considered as completely covered (100% of resident population). UMTS coverage is based on Between's National Broadband Observatory data.

## Penetration



■ 3G coverage as a % of population ■ penetration (% area population) ■ penetration/coverage

The differences in service penetration between urban, suburban and rural areas are primarily due to the differences in service availability (coverage). There are in fact only slight disparities in the level of relative penetration (defined as penetration/coverage) between the different areas.

According to the National Regulatory Agency (Annual Report 2009), there were 29 million UMTS lines (all available terminals, SIM cards & dedicated mobile broadband data services) at the end of 2008. At the same time, there were 8.1 million active mobile broadband users (access to dedicated data services via modems/cards and other active 3G equivalent advanced data users using mobile terminals) and 1.7 million dedicated mobile data-service-only devices (cards/modems/keys).

The Italian mobile market is comprised of four operators, plus a small number of MVNOs:

- TIM (Telecom Italia) with 34.8 million customers, of which 7.3 million UMTS lines;
- Vodafone Italia, with 30 million customers, of which more than 9.5 million UMTS lines;
- Wind, with 16.9 million mobile customers, of which 3.6 million UMTS lines;
- H3G with near 8.6 million customers (all lines are UMTS).

MVNOs currently account for a limited number of customers, the largest one being Poste Mobile – the mobile telecom arm of the national postal service provider – with a base of around 0.7 million customers, according to the National Regulatory Agency's 2009 Annual Report 2009.

## 4.16.Latvia

### 4.16.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,470,827  | 68,126        | 729,896    | 2,268,849 |
| Share of total population | 64.8%      | 3.0%          | 32.2%      | 100.0%    |

### 4.16.2. General broadband data

|                                                  | 12/04  | 12/05   | 12/06   | 12/07   | 12/08    |
|--------------------------------------------------|--------|---------|---------|---------|----------|
| DSL coverage (% of population)                   | -      | -       | 72%     | 87%     | 88%      |
| DSL subscribers                                  | 43,740 | 68,569  | 120,000 | 158,000 | 182,326  |
| DSL penetration (% of population)                | 1.9%   | 3.0%    | 5.3%    | 7.0%    | 8.0%     |
| Cable modem coverage (% population)              | -      | -       | 50%     | 65%     | 65%      |
| Cable modem subscribers                          | 6,480  | 16,000  | 27,000  | 38,000  | 37,217   |
| Cable modem penetration (% population)           | 0.3%   | 0.7%    | 1.2%    | 1.7%    | 1.6%     |
| FTTx subscribers                                 | 0      | 1,000   | 1,200   | 8,700   | 159,808* |
| PLC subscribers                                  | 0      | 44      | 60      | 60      | 0        |
| WLL subscribers                                  | 1,000  | 54,623  | 92,000  | 109,798 | 50,485** |
| Satellite subscribers                            | -      | -       | 60      | 80      | 329      |
| Total                                            | 51,220 | 140,236 | 240,320 | 314,638 | 430,165  |
| Total fixed broadband penetration (% population) | 2.2%   | 6.1%    | 10.6%   | 13.8%   | 19.0%    |
| Mobile broadband subscribers                     |        |         |         |         | 33,604   |
| Mobile broadband penetration (% population)      |        |         |         |         | 1.5%     |

\* including 152 210 LAN subscribers

\*\* including 36,000 CDMA-based FWA connections (Triatel)

The Latvian broadband access market continued to grow in 2008. In total, there were 430,165 fixed broadband subscribers at the end of the year, a 36.7%-increase over 2007. DSL coverage is still below EU average, however, and increased very little in 2008.

The main broadband solutions marketed in Latvia are DSL and LAN. DSL holds the largest market share (42.3%), while LAN has also been very popular as an alternative access technology.

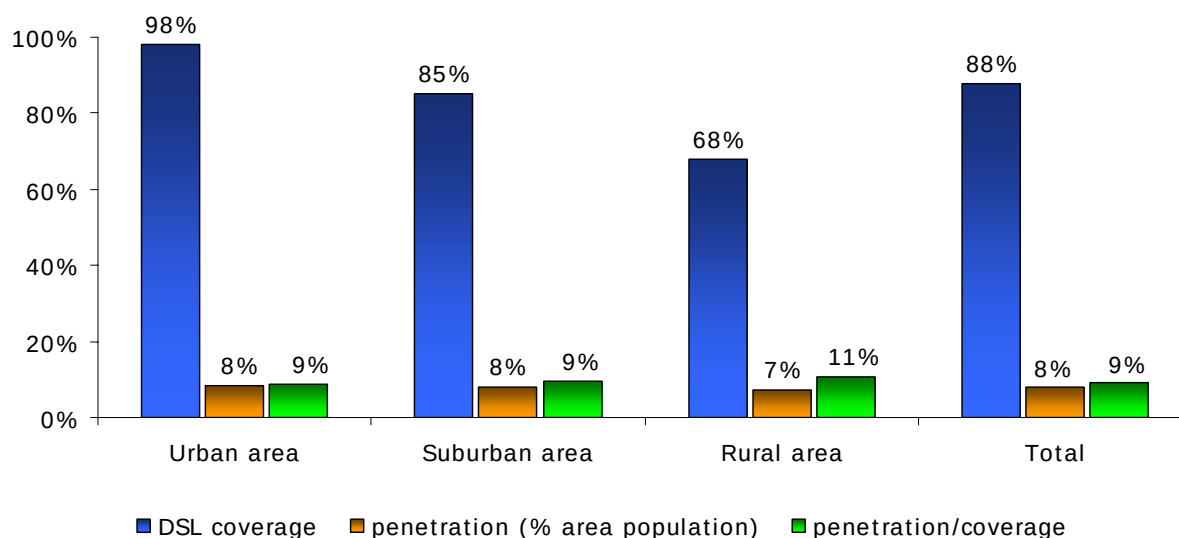
In addition to these figures, the main developments in Latvia's broadband market over the past year have been the following:

- Fibre-to-the-home development. The incumbent carrier, Lattelecom, has announced an ambitious plan for deploying FTTx infrastructure in major Latvian cities. It is expected that LAN and cable modem network operators will feel serious pressure as a result.
- Mobile broadband growth. Mobile networks are able to provide speeds and prices comparable to fixed Internet access, so mobile network operators have focused their efforts and investments on capturing as large a share of this new market as possible. The government does, however, support wireless broadband rollouts for delivering Internet access to rural areas, which has spurred the market's growth substantially.



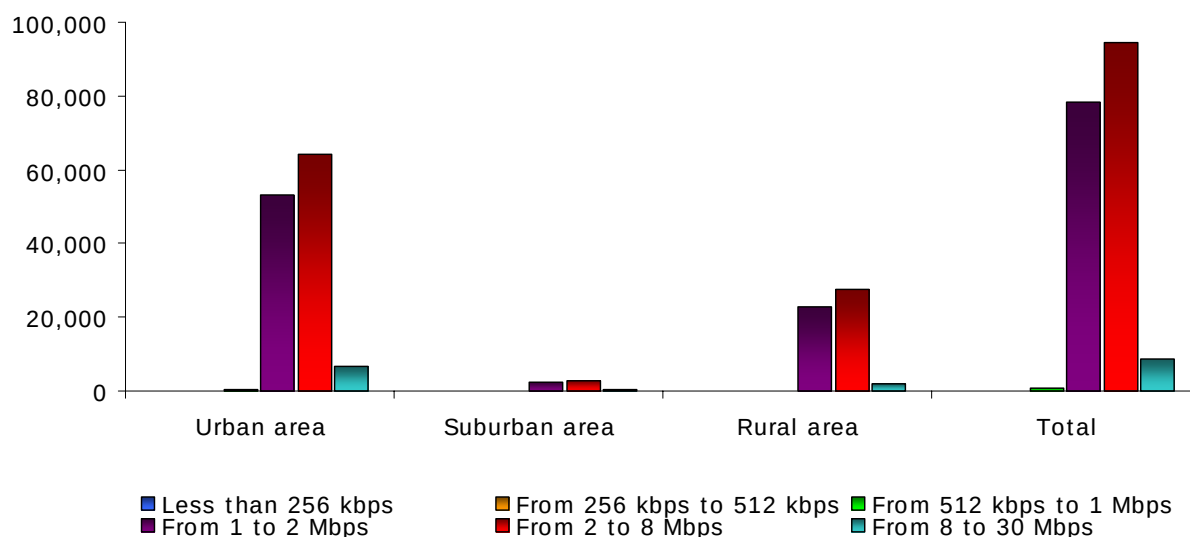
### 4.16.3. DSL coverage and take-up

#### Coverage and penetration



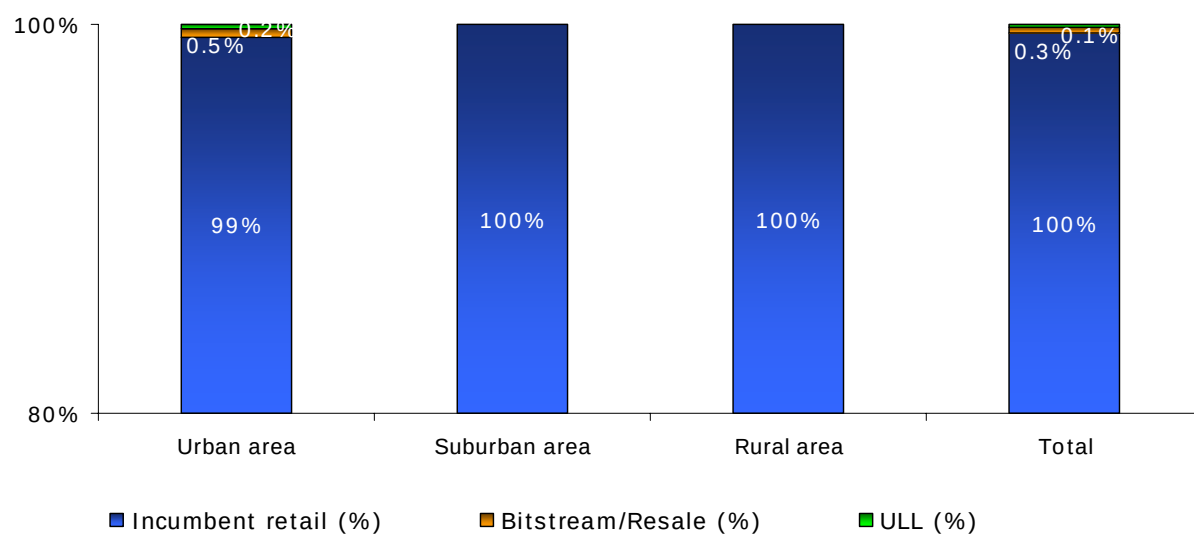
DSL is the main broadband access technology in Latvia. It is the first, and sometimes only, option for customers outside urban centres. In 2008, the country's DSL subscriber base increased by 15.4%, to a total 182,326 customers. There was no significant progress made on the coverage front: the population density and income level in uncovered rural areas are not sufficient to build a sustainable business model.

#### Number of DSL connections by download rate



Strong competition has forced the incumbent to improve its DSL service. Speeds below 1 Mbps were removed from the product line-up and are no longer available to regular customers. Keeping up with market trends, Lattelecom has added its own IPTV service, "interactive television", and free phone calls to certain destinations to its DSL access package. 1-2 Mbps and 2-5 Mbps plans are popular with residential users, while the 10 Mbps plan is used chiefly by business customers.

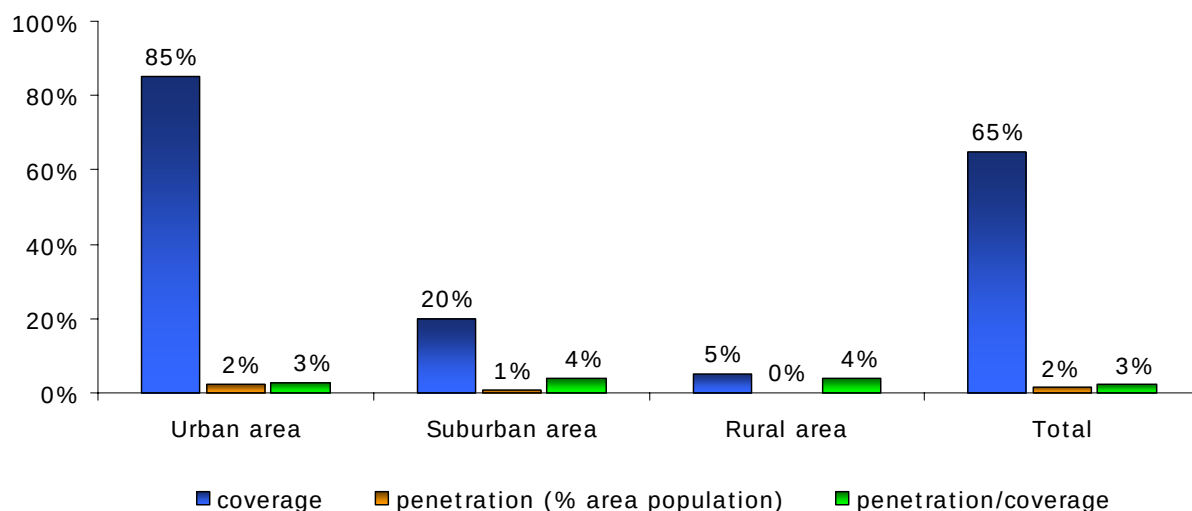
### Percentage of DSL connections by type of provider



Although Latvian legislation requires the SMP operator to provide unbundling, ISPs have not chosen DSL access provision via LLU as their core business. Strong competition and the small size of the Latvian market have led the players to focus on building their own networks and products.

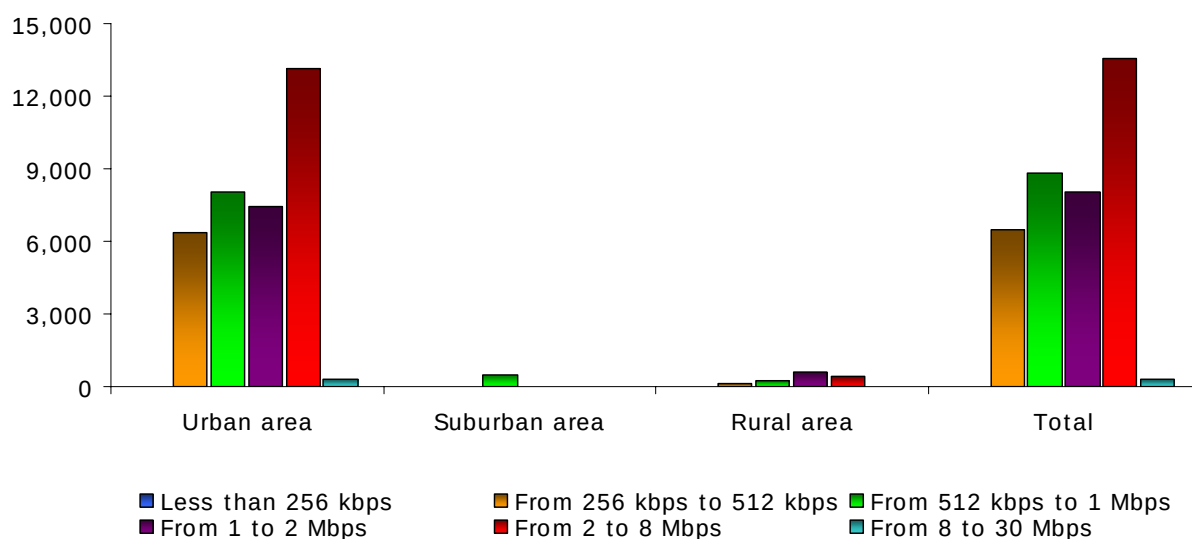
#### 4.16.4. Cable modem coverage and take-up

##### Coverage and penetration



Latvia's larger cable companies upgraded their networks and added new services in 2008. To increase their network capacity and range of services, CATV network are being replaced with optical fibre and LAN, so customers are switching from cable modem to Ethernet while staying with the same operator. This trend is expected to continue in the coming years.

##### Number of cable modem connections by download rate



Keeping pace with market development, cable modem speeds increased notably in 2008. More than half of all connections are now over 1 Mbps. The overwhelming majority of cable modem customers is still located in cities.

## 4.16.5. Other broadband access technologies

### FTTx/LAN

In Latvia, LAN services appeared as an early alternative to expensive dial-up solution, and many small businesses were initially equipped with local area networks that covered their office building. Despite intense market consolidation over the past several years, there are still more than 400 ISPs operating in Latvia.

LAN operators provide Internet access at an average speed of 2 to 5 Mbps. The service satisfies market demand and has had a considerable impact on broadband market development in Latvia: there were 152,210 LAN subscribers at the end of 2008, or 35.4% of the total fixed broadband customer base.

Over the past few years, the copper pair network that originally supported the LAN infrastructure, and the backbone in particular, has been steadily upgraded to optical fibre, which means that LANs have been migrating to FTTN and FTTB services. Although fibre optics have not been deployed in the last mile in Latvia (only 7,598 customers), there is a general consensus that it will need to happen to be able to satisfy users' growing needs. Lattelecom has announced plans to deploy FTTB infrastructure in all of the country's major cities, starting with Riga. Cable TV provider, Baltcom TV, and several smaller companies already offer such services on a small scale. LAN and cable modem networks are expected to be replaced by optical fibre infrastructure over the next few years, with FTTx becoming a basic broadband access technology for Latvia's urban population.

### Wi-Fi

Public Wi-Fi services in Latvia are provided by the incumbent carrier, Lattelecom. Users need to purchase access cards to connect to the network. These hotspots are not widely used, however, and have had no real impact on the country's broadband market, added to which there appear to be no plans in place to further develop public Wi-Fi solutions.

### WLL/WiMAX

There are as many as 20 ISPs in Latvia using WiMAX and WLAN solutions. Lattelecom owns the WiMAX network that covers the capital city of Riga, its surrounding area and several neighbouring cities (Ogre, Daugavpils, Dunalka). Because of the technology's inherent limitations, along with growing pressure from 3G mobile networks, WiMAX development in Latvia is still small-scale and its future uncertain.

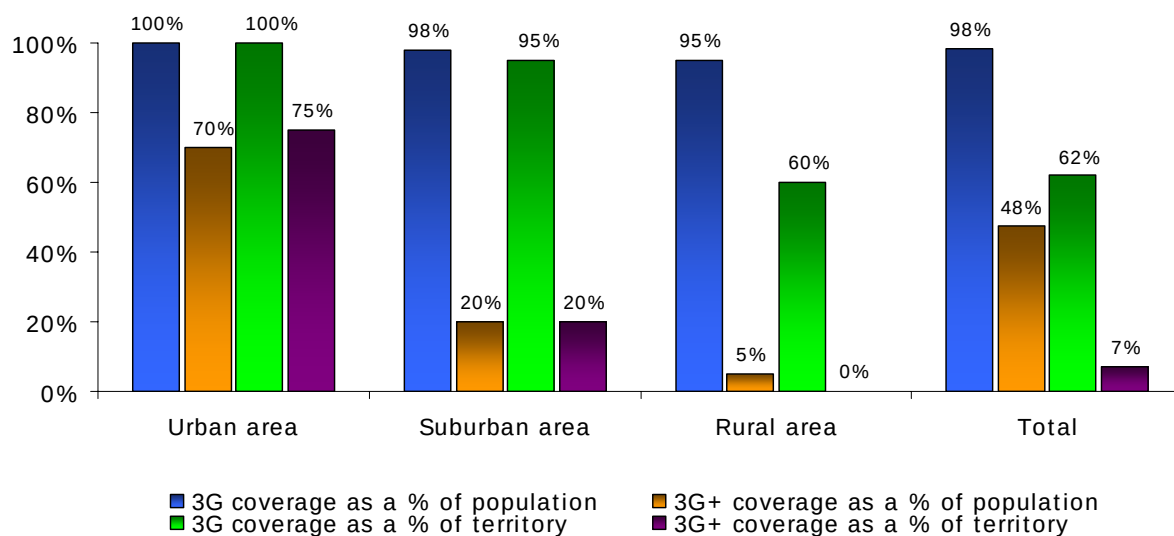
Triatel is a company that provides WLL solutions based on a CDMA 450 1x network, reporting a base of 36,000 WLL customers at the end of 2008, most of them in rural areas.

### Satellite

The quantity of satellite users has increased, but is still not terribly significant.

## 4.16.6. Mobile broadband coverage and take up

### Coverage by technology

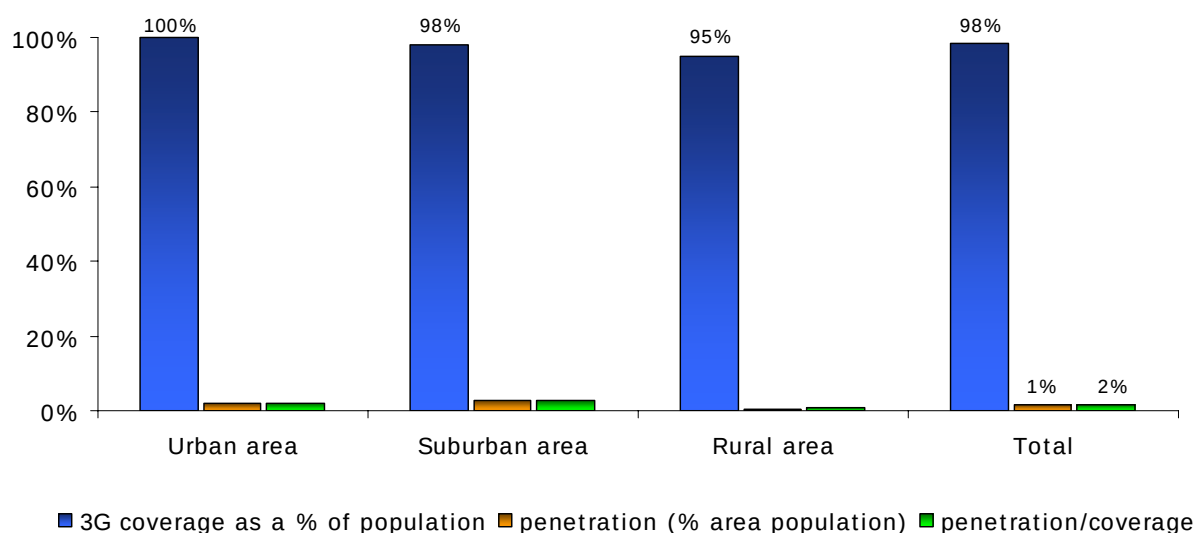


There are four mobile Internet service network operators in Latvia: Latvijas mobilais telefons (LMT), Tele2, Bite and Triatel. LMT, Tele2 and Bite operate GSM/UMTS/HSDPA networks (3G+). Triatel owns a CDMA EV-DO Rev, A network using the 450 MHz frequency (3G) that provides Internet access with speed 3.2 Mbps downstream, and 1.8 Mbps upstream.

3G+ services are available in all major Latvian cities, covering roughly 48% of the population.

In 2008, Triatel completed the “Broadband development in rural areas” project initiated by the Latvian Republic Ministry of Transport, making 3G mobile broadband services available for around 98% of the country population.

### Penetration



## 4.17.Lithuania

### 4.17.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,971,039  | 237,001       | 1,142,039  | 3,350,079 |
| Share of total population | 58.8%      | 7.1%          | 34.1%      | 100.0%    |

### 4.17.2. General broadband data

|                                                  | 12/04   | 12/05   | 12/06   | 12/07   | 12/08   |
|--------------------------------------------------|---------|---------|---------|---------|---------|
| DSL coverage (% of population)                   | -       | 82%     | 83%     | 88%     | 88%     |
| DSL subscribers                                  | 50,074  | 104,798 | 178,302 | 231,951 | 250,966 |
| DSL penetration (% of population)                | 1.5%    | 3.1%    | 5.3%    | 6.9%    | 7.5%    |
| Cable modem coverage (% population)              | -       | -       | -       | -       | 50%     |
| Cable modem subscribers                          | 32,227  | 49,631  | 59,000  | 64,995  | 65,487  |
| Cable modem penetration (% population)           | 0.9%    | 1.4%    | 1.9%    | 1.9%    | 2.0%    |
| FTTx subscribers*                                | 35,748  | 60,260  | 89,171  | 145,178 | 212,729 |
| PLC subscribers                                  | 0       | 0       | 0       | 0       | 0       |
| WLL subscribers**                                | 9,019   | 17,937  | 33,618  | 64,084  | 59,425  |
| Satellite subscribers                            | 0       | 0       | 0       | 0       | 0       |
| Total                                            | 127,682 | 232,626 | 366,849 | 506,208 | 588,607 |
| Total fixed broadband penetration (% population) | 3.7%    | 6.8%    | 10.8%   | 15.0%   | 17.6%   |
| Mobile broadband subscribers                     |         | 46,000  |         |         | 351,600 |
| Mobile broadband penetration (% population)      |         | 1.3%    |         |         | 10.5%   |

\* including LAN subscribers

\*\* including WLAN connections

In 2008, infrastructure-based competition in the broadband communications market remained intense. Efforts and investments were focused chiefly on fibre access networks, while DSL coverage remained stable in 2008, lagging behind the EU average. The main broadband access technologies in Lithuania are: xDSL, FTTx and wireless connections.

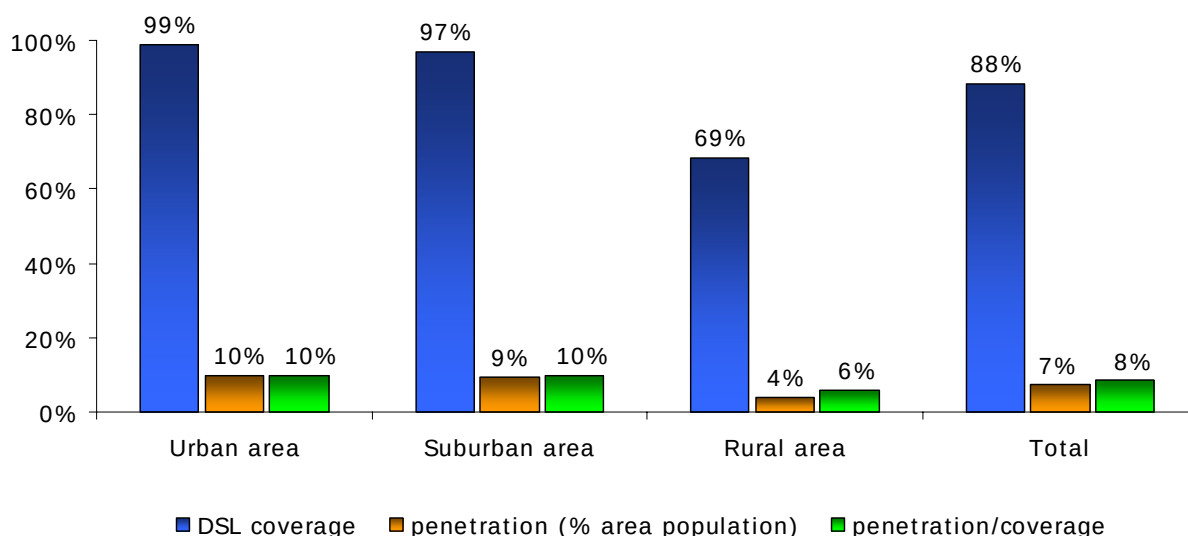
At the end of 2008, broadband penetration (including mobile broadband) was at 21.1%. Excluding mobile users, broadband penetration was at 17.6%, representing 588,607 fixed broadband users – a 16.3% increase over 2007.

Although xDSL is still the most popular Internet access technology, FTTx is the fastest growing one, enjoying a 28% share of the market at the end of 2008.

In 2008, IPTV solutions were provided by AB 'TEO LT', UAB 'Penkių kontinentų komunikacijų centras', UAB 'Alpha Komunikacijos-2'. At the end of the year, there were 41,100 IPTV customers in Lithuania, with 98.2% of them (or 40,350 users) subscribing to the incumbent provider, AB 'TEO LT'.

### 4.17.3. DSL coverage and take-up

#### Coverage and penetration

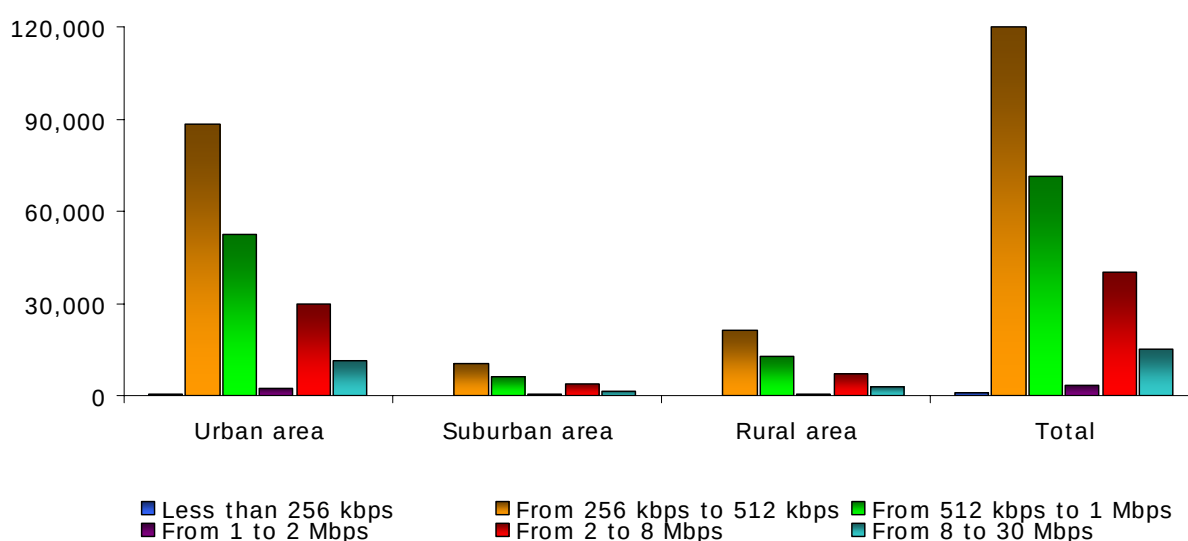


About 94% of local exchanges are DSL-enabled.

The incumbent xDSL provider is AB 'TEO LT' (part of TeliaSonera group). In 2008, its copper DSL access network was expanded by 50,000 new lines, and some 45,000 new and existing customers were connected to the new lines. The existing customers were switched over from older DSL nodes that cannot support new AB 'TEO LT' services. Switching customers over from DSL to the new generation ADSL2+/FTTH technologies will continue on through 2009.

At the end of 2008, DSL coverage in Lithuania was estimated at 88 %, with only very little progress made during the year: increasing by only 0.2 points in suburban areas and by 1 point in rural areas. Meanwhile, the subscriber base increased by 8.5% during the year.

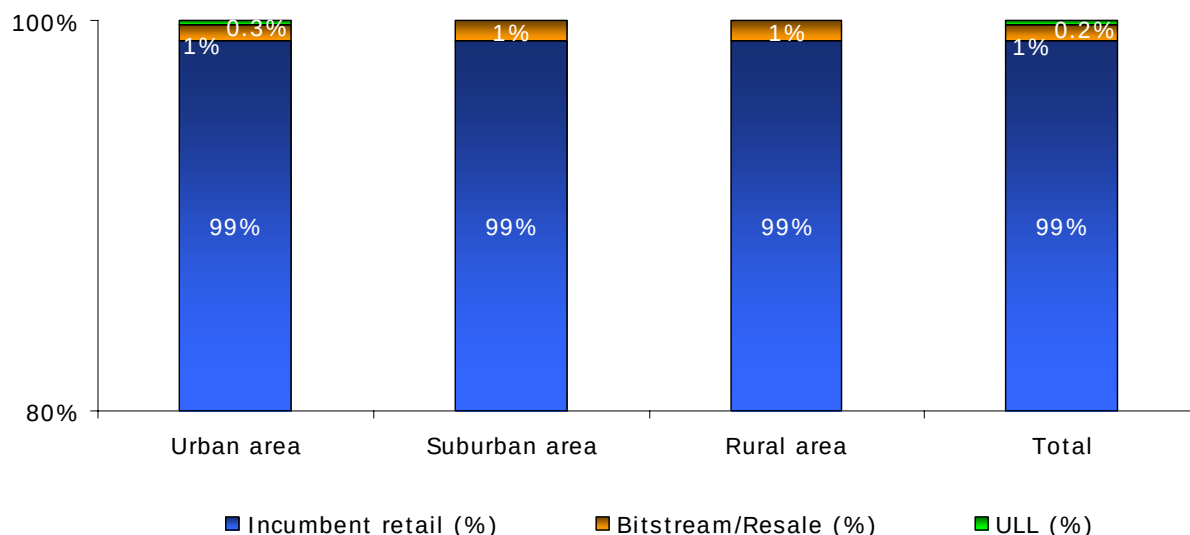
#### Number of DSL connections by download rate



In mid-2008, the incumbent provider increased access speeds by up to four times for Lithuanian traffic and up to two times for foreign traffic. Customers have a choice between solutions running at up to 1 Mbps, 4 Mbps and 10 Mbps.

Most of the country's DSL users, regardless of where they live, continue to subscribe to an access service at 512 kbps. Despite the fact that xDSL plans delivering speeds of up to 10 Mbps were launched in June, the offers had attracted only 6% of all DSL subscribers by the end of the year.

### Percentage of DSL connections by type of provider

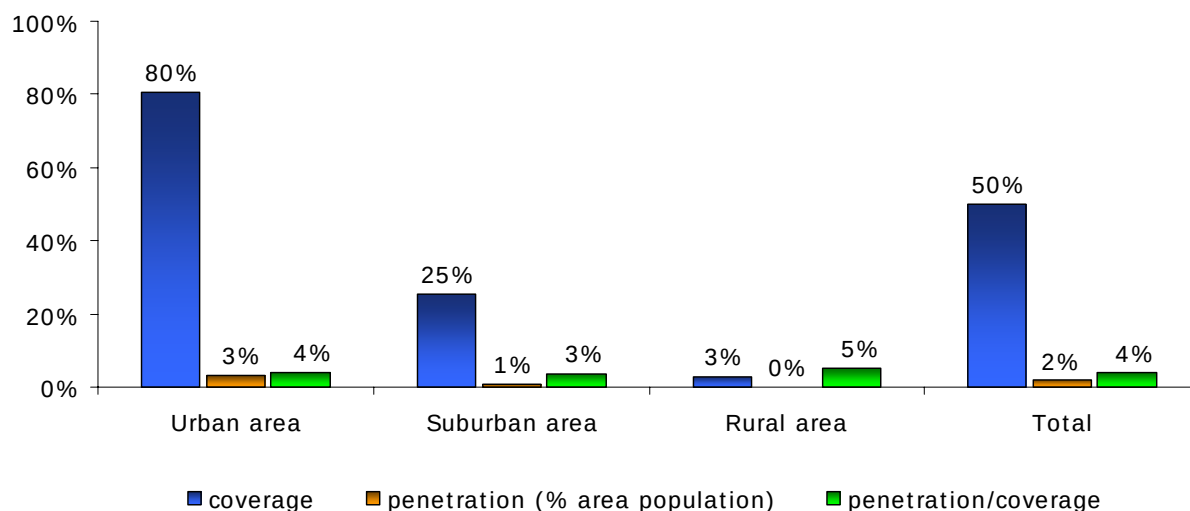


The incumbent ISP, AB 'TEO LT', is the leading provider of broadband Internet access in Lithuania, with a 98.9% share of xDSL subscribers at the end of 2008 – the remaining shares being split between nine other ISPs. Only 2,217 lines were delivered via wholesale solutions and, according to data from the NRA, there were 473 fully unbundled connections operating in Lithuania in 2008.



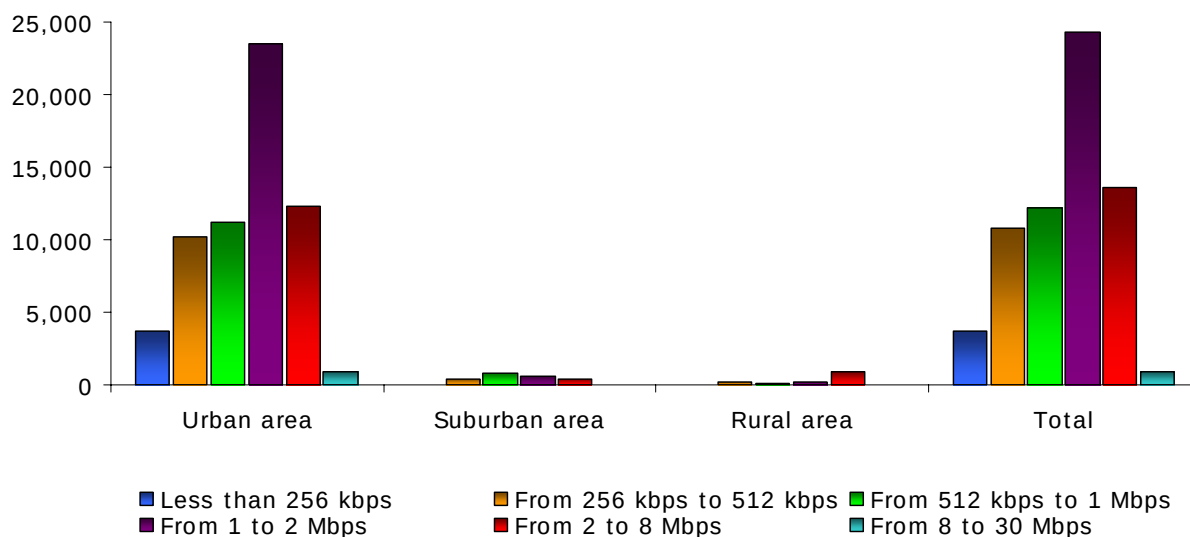
#### 4.17.4. Cable modem coverage and take-up

##### Coverage and penetration



Most cable TV networks are concentrated in urban areas – with generally one operator active in each city – providing coverage for a high percentage of households. Almost 80.4% of urban and only 2.6% of rural areas are covered with cable TV networks, while the number of cable modem subscribers increased by only 0.8% in 2008.

##### Number of cable modem connections by download rate



Broadband connections running at 1-2 Mbps are the most popular amongst broadband cable subscribers, because they are reasonably priced. According to information collected from providers, access services at 1-2 Mbps are the most popular in urban areas. In rural areas, there are only 1,500 subscribers, but mainly in the 2-8 Mbps range (in particular, all customers of the major cable operator active in these areas, accounting for 46% of the total rural cable modem connections, subscribe to connections in this range).

### 4.17.5. Other broadband access technologies

#### FTTx/LAN

As mentioned in previous reports, one thing that sets Lithuania's broadband market apart is the use of local area networks for accessing the Web. At the end of 2008, the Lithuanian NRA reported that 8.4% of the country's broadband subscribers were connected to the Internet via Ethernet. Although their numbers are shrinking year after year, they are still a substantial group.

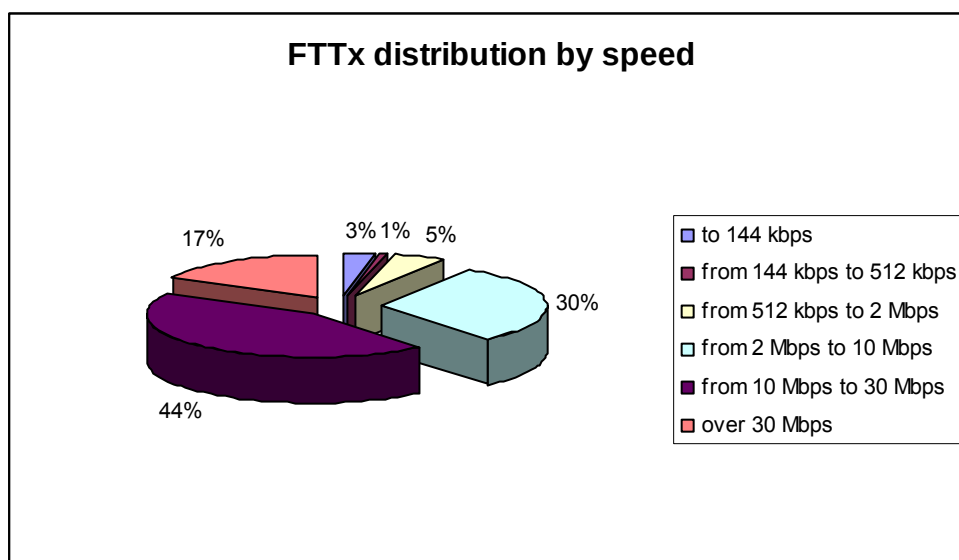
FTTx networks are growing rapidly in Lithuania. At the end of 2008, there were 212,729 optical fibre subscribers in the country (including 49,590 LAN subscribers), or 46% more than at the end of 2007.

FTTx segment breakdown by type of access:

|                               | 2007           | 2008           |
|-------------------------------|----------------|----------------|
| FTTB subscribers              | 94,698         | 148,013        |
| FTTH subscribers              |                | 15,126         |
| LAN subscribers               | 50,480         | 49,590         |
| <b>Total FTTx subscribers</b> | <b>145,178</b> | <b>212,729</b> |

As we can see from the table, FTTB accounts for the majority of optical fibre connections. FTTH access was introduced in 2007, and has grown rapidly – primarily in the major cities and surrounding towns. One of the main FTTH providers, AB "TEO LT", has focused its efforts and investments heavily on developing its FTTH access network, installing optical fibre in 1,862 apartment buildings: 926 of which are located in cities and 936 in surrounding towns. By the end of the 2008, 5,114 MDUs had been equipped by the operator for either FTTH or FTTB access, which means that 291,000 households in Lithuania had access to an optical fibre connection by the end of the year.

FTTx providers offer speeds of up to 100 Mbps. A breakdown by speed is given in the graph below.



Figures for access up to 10 Mbps are based on data from the Lithuanian regulatory authority. Based on responses from the country's leading providers, we estimate that around 17% of fibre optic subscribers have a connection running at over 30 Mbps, and 44% are connected at a speed of between 10 and 30 Mbps.

The rollout of the publicly funded rural fibre backbone network, RAIN (Rural Area Information Technology Broadband Network, [http://www.rain.lt/EN/index\\_1.php](http://www.rain.lt/EN/index_1.php)) – whose purpose is to provide broadband access to the majority of public sector administrations, hospitals, laboratories, schools, museums, libraries and residential and business customers in rural areas, along with public access points – was completed in 2008. The optical-fibre based network connects all local administrations (around 600 at LAU2 level) attached to local authorities, along with some 300 schools in rural areas. the public company, “Placiujuostis Internetas” supplies ISPs and local organisations with wholesale broadband access solutions, and providers and users can also rent optical fibre infrastructure from “TEO LT”, which also serves rural areas.

## Satellite

There are no broadband satellite providers in Lithuania.

## Wi-Fi

At the end of 2008, there were 4,506 hotspots operating in the country, marking a 30% increase compared to 2007. There were also 53,441 Wi-Fi users, 43% of whom have an account with the incumbent carrier which operates a network of 4,203 hotspots. No new provider entered the Wi-Fi market during the past year, and the market is shared by four vendors:

- Omnitel
- Bite Lietuva
- Baltnetos komunikacijos
- Penkių kontinentų komunikacijos centras

Hotspots with a download speed of up to 10 Mbps are available in airports, hotels, restaurants, petrol stations, shopping centres, etc., and there are 170 free hotspots located in public spaces.

## WLL/WiMAX

In terms of user numbers, wireless broadband is the third most popular Internet access technology, and is particularly useful in rural areas where no alternative technology is available. There are around 22 BWA providers in the country, most of which supply WLL access over in unlicensed frequencies.

The main suppliers of broadband wireless access are:

- Lithuanian Radio Television Centre
- Balticum – TV
- Baltnetos Communications

In 2008, three vendors were providing broadband wireless access services over the 3.5 GHz frequency band, two over 10.5 GHz frequency band, four over the 26 GHz band and one provider was using the 28 GHz band.

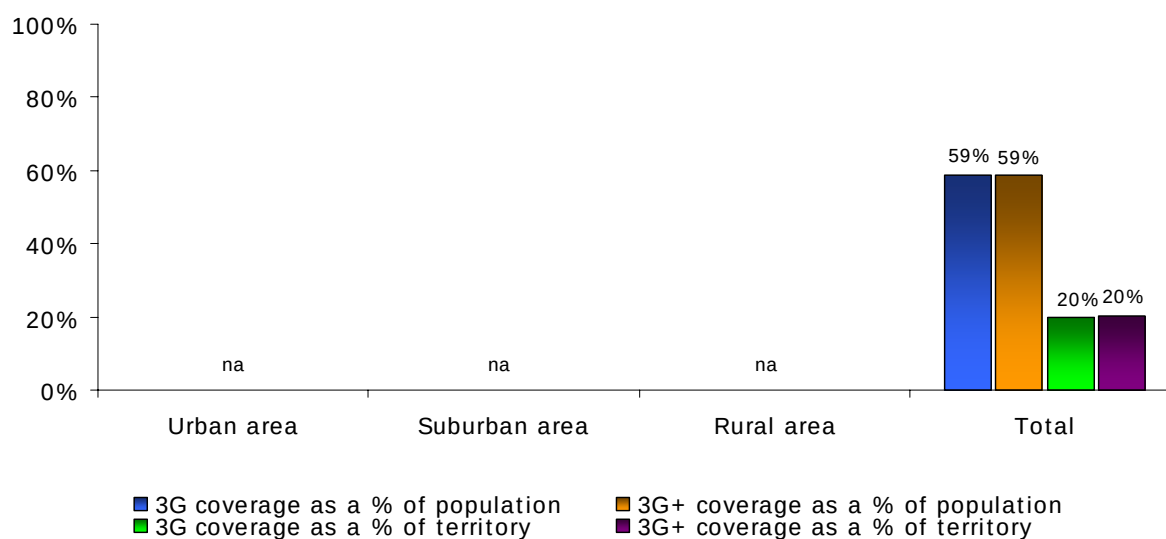
Three of these providers, Lithuanian Radio Television Centre, Balticum-TV and Nelte, installed WiMAX base stations in Lithuania's four biggest cities (Kaunas, Klaipėda, Šiauliai and Vilnius) in 2008, but had only 156 WiMAX users at the end of the year. The market is expected to grow substantially in 2009, and Lithuanian Radio Television Centre plans on achieving nationwide coverage for its WiMAX service by the end of that year – after having launched its network in 2008, but only on a trial basis.

The BWA user base (excluding Wi-Fi) can be broken down as follows:

| User base, according to technology | 12/08 |
|------------------------------------|-------|
| WiMAX                              | 156   |
| Other broadband wireless           | 5,828 |
| Total                              | 5,984 |

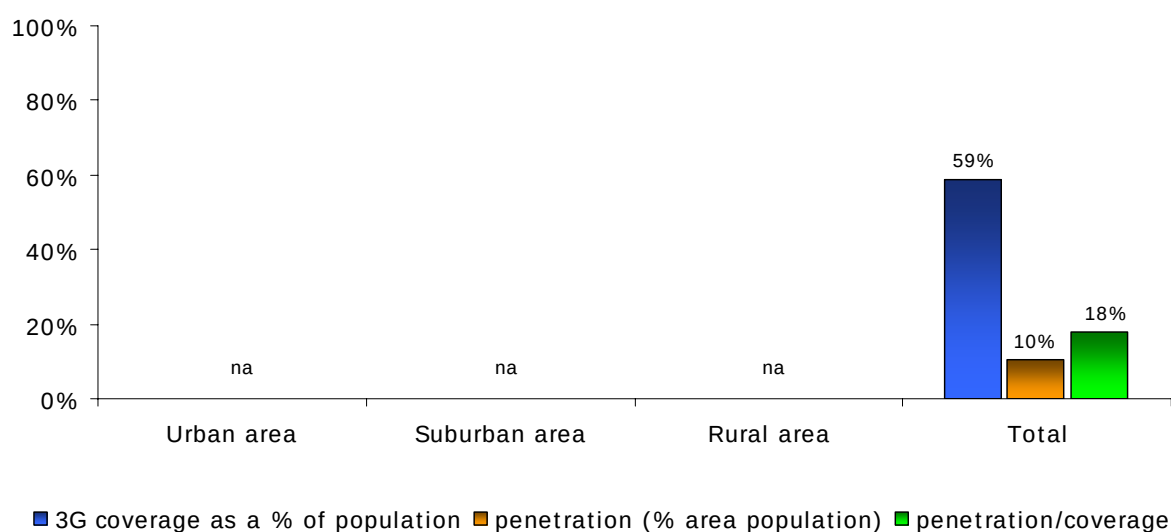
## 4.17.6. Mobile broadband coverage and take-up

### Coverage by technology



The number of UMTS base stations increased by 39.5% in 2008, bringing the total to 728 by year end. Coverage data for UMTS/HSDPA are based on numbers from the leading supplier.

### Penetration



According to information from the NRA, 1,476,585 subscribers have used data transmission services (GPRS and/or EDGE and/or UMTS) via the public mobile telephone network: 116,580 via PC and 1,360,695 via SIM cards.

There were 351,600 active mobile Internet subscribers, using UMTS services at the end of 2008. 45% of customers have access to download speeds in the range of 512-1024 kbps but, in some rural areas, only services running at 256 kbps are available.

There were 85,300 subscribers using HSDPA services in Lithuania in 2008 – including both mobile handset and laptop PC users.

## 4.18. Luxembourg

### 4.18.1. Population

|                           | Urban area | Suburban area | Rural area | National |
|---------------------------|------------|---------------|------------|----------|
| Inhabitants               | 212,604    | 184,351       | 83,267     | 480,222  |
| Share of total population | 44.3%      | 38.4%         | 17.3%      | 100.0%   |

### 4.18.2. General broadband data

|                                                  | 12/04  | 12/05  | 12/06  | 12/07   | 12/08   |
|--------------------------------------------------|--------|--------|--------|---------|---------|
| DSL coverage (% of population)                   | 100%   | 100%   | 100%   | 100%    | 100%    |
| DSL subscribers                                  | 31,243 | 63,132 | 87,275 | 108,621 | 114,853 |
| DSL penetration (% of population)                | 7.0%   | 14.2%  | 19.7%  | 22.6%   | 23.9%   |
| Cable modem coverage (% population)              | 34%    | 50%    | 70%    | 71%     | 71%     |
| Cable modem subscribers                          | 4,081  | 6,877  | 9,566  | 11,531  | 17,427  |
| Cable modem penetration (% population)           | 0.9%   | 1.5%   | 2.2%   | 2.4%    | 3.6%    |
| FTTx subscribers                                 | -      | 150    | 300    | 650     | 1,000   |
| PLC subscribers                                  | 0      | 0      | 0      | 0       | 0       |
| WLL subscribers                                  | -      | 69     | 120    | 140     | 140     |
| Satellite subscribers                            | 0      | 0      | 0      | 0       | 0       |
| Total                                            | 35,324 | 70,228 | 97,261 | 120,942 | 133,420 |
| Total fixed broadband penetration (% population) | 8.0%   | 15.8%  | 21.9%  | 25.2%   | 27.8%   |
| Mobile broadband subscribers                     |        |        |        |         | 152,000 |
| Mobile broadband penetration (% population)      |        |        |        |         | 31.7%   |

With a penetration rate of 27.8%, Luxembourg is now well equipped with fixed broadband access. Growth is slowing down.

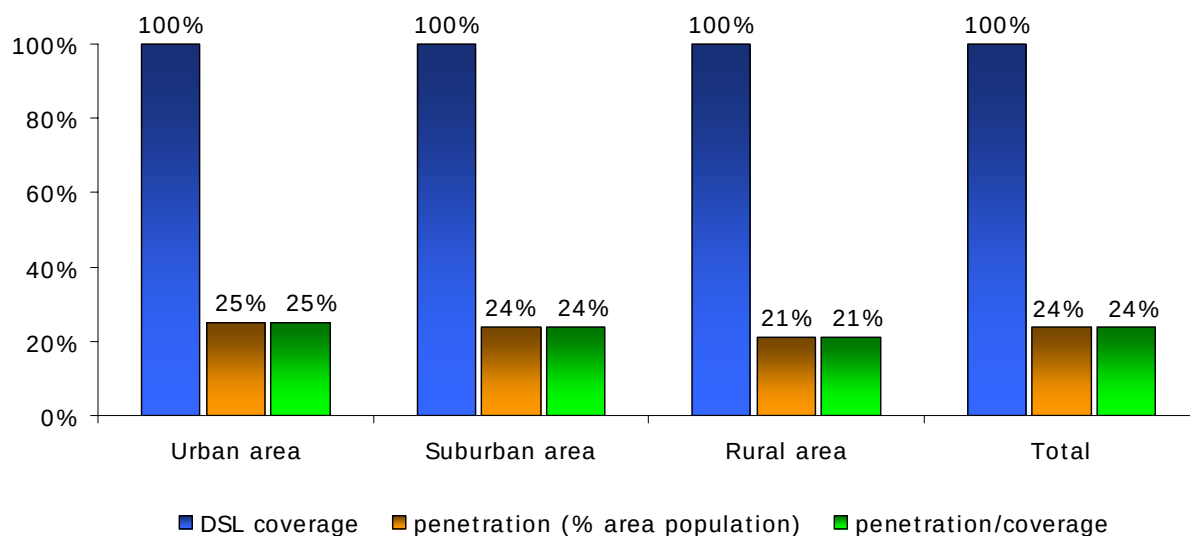
DSL remains largely dominant (coverage is complete and 86% of all broadband connections are DSL-based), although it lost some of its market share in 2008 and 80% of ADSL retail lines are still provided by the incumbent operator, PT Luxembourg. All local exchanges are DSL-equipped.

The cable modem subscriber base increased tremendously in 2008 (+50%) but, because they came late to the broadband market, cable operators are still lagging behind their DSL rivals.

Wireless broadband is now available to most people in Luxembourg, and 3G users accounted for 25% of mobile customers at the end of 2008.

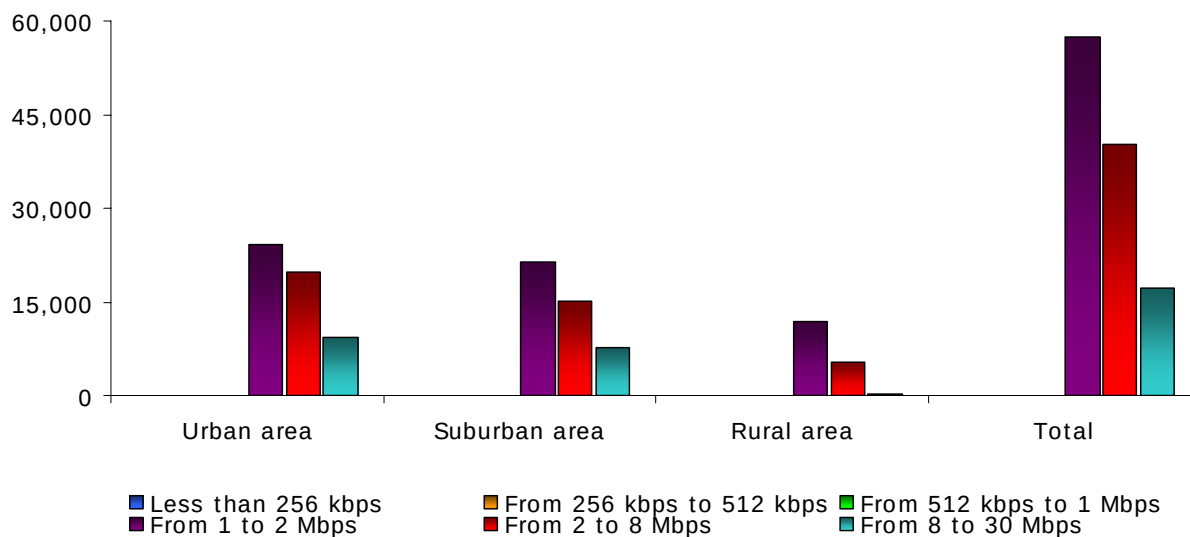
### 4.18.3. DSL coverage and take-up

#### Coverage and penetration



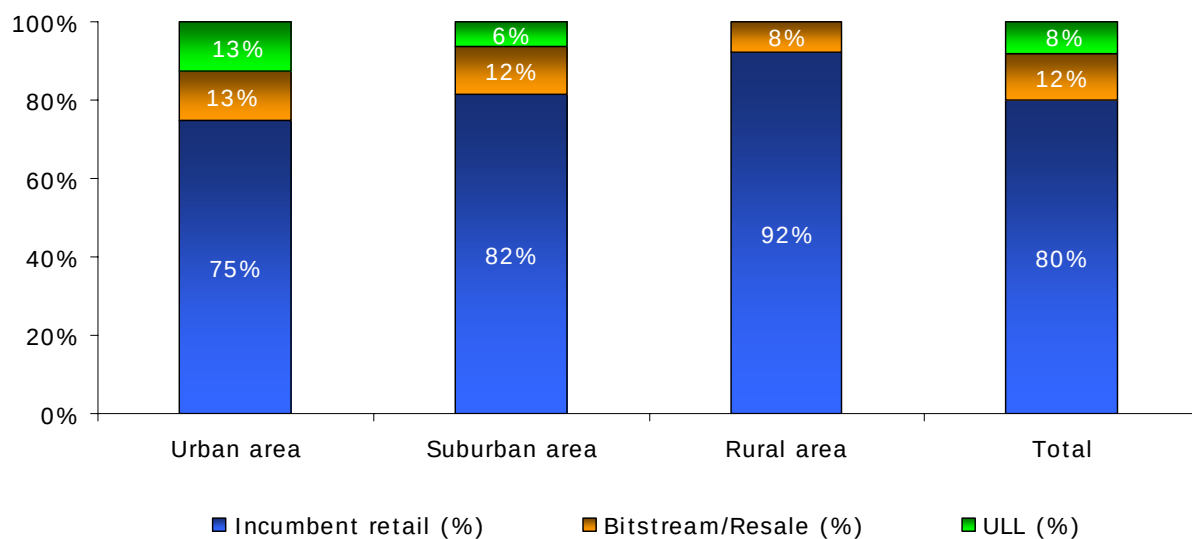
All local exchanges are DSL-equipped, and DSL penetration reached 23.9% at the end of 2008, which is one of the highest levels in Europe (ranking fourth after Iceland, France and Germany).

#### Number of DSL connections by download rate



DSL download speeds have been upgraded to 2 Mbps, 8 Mbps and 15-20 Mbps. Due to the tariff structure, 2 Mbps offers are the most popular.

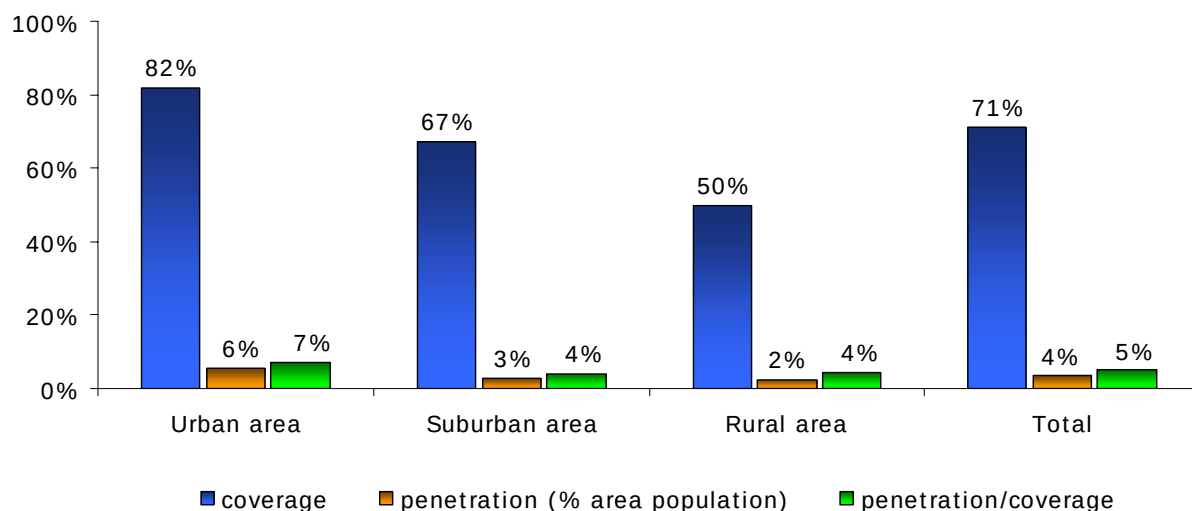
### Percentage of DSL connections by type of provider



PT Luxembourg is by far the leading vendor in the retail DSL market. Its competitors rely on simple resale or unbundling.

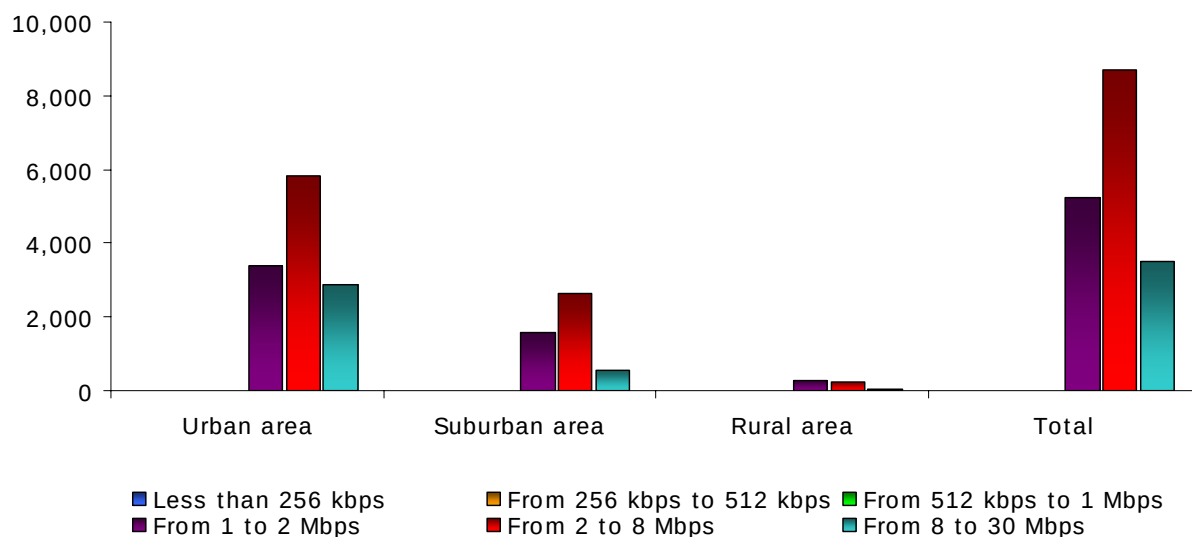
#### 4.18.4. Cable modem coverage and take-up

##### Coverage and penetration



Despite enjoying a strong increase in subscriber numbers – from 11,500 at the end of 2007 to 17,400 at the end of 2008 – cable modem only accounts for 13% of fixed broadband connections in Luxembourg.

##### Number of cable modem connections by download rate



Cable modem offers provide higher speeds than DSL access.

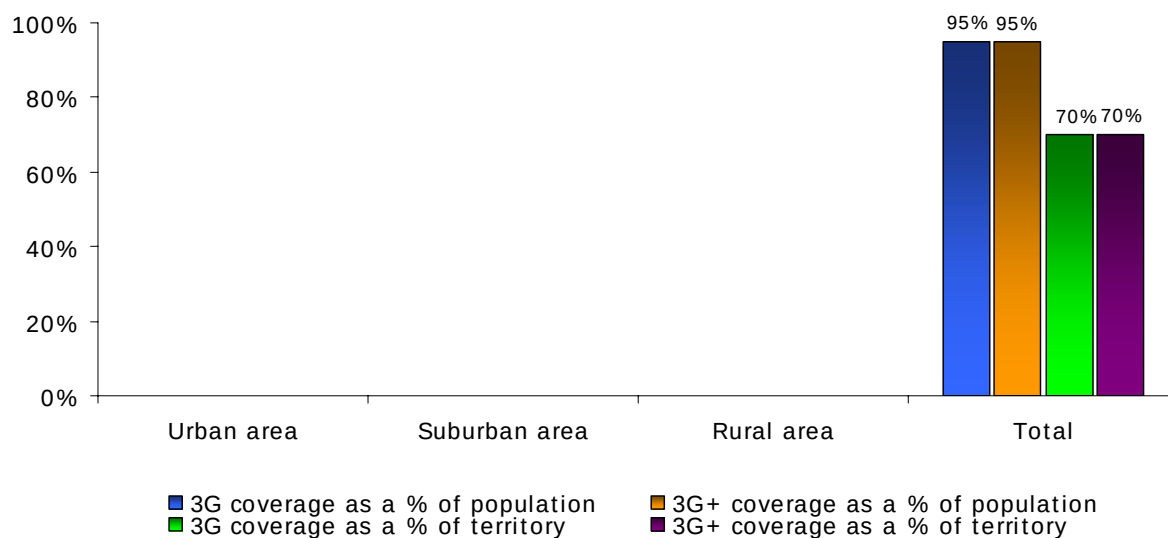


#### **4.18.5. Other broadband access technologies**

There were only a few FTTC (1,000) and WLL/WiMAX (140) subscribers in Luxembourg at the end of 2008.

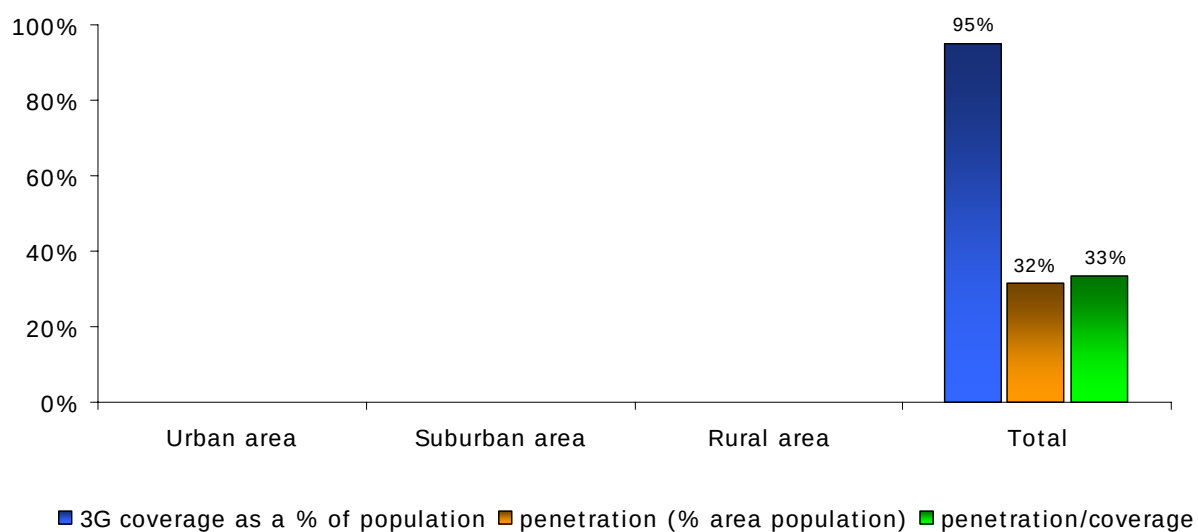
## 4.18.6. Mobile broadband coverage and take-up

### Coverage by technology



3G coverage is almost complete in Luxembourg.

### Penetration



There were 152,000 3G customers at the end of 2008.

## 4.19. Malta

### 4.19.1. Population

|                           | Urban area | Suburban area | Rural area   | National |
|---------------------------|------------|---------------|--------------|----------|
| Inhabitants               | 410,290    | not relevant  | not relevant | 410,290  |
| Share of total population | 100.0%     | not relevant  | not relevant | 100.0%   |

### 4.19.2. General broadband data

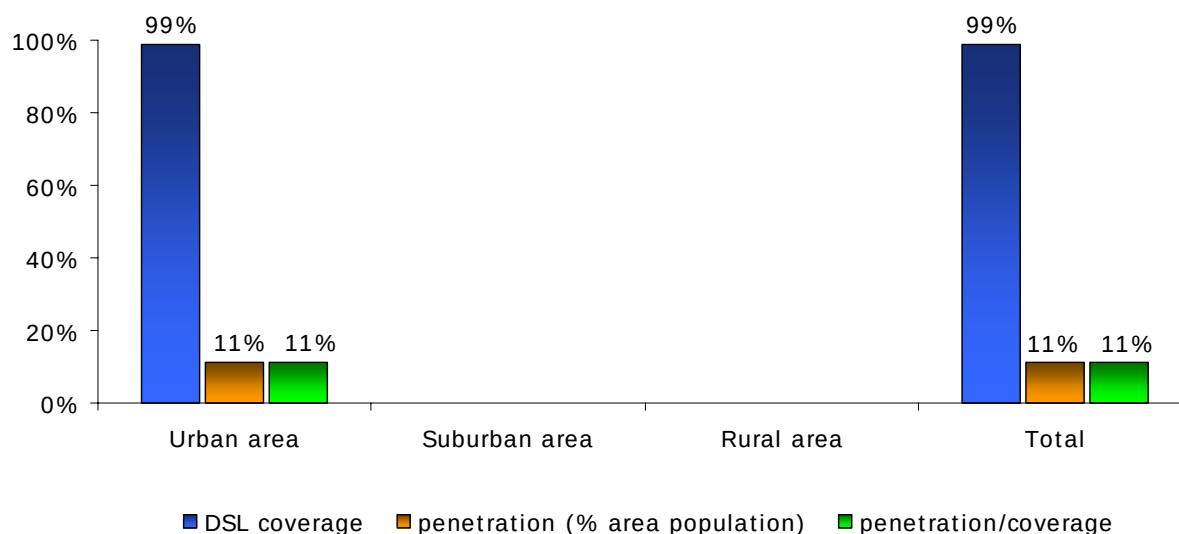
|                                                  | 12/04  | 12/05  | 12/06  | 12/07  | 12/08   |
|--------------------------------------------------|--------|--------|--------|--------|---------|
| DSL coverage (% of population)                   | 95%    | 99%    | 99%    | 99%    | 99%     |
| DSL subscribers                                  | 21,000 | 30,000 | 35,704 | 38,972 | 46,004  |
| DSL penetration (% of population)                | 5.2%   | 7.5%   | 8.8%   | 9.6%   | 11.2%   |
| Cable modem coverage (% population)              | 81%    | 95%    | 95%    | 95%    | 95%     |
| Cable modem subscribers                          | 16,000 | 21,000 | 30,629 | 42,185 | 51,983  |
| Cable modem penetration (% population)           | 4.0%   | 5.2%   | 7.6%   | 10.3%  | 12.7%   |
| FTTx subscribers                                 | 0      | 0      | 0      | 0      | 0       |
| PLC subscribers                                  | 0      | 0      | 0      | 0      | 0       |
| WLL subscribers                                  | 50     | 100    | -      | 949    | 2,882   |
| Satellite subscribers                            | 12     | 12     | 15     | -      | -       |
| Total                                            | 37,062 | 51,112 | 66,348 | 82,106 | 100,869 |
| Total fixed broadband penetration (% population) | 9.2%   | 12.7%  | 16.4%  | 20.2%  | 24.6%   |
| Mobile broadband subscribers                     |        |        |        |        | 40,887  |
| Mobile broadband penetration (% population)      |        |        |        |        | 10.0%   |

Broadband in Malta is accessible through DSL, cable modem and WiMAX. Coverage levels are high for all three technologies. As of December 2008, 45.5% of broadband connections were DSL, 51.6% were cable modem and the remaining 2.9% were WiMAX connections. Total broadband penetration stood at 24.6% of the population, with a 11.2% DSL penetration rate, 12.7% cable penetration and 0.7% WiMAX penetration rate.

All three platforms (DSL, cable and WiMAX) enjoy nationwide coverage and can be accessed by nearly all households. DSL is provided chiefly by GO plc. (incumbent carrier) and a small number of retail ISPs. Cable broadband is accessed via cable modem, and is available nationwide through a two-way hybrid fibre-coax (HFC) cable network owned by Melita plc. The first WiMAX network was deployed in Malta by Vodafone, based on the 802.16d standard, and also boasts nationwide coverage. The mobile arm of incumbent carrier GO, GO Mobile, is currently deploying the second nationwide WiMAX network, and will be using the 802.16e standard. Commercial operations are expected to commence soon.

### 4.19.3. DSL coverage and take-up

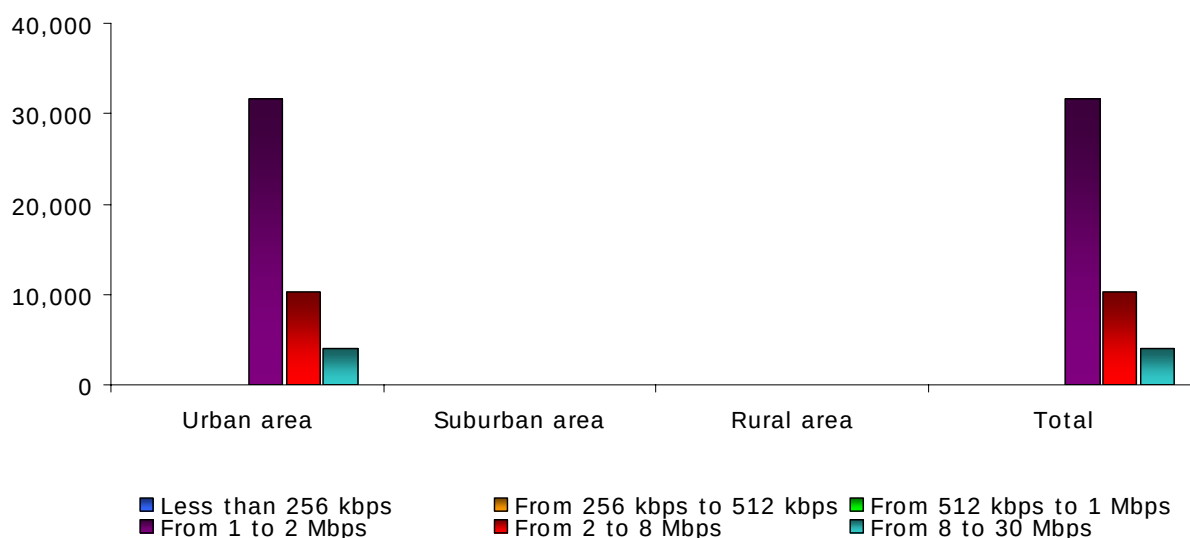
#### Coverage and penetration



*Note: data for suburban areas and rural areas are not relevant as the whole Maltese territory was considered an urban area.*

In 2008, the DSL subscriber base continued to grow, and DSL penetration stood at 11.2% – a 1.8% increase over the 9.4% reported in 2007. Penetration rates in covered areas stood at 11.3%, with growth being spurred chiefly by products aimed at entry-level users, i.e. services running at 2 Mb, downstream. A number of price reductions and special offers, coupled with increases in download limits and speeds also helped attract new users.

#### Number of DSL connections by download rate

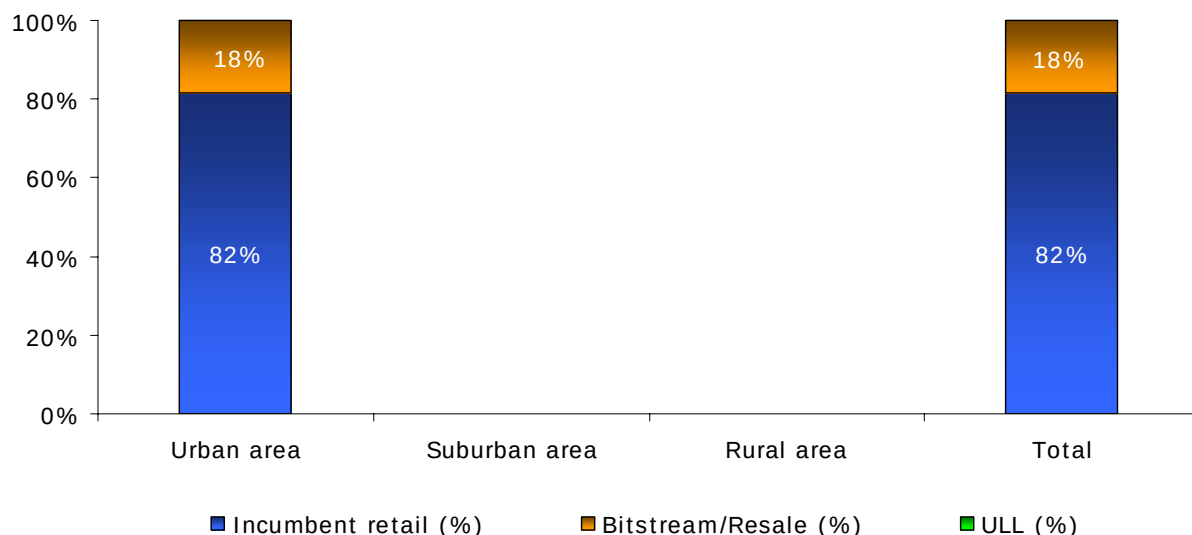


Over the course of 2008, the DSL incumbent upgraded its entire product line-up once again and doubled the speed of nearly all its connections, in addition to providing large increases in download limits compared to what was available in 2007. At the end of 2008, it was marketing 2 Mbps, 8 Mbps, 12 Mbps and 20 Mbps solutions, each with different download limits and prices. Most of these increases in speeds and download limits were made at no extra cost to the customer.

In 2008, GO launched a new high-speed service delivering access at 20 Mbps (download), but managed to attract only a few subscribers. The low take-up is attributed mainly to low demand for such a high speed service.

A number of independent ISPs also market DSL services and all offer the same broadband packages as the incumbent, albeit at slightly higher prices. The number of ISPs declined in 2008 due to ongoing market consolidation.

### Percentage of DSL connections by type of provider

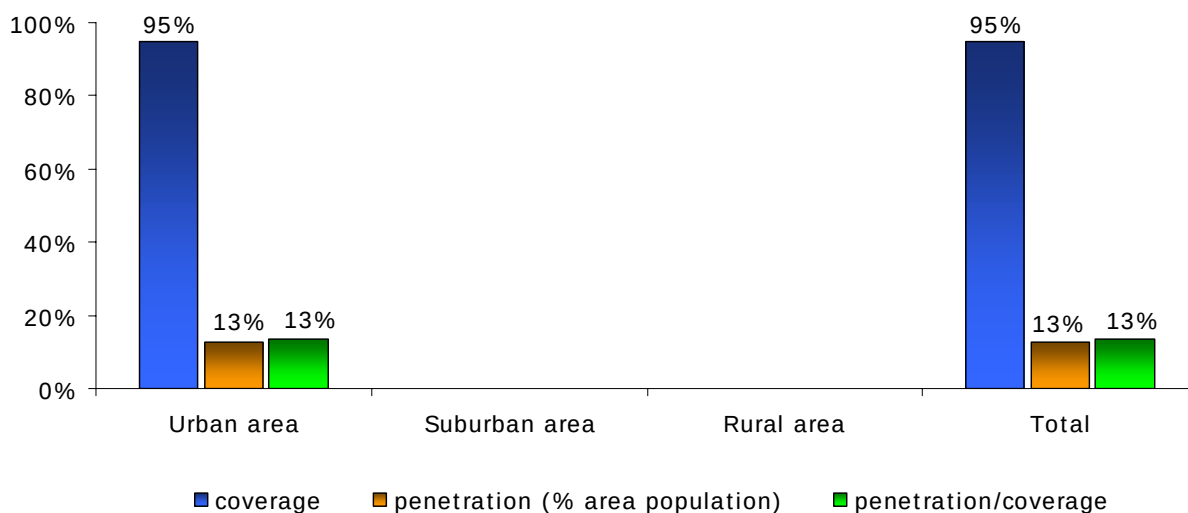


At the end of 2008, there were around eight ISPs providing DSL access in Malta – their numbers having decreased as a result of ongoing market consolidation. Their combined market share has also shrunk, from 25.8% in 2007 to 18.3% in 2008. Meanwhile, the incumbent DSL provider increased its market share from 74.2% in 2007 up to 83%.

Alternative operators have not yet adopted GO's reference unbundling offer, which was first published in 2005.

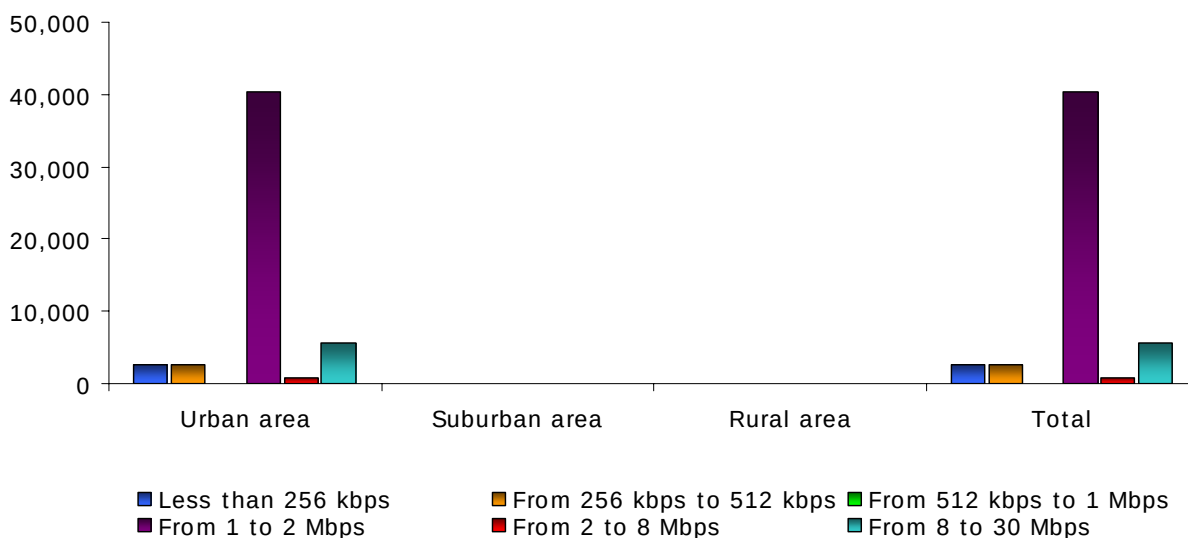
#### 4.19.4. Cable modem coverage and take-up

##### Coverage and penetration



Cable broadband in Malta is supplied exclusively by Melita plc. The cable network has near ubiquitous coverage, with more than 95% of homes passed. Broadband cable penetration has reached 12.7% of the population and 13.3% of the territory. Melita continued to increase its market presence in the broadband sector over the course of 2008.

##### Number of cable modem connections by download rate



As of December 2008, there were 52,029 broadband cable connections, 9,844 more than the year before. Of these, 40,230 customers, or 77% of the total base, subscribe to a service running at between 1 to 2 Mbps.

A number of legacy subscribers still have a connection running at 128 kbps or 256 kbps, while newer customers subscribe to services delivering access at 10 Mbps or 30 Mbps. In a similar fashion to the DSL incumbent, the cable packages were upgraded in 2008 (to 2 Mbps, 10 Mbps and 30 Mbps) at no or little cost to the consumer.

### 4.19.5. Other broadband access technologies

#### FTTX

No FTTx connections were available in 2008.

#### Wi-Fi

Wireless LAN technology is becoming increasingly popular, thanks to its ability to serve roaming users. Both public and private entities have adopted the technology to provide access in a number of buildings around Malta. Wi-Fi is being installed in public spaces, providing high-speed access to the Internet. The two mobile operators, GO Mobile and Vodafone, operate a number of hotspots in public places, mostly in tourist and business areas. Take-up of this service is difficult to measure.

#### WLL/WiMAX

Vodafone Malta Ltd. continued to offer broadband and fixed telephony services over its WiMAX network. The number of subscribers at the end of 2008 stood at 2,882. A second WiMAX network is currently being deployed by the incumbent's mobile arm, GO Mobile, and will soon become operational. The third licence for building a WLL network has been handed back to the MCA, which is currently examining the future allocation of this spectrum.

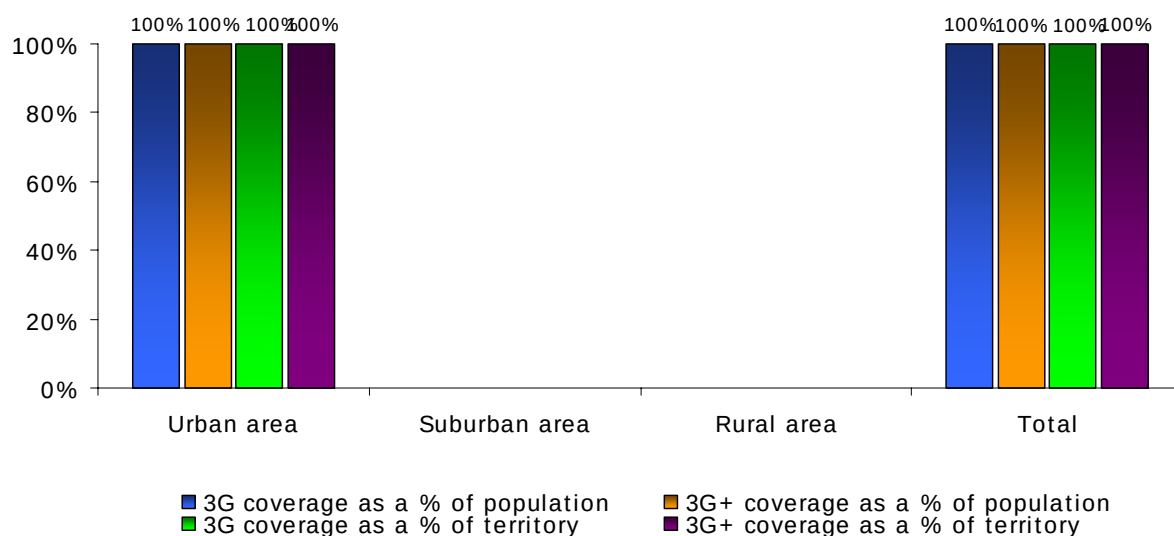
The WiMAX operator markets two access services: 2 Mbps and 4 Mbps, with prices similar to those charged by the country's DSL and cable operators.

#### Satellite

Satellite access is only used by a very small number of large commercial institutions for back-up interconnectivity and data transfer. No data is available on this service.

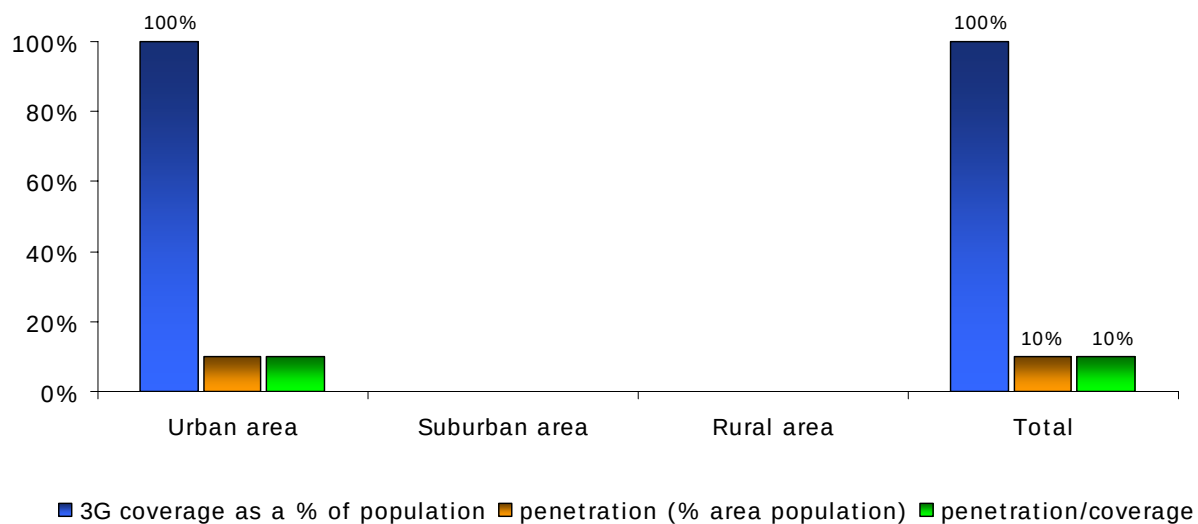
## 4.19.6. Mobile broadband coverage and take-up

### Coverage by technology



At the end of 2008, both mobile network operators had achieved full 3G coverage, and both continue to maintain parallel 2G and 3G networks. The majority of mobile subscribers are still using 2G SIM cards.

### Penetration



There were 40,887 active mobile broadband users at the end of 2008, who accounted for 10% of the population. 4,966 of these subscribers access broadband through dedicated mobile broadband data solutions (only cards/modems/dongles).



## 4.20. The Netherlands

### 4.20.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 10,850,400 | 5,270,752     | 367,880    | 16,489,032 |
| Share of total population | 65.8%      | 32.0%         | 2.2%       | 100.0%     |

### 4.20.2. General broadband data

|                                                  | 12/04     | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 99%       | 99%       | 99%       | 99%       | 99%       |
| DSL subscribers                                  | 1,841,333 | 2,551,052 | 3,028,000 | 3,410,000 | 3,590,000 |
| DSL penetration (% of population)                | 11.3%     | 15.6%     | 18.5%     | 20.9%     | 21.8%     |
| Cable modem coverage (% population)              | 82%       | 82%       | 90%       | 92%       | 93%       |
| Cable modem subscribers                          | 1,297,303 | 1,562,521 | 1,970,000 | 2,207,000 | 2,210,000 |
| Cable modem penetration (% population)           | 8.0%      | 9.6%      | 12.1%     | 13.5%     | 13.4%     |
| FTTx subscribers                                 | 50,000    | 60,000    | 111,000   | 140,000   | 180,000   |
| PLC subscribers                                  | -         | -         | -         | -         | 0         |
| WLL subscribers                                  | -         | -         | -         | -         | 0         |
| Satellite subscribers                            | 1,000     | 1,000     | 1,000     | 1,000     | 0         |
| Total                                            | 3,139,636 | 4,173,573 | 5,110,000 | 5,758,000 | 5,980,000 |
| Total fixed broadband penetration (% population) | 19.3%     | 25.6%     | 31.1%     | 35.3%     | 36.3%     |
| Mobile broadband subscribers                     |           |           |           |           | 2,070,000 |
| Mobile broadband penetration (% population)      |           |           |           |           | 12.6%     |

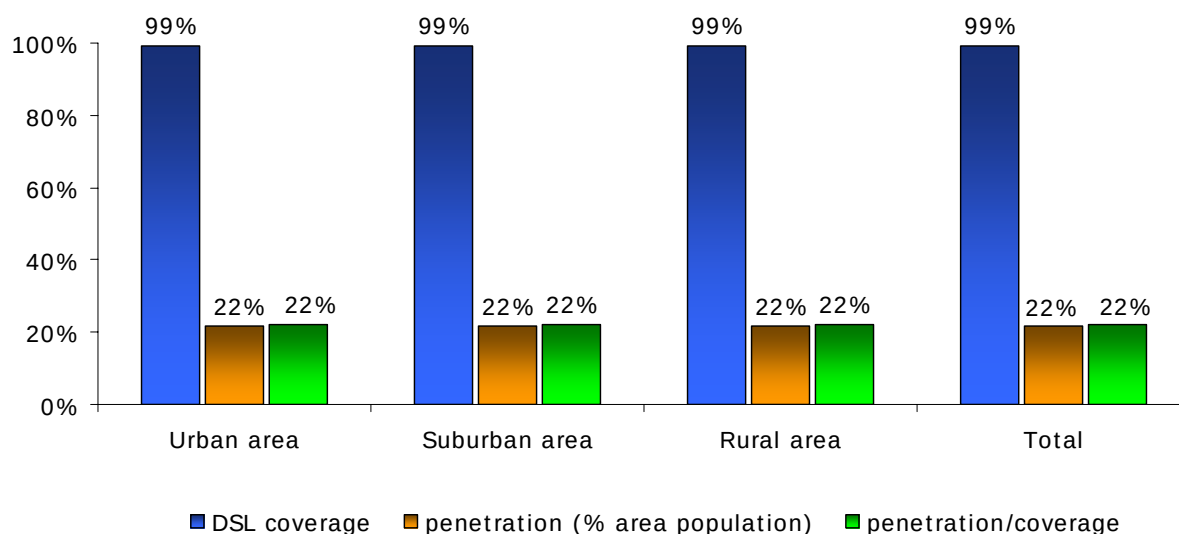
Broadband penetration in the Netherlands is one of the highest in Europe: at more than 36% at the end of 2008, it ranks second after Denmark.

There are almost no more DSL white zones in the Netherlands, and DSL remains the dominant access technology – growing by a further 5% in 2008. The Dutch market is nevertheless characterized by strong infrastructure-based competition with substantial pressure from cable and a significant number of FTTH networks.

Competitive pressure is also coming from unbundling, which has gained momentum (30% of DSL connections are supplied by alternative operators through unbundled lines).

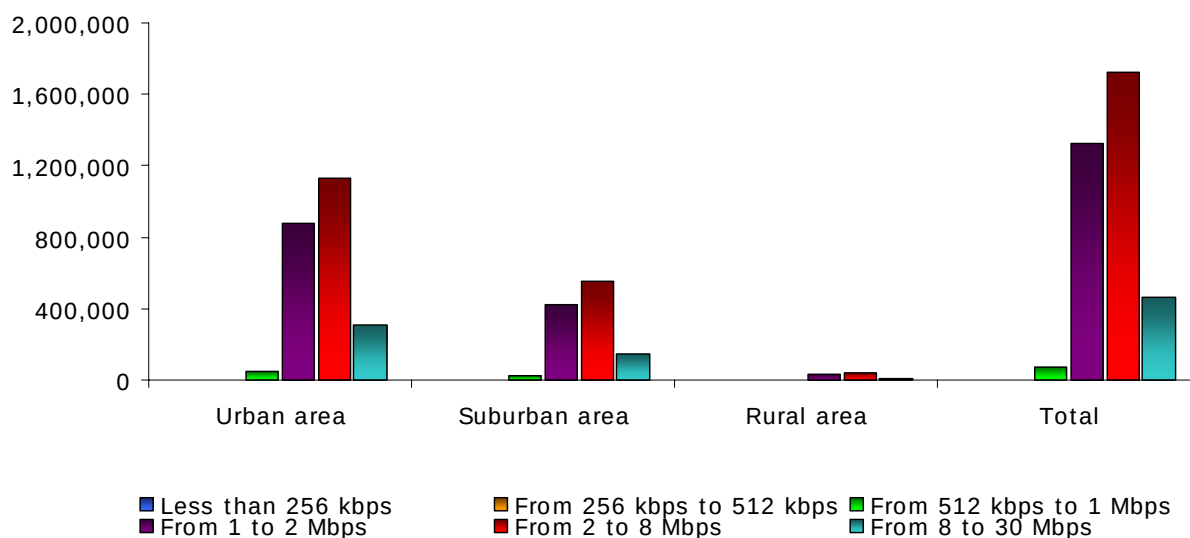
### 4.20.3. DSL coverage and take-up

#### Coverage and penetration



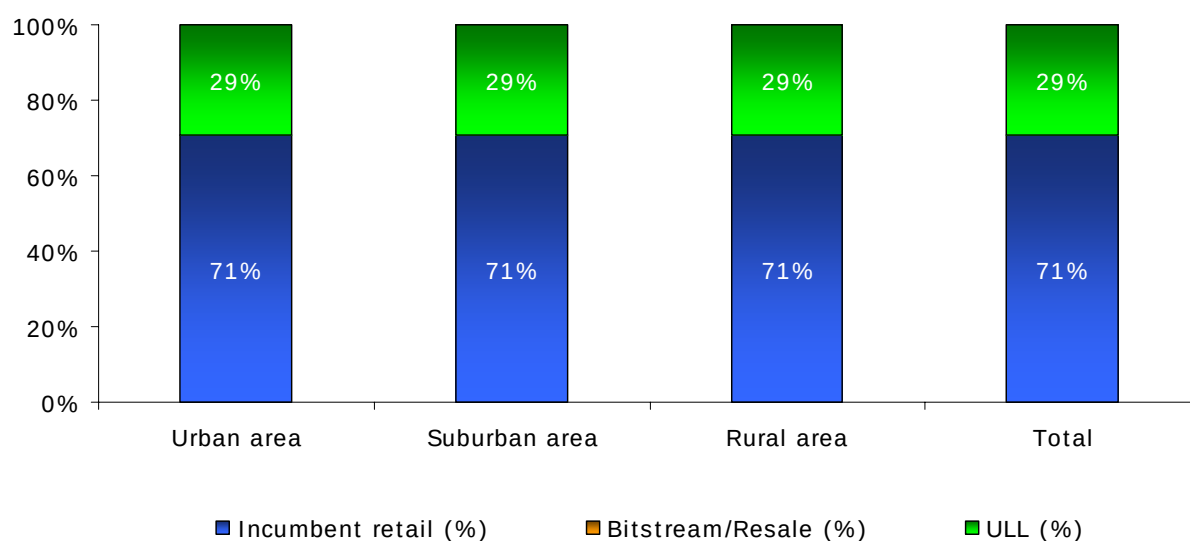
DSL coverage is almost complete in the Netherlands, with the average penetration rate at the end of 2008 of 21.8% (20.9% at the end of 2006). This presumes that rates are the same in all parts of the country, given its geographical structure.

#### Number of DSL connections by download rate



At the end of 2008, more than half of DSL connections were supplying speeds of over 2 Mbps (including 13% with more than 8 Mbps, and corresponding to ADSL2+ offers), which means that average DSL download rates have increased since the previous year.

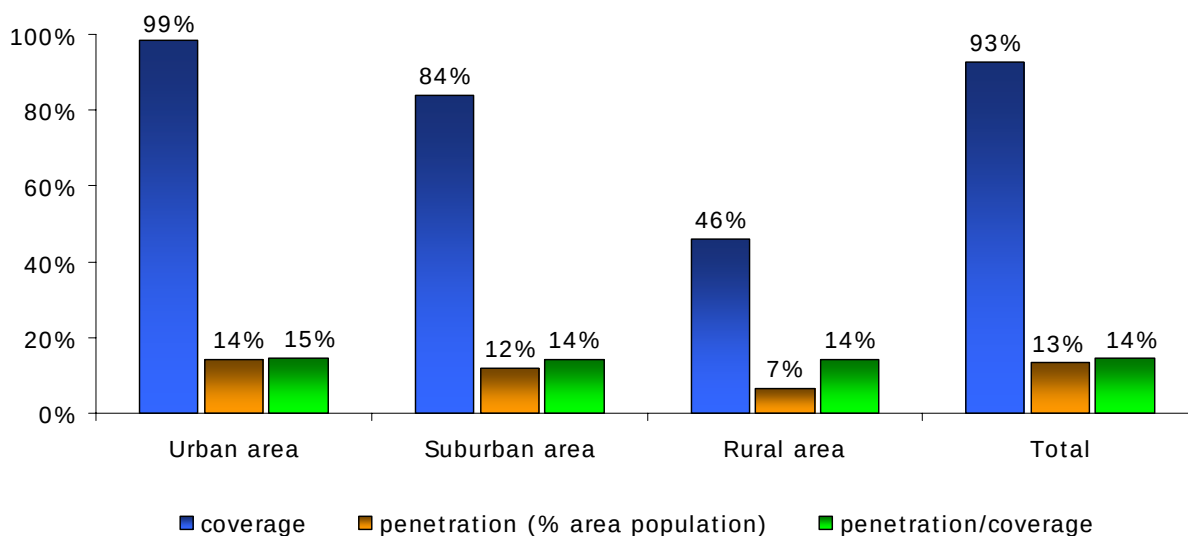
### Percentage of DSL connections by type of provider



Compared to the year before, the market share of former incumbent KPN remained relatively stable. At the end of 2008, KPN was retailing 70.6% of DSL directly (KPN Direct) or through its ISP subsidiaries (Planet Internet, XS4ALL, Het Net), compared to 70.4% one year before. LLU accounts for nearly 30% of DSL connections, with most unbundled lines being shared access lines.

## 4.20.4. Cable modem coverage and take-up

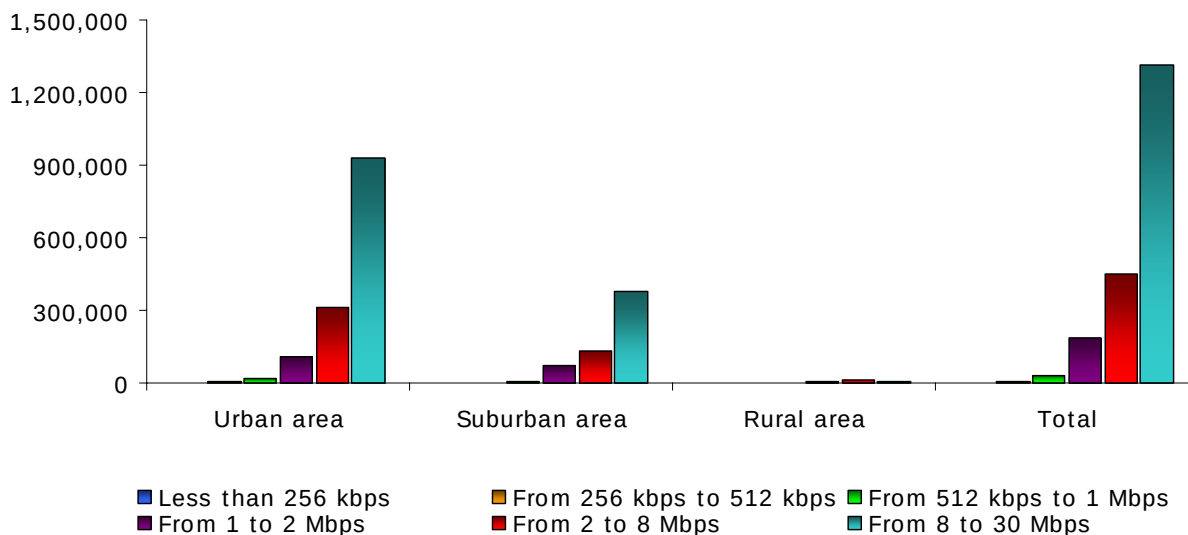
### Coverage and penetration



The biggest change in the Dutch cable market was the merger between Multikabel, @Home Network and Casema. The fruit of the merger is Ziggo, which was launched in May 2008 and is now the biggest cable operator in the Netherlands.

There was only a slight increase in terms of cable coverage and penetration. Broadband cable coverage is now at 92.7%, while there are roughly 2.2 million cable modem subscribers (13.4%).

### Number of cable modem connections by download rate



On average, cable modem connections in the Netherlands are faster than DSL solutions. Almost 90% of cable modem users subscribe to services running at more than 2 Mbps, and 70% to services at more than 8 Mbps.

## 4.20.5. Other broadband access technologies

### FTTH

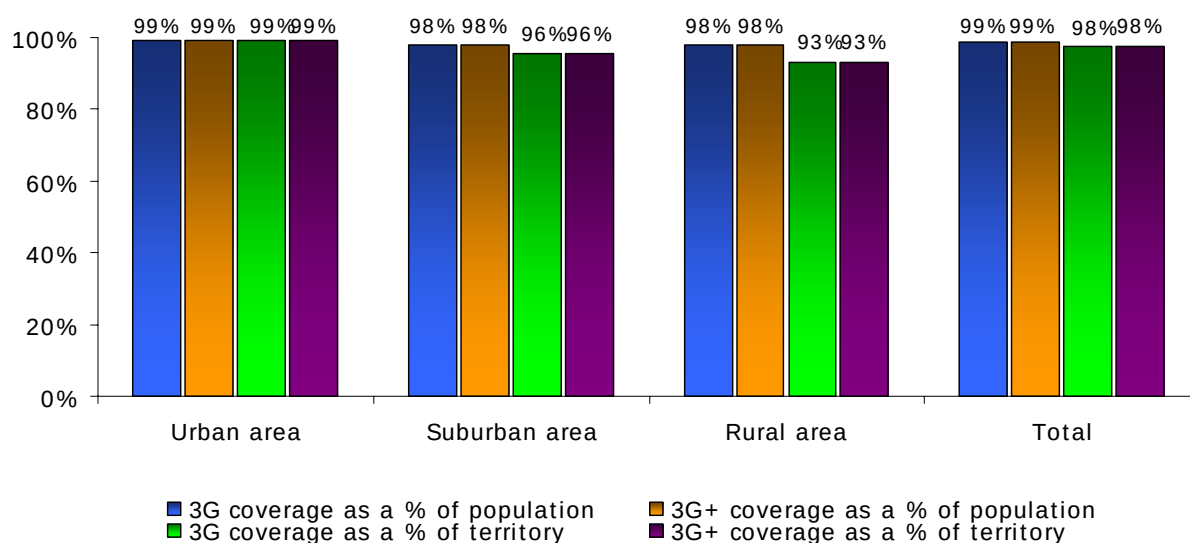
FTTH was first deployed in the Netherlands in 2004. Enabled through contracts with housing corporations and city projects, the Netherlands has reached a total of approximately 180,000 FTTH lines. Former incumbent KPN and the major cable operators still have quite limited FTTH deployments, but several indicators suggest that this might change in the near future: KPN recently acquired a minority share in fibre network installer Reggefibre, and cable operator UPC launched Fibre Power in September 2008, based on Euro DOCSIS 3.0 technology, supplying download speeds of up to 120 Mbps.

### Wi-Fi

Wi-Fi services are available in some urban areas, mostly in cafés, hotels and airports. In most cases, they are used on an *ad hoc* basis as a complement to fixed access technologies.

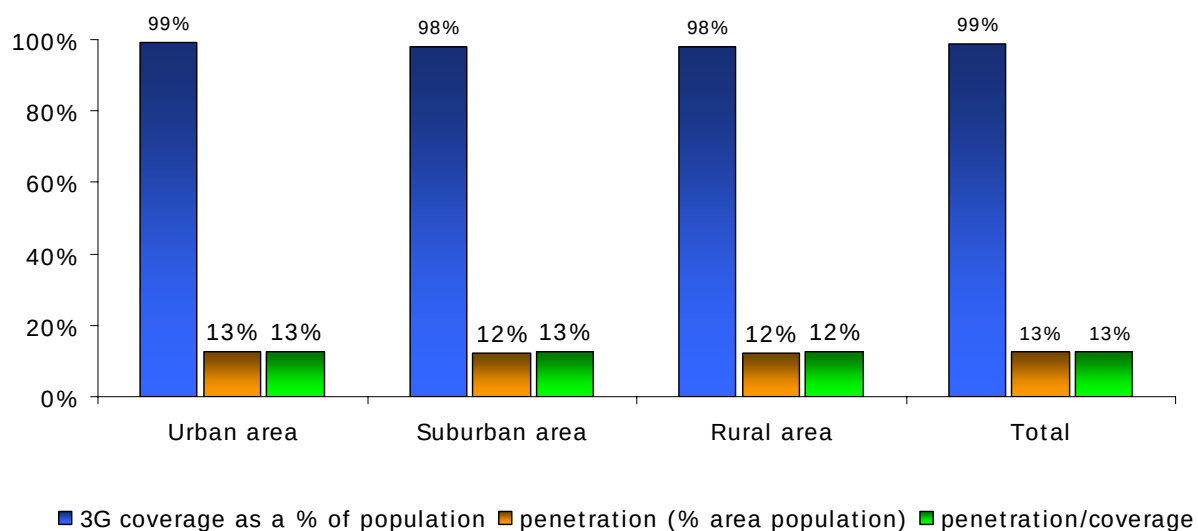
## 4.20.6. Mobile broadband coverage and take-up

### Coverage by technology



3G coverage in this densely populated country was over 98%, with the entire network having been upgraded to HSDPA within the last year.

### Penetration



The importance of mobile data services has grown rapidly within the last year: the data volumes on KPN mobile data networks grew by more than 500% compared to the year before, for instance, and there were approximately 2 million active mobile Internet subscribers in the Netherlands at the end of 2008.

## 4.21. Norway

### 4.21.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,206,809  | 1,265,009     | 2,327,434  | 4,799,252 |
| Share of total population | 25.1%      | 26.4%         | 48.5%      | 100.0%    |

### 4.21.2. General broadband data

|                                                  | 12/04   | 12/05   | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|---------|---------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 82%     | 88%     | 91%       | 96%       | 96%       |
| DSL subscribers                                  | 548,125 | 801,988 | 997,140   | 1,110,914 | 1,109,989 |
| DSL penetration (% of population)                | 11.7%   | 17.1%   | 21.3%     | 23.5%     | 23.1%     |
| Cable modem coverage (% population)              | 20%     | 20%     | 20%       | 20%       | 30%       |
| Cable modem subscribers                          | 91,833  | 136,706 | 177,104   | 225,000   | 321,439   |
| Cable modem penetration (% population)           | 2.0%    | 2.9%    | 3.8%      | 4.7%      | 6.7%      |
| FTTx subscribers                                 | 17,875  | 38,823  | 70,303    | 95,000    | 152,667   |
| PLC subscribers                                  | 0       | 0       | 0         | 0         | 0         |
| WLL subscribers                                  | 12,859  | 13,215  | 26,900    | 36,800    | 31,265    |
| Satellite subscribers                            | 0       | 0       | 0         | 0         | 0         |
| Total                                            | 670,692 | 990,732 | 1,271,447 | 1,467,714 | 1,615,360 |
| Total fixed broadband penetration (% population) | 14.3%   | 21.2%   | 27.2%     | 31.0%     | 33.7%     |
| Mobile broadband subscribers                     |         |         |           |           | 266,060   |
| Mobile broadband penetration (% population)      |         |         |           |           | 5.5%      |

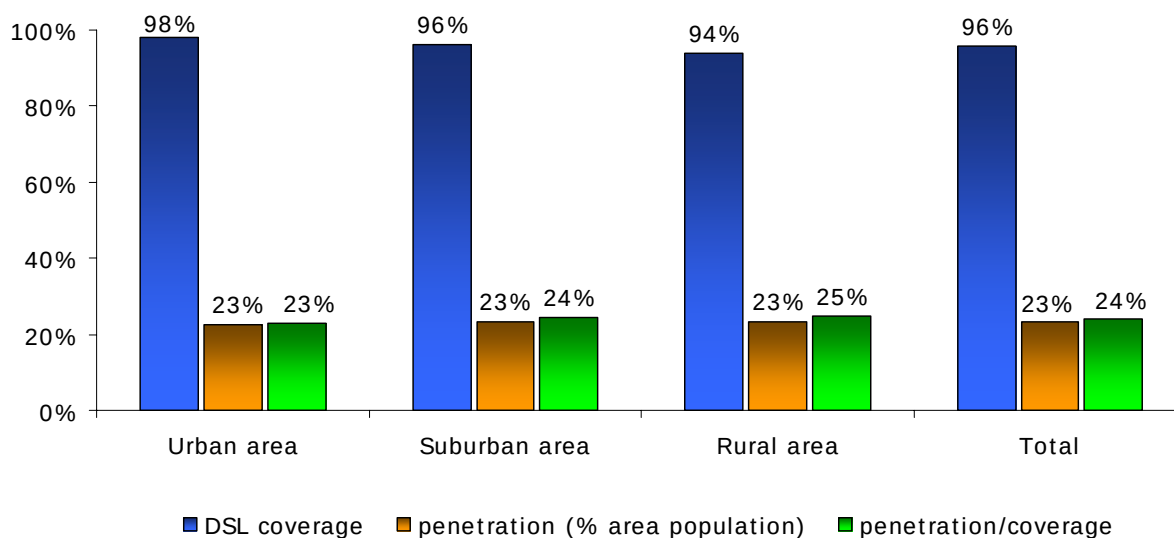
With a penetration rate of 33.7%, Norway's broadband market still ranks among the most advanced.

While still the dominant technology, DSL continues to lose both absolute and relative market share to other broadband technologies. Following a period of steady progress, DSL coverage did not increase in 2008. 69% of subscriptions are now through DSL, down from 76% in 2007 and 78% in 2006. The incumbent operator, Telenor, is active in both DSL (with a 58% market share, up slightly from previous years) and in cable through its subsidiary, Canal Digital. It still retains more than half of the broadband subscriber base despite strong pressure from the competition, especially through unbundling.

Broadband cable enjoyed strong growth in 2008, thanks chiefly to attractive bundles that include digital TV and PVRs. FTTx also continues to undergo strong growth.

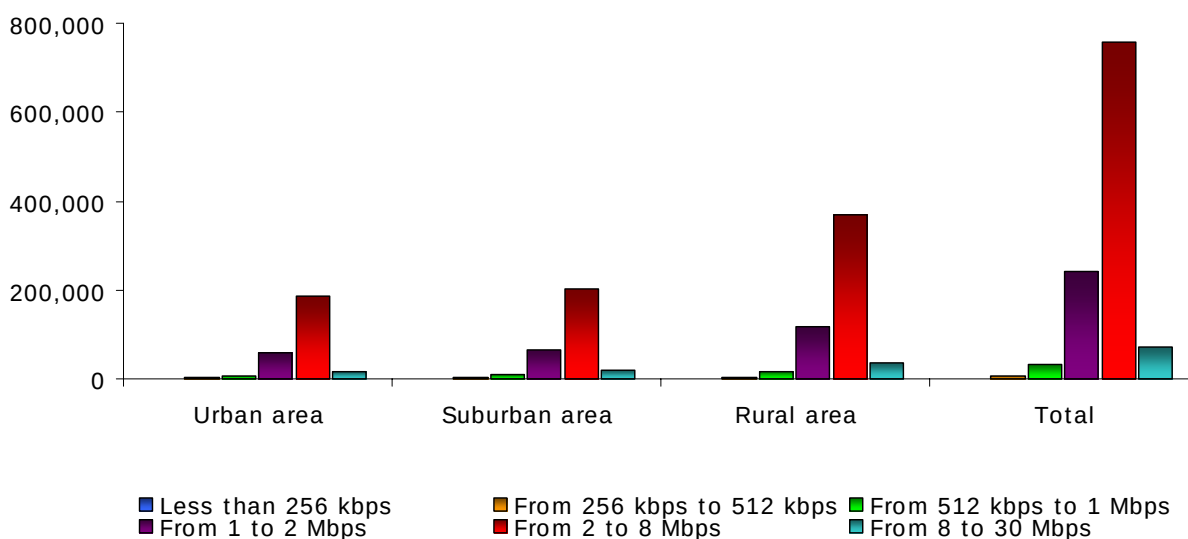
### 4.21.3. DSL coverage and take-up

#### Coverage and penetration



There was virtually no change in national coverage in 2008, and it remains at 96%.

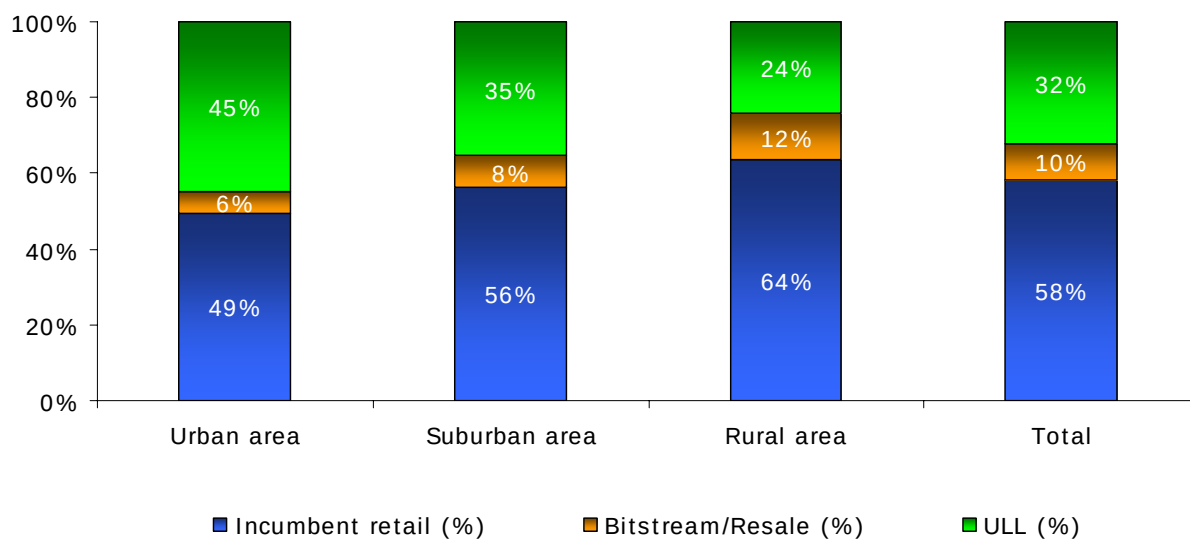
#### Number of DSL connections by download rate



The number of DSL subscriptions fell for the first time in 2008, even if only by 0.1%. Download speeds continued to increase, and around 75% of connections are now above 2 Mbps.

The number of very high speed connections, i.e. higher than 8 Mbps, increased its relative share of total connections from 2.5% in 2007 to 6.5% in 2008.

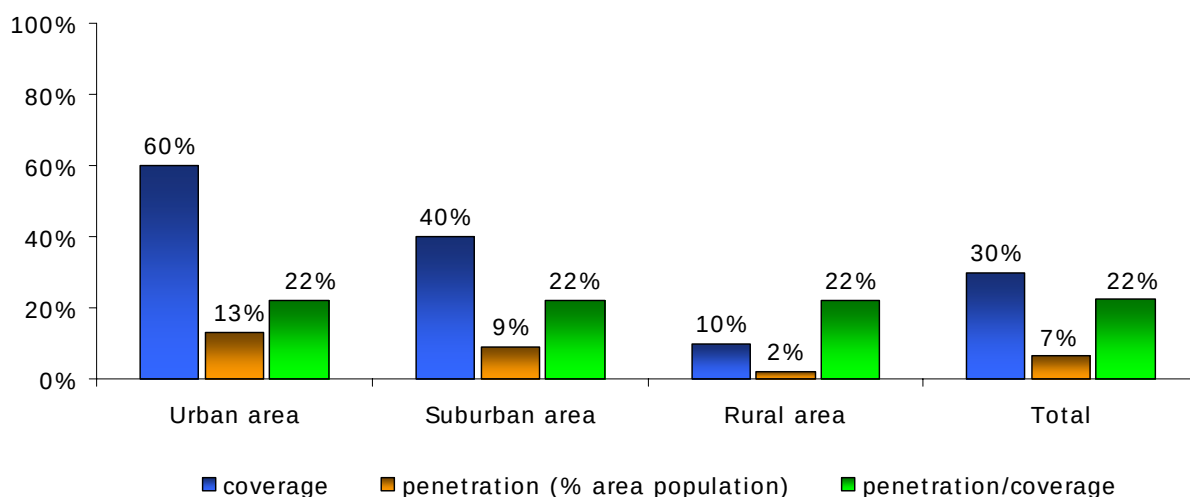


**Number of DSL connections by type of provider**

As in 2007, these numbers changed only slightly in 2008, with the incumbent gaining a fraction (about 1 percentage point).

#### 4.21.4. Cable modem coverage and take-up

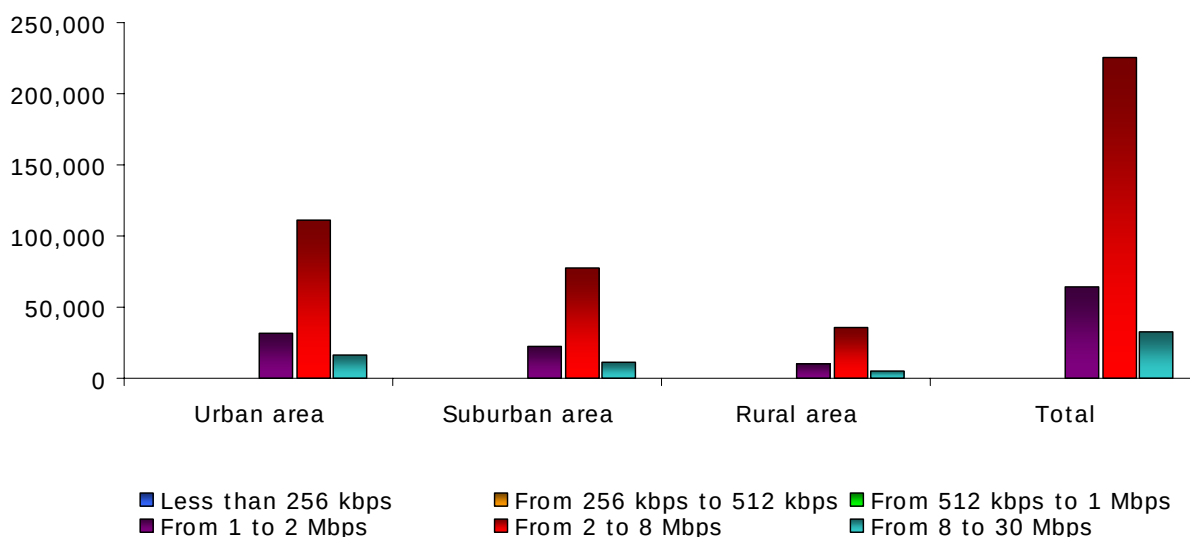
##### Coverage and penetration



Cable modem subscriptions rose by a substantial 27% in 2008. Both major operators, Telenor (Canal Digital) and Get (formerly UPC), continue their aggressive marketing of broadband connections and VoIP alongside their digital TV (and lately HDTV) offers.

Coverage estimates were revised in 2008, while penetration increased from 4.7% to 6.7%.

##### Number of cable modem connections by download rate



Given the competitive nature of the Norwegian broadband market, cable download rates are assumed to be similar to DSL download rates, with the majority of connections being in the 2-8 Mbps range. See also: Methodology notes.

### 4.21.5. Other broadband access technologies

#### Wi-Fi

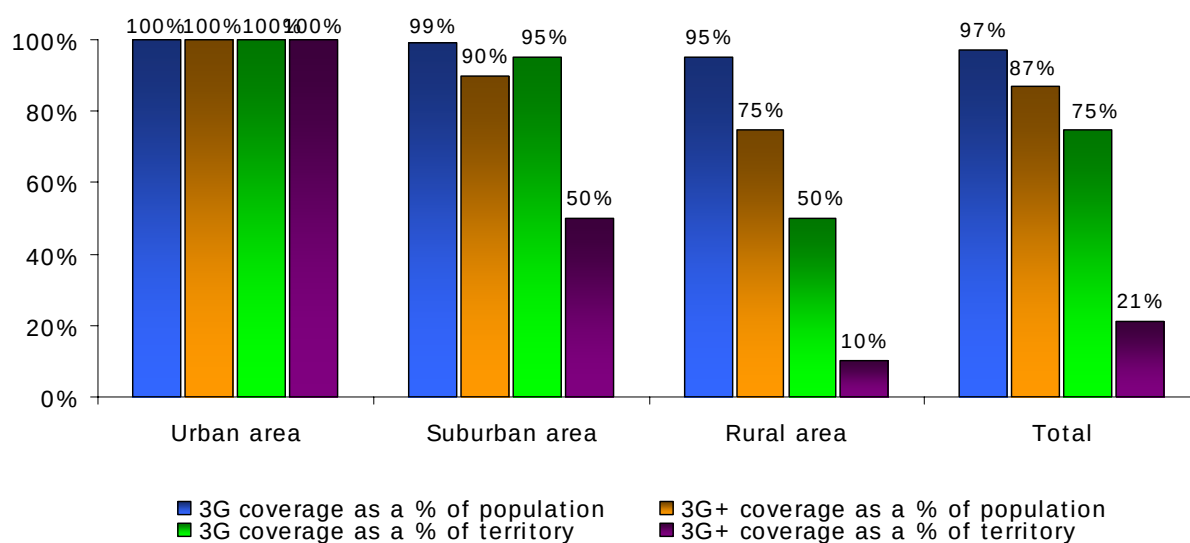
Telenor is by far the largest Wi-Fi operator in Norway, with an almost ubiquitous presence in hotels, restaurants, airports, Statoil petrol stations and other public places throughout the country.

#### WLL

WLL does not play a significant role in the Norwegian market, given that both DSL and mobile broadband (be it GPRS, EDGE, CDMA2000...) are available at a reasonable price almost everywhere. There were 31,625 WLL subscribers in Norway at the end of 2008 which is less than 2% of total fixed broadband connections.

## 4.21.6. Mobile broadband coverage and take-up

### Coverage by technology

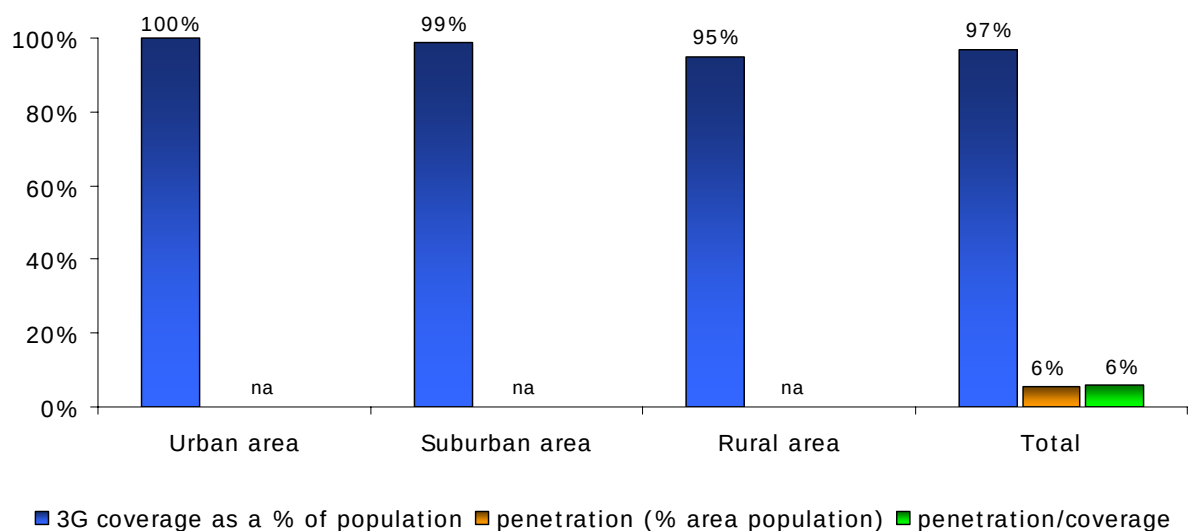


Telenor was the first to introduce commercial UMTS services, back in December 2004, with NetCom following suit in late February 2005. Both initially launched data card services for laptop users, with 3G handsets following shortly afterwards.

The service faces stiff competition from ICE, a CDMA2000-based service operating in the 450 MHz space previously occupied by NMT, which was the dominant mobile technology in Scandinavia before the arrival of GSM.

By the end of 2008, more than 95% of the population was covered by a 3G technology.

### Penetration



At the end of 2008, there were 266,060 active 3G subscribers in Norway.

## 4.22. Poland

### 4.22.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 18,486,216 | 7,394,486     | 12,235,307 | 38,115,909 |
| Share of total population | 48.5%      | 19.4%         | 32.1%      | 100.0%     |

### 4.22.2. General broadband data

|                                                  | 12/04   | 12/05     | 12/06     | 12/07     | 12/07     |
|--------------------------------------------------|---------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | -       | 56%       | 60%       | 64%       | 70%       |
| DSL subscribers                                  | 668,000 | 1,254,029 | 1,855,000 | 2,376,629 | 2,725,632 |
| DSL penetration (% of population)                | 1.7%    | 3.3%      | 4.9%      | 6.2%      | 7.2%      |
| Cable modem coverage (% of population)           | -       | 12%       | 18%       | 25%       | 33%       |
| Cable modem subscribers                          | 202,000 | 371,000   | 721,000   | 946,500   | 1,175,200 |
| Cable modem penetration (% of population)        | 0.5%    | 1.0%      | 1.9%      | 2.5%      | 3.1%      |
| FTTx subscribers                                 | -       | -         | -         | 180,000   | 184,000   |
| PLC subscribers                                  | -       | 0         | 0         | 0         | 0         |
| WLL subscribers                                  | -       | -         | -         | 575,000   | 354,000   |
| Satellite subscribers                            | -       | 93        | 100       | 1,000     | 1,000     |
| Total                                            | 874,000 | 1,637,108 | 2,596,100 | 4,079,129 | 4,439,832 |
| Total fixed broadband penetration (% population) | 2.3%    | 4.3%      | 6.8%      | 10.7%     | 11.6%     |
| Mobile broadband subscribers                     |         |           |           |           | 1,550,000 |
| Mobile broadband penetration (% population)      |         |           |           |           | 4.1%      |

At the end of 2008, there were almost 4.5 million fixed broadband subscribers in Poland. The overall growth may seem to be moderate (9%), but significant changes could be observed both in the structure, speeds and availability of broadband access. Broadband penetration growth has been due to an increase in DSL coverage (although it is still minimal compared to other EU countries) and a steady rise in the number of available cable connections.

Approximately 61% of connections were provided over telecom lines using DSL technology, and 26% via cable modem over CATV networks.

The largest broadband provider is the incumbent, Telekomunikacja Polska (TP), delivering 47% of all fixed broadband connections. Its overall share of the retail market dropped from 85% in 2007 to 77% of DSL in 2008 – having increased its subscriber base by only 3%. In the consumer and SME market, TP's offer consists almost exclusively of ADSL/ADSL2+.

The number of retail DSL connections provided by alternative operators over their own lines has increased by 25% to 275,000. The most dynamic growth (178%) was in the number of connections supplied by alternative providers on the incumbent's lines in broadband service aggregator, or BSA, mode.

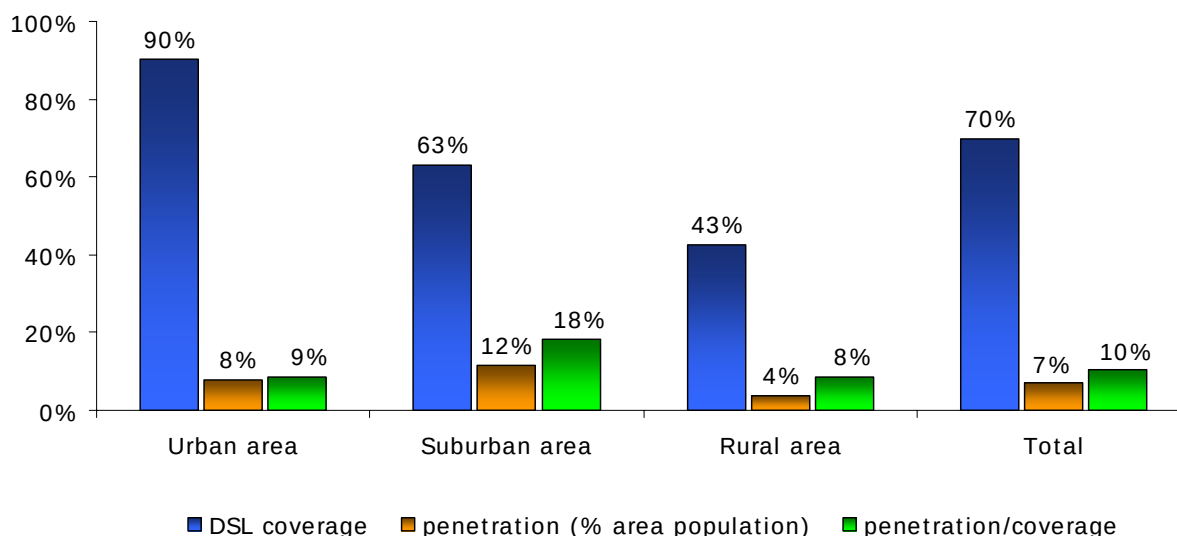
It should be noted that there is still a great deal of uncertainty over the actual number of WLL and FTTx connections, unlike the information available on DSL and CATV connections. There is no reliable data on the number of Ethernet and Wi-Fi users relying on local ISPs which are quite popular in Poland, especially in rural and suburban areas. The usual architecture of local ISPs' networks is as follows: a high-speed link – wireless (LMDS/WiMAX) or fixed (fibre optic/ATM/Frame Relay, DSL) in the “last but one mile” up to the local ISP's distribution point, then Wi-Fi or Ethernet LAN in the last mile – depending on local conditions. Generally, in residential areas with apartment blocks, an Ethernet LAN architecture is used, and Wi-Fi access in suburban or rural areas. The total number of people using these networks – both wireless and Ethernet LAN – is estimated by various sources to range from 200,000 up to 1.5 million. The number given in this report has been estimated based chiefly on reports from alternative telecom operator Netia, which has been acquiring local Ethernet ISPs since 2007.

PLC technology has disappeared from the Internet access market, and is used in only a very small number of cases as means of IP transport in a LAN situation only.

There was a significant rise in mobile Internet connections in 2008, as all four MNOs upgraded their 3G networks. At the end of 2008, HSDPA technology became available in all major Polish city centres.

### 4.22.3. DSL coverage and take-up

#### Coverage and penetration

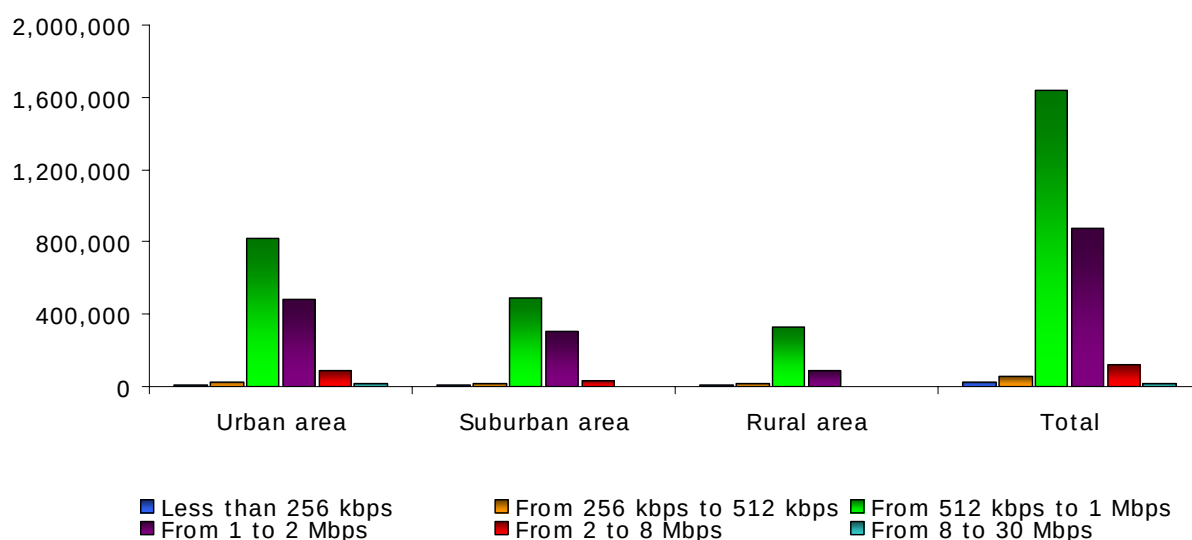


The main obstacle to DSL take-up in Poland continues to be limited coverage – not only of DSL technology, but of fixed lines in general. The density of fixed lines has never exceeded 30%, and has actually been decreasing in the consumers segment since 2004. Incumbent TP lost 993,000 of its 8.9 million lines in 2008, and only 380,000 of them were taken over by alternative operators via WLR (Wholesale Line Rental) solutions. The remainder, i.e. 613,000 lines, have been switched off as a result of fixed-mobile substitution. The number of fixed lines controlled by alternative operators remained unchanged, and in some cases decreased slightly during the year.

Over the past several years, DSL take-up has been quite sluggish for both the incumbent, TP, and alternative operators. None has been particularly eager to install DSLAMs, at a time of decreasing fixed density and declining fixed voice revenue. TP was reporting a very slight 3% increase in its DSL customer base, although even this could be considered an achievement given the sharp decline of its base of fixed lines.

The situation for alternative operators has been very different. The number of DSL connections retailed by alternative providers using the incumbent's BSA wholesale offer has grown by a tremendous 178%: from 127,000 up to 353,400, while services marketed over their own lines has also increased at a healthy but by no means as dramatic rate of 24%.

## Number of DSL connections by download rate

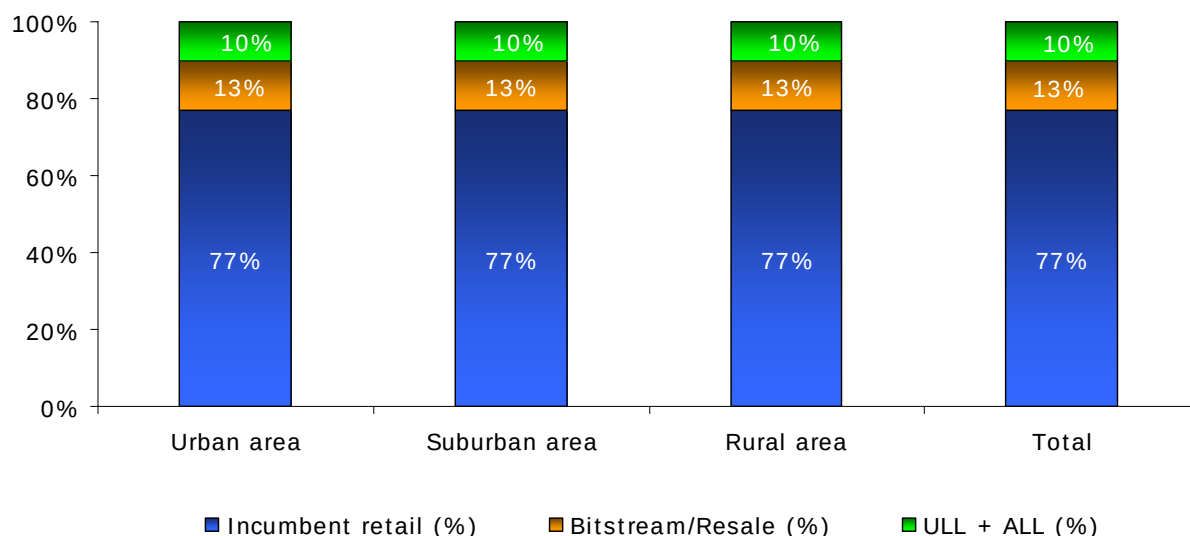


As there was no commercially available VDSL technology on DSL lines, the highest speeds available on DSL remained the same as at the end of 2007: 6 Mbps for the residential market and 15 Mbps for business customers, via ADSL2+ technology. There was a significant change to the breakdown of access speeds in 2008, with those below and including 256 kbps having practically disappeared from the DSL market. Various upgrade offers, especially from the incumbent, TP, were rolled out – the main purpose being to retain existing customers by offering them a higher speed service at the same price, and secure their loyalty by having them sign up for at least another 12 months. The strategy had a visible impact: by the end of the year, entry-level speeds of up to (and including) 512 kbps accounted for less than 5% of the DSL market. The vast majority of connections – estimated at more than 90% – were delivering speeds from 512 kbps to 2 Mbps. Services at 2 Mbps were the fastest connections marketed by alternative operators in BSA mode in 2008. The services marketed over their own lines generally mimicked those sold by the incumbent, however – in many cases offering lower prices for the same speeds. The fastest service delivered over their own lines in 2008 did therefore not exceed 6 Mbps.

The only DSL connections exceeding 6 Mbps in 2008 were solutions for business customers – i.e. the incumbent's 8 Mbps and 15 Mbps DSL services – carrying service level agreements (SLA) and priced approximately 3 times higher (for 1 Mbps access) than consumer offers. A DSL service running at 20 Mbps was introduced in 2009.



## Percentage of DSL connections by type of provider



TP's overall share of the DSL retail market decreased from 85.3% to 76.9% in 2008, due chiefly to the sizeable increase in the number of connections retailed by alternative providers in BSA mode.

The growth in the number of lines retailed by incumbent TP was very moderate: 3% only, reaching 2.095 million at the end of the year. The number of retail DSL broadband connections provided by alternative operators over their own lines increased by 25%, to approximately 275,000.

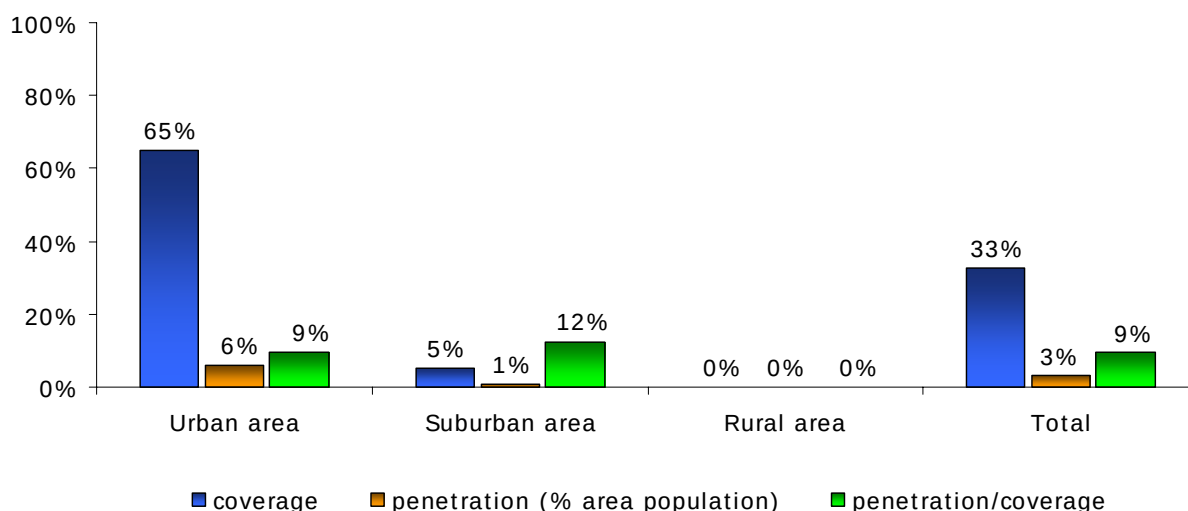
2008 can be viewed as marking the true onset of BSA access supplied by alternative providers over the incumbent's lines: at the end of the year, the number of DSL BSA connections was approximately 353,440. Although growth was very high (178%), DSL BSA connections still account for only just over 13% of all DSL connections.

Because of pricing structures and cooperation issues between the incumbent and alternative operators, the number of fully unbundled and shared access lines (LLU) was still insignificant, totalling only 1,632 lines, and naked DSL is practically non-existent.

275,560 DSL were provided by Alternative Local Loop (ALL) operators at the end of 2008.

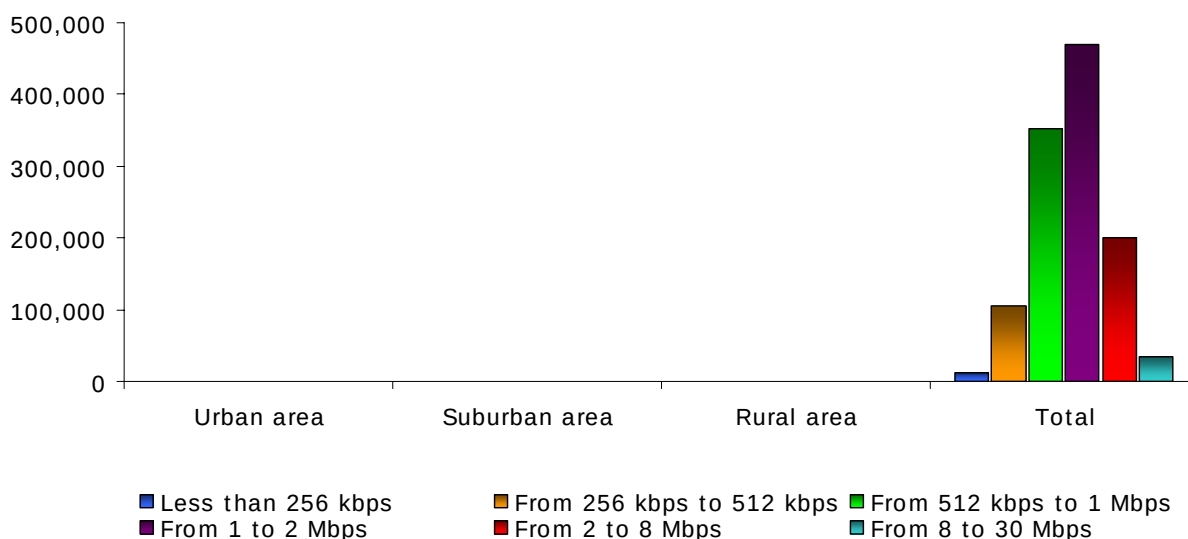
#### 4.22.4. Cable modem coverage and take-up

##### Coverage and penetration



Poland is among the top five countries in Europe in terms of homes passed for cable. CATV networks have been supplying Internet access since the late 1990s, capturing a 26% share of the country's broadband access market over the past 10 years. In cities, CATV networks provide telecom operators with stiff competition, serving a base of around 4.5 million TV subscribers, more than 1 million broadband access customers and close to 0.5 million of fixed phone lines at the end of 2008. Six of the 10 largest CATV networks had more than 50,000 broadband subscribers each, the top three being UPC Poland (358,000 subscribers), Multimedia Polska (278,000) and Vectra with 192,000 customers. At the end of the year, one of country's top CATV networks, Aster, introduced a quadruple-play services, acting as an MVNO for the mobile telephony component.

##### Number of cable modem connections by download rate



The CATV networks offered the highest speeds available to residential customers: up to 20 Mbps using HFC/DOCSIS 2.0 technology. The majority of customers (57%) subscribe to services running at 1 to 8 Mbps, with the speeds above 8 Mbps used by only around 3% of subscribers. The trend of doubling speeds in the evening, which was introduced by CATV networks some years ago, was copied by many other ISPs, including WLL providers, in 2008.

## 4.22.5. Other broadband access technologies

### FTTH

At the end of 2008, one of the three biggest alternative telecom operators, Netia, had a base of more than 90,500 Ethernet customers on its FTTx/Ethernet LAN architecture. The majority of other FTTx/LAN subscribers were serviced mainly by small and mid-size ISPs using this technology in urban areas. The FTTx/LAN architecture could be even more popular, but its development was hindered until recently by administrative constraints and a lack of available ducts. The situation is likely to improve as dedicated legislation was drafted in 2009 to support investments in broadband infrastructure by or together with local authorities and public utilities.

The FTTx/LAN networks provide Ethernet/Fast Ethernet access with advertised speeds ranging from as low as 512 kbps up to 100 Mbps. There are no mass market 1 Gbps services commercially available as yet.

### WLL/WiMAX

After cancelling the 2006 tender for 3.6–3.8 GHz (pre-WiMAX) frequencies, UKE (the Office of Electronic Communications) has defined a new plan for 60 areas (at NUTS 3 level) for point-to-multipoint wireless systems which may be used for fixed wireless Internet access in the 3.4–3.6 and 3.6–3.6 GHz frequencies. In late September 2007, the call was issued for the first area, with a local authority being awarded the licence. The calls for other areas were issued in 2008, but the results were mixed and some procedures may need to be repeated or revised in 2009. According to the frequency management strategy published by UKE in April 2007, the use of other bands (i.e. 2.2–2.3 GHz/2.3–2.4 GHz, 10.15–10.30/10.50–10.65 GHz) is also being considered for WLL/point-to-multipoint systems.

WLL access services are provided by several ISPs and telecom operators (including Crowley Data Poland, Exatel, GTS Energis, Netia, NASK, SferaNet) using mainly the 3.5 and 5.9 GHz frequency bands, alongside other wireless technologies (e.g. LMDS). As the price of equipment for these frequencies is still high, the offers are aimed mainly at business users, especially mid-size and large companies.

The number of users at the end of 2008 was estimated at 354,000. The apparent decrease in the number of WLL connections, when compared to figures from 2007, is in fact a clarification enabled by drawing on data collected from various sources. The number of WLL connections in the report covers both WiMAX and Wi-Fi local networks, but does not include Wi-Fi hotspots run by public authorities, mobile operators or various commercial entities (i.e. owners of restaurants and cafés), which are used occasionally by their customers and analysed in the next section.

### Wi-Fi

The online database of community-driven hotspots ([www.hot.spots.pl](http://www.hot.spots.pl)) lists approximately 1,800 hotspots and more than 150 Wi-Fi providers across Poland, in big cities, small towns, popular tourist destinations, etc. It does not, however, cover all Wi-Fi networks available in Poland, and there no national statistics are available. More than 60% of hotspots listed are free of charge, including Wi-Fi access for students at almost all large universities, as well as hotspots in cafés and restaurants. Approximately 500 paid hotspots are run by three biggest mobile operators, and access is included in customers' subscriptions. There are for-pay and free hotspots in all major hotels in Poland. The listing also includes hotspots run by municipalities covering the main places of interest (e.g. famous Old Town markets in Cracow) and entire cities in some cases (e.g. in Rzeszów where there is a free municipal network).

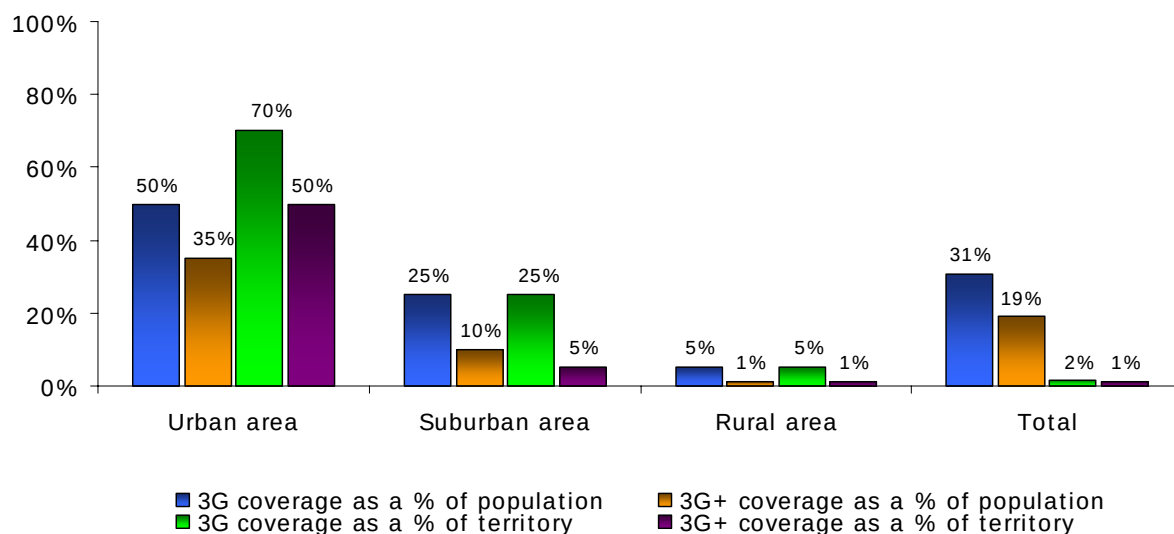
Worth noting is that roaming Wi-Fi users (business travellers, students, tourists, etc.) generally use hotspots as a supplementary access service. The number of people using Wi-Fi as a last mile access technology for WLL services is estimated in the section devoted to WLL/WiMAX. The transfers speeds available at Wi-Fi hotspots will vary depending on the capacity of a given network, the number of users, etc.

## Satellite

Satellite access remains a niche technology mainly because of its technical limitations and high equipment costs. The advantages of one-way connectivity (satellite downlink, modem or GPRS uplink) e.g. low cost of equipment, small antenna etc. do not offset its main disadvantage, namely the narrowband uplink. If, in a given location, a wireline or wireless upstream connection is available, it does not make sense to use a separate satellite downlink, so these offers have practically disappeared from the market. Satellite access only makes sense in those areas bereft of other forms of access, or which have specific issues and needs, as is the case of Polish troops in Iraq and Afghanistan where two-way satellite links are used by the Polish army, and of the 800 VSAT terminals used by the state lottery, chiefly over narrowband connections. The use of two-way satellite connectivity as a back-up for other technologies has not developed much, holding steady at around 1,000 connections, as various other networks have increased their back-up capabilities, both wireline and wireless depending on local conditions.

## 4.22.6. Mobile broadband coverage and take-up

### Coverage by technology

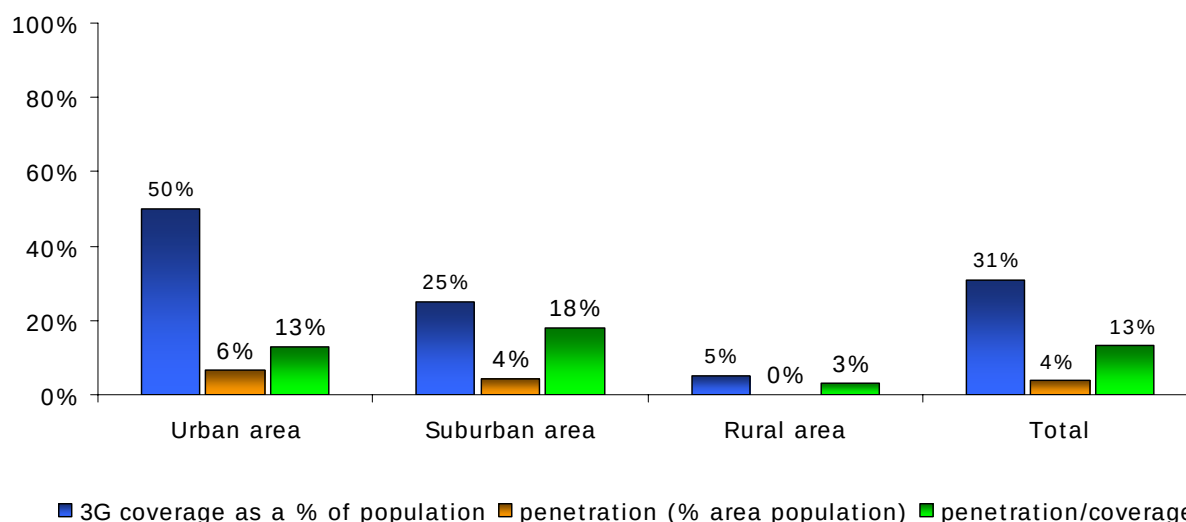


The networks have been upgraded, both in the number of B nodes (3G base stations) and the technology (commercial rollout of HSDPA). At the end of 2008, mobile broadband access was available in virtually all major city centres. Average mobile broadband speeds recorded in a country-wide survey by Audytel in late 2008, based on 1,700 measurements, was 706 kbps (download) and 213 kbps (upload). The highest registered downstream speed was 5,644 kbps in the centre of Warsaw.

According to estimates, more than 77% of mobile Internet users were located in urban areas, where the highest speeds are available.

National 3G coverage is still limited – estimated at 70% of urban areas the end of 2008, but only 25% of suburban and 5% of rural areas. Territorial coverage for 3G+ (HSDPA) was estimated at 50% of urban areas, 5% of suburban and 1% of rural areas.

### Penetration



The significant growth of mobile Internet connections observed in 2008 was the result of all four of the country's MNOs having upgraded their 3G networks.

The figure of 1.55 million given in the report is the number of mobile Internet connections using dedicated GSM/3G modems (PC cards, USB devices) as reported by mobile operators. The number does not include occasional Internet access by mobile phones or smartphones. Mobile access acts chiefly as a complementary technology (e.g. for roaming workers, business travellers, sales people, etc.) as 3G and HSDPA are available in urban areas only – fixed access being generally the first choice when available.

CDMA 2000 1xEV DO technology mentioned above is used exclusively for fixed (or roaming) wireless access, even by mobile operator PTK Centertel/Orange.

## 4.23. Portugal

### 4.23.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 4,884,085  | 3,408,242     | 2,325,248  | 10,617,575 |
| Share of total population | 46.0%      | 32.1%         | 21.9%      | 100.0%     |

### 4.23.2. General broadband data

|                                                  | 12/04   | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|---------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 92%     | 93%       | 94%       | 95%       | 95%       |
| DSL subscribers                                  | 420,625 | 672,800   | 883,746   | 1,087,725 | 1,069,000 |
| DSL penetration (% of population)                | 4.0%    | 6.3%      | 8.3%      | 10.2%     | 10.1%     |
| Cable modem coverage (% population)              | 71%     | 75%       | 80%       | 85%       | 85%       |
| Cable modem subscribers                          | 414,916 | 489,892   | 537,552   | 605,887   | 661,685   |
| Cable modem penetration (% population)           | 3.9%    | 4.6%      | 5.1%      | 5.7%      | 6.2%      |
| FTTx subscribers                                 | 3,282   | 3,218     | 4,180     | 6,700     | 14,500    |
| PLC subscribers                                  | 0       | 1,600     | 0         | 0         | 0         |
| WLL/WiMAX subscribers                            | -       | 1,700     | 3,700     | 8,200     | 21,504    |
| Satellite subscribers                            | -       | -         | -         | -         | 15        |
| Total                                            | 838,823 | 1,169,210 | 1,429,178 | 1,708,512 | 1,766,704 |
| Total fixed broadband penetration (% population) | 7.9%    | 11.0%     | 13.5%     | 16.1%     | 16.6%     |
| Mobile broadband subscribers                     |         |           |           |           | 1,215,000 |
| Mobile broadband penetration (% population)      |         |           |           |           | 11.4%     |

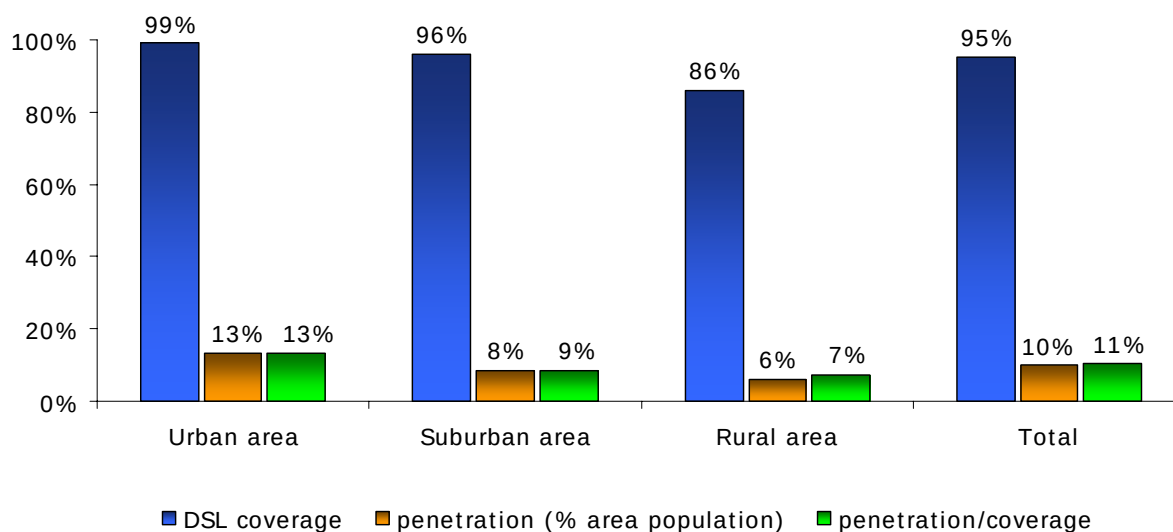
At the end of 2008, fixed broadband penetration stood at 16.6%. The decrease in DSL subscriber numbers for 2008 can be attributed mainly to the adjustments made to Portugal Telecom's database, to remove inactive prepaid broadband customers. This means that fixed broadband penetration was only 15.1% at the end of 2007.

ADSL remains the chief means of broadband Internet access (58% of fixed broadband connections) but cable modem lines are growing more rapidly: cable modem coverage in Portugal also ranks among the highest in the EU.

In addition, 1.2 million users access the Internet through their mobile phone.

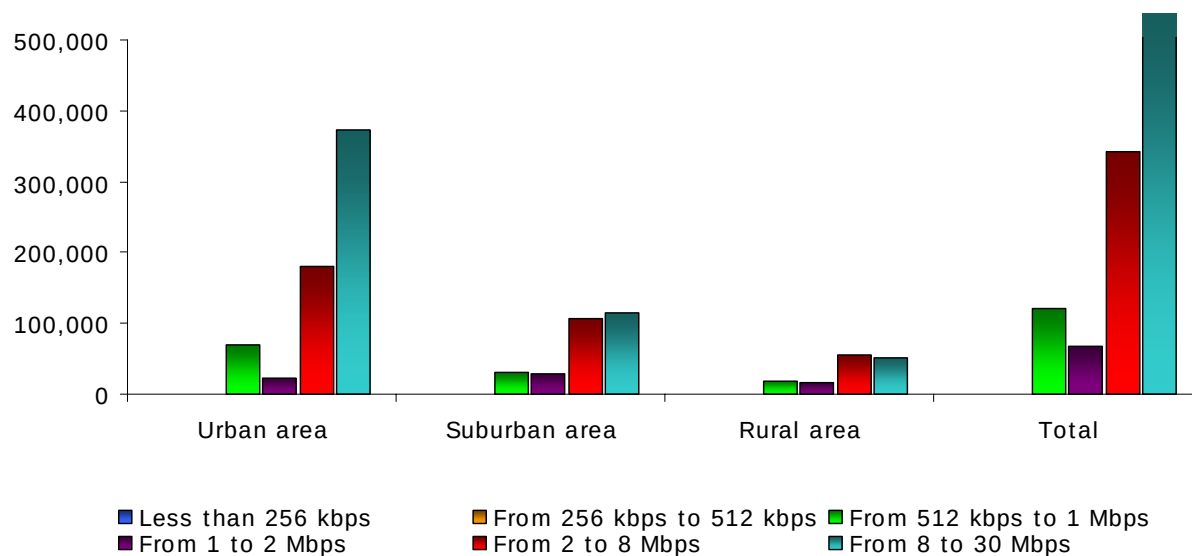
### 4.23.3. DSL coverage and take-up

#### Coverage and penetration



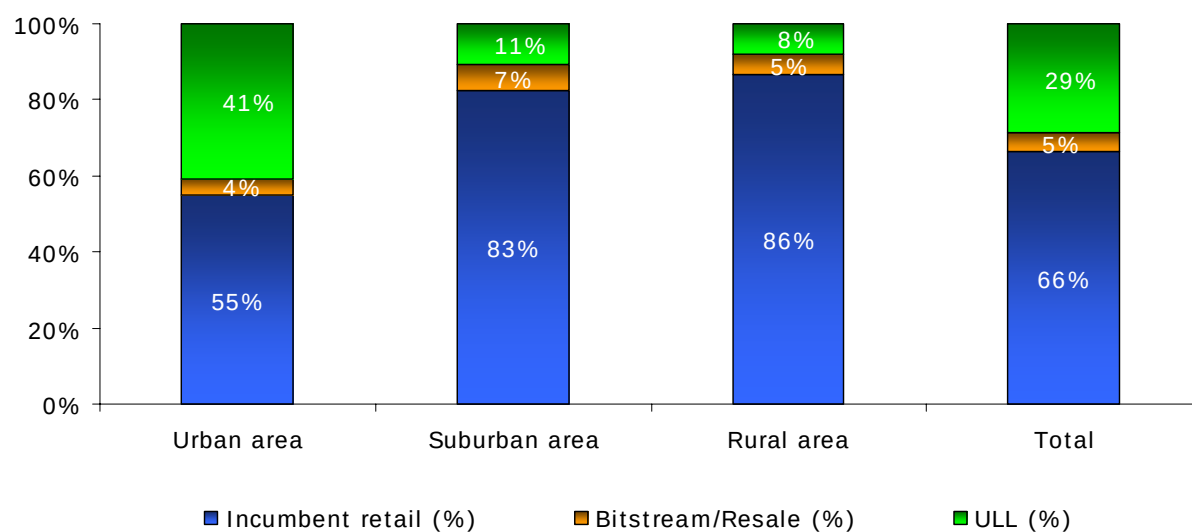
In urban areas, DSL coverage totals 99%, while in rural areas coverage is around 86%. DSL penetration reached 10.1% at the end of 2008.

#### Number of DSL connections by download rate



DSL offers have been upgraded and connections with download speeds of 12, 16 or 24 Mbps have become very popular.

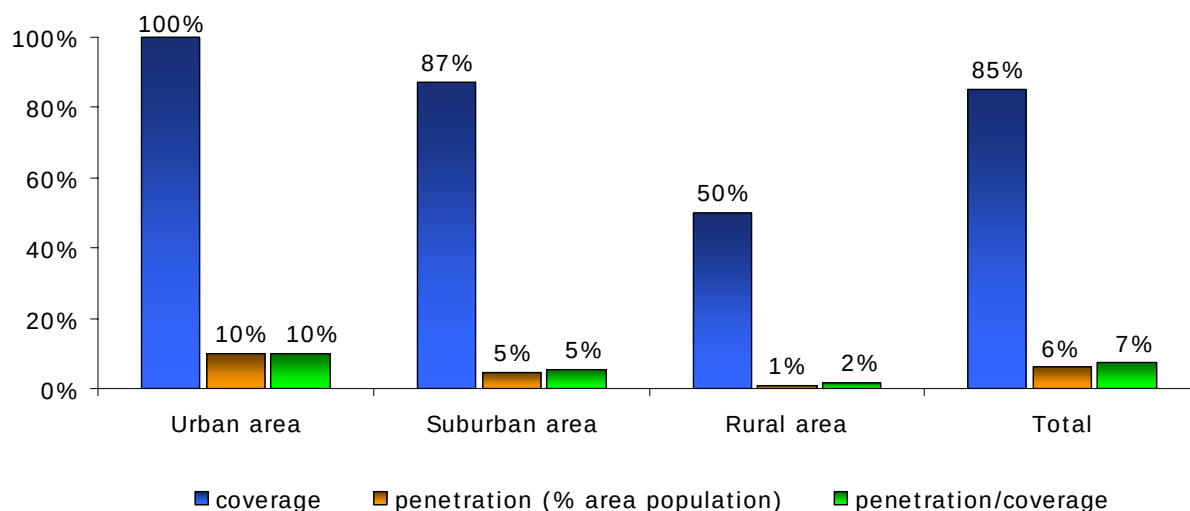


**Percentage of DSL connections by type of provider**

Competition is strong in urban areas, where unbundling is highly developed. In suburban and rural areas, Portugal Telecom remains largely dominant.

#### 4.23.4. Cable modem coverage and take-up

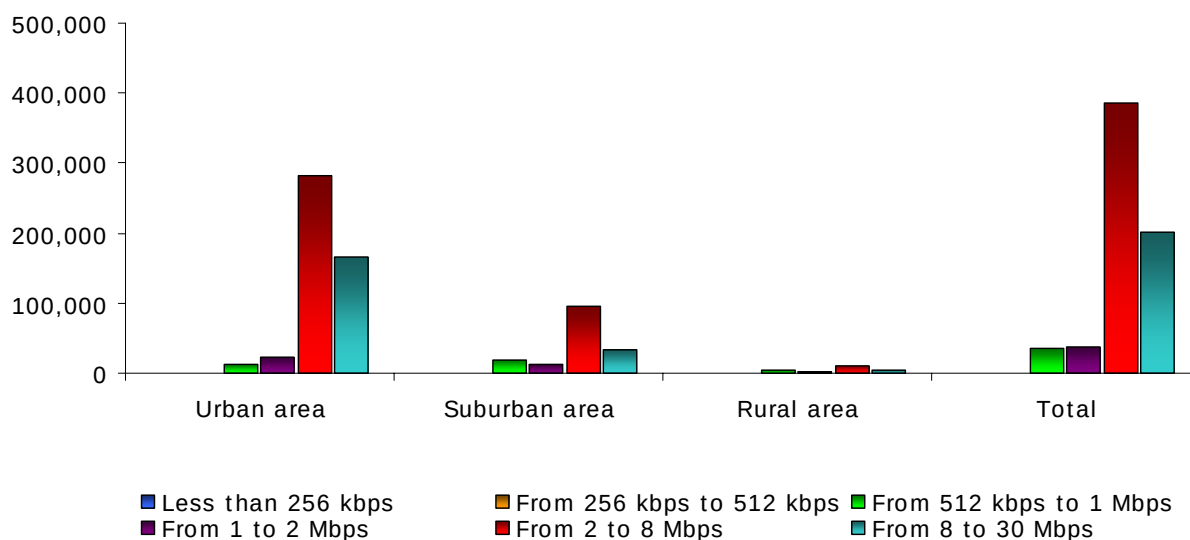
##### Coverage and penetration



Cable modem is widely available in Portugal, primarily in urban areas where there is full coverage, but also in the other parts of the country.

The rate of cable penetration rose to 6.2% in 2008 from 5.7% the year before.

##### Number of cable modem connections by download rate



Internet services with a download rate of over 2 Mbps are dominant in the cable modem market (close to 90% of the total).

TV Cabo (previously PT Group's cable operator) was part of a spin-off and has become part of the Zon Multimedia Group.

### 4.23.5. Other broadband access technologies

#### **FTTH**

In September 2008, Sonaecom became the first operator to launch fibre-based broadband services in Portugal, aiming to achieve coverage of one million households and 25% of the population.

#### **PLC**

All PLC projects in Portugal (trials) have been stopped.

#### **Wi-Fi**

There are around 1,600 hotspots in Portugal, most of them owned and operated by PT.

The government's campaign to deploy hotspots around the country, particularly in public areas and educational centres, has contributed to this increase. Nevertheless, the main users are the hotels and airports.

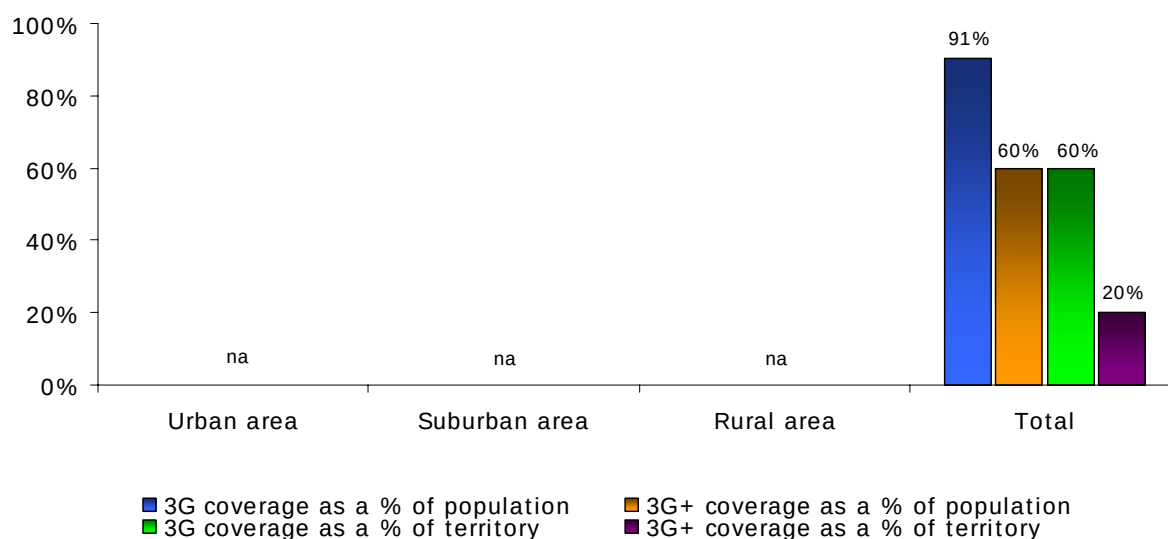
#### **WiMAX**

In 2006, Anacom, the telecommunications regulator in Portugal, released a proposal for the allocation of 3.4-3.8 GHz band spectrum. Following an initial public consultation, which received 19 responses in 2007, Anacom published a final consultation with the expectation of allocating frequencies in 2008.

Trials were carried out until 2009 and extended to the 2.5 GHz and 5.7 GHz bands.

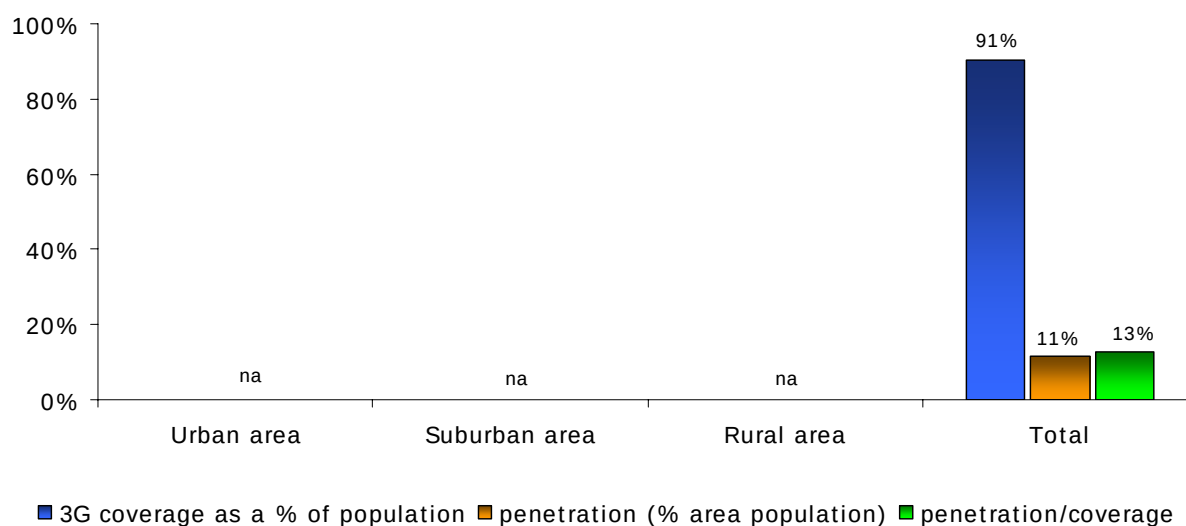
## 4.23.6. Mobile broadband coverage and take-up

### Coverage by technology



The three mobile operators active in Portugal (PT's TMN, Sonaecom's Optimus and Vodafone) have deployed their 3G networks on a large scale, and a substantial portion of them have already been upgraded to HSDPA.

### Penetration



At the end of 2008, there were 1.2 million 3G subscribers, which accounted for 8% of the total mobile subscriber base.

## 4.24. Romania

### 4.24.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 11,848,948 | 0             | 9,655,494  | 21,504,442 |
| Share of total population | 55.1%      | 0%            | 44.9%      | 100.0%     |

### 4.24.2. General broadband data

|                                                  | 12/04 | 12/05   | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|-------|---------|-----------|-----------|-----------|
| DSL coverage (% of population)                   |       | -       | -         | -         | 68%       |
| DSL subscribers                                  |       | 10,000  | 100,000   | 360,000   | 660,000   |
| DSL penetration (% of population)                |       | 0.0%    | 0.5%      | 1.7%      | 3.1%      |
| Cable modem coverage (% population)              |       | -       | -         | -         | 65%       |
| Cable modem subscribers                          |       | 250,000 | 390,000   | 440,000   | 470,000   |
| Cable modem penetration (% population)           |       | 1.2%    | 1.8%      | 2.0%      | 2.2%      |
| FTTx subscribers                                 |       | 120,000 | 580,000   | 1,110,000 | 1,360,000 |
| PLC subscribers                                  |       | -       | -         | -         | -         |
| WLL subscribers                                  |       | -       | 14,000    | 11,000    | 10,000    |
| Satellite subscribers                            |       | -       | 100       | 200       | 400       |
| Total                                            |       | 380,000 | 1,084,100 | 1,921,200 | 2,500,400 |
| Total fixed broadband penetration (% population) |       | 1.8%    | 5.0%      | 8.9%      | 11.6%     |
| Mobile broadband subscribers                     |       | —       | 480,000   | 790,000   | 1,530,000 |
| Mobile broadband penetration (% population)      |       |         | 2.2%      | 3.7%      | 7.1%      |

Although the total number of broadband subscribers increased substantially in 2008 (+579,200) and penetration reached 11.6%, both are very low compared to the EU average.

The DSL subscriber base increased by 80% in 2008 and penetration reached 3.1%. With 300,000 new subscribers, DSL technology was the fixed broadband market's main growth driver in 2008, and DSL subscribers now outnumber cable modem subscribers. However, DSL coverage remains the lowest in the EU.

Most of high-speed Internet subscribers use FTTx technology (including LAN), however. LANs are very well developed in Romania: at the end of 2008, the national regulatory authority reported that 1,270,000 broadband subscribers were connected to the Internet via UTP/FTP cable, and 90,000 subscribers via FTTH.

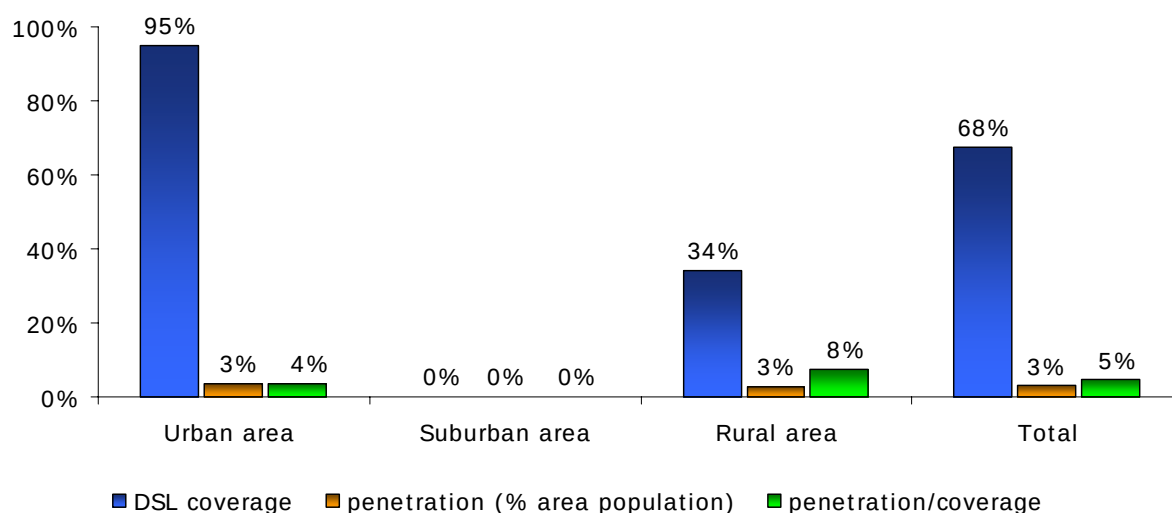
Competition remained intense in 2008, with 1,100 ISPs providing Internet access at the end of the year (vs. 1,338 ISPs at the end of 2007).

The incumbent carrier, Romtelecom, controls the DSL customer base, while RDS&RCS and UPC Romania are the biggest players in the cable modem and FTTx market. The rest of the ISPs connect their smaller FTP/UTP or WLL networks through FTTx connections.

Mobile broadband also increased significantly (+94% mobile broadband subscribers in 2008) with the penetration rate up to 7.1% at year-end.

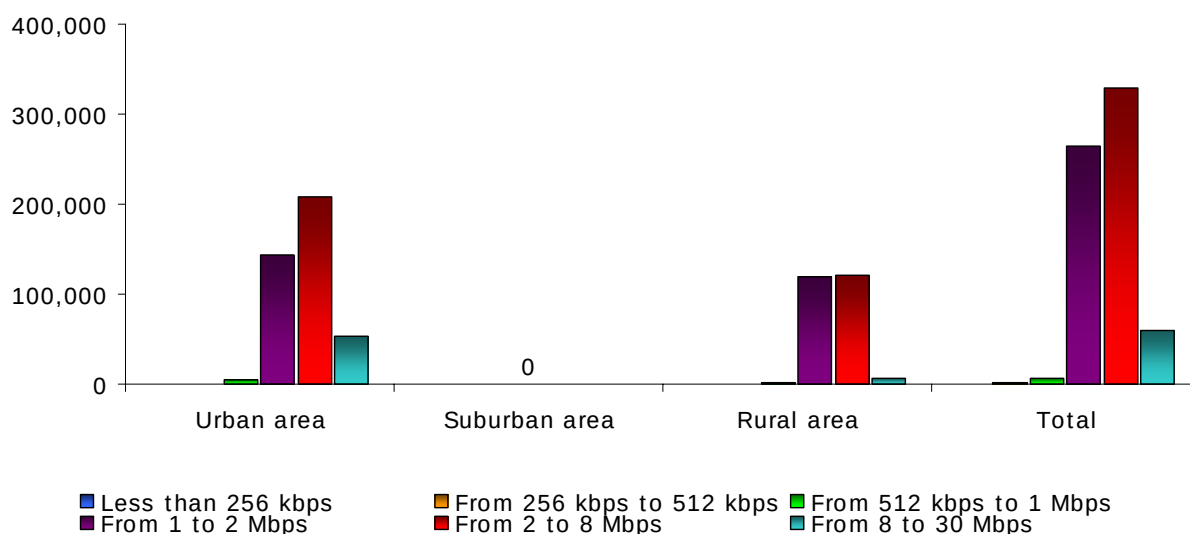
### 4.24.3. DSL coverage and take-up

#### Coverage and penetration



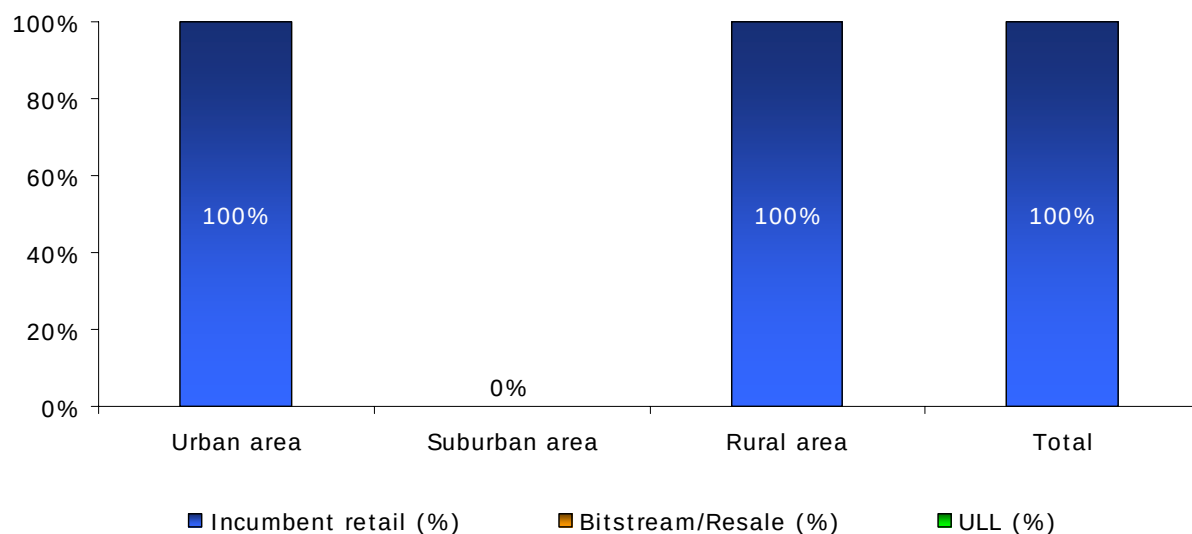
In 2008, both DSL coverage and the subscriber base continued to increase, with notable progress made in rural area coverage levels.

#### Number of DSL connections by download rate



In 2008, the DSL provider offered four plans, with download rates of 2 Mbps, 6 Mbps, 8 Mbps and 20 Mbps.

Most DSL users were connected to the Internet via access at 6 or 8 Mbps. Services delivering access at 20 Mbps are offered mostly in urban centres, and 512 kbps or 1 Mbps download rates were offered only as a back-up solution where the highest speed is not working. In 2008, the DSL provider increased the speeds supplied to all its subscribers, as it did in previous years.

**Percentage of DSL connections by type of provider**

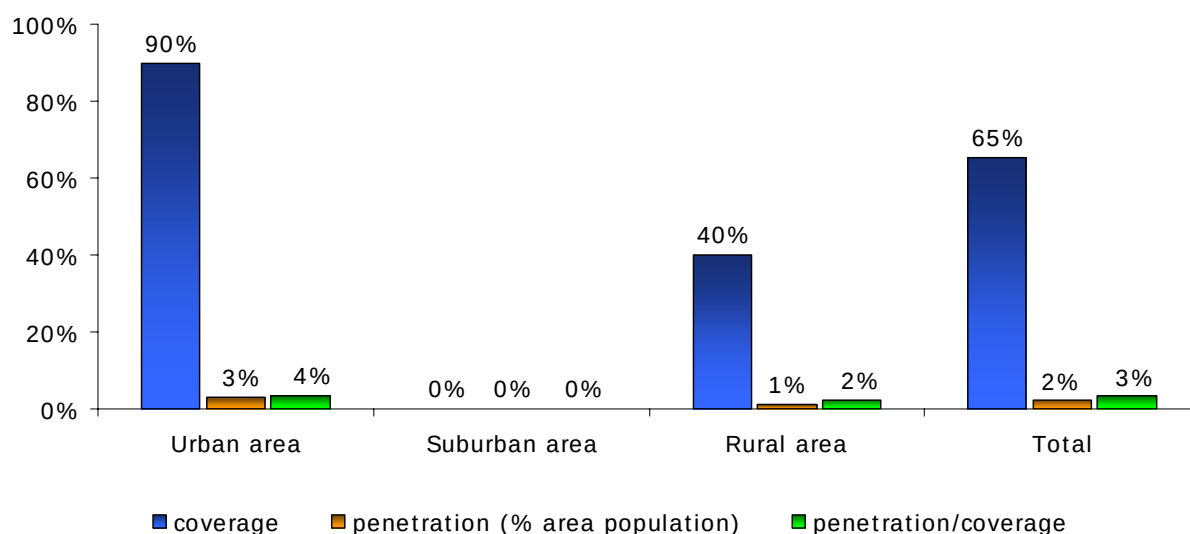
The incumbent carrier provides all DSL connections directly.

Unbundling has not yet been used in Romania. There have been several unsuccessful attempts by smaller providers to lease the local loop.

ISPs are expecting the national regulatory authority to release a review of local loop access prices in 2009.

#### 4.24.4. Cable modem coverage and take-up

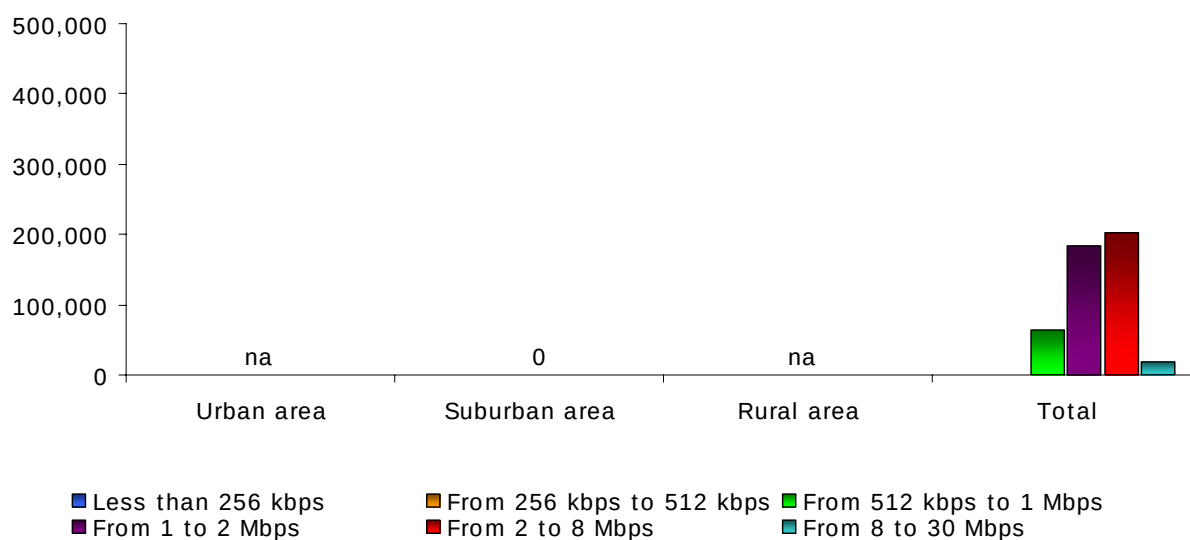
##### Coverage and penetration



The decline in cable modem's market share continued on through 2008, going from 22.6% to 18.6% of fixed broadband connections, although the subscriber base increased (+30,000). It is also worth comparing to its market share of 66.1% in 2005.

Most local cable operators in Romania provide broadband Internet access in a market dominated by RDS&RCS and UPC Romania.

##### Number of cable modem connections by download rate



As Romania is home to more than 100 cable service providers, data shown above are collected from the national regulatory authority, specialized forums and press releases.

The most popular download rates are between 1 and 8 Mbps, i.e. similar to supplied by DSL.



### 4.24.5. Other broadband access technologies

#### **FTTx**

At the end of 2008, there were 1,360,000 FTTx/LAN subscribers in the country (90,000 FTTx and 1,270,000 LAN subscribers), 250,000 more compared to 2007. They account for more than half of total fixed broadband subscriber base.

FTTx networks covered most of the biggest cities of Romania but also some rural areas.

#### **Wi-Fi**

At the end of 2008, there were more than 1,500 hotspots in the country -hotels, shopping centers, airports, ...- mostly with free access.

#### **WLL/WiMAX**

WiMAX is not available in Romania yet.

The largest percentage of WLL subscribers are located in the areas where access to other technologies (DSL, cable modem, FTTx,...) is limited. However, their number is regularly decreasing; 10,000 at the end of 2008, which is 1,000 fewer in one year.

#### **Satellite**

400 subscribers were connected to broadband via satellite at the end of 2008, according to the national regulatory authority's annual report.

#### 4.24.6. Mobile broadband coverage and take-up

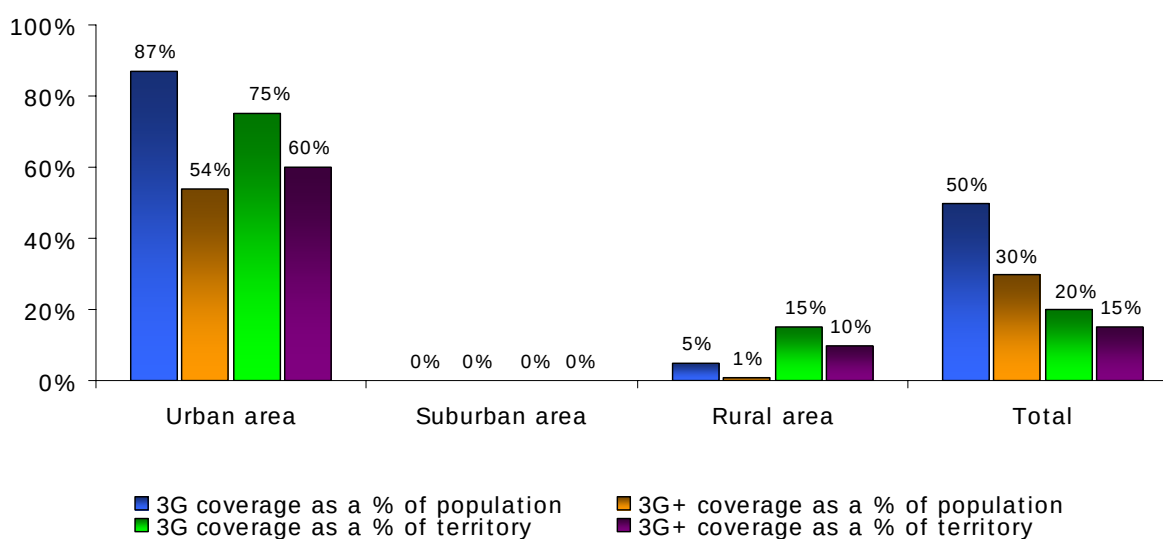
By the end of 2008, there were 1,530,000 mobile broadband subscribers in Romania, compared to 790,000 at the end of 2007, from a total of 2,740,000 mobile Internet subscribers (including GPRS).

There are three mobile operators in Romania providing access to the mobile Internet: Vodafone, Orange, using HSDPA, UMTS, EDGE and Zapp, using CDMA/EVDO 1x and UMTS technologies.

Late in the year, Romtelecom began to develop a new CDMA/EVDO 2x network.

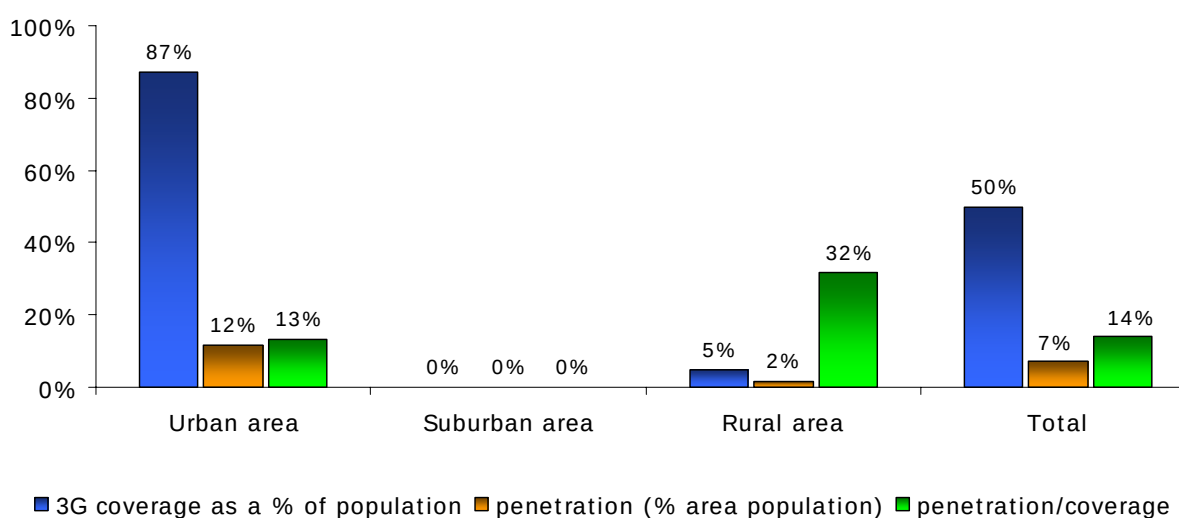
Another mobile operator, DIGI Mobil, which was awarded a 3G license, is not yet marketing mobile broadband connection, while mobile service provider, Cosmote Romania, is offering only GPRS connections.

##### Coverage by technology



3G, UMTS, HSDPA, HSUPA, CDMA/EVDO geographical coverage has increased substantially over the past two years. 50% of the population are covered with 3G, and 30% are covered with 3G+, which is available mainly to customers in the largest cities.

##### Penetration



The number of broadband mobile subscribers grew from 480,000 in 2006 to 1,530,000 in 2008.

## 4.25. Slovakia

### 4.25.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 1,870,372  | 1,952,724     | 1,589,158  | 5,412,254 |
| Share of total population | 34.6%      | 36.1%         | 29.4%      | 100.0%    |

### 4.25.2. General broadband data

|                                                  | 12/04  | 12/05   | 12/06   | 12/07   | 12/08   |
|--------------------------------------------------|--------|---------|---------|---------|---------|
| DSL coverage (% of population)                   | 44%    | 61%     | 66%     | 74%     | 78%     |
| DSL subscribers                                  | 38,334 | 104,899 | 182,391 | 277,832 | 336,369 |
| DSL penetration (% of population)                | 0.7%   | 1.9%    | 3.4%    | 5.1%    | 6.2%    |
| Cable modem coverage (% population)              | 4%     | 8%      | 15%     | 24%     | 31%     |
| Cable modem subscribers                          | 10,854 | 26,083  | 36,701  | 51,405  | 63,806  |
| Cable modem penetration (% population)           | 0.2%   | 0.5%    | 0.7%    | 1.0%    | 1.2%    |
| FTTx subscribers                                 | 2,000  | 17,819  | 30,875  | 52,421  | 118,985 |
| PLC subscribers                                  | 0      | 0       | 0       | 0       | 0       |
| WLL subscribers                                  | 11,000 | 24,518  | 69,629  | 92,356  | 94,257  |
| Satellite subscribers                            | 400    | 420     | 317     | 130     | 26      |
| Total                                            | 62,588 | 173,739 | 319,913 | 474,144 | 613,443 |
| Total fixed broadband penetration (% population) | 1.2%   | 3.2%    | 5.9%    | 8.8%    | 11.3%   |
| Mobile broadband subscribers                     | 0      | 2,200   | 97,176  | 192,329 | 216,147 |
| Mobile broadband penetration (% population)      | 0.0%   | 0.0%    | 1.8%    | 3.6%    | 4.0%    |

There are 610,000 fixed broadband connections in Slovakia, a net increase of around 136,000 since the previous year (+28.7%).

In the DSL segment, Slovak Telekom still enjoys a very strong position, as bitstream/resale offers only account for 7.4% of connections and unbundling has not yet been truly implemented. Coverage has increased steadily over the past several years, but still lags far behind the EU average. Cable modem penetration is still low, due chiefly to coverage constraints.

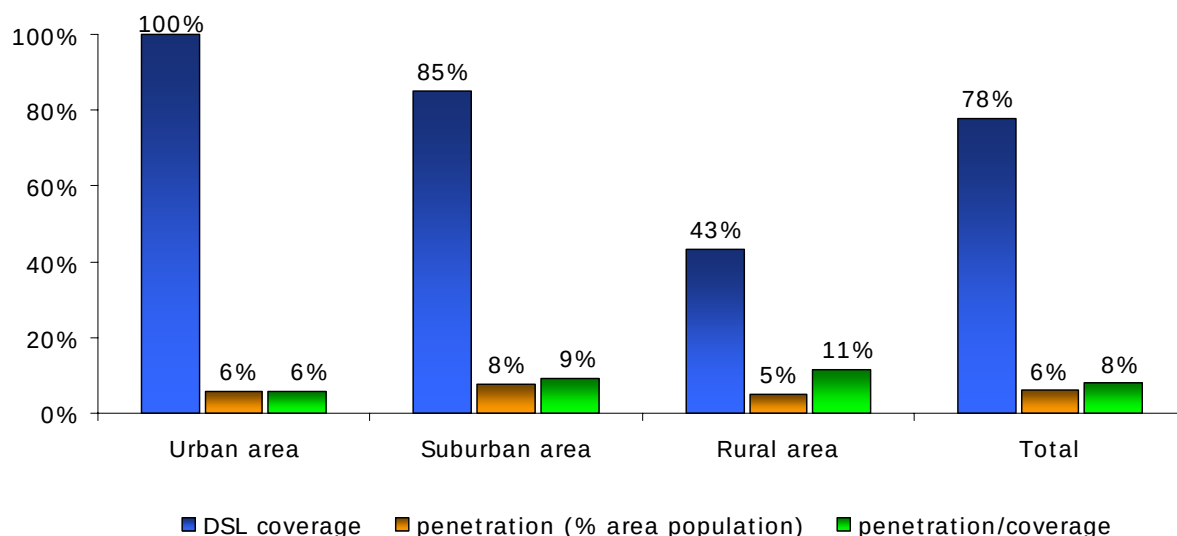
The market development is influenced by:

- the virtual monopoly over fixed telephone network infrastructure held by the incumbent carrier, Slovak Telekom;
- 4% increase in xDSL coverage by the incumbent operator (close to 100 more towns covered each year), but only 33.1% of municipalities were covered by the end of 2008, with 2,000 small villages still without access;
- a gradual increase in coverage by alternative fixed infrastructure at the local level. Broadband cable is available in only 36 municipalities, 16 more than in 2007, but CATV penetration is high with 35.3% of homes passed;
- rapid rise in the commercial use of the existing national and new regional fibre optic backbones deployed by few alternative operators, enabling the introduction of FTTx access, which has come as the result of a longstanding absence of a LLU scheme in Slovakia;

- gradual development of mobile Internet access via UMTS (services launched in January-February 2006 by only two mobile operators) and FLASH-OFDM (also called FLARION), which enables the supply of mobile Internet access at a speed of up to 5.3 Mbps;
- stagnation of commercial and municipal wireless broadband (Wi-Fi, BWA/WiMAX and WLL (FWBA) networks).

### 4.25.3. DSL coverage and take-up

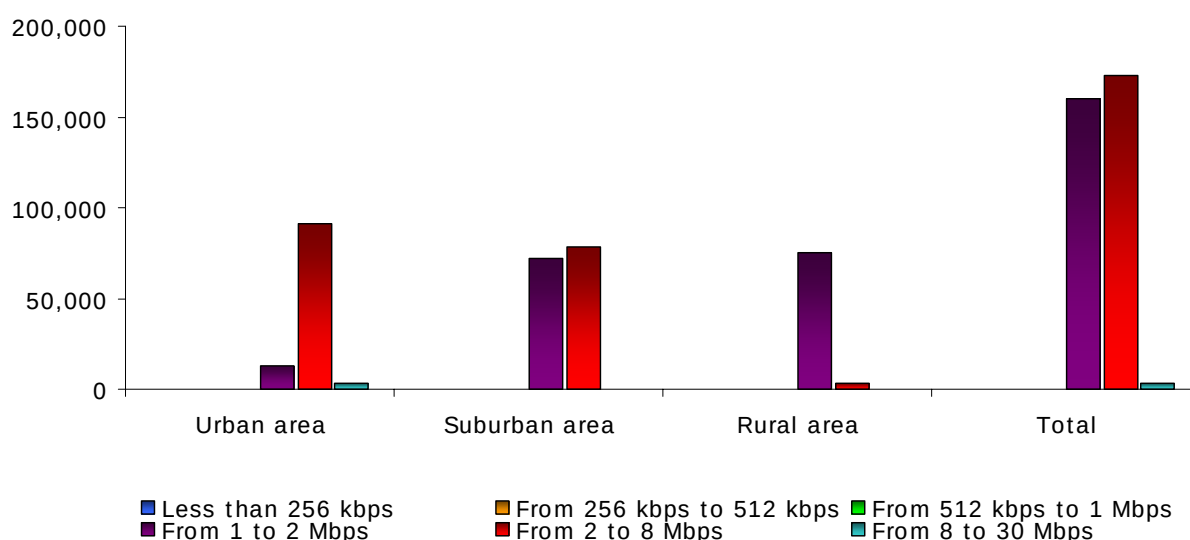
#### Coverage and penetration



In 2008, ADSL services were available in 969 municipalities (including 17 municipalities within greater Bratislava and 22 municipalities within greater Kosice), which represent 33.1% of the country's 2,928 municipalities and around 78% of the total population. xDSL availability is limited because not all PSTN lines are capable of delivering xDSL, mainly because of distance restrictions.

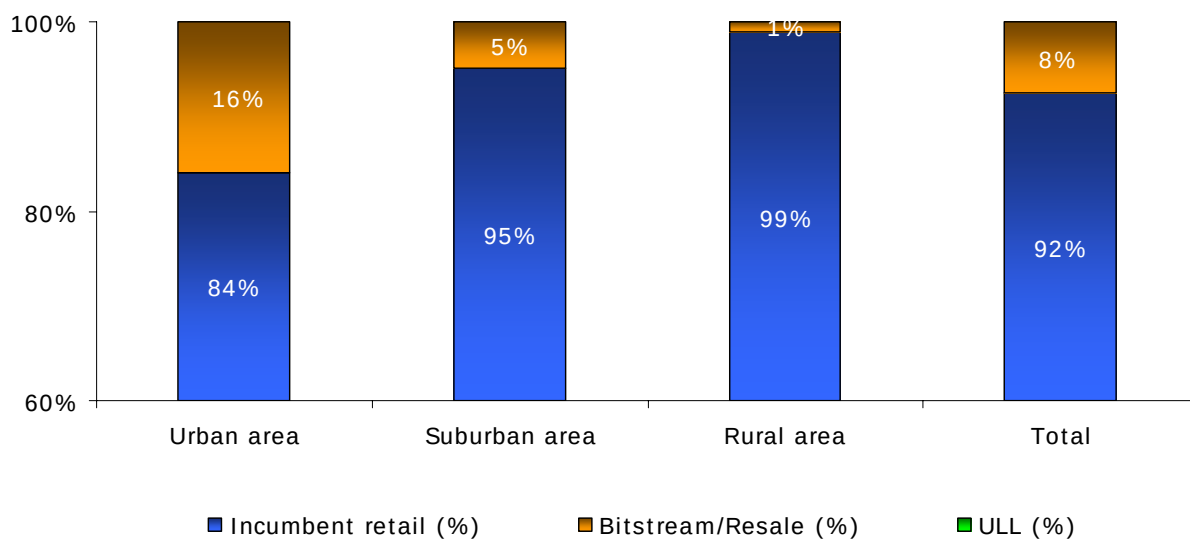
85 more municipalities were covered in 2008, which translates into a further 226,000 eligible users. There were still close to 2,000 municipalities in Slovakia, chiefly in rural areas, not covered by xDSL services at the end of the year.

#### Number of DSL connections by download rate



ADSL services were launched in 2004 and ADSL2+ services were introduced in late 2006. In 2008, approximately 1.2% of customers used the highest available rate of 12 Mbps (512 Kbps upstream), which is available only in urban areas located near the incumbent's exchanges. The slowest download rate (previously 512 Kbps/128 Kbps) was increased to 1.5 Mbps (256 Kbps upstream) during the year.

### Percentage of DSL connections by type of provider



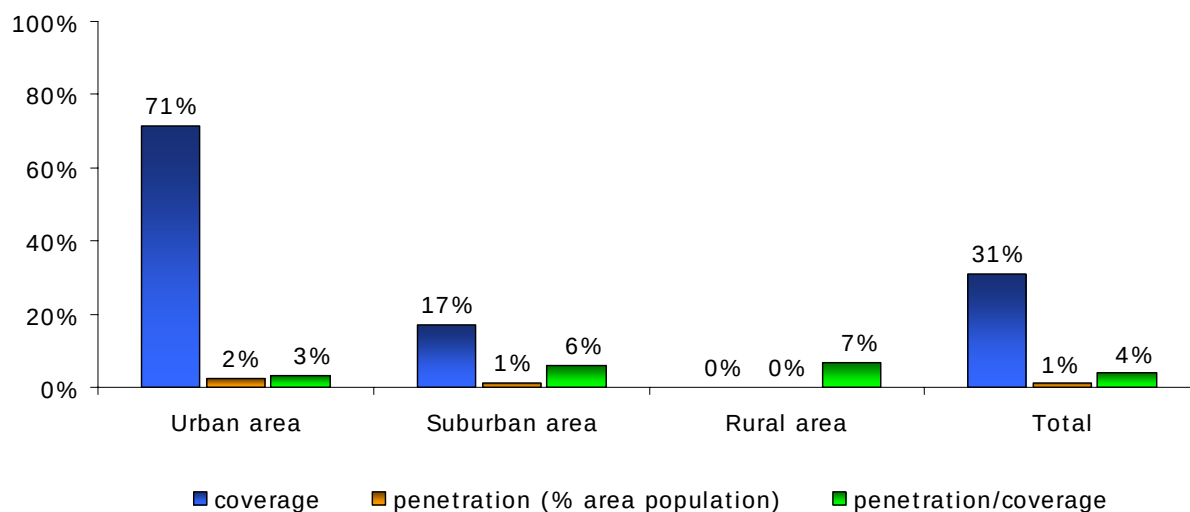
With 336,000 lines, Slovak Telekom delivers 92.6% of all xDSL directly (the same as in 2007). The remaining 7.4% are supplied via bitstream/resale offers. The ADSL wholesale model has been available only since March 2006. LLU tariffs decreased in 2008, but no real unbundling agreement was implemented.

The main ADSL market players are:

- Slovak Telekom,
- Slovanet,
- GTS Nextra,
- eTel.

#### 4.25.4. Cable modem coverage and take-up

##### Coverage and penetration

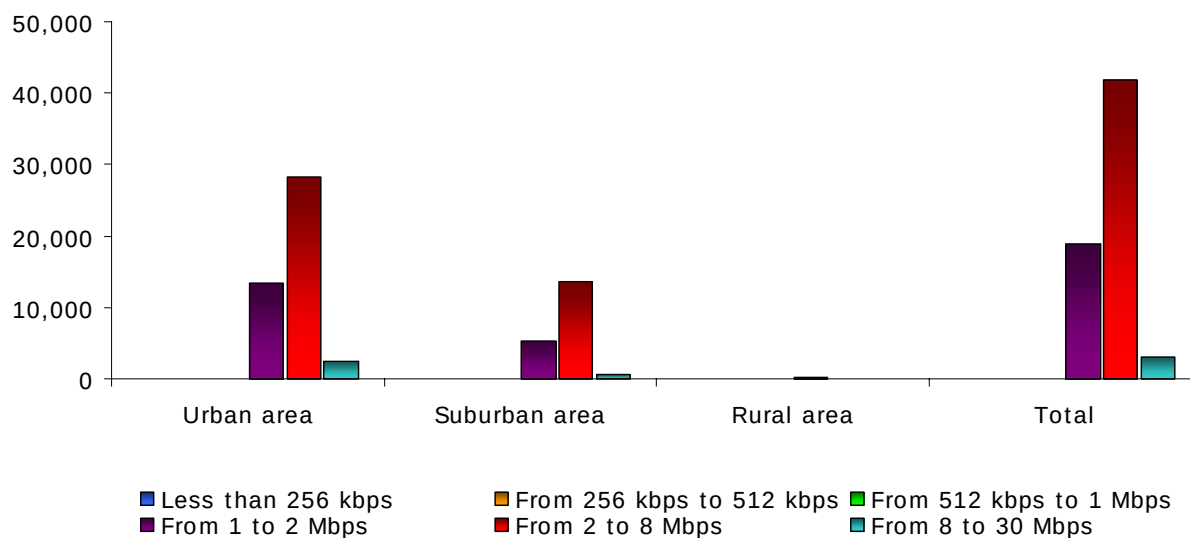


CATV households penetration in Slovakia is relatively high (35.4%). Broadband cable networks were available in 55 municipalities (including several municipalities within the greater Bratislava and Kosice areas), which represents 1.87% of the 2,928 municipalities and less than 31% of total population (1.672 million inhabitants).

Cable modem services were available mainly in urban (30 towns or most of metropolitan Bratislava and several Kosice municipalities) and suburban areas (22 municipalities) in 2008, but in only three rural towns.

Ten more municipalities were covered in 2008, with a combined population of 376,000.

##### Number of cable modem connections by download rate



Cable modem services were introduced in Slovakia in 2003, and were the first broadband services offered in the country.

## 4.25.5. Other broadband access technologies

### FTTH

FTTx services were provided by several national and few local alternative operators in 47 towns and several municipalities within the greater Bratislava and Kosice areas. FTTx services are available in urban areas only. The total number of FTTx customers increased by 127% in 2008 to 119,000 customers at year-end.

The FTTH operators with the largest customer bases are Orange, Antik, SWAN (formerly NITRANET and PEEM), Slovanet (formerly Micronet), Slovak Telekom and GAYA/W-COM. Several local and regional operators have also become very active in building and providing of local FTTx services.

FTTB services were supplied by a few national alternative providers and one academic network operator (SANET). The main FTTB providers are Energotel, Železnice telekomunikacie/Railways Telecom, Orange and SANET at the national level, and Orange, Slovanet (former Micronet), Slovak Telekom and Antik at the local level. Commercial FTTB services were available mainly in urban and suburban areas, but also in some rural areas that are close to energy distribution installations and railway stations.

Triple play bundles were introduced in 2008. At year-end, there were 84,000 triple play customers, and bundled solutions were available to approximately 38.8% of the population (2.1 million inhabitants) in 126 municipalities. Several operators are competing in the same areas. In 2008, the main players were Slovak Telekom (34,000 customers), UPC Broadband Slovakia (29,300 customers), Orange Slovakia (10,300 customers) and Slovanet (approximately 6,000).

FTTx access with a download rate of more than 30 Mbps (up to 70 Mbps) was available to 21.7% of the population (1,175 million inhabitants). For FTTB services, rates between 10 Mbps and 1 Gbps are available.

### WLL

The WLL services are based on several different frequency bandwidths.

Tenders for FWA licences in the 26 GHz frequency band were issued by the Telecommunication Office in 2001 and, in July of that year, three licences were awarded, of which one was later withdrawn. The country's two operators are GTS Nextra (formerly Telenor Networks) and SWAN.

Tenders for FWA licences in the 3.5 GHz band were issued in August 2005, with four licences awarded: to Amtel Slovensko, GlobalTel, Telenor Networks and WiMax Telecom Slovakia. Three operators had launched commercial services before the end of 2005. All operators are using WiMAX technology.

During 2008, ten new licences for FWA in the 10 GHz frequency band (covering 16 localities) were awarded by national regulator (Telecommunication Office).

The first Wi-Fi pilot projects, based on the 802.11b standard, were launched in Slovakia in 2003. The following wireless technologies can be used in Slovakia without a licence, i.e. under a system of general authorisation with an obligation only to register: RLAN (2400 – 2483.5 MHz), HIPERLAN (5150 – 5350 MHz only indoor) and HIPERLAN (5470 – 5725 MHz outdoor).

The number of public Wi-Fi hotspots increased rapidly between 2003 to 2008, reaching around 3,800 by the end 2008. No data are available on for private Wi-Fi LAN.

Since 2007, several municipalities have been providing non-commercial public hotspot services free of charge – mainly in urban and suburban areas.

FWA services are available mainly in urban and suburban areas. Wi-Fi technology covered more than 1,439 municipalities (incl. municipalities in Bratislava-City and Kosice-City): 62 towns and municipalities in urban areas, 532 municipalities in suburban areas and 845 municipalities in rural areas –covering in total territories with approx. 4 million inhabitants (73.9% of total population).

At the end of 2008, the number of WLL customers in Slovakia totalled more than 94,000. Most WLL customers were Wi-Fi customers (more than 79,000) followed by FWA 3.5 GHz customers (nearly 10,800) and FWA 26 GHz customers (nearly 4,400).

The leading operators in 2008 were WiMax Telecom Slovakia (for FWA 3.5 GHz, operating mainly on wholesale regime for other internet providers) and SWAN (for FWA 26 GHz services). In addition, there were 206 Wi-Fi operators.



**Satellite**

Two-way Internet access via satellite is offered in Slovakia primarily by GiTy and Sitel VSAT. A few other companies resell foreign satellite Internet access services.

At end of December 2008, the total number of satellite Internet subscribers was 26.

**PLC**

Since 2006, PLC has been confined to a handful of announced trials by a few private companies in co-operation with power utilities.

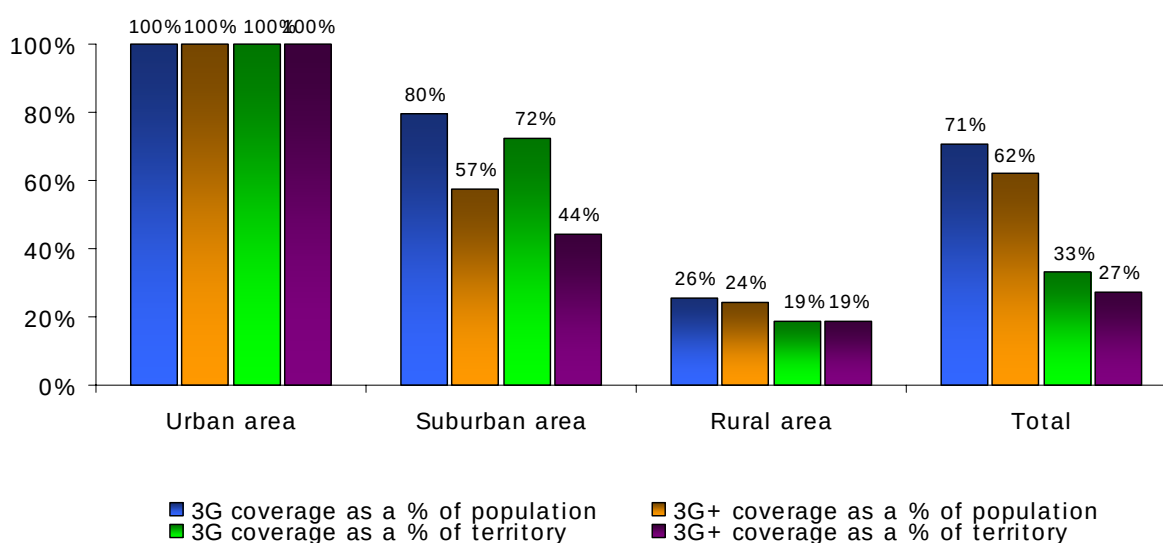
#### 4.25.6. Mobile broadband coverage and take-up

T-Mobile in Slovakia launched the first FLARION services back in October 2005, based on FLASH-OFDM broadband technology (actual average download rate of 5.3 Mbps and 500 kbps upload) operating in the 450 MHz band (using the former NMT-450 frequencies allocated for T-Mobile in Slovakia). T-Mobile operates mobile broadband services with EDGE/UMTS/FLASH-OFDM technologies, while the Orange mobile Internet offering is based only on the operator's 3G network.

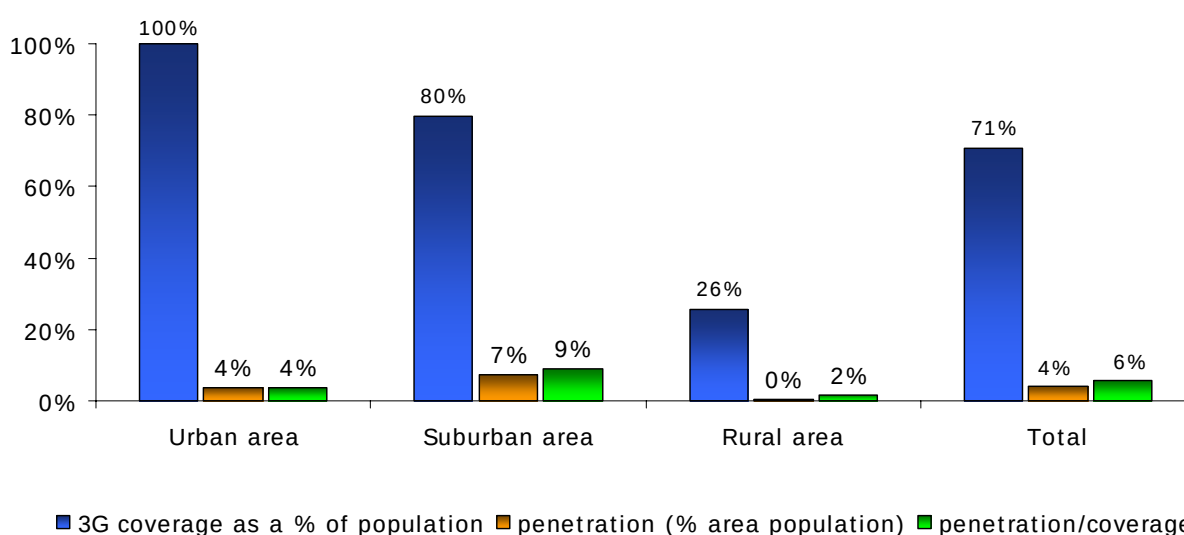
At the end of 2008, there were 5,520,043 mobile subscribers in Slovakia (penetration rate of 102% of the population) of which 815,377 were GPRS/EDGE subscribers, 567,503 were 3G customers and 216,147 customers were using 3.5G mobile broadband services.

At the end of 2008, UMTS coverage reached 33% of the national territory and 71% of the population, while HSDPA was available in 379 municipalities (62% of total population, 27% of territory).

##### Coverage by technology



##### Penetration



## 4.26.Slovenia

### 4.26.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 454,141    | 800,400       | 779,821    | 2,032,362 |
| Share of total population | 22.3%      | 39.4%         | 38.3%      | 100.0%    |

### 4.26.2. General broadband data

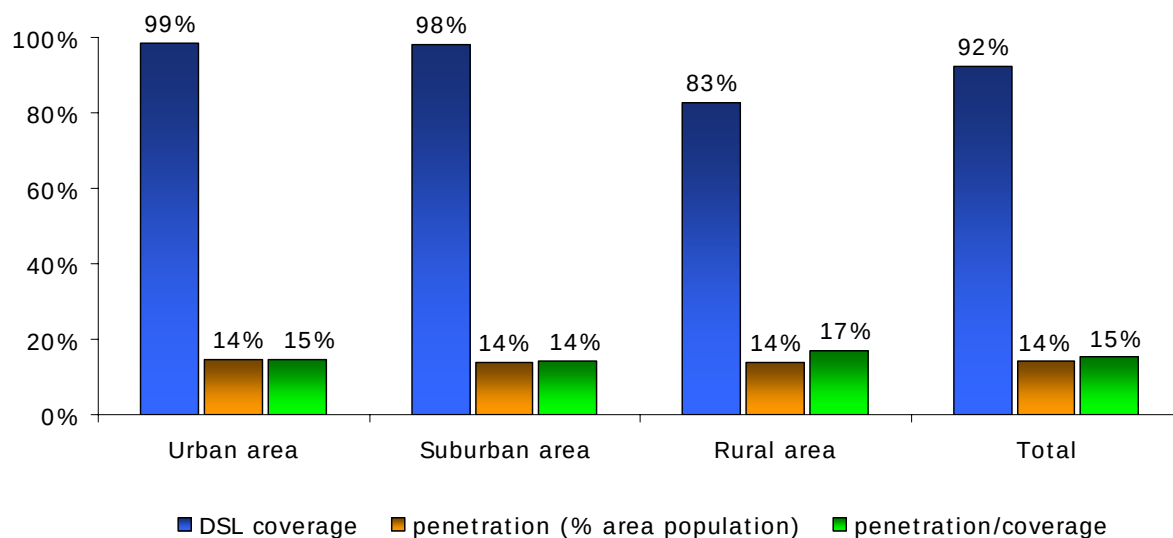
|                                                  | 12/04   | 12/05   | 12/06   | 12/07   | 12/08   |
|--------------------------------------------------|---------|---------|---------|---------|---------|
| DSL coverage (% of population)                   | -       | 55%     | 88%     | 92%     | 92%     |
| DSL subscribers                                  | 73,730  | 130,602 | 194,250 | 247,195 | 285,866 |
| DSL penetration (% of population)                | 3.7%    | 6.5%    | 9.7%    | 12.2%   | 14.1%   |
| Cable modem coverage (% population)              | -       | -       | -       | 51%     | 52%     |
| Cable modem subscribers                          | 38,836  | 46,822  | 81,446  | 85,502  | 95,076  |
| Cable modem penetration (% population)           | 1.9%    | 2.3%    | 4.0%    | 4.2%    | 4.7%    |
| FTTx subscribers                                 | -       | 1,188   | 2,876   | 10,022  | 44,564  |
| PLC subscribers                                  | 0       | 0       | 0       | 0       | 0       |
| WLL subscribers                                  | 2,503   | 2,645   | 3,273   | 921     | 764     |
| Satellite subscribers                            | -       | 15      | 0       | 7       | 7       |
| Total                                            | 115,069 | 181,272 | 281,845 | 343,640 | 426,277 |
| Total fixed broadband penetration (% population) | 5.7%    | 9.0%    | 14.0%   | 17.0%   | 21.0%   |
| Mobile broadband subscribers                     | 6,279   | 25,670  | 100,291 | 261,765 | 446,863 |
| Mobile broadband penetration (% population)      | 0.3%    | 1.3%    | 5.0%    | 12.9%   | 22.0%   |

In 2008, fixed broadband access was still most commonly provided via DSL technologies utilizing the public telephone network's copper local loops, but was still not available to 8% of the population, or via cable networks, but optical fibre access began making strides.

By 31 December 2007, however, mobile broadband subscribers outnumbered DSL subscribers and, by 31 December 2008, there were more mobile broadband subscribers in Slovenia than fixed broadband subscribers.

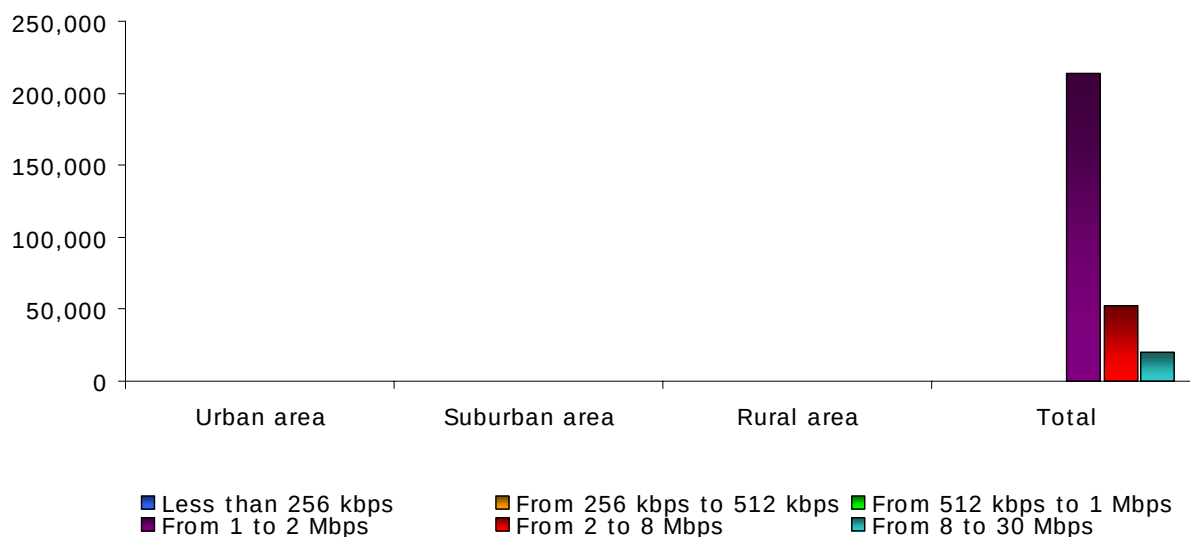
### 4.26.3. DSL coverage and take-up

#### Coverage and penetration



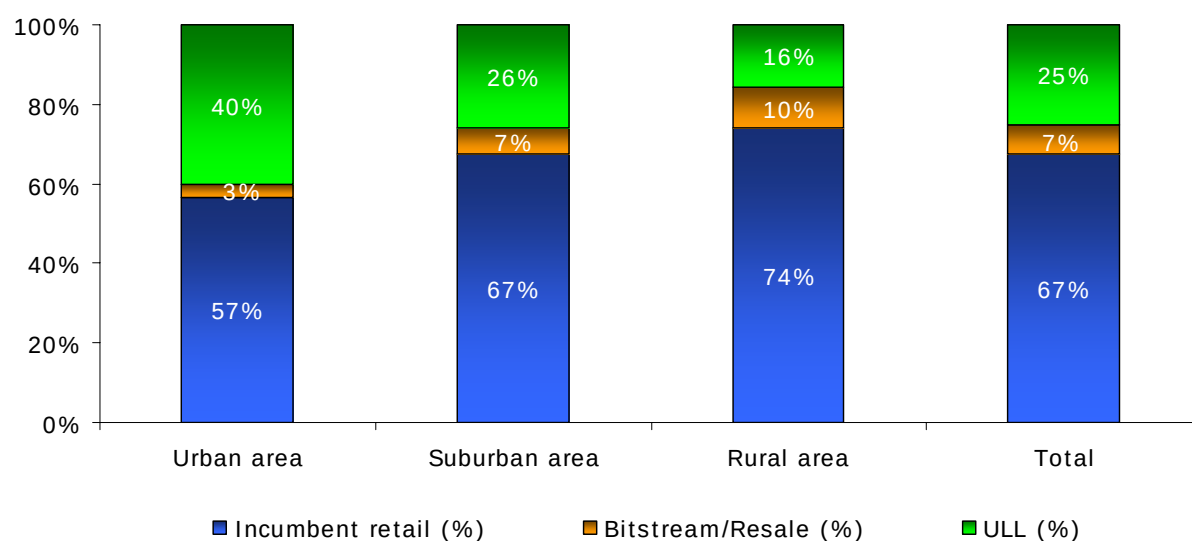
National DSL coverage increased by 1 point between the end of 2007 and the end of 2008, to 92%.

#### Number of DSL connections by download rate



Most users still subscribe to offers with download speeds of up to 2 Mbps (74.6%). However, the share of connections with higher speeds increased significantly between the end of 2007 and 2008 (+11.7 points).

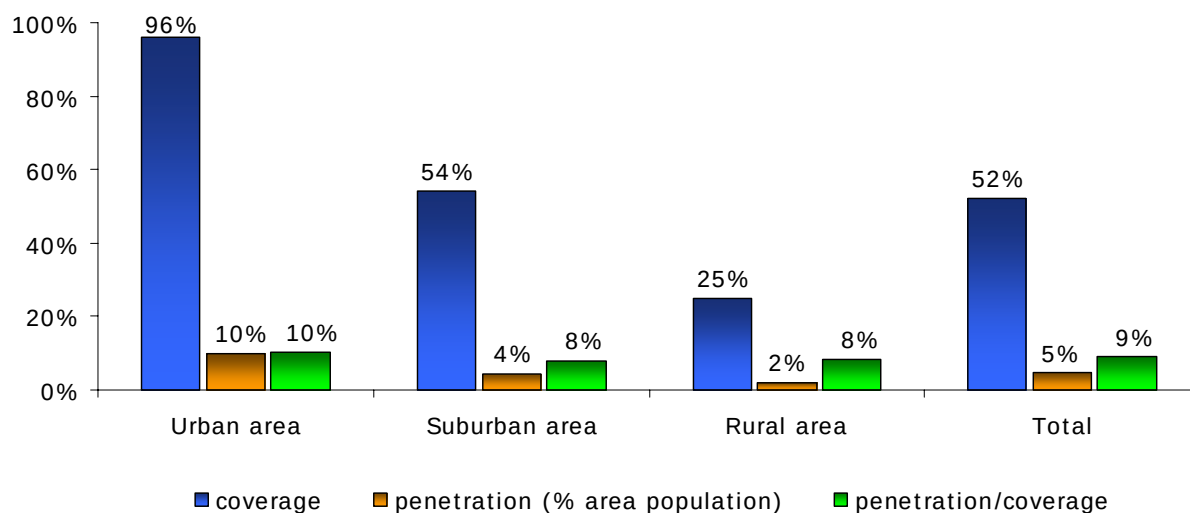
### Percentage of DSL connections by type of provider



The incumbent carrier's share of the national broadband retail market decreased from 69.6% to 67.5% between the end of 2007 and 2008, while bitstream/resale services' share of the access market dropped from 7.8% to 7.2%. Unbundling is now relatively well advanced in all areas.

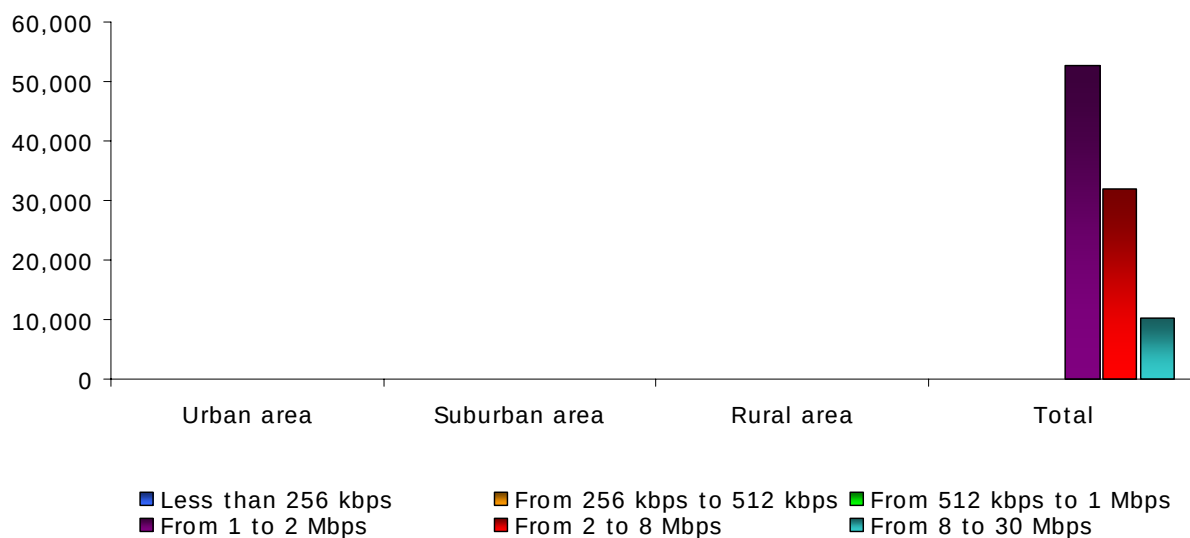
#### 4.26.4. Cable modem coverage and take-up

##### Coverage and penetration



National cable modem coverage increased slightly to 52%, but penetration remains low.

##### Number of cable modem connections by download rate



More than half (55.5%) of cable modem users subscribe to connections with download speeds up to 2 Mbps. However, the share of connections with higher speeds increased very significantly between the end of 2007 and 2008 (+25.9 points): connections with speeds of more than 8 Mbps account for just over 10% of the cable modem subscriber base.

## 4.26.5. Other broadband access technologies

### FTTx

The number of FTTH subscribers increased from 10,000 at the end of 2007 to close to 45,000 at the end of 2008. They are located mainly in urban (19,511 subscribers, i.e. a 4.3% penetration rate) and suburban (24,131 subscribers, i.e. a 3.0% penetration rate) areas.

The vast majority (98%) of FTTH connections deliver download speeds of over 10 Mbps.

### Wi-Fi

Three telecommunication operators provide Wi-Fi access to the Internet in Slovenia: Mobitel (a subsidiary of the incumbent operator, Telekom Slovenije; its network is called NEOWLAN), Softnet and Alternet.

Three public networks should also be mentioned:

- Ki-Wifi (a network of hotspots in the cities of Nova Gorica and Šempeter - Vrtojba offering free and secure Internet access; a project run by the Multimedia Center Mostovna);
- Eduroam (installation of the EDUROAM network<sup>4</sup> at public universities in Slovenia was financed by the Ministry for Higher Education, Science and Technology over the course of 2005 to 2008. By 2008, all of the faculties and other members of all three Slovenian public universities were connected to the European EDUROAM system (Ministry for Higher Education, Science and Technology, 2008);
- e-Spots (a network of hotspots established and financed by the Ministry of the Economy to promote broadband access to the Internet in rural and less developed areas of Slovenia).

All three private telecommunications operators have concentrated their hotspots in urban and suburban areas. Alternet has the largest number of hotspots, but 90% of them are owned by private users and only 10% by business users. This means that the majority of those hotspots are not publicly available, unlike the ones operated by Mobitel and Softnet.

The hotspots attached to the Eduroam network are concentrated predominantly in urban areas, where the universities are located. The ki-Wifi network hotspots, on the other hand, are located only in suburban areas, while the e-Spots deployed and financed by the Ministry of the Economy were installed predominantly in rural areas, and later suburban areas.

### WLL/WiMAX

The number of WiMAX subscribers has decreased during the last two years, from 1,153 at the end of 2006 to 764 at the end of 2008.

WiMAX was expected to bring Internet access to rural areas which are still without any fixed broadband access. However it appears that the technology lost its appeal before it was able to take off. APEK<sup>5</sup> awarded the first WiMAX service and WiMAX spectrum licence to a company called Incotel, whose network construction did not meet expectations, as a result of which it lost its licence. In 2006, licences were awarded to the incumbent operator, Telekom Slovenije, and to Tok Telekomunikacije. Telekom Slovenije began performing trials and installed several base stations, but soon came to the conclusion that its existing fixed broadband network and mobile broadband network (Mobitel) were robust enough to deliver broadband solutions, which meant that Tok Telekomunikacije became the only provider of WiMAX access. However, the small number of base stations that it installed was not enough to persuade a critical mass of potential users of its viability as an alternative form of Internet access (Monitor, 2009).

<sup>4</sup> The Eduroam service provides its users with secure and simple access to their own organisation's (wireless) network and hosting on the networks of other institutions that are part of the Eduroam network. For more information on Eduroam, visit <http://www.eduroam.org/>.

<sup>5</sup> Agencija za pošto in elektronske komunikacije (APEK) - Post and Electronic Communications Agency of the Republic of Slovenia (in English)

## Satellite

The number of satellite subscribers in Slovenia is very small. At the beginning of 2008, two companies were providing a two-way satellite Internet access service: Sensolink and ELSAT.

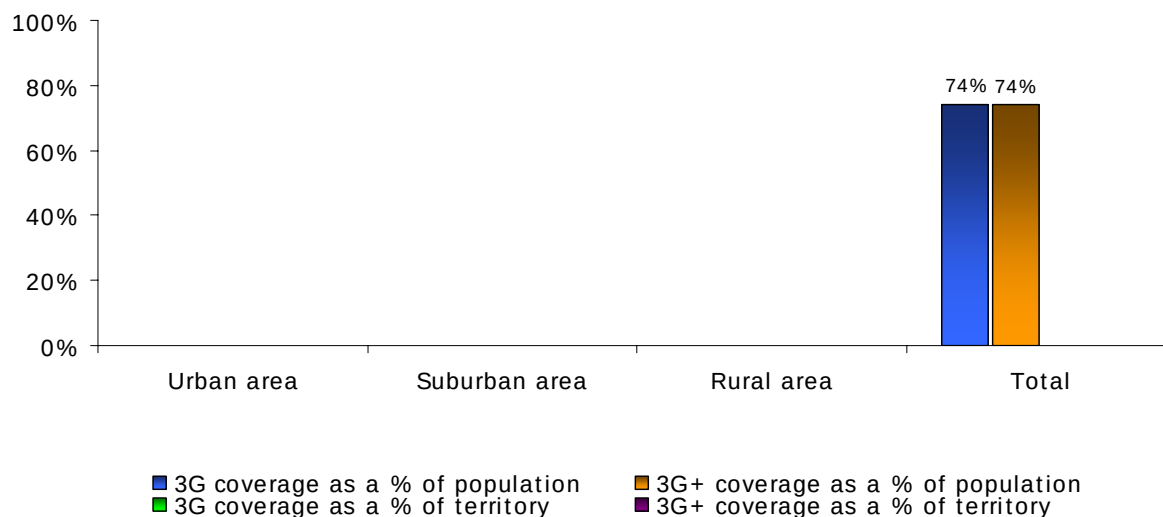
Sensolink has been focused on providing satellite Internet access to business users (with faster downlink speeds of up to 8 Mbps and uplink speeds of up to 2 Mbps).

ELSAT, on the other hand, also markets its service to residential users. At the beginning of August 2009, ELSAT had 20 subscribers – 15 business users and 5 private users (ELSAT prodajni inženiring, 2009b).



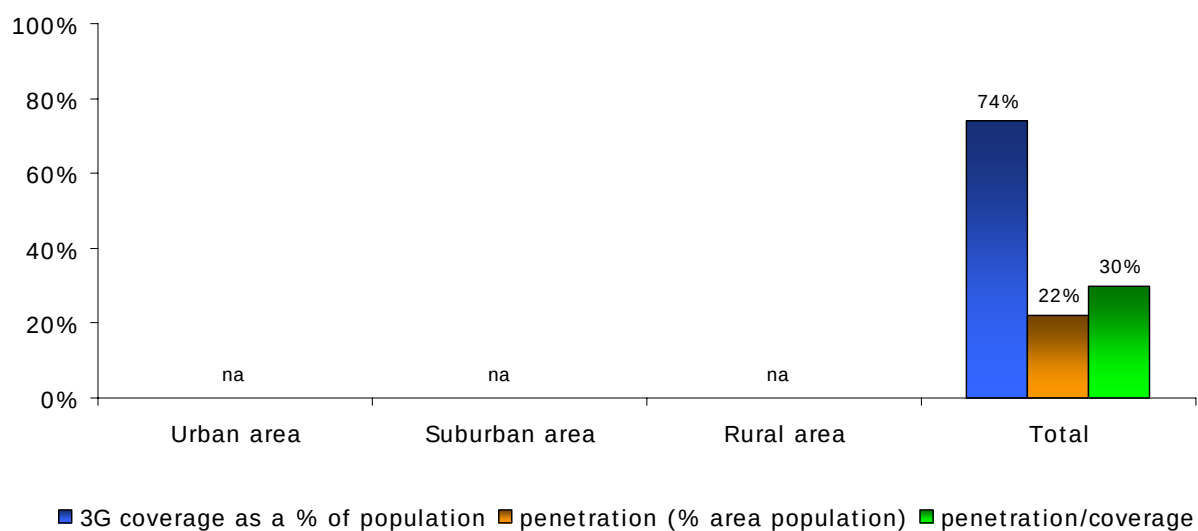
## 4.26.6. Mobile broadband coverage and take-up

### Coverage by technology



3G/3G+ coverage has reached about 74% of the Slovenian population.

### Penetration



By the end of 2008, there were 446,863 active mobile broadband (UMTS) users in Slovenia.

## 4.27. Spain

### 4.27.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 26,084,023 | 10,844,833    | 9,228,966  | 46,157,822 |
| Share of total population | 56.5%      | 23.5%         | 20.0%      | 100.0%     |

### 4.27.2. General broadband data

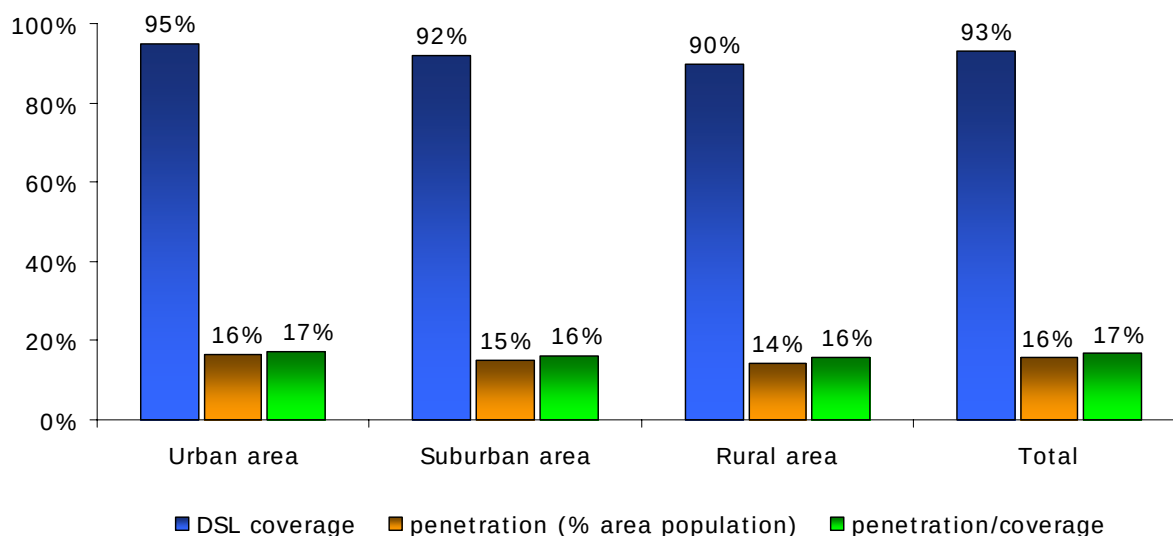
|                                                  | 12/04     | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 87%       | 89%       | 90%       | 91%       | 93%       |
| DSL subscribers                                  | 2,604,067 | 3,876,360 | 5,243,094 | 6,393,952 | 7,166,402 |
| DSL penetration (% of population)                | 6.1%      | 9.0%      | 12.0%     | 14.1%     | 15.5%     |
| Cable modem coverage (% population)              | 42%       | 42%       | 48%       | 51%       | 53%       |
| Cable modem subscribers                          | 839,635   | 1,176,064 | 1,417,340 | 1,633,489 | 1,777,691 |
| Cable modem penetration (% population)           | 2.0%      | 2.7%      | 3.2%      | 3.6%      | 3.9%      |
| FTTx subscribers                                 | 1,670     | 3,000     | 3,100     | 3,500     | 33,000    |
| PLC subscribers                                  | 2,300     | 3,650     | 2,780     | 2,200     | 1,887     |
| WLL/WiMAX subscribers                            | 9,400     | 12,500    | 30,000    | 36,600    | 80,878    |
| Satellite subscribers                            | 1,850     | 4,450     | 7,000     | 9,500     | 2,144     |
| Total                                            | 3,458,922 | 5,076,024 | 6,703,314 | 8,079,241 | 9,062,002 |
| Total fixed broadband penetration (% population) | 8.2%      | 11.8%     | 15.3%     | 17.9%     | 19.6%     |
| Mobile broadband subscribers                     |           |           |           |           | 9,945,111 |
| Mobile broadband penetration (% population)      |           |           |           |           | 21.5%     |

The total number of broadband lines continued to increase in 2008 with a growth rate of over 12% and one million new subscribers. Trends from previous years carried on through 2008, especially due to the consolidation of bundling strategies (voice, broadband and IPTV) and the aggressive marketing campaigns promoting ADSL as the predominant form of access to broadband services – although its technical limitations are causing both the incumbent and certain cable operators to step up their plans to introduce optical fibre. DSL coverage continued to increase in 2008, and DSL was by far the most widely used technology (86.3%; the remaining 13.7% are covered by cable or wireless technologies) for the PEBA Plan to make broadband access available in rural areas that were without Internet access.

Broadband cable coverage remains practically unchanged. Mobile data contracts (data cards) are increasing rapidly and the overall number of active UMTS users is quite high.

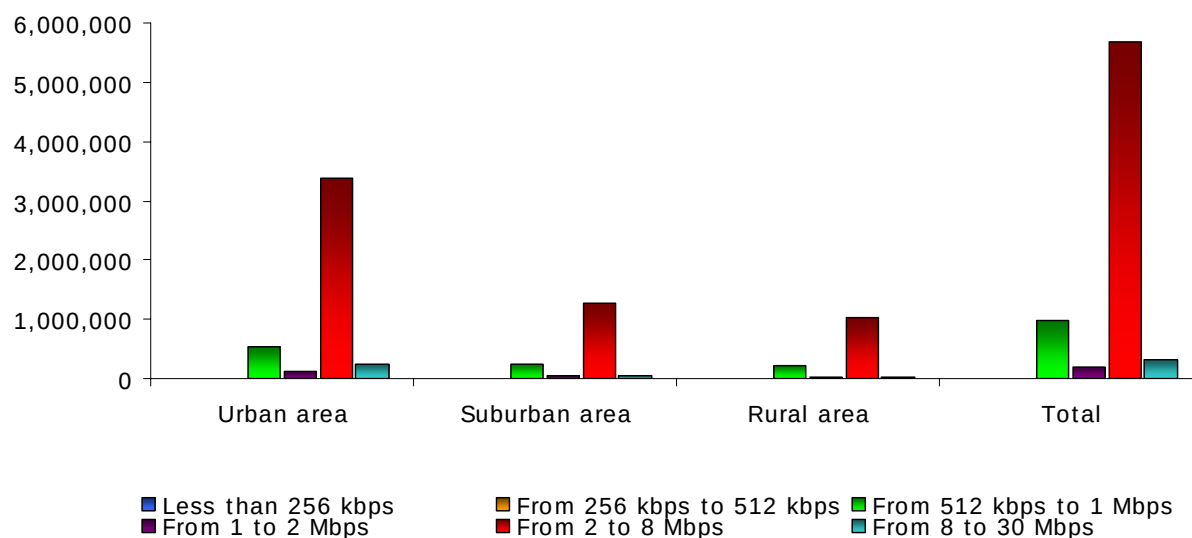
### 4.27.3. DSL coverage and take-up

#### Coverage and penetration



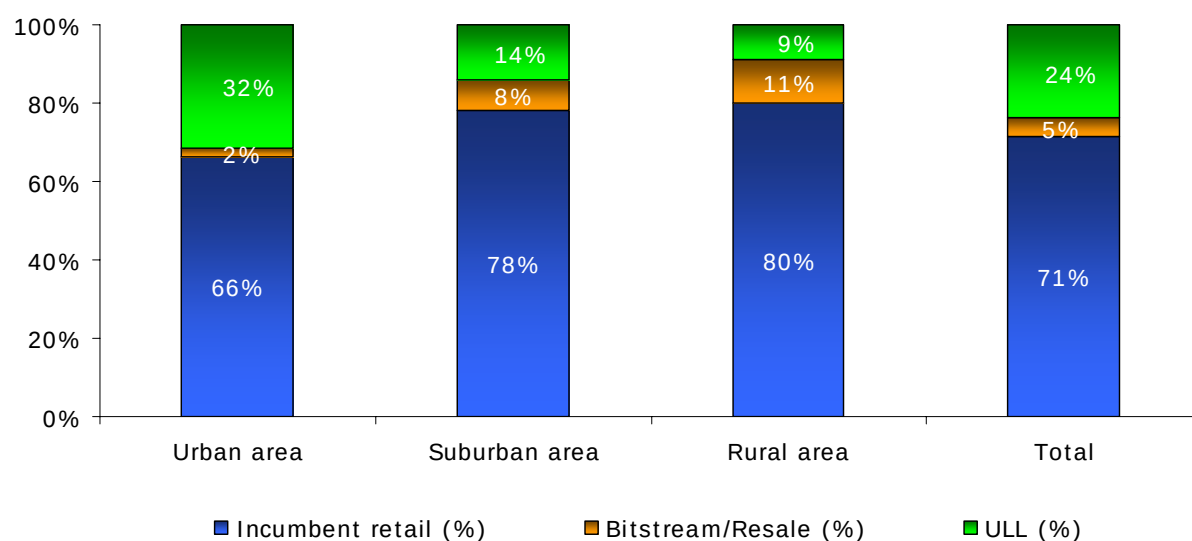
Coverage has increased from 2007, mainly due to the government's plans to promote broadband access in rural areas. These plans involve combining ADSL with other wireless technologies to make broadband access available to 5,706 municipalities, most of them over DSL. Total coverage has increased to 93%, and 95% in urban areas.

#### Number of DSL connections by download rate



Because the incumbent has such a large market share, most of the available commercial offers are limited by Telefónica de España infrastructure. Operators have chosen to offer successive bandwidth upgrades to all their customers, having gone from the initial basic offer of 3 Mbps to one running at 6 Mbps. Telefónica's commercial offers are currently limited to download rates that range from 6 Mbps to 10 Mbps, and very geared to bundling strategies.

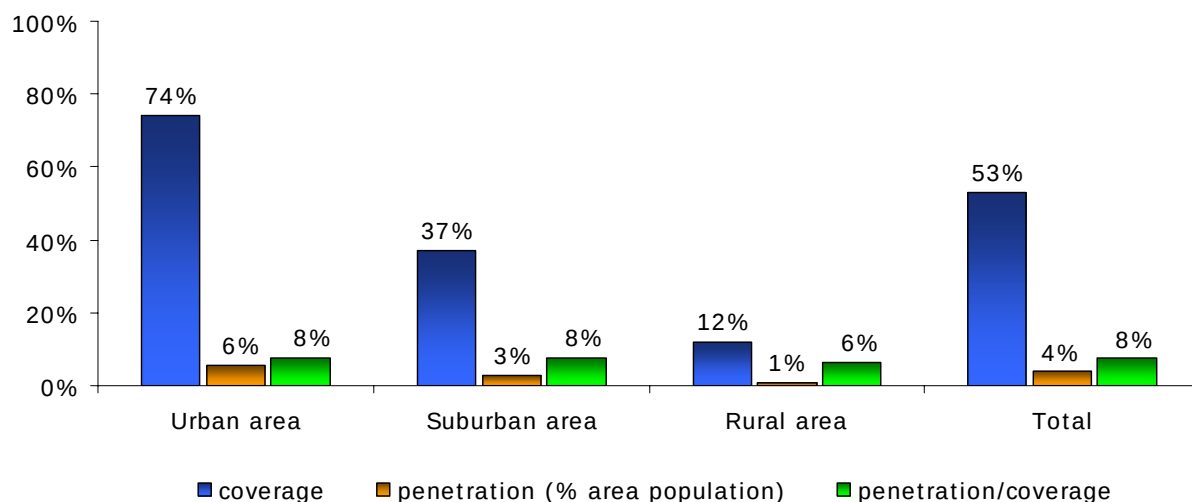
### Percentage of DSL connections by type of provider



The incumbent carrier, Telefónica de España, has not only held onto its previous market share, but even increased it slightly to 71.5% in 2008, from 71.0% the year before. One explanation for this is the fact that no new providers using alternative technologies have entered the market, although the number of unbundled loops continues to grow, thereby reducing alternative operators' dependence on Telefónica de España.

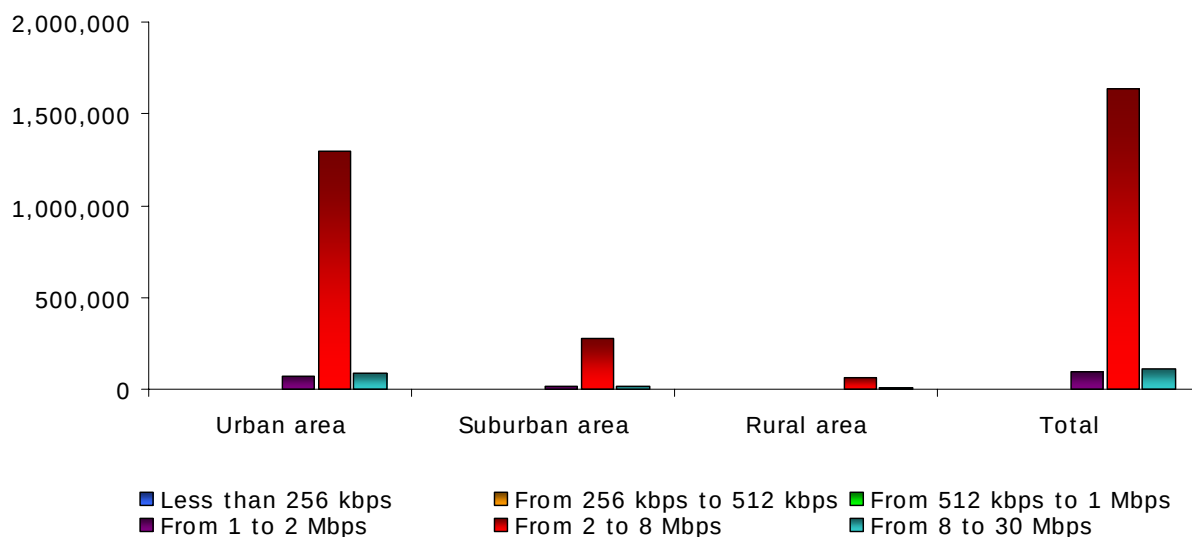
#### 4.27.4. Cable modem coverage and take-up

##### Coverage and penetration



The total number of cable connections continued to rise, at a rate of slightly more than 4%, although penetration has not increased significantly in areas with cable coverage. ONO has 74% share of the market, with the balance being in the hands of minor regional operators.

##### Number of cable modem connections by download rate



Internet services with a download rate of between 4 Mbps and 10 Mbps are the most common in the cable modem market, although operators' commercial offers are increasingly in the 10 Mbps range.

### 4.27.5. Other broadband access technologies

#### **FTTx**

There has been a substantial increase in the number of optical fibre connections deployed. Residential take-up has increased very little, with the bulk of growth confined to the business market. xDSL technologies are nevertheless reaching their limits, and FTTx access is expected to enjoy considerable growth as most operators are only just beginning to launch their commercial offers.

#### **Wi-Fi/WLL/WiMAX**

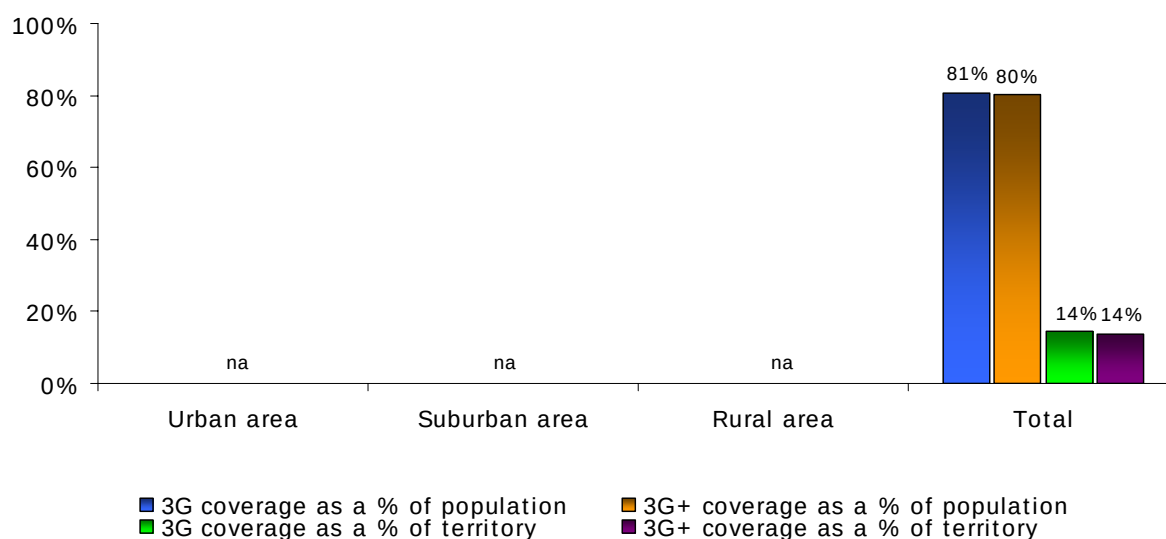
The expansion of WiMAX lines, and of all other wireless broadband technologies, is closely bound up with the implementation of the Ministry of Industry's PEBA plan (programme to promote increased bandwidth in rural areas and areas that are hard to reach with other network technologies). WiMAX covers 5.1% of the population in rural areas thanks to the PEBA plan.

#### **Satellite**

Satellite access is also increasing thanks to the PEBA plan, which is examining the possible use of satellite access to serve the most complex and isolated areas. Satellite is basically used to make broadband available to 8.4% of the population in rural areas thanks to the PEBA plan.

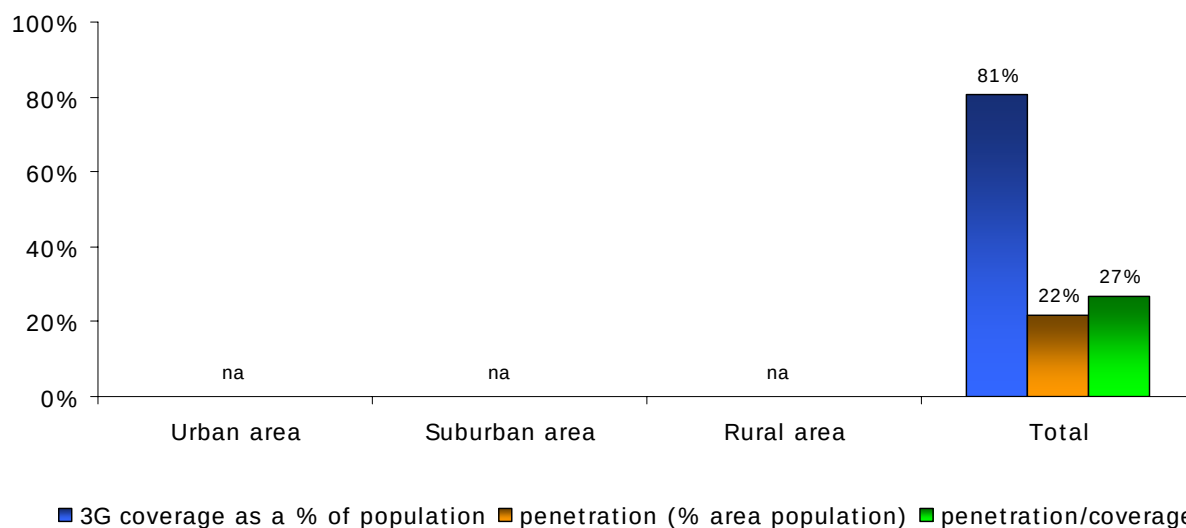
## 4.27.6. Mobile broadband coverage and take-up

### Coverage by technology



3G coverage reached over 14% of the territory (and very close to that for 3G+). The areas covered contain the vast majority of the population.

### Penetration



Penetration levels are still low, but data card sales are increasing rapidly and operators are investing a great deal in marketing. Additionally, the data contracts associated with the latest generation of smartphones are bound to generate a great deal of mobile broadband traffic in the near future. At the end of 2008, there were 1.125 million users of 3G datacards/modems/dongles and we estimate there were close to 10 million 3G active users, including those using mobile handsets.

## 4.28.Sweden

### 4.28.1. Population

|                           | Urban area | Suburban area | Rural area | National  |
|---------------------------|------------|---------------|------------|-----------|
| Inhabitants               | 4,149,649  | 3,960,178     | 1,146,480  | 9,256,347 |
| Share of total population | 44.8%      | 42.8%         | 12.4%      | 100.0%    |

### 4.28.2. General broadband data

|                                                  | 12/04     | 12/05     | 12/06     | 12/07     | 12/08     |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| DSL coverage (% of population)                   | 91%       | 93%       | 95%       | 98%       | 98%       |
| DSL subscribers                                  | 845,939   | 1,207,146 | 1,531,277 | 1,764,000 | 1,769,000 |
| DSL penetration (% of population)                | 9.3%      | 13.2%     | 16.8%     | 19.2%     | 19.1%     |
| Cable modem coverage (% population)              | 35%       | 36%       | 37%       | 37%       | 37%       |
| Cable modem subscribers                          | 243,438   | 354,699   | 454,291   | 550,000   | 563,000   |
| Cable modem penetration (% population)           | 2.7%      | 3.9%      | 5.0%      | 6.0%      | 6.1%      |
| FTTx subscribers                                 | 241,089   | 289,199   | 356,558   | 400,000   | 590,000   |
| PLC subscribers                                  | 100       | 100       | 0         | 0         | 0         |
| WLL subscribers                                  | 3,400     | 3,400     | 6,578     | 6,578     | -         |
| Satellite subscribers                            | 775       | 1,039     | 704       | 704       | 2,200     |
| Total                                            | 1,334,741 | 1,855,583 | 2,349,408 | 2,721,282 | 2,924,200 |
| Total fixed broadband penetration (% population) | 14.6%     | 20.4%     | 25.8%     | 29.6%     | 31.6%     |
| Mobile broadband subscribers                     |           |           |           |           | 877,000   |
| Mobile broadband penetration (% population)      |           |           |           |           | 9.5%      |

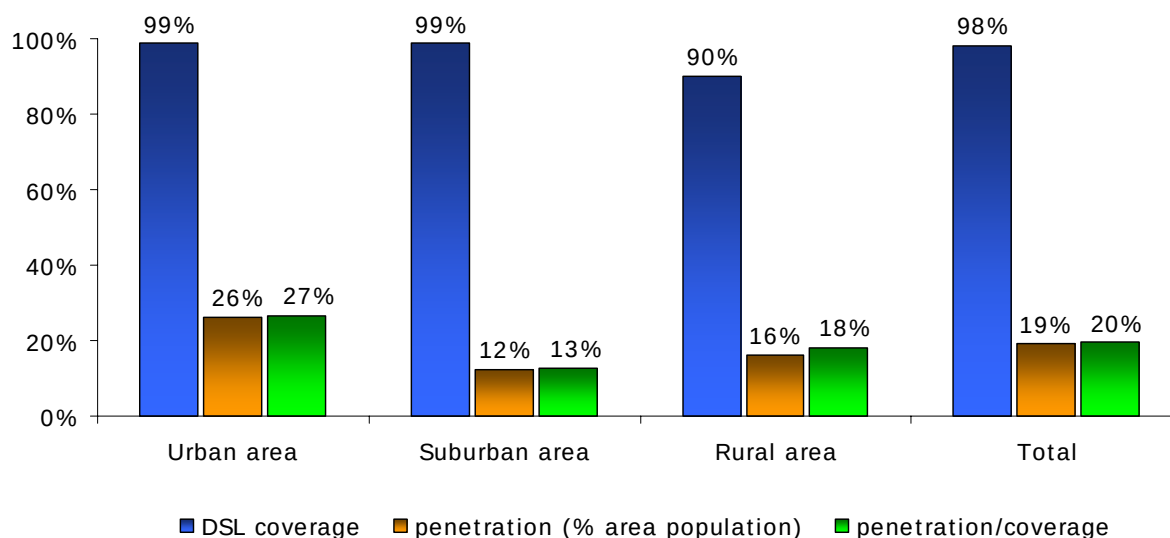
Sweden's broadband penetration rate was 31.6% at the end of 2007, placing Sweden among the highest in Europe, but behind its Scandinavian neighbours, Norway and Denmark.

DSL continues to be the dominant technology, but growth in both coverage and subscriber numbers has now flattened. FTTH saw strong growth in 2008 and has now eclipsed cable as the second most popular technology.



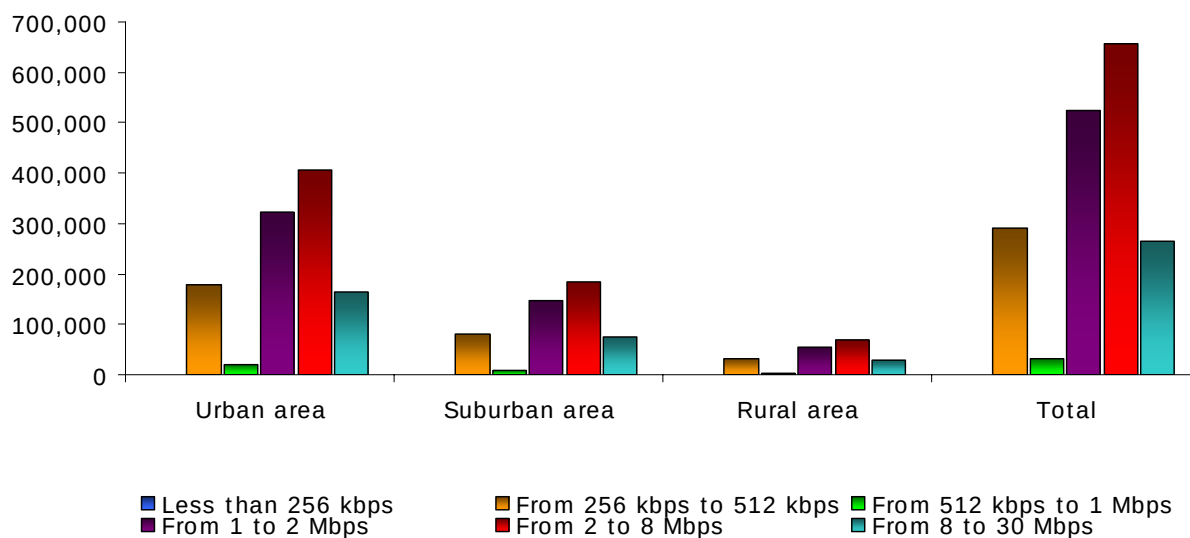
### 4.28.3. DSL coverage and take-up

#### Coverage and penetration



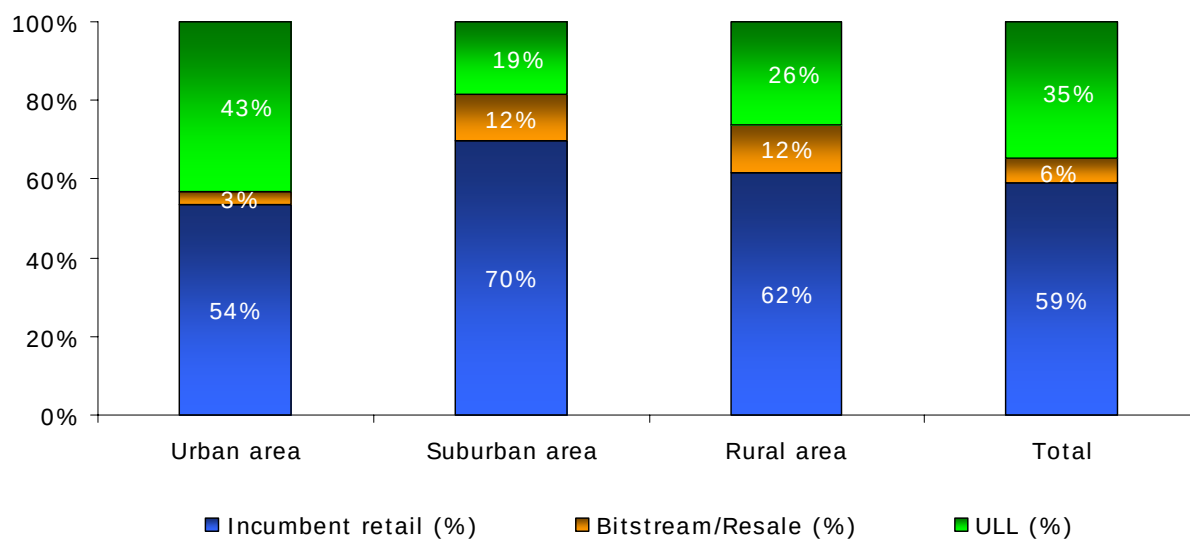
DSL continues to lead the way in Sweden's broadband market, in terms of both coverage (98%) and penetration (19%, or 60% of all broadband subscriptions). Both coverage and absolute numbers of subscribers has remained relatively unchanged since 2007, however.

#### Number of DSL connections by download rate



A relatively large number of DSL subscriptions (16.4%) still have rates below 512 kbps, but more than half of all subscriptions (52%) are above 2 Mbps.

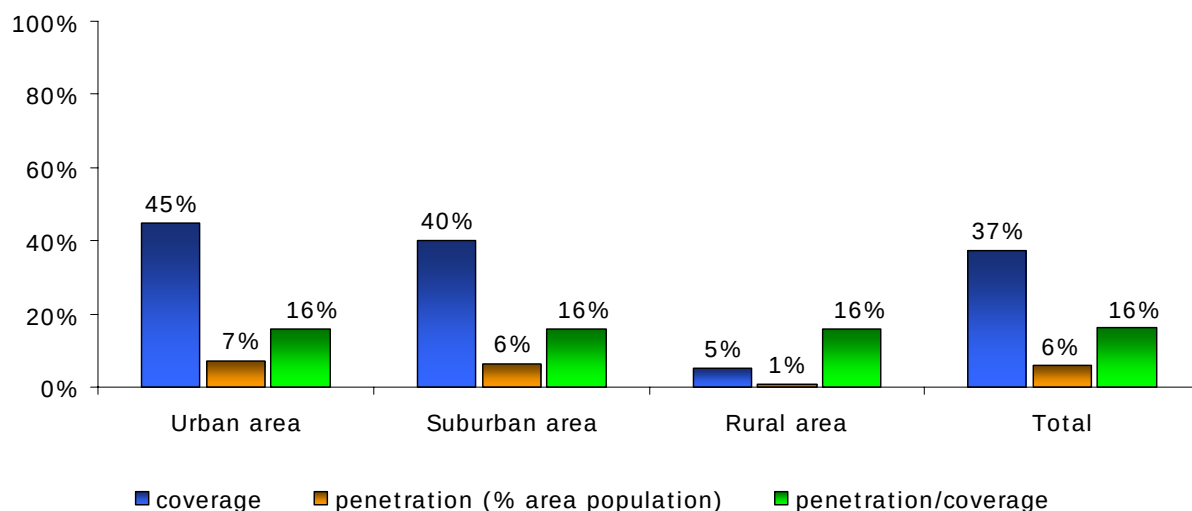
### Percentage of DSL connections by type of provider



Local loop unbundling has traditionally been used to provide competitive DSL services. At the national level, LLU's market share grew from 30.5% in 2005 to 34.5% in 2007. At the end of 2008, its relative share was still 34.5%. The incumbent's share grew from 57.3% in 2007 to 59% in 2008.

#### 4.28.4. Cable modem coverage and take-up

##### Coverage and penetration

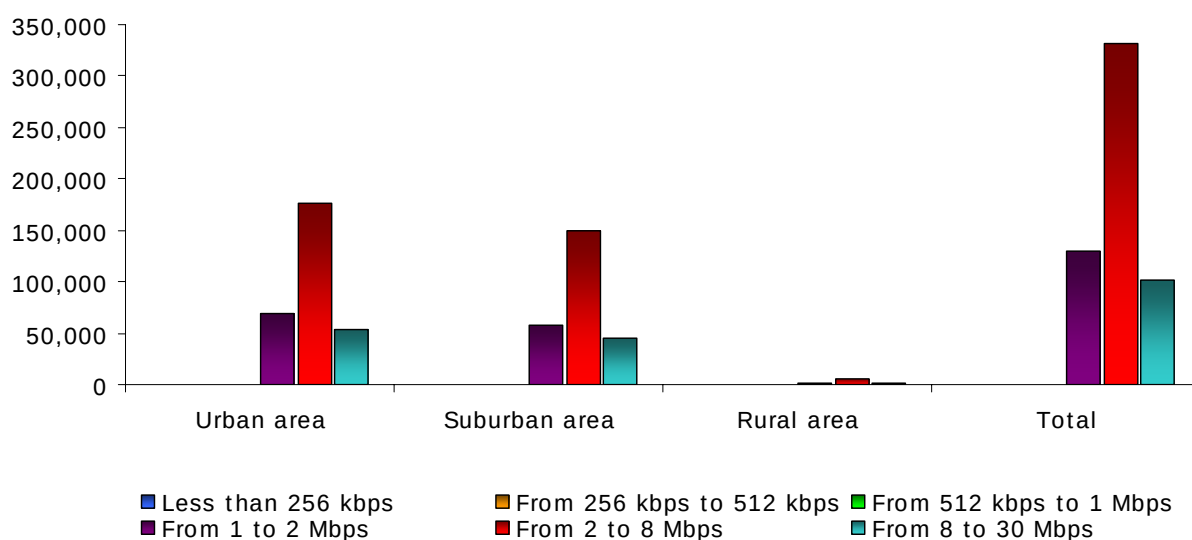


Cable operators were comparatively late in upgrading their infrastructure for broadband Internet. In a new comprehensive study released in February 2009, the Swedish regulator revised its previous estimates for cable coverage to 37% (down from 48% in 2007).

Cable is a predominantly urban phenomenon. Only two out of 290 municipalities offer cable to more than 80% of its population. More than half of the municipalities have no cable whatsoever.

Cable modem penetration reported low growth in 2008 and was overtaken by FTTH as the second most popular broadband technology.

##### Number of cable modem connections by download rate



By the end of 2008, about 75% of all the broadband cable subscribers had speeds above 2 Mbps.

### 4.28.5. Other broadband access technologies

#### FTTx

FTTx continues to play a major role in the Swedish broadband market. It is deployed primarily by Bredbandsbolaget. Also referred to as fibre LAN or Ethernet LAN, it targets chiefly large apartment buildings or multi-dwelling units.

Broadband Internet access via fibre offers download rates of well over 2 Mbps, and Bredbandsbolaget is continuously upgrading existing customers to 100 Mbps.

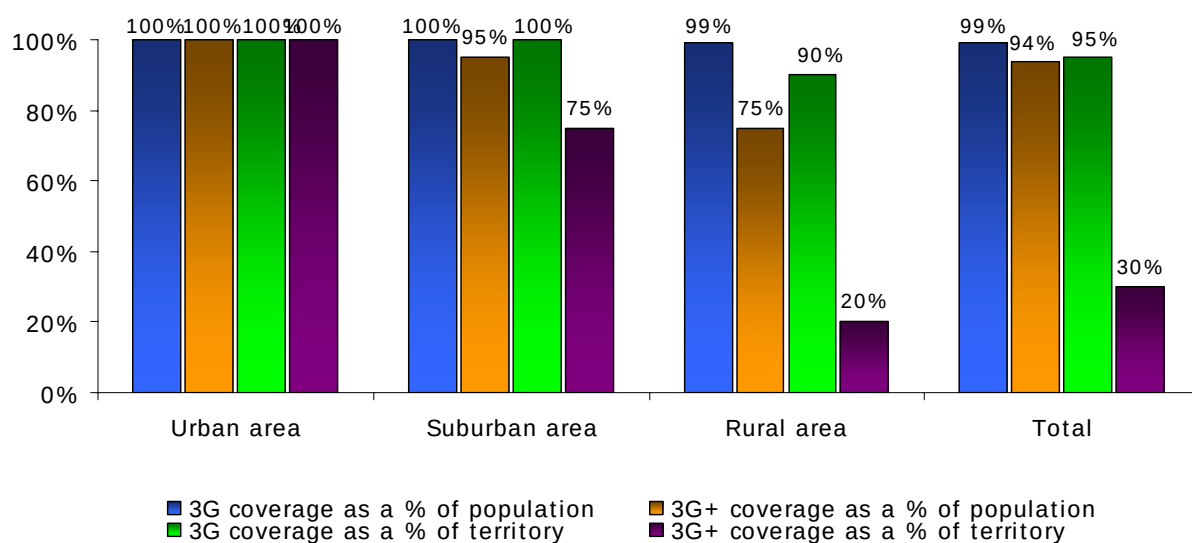
In 2004, FTTx had almost as many subscribers as cable, then the gap widened and the technology experienced lower relative growth than both DSL and cable in both 2006 and 2007. FTTx grew strongly in 2008, however, and eclipsed cable as the second most popular broadband technology.

#### Wi-Fi

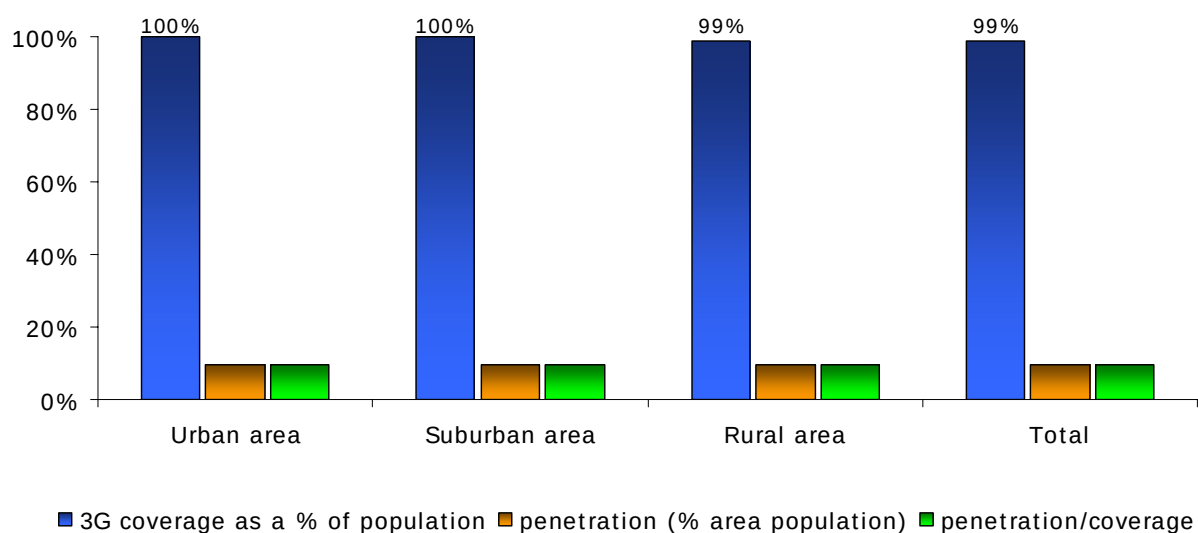
There are no official numbers on the number of hotspots.

## 4.28.6. Mobile broadband coverage and take-up

### Coverage by technology



### Penetration



## 4.29. The United Kingdom

### 4.29.1. Population

|                           | Urban area | Suburban area | Rural area | National   |
|---------------------------|------------|---------------|------------|------------|
| Inhabitants               | 37,391,083 | 17,293,022    | 6,290,895  | 60,507,725 |
| Share of total population | 61.3%      | 28.4%         | 10.3%      | 100.0%     |

### 4.29.2. General broadband data

|                                                  | 12/04     | 12/05     | 12/06      | 12/07      | 12/08      |
|--------------------------------------------------|-----------|-----------|------------|------------|------------|
| DSL coverage (% of population)                   | 95%       | 99%       | 99%        | 100%       | 100%       |
| DSL subscribers                                  | 4,263,969 | 7,194,913 | 9,974,000  | 12,186,000 | 13,593,000 |
| DSL penetration (% of population)                | 7.2%      | 12.1%     | 16.6%      | 20.1%      | 22.3%      |
| Cable modem coverage (% population)              | 48%       | 48%       | 48%        | 48%        | 48%        |
| Cable modem subscribers                          | 1,937,320 | 2,663,388 | 3,058,500  | 3,413,400  | 3,683,000  |
| Cable modem penetration (% population)           | 3.3%      | 4.5%      | 5.1%       | 5.6%       | 6.0%       |
| FTTx subscribers                                 | 0         | 0         | 0          | 1,500      | 3,150      |
| PLC subscribers                                  | -         | -         | -          | -          | -          |
| WLL subscribers                                  | 2,500     | 2,500     | 2,500      | 2,500      | 2,500      |
| Satellite subscribers                            | 6,000     | 6,000     | 6,000      | 6,000      | 6,000      |
| Total                                            | 6,201,289 | 9,866,801 | 13,041,000 | 15,609,400 | 17,287,650 |
| Total fixed broadband penetration (% population) | 10.5%     | 16.7%     | 21.7%      | 25.8%      | 28.4%      |
| Mobile broadband subscribers                     |           |           |            |            | 8,100,000  |
| Mobile broadband penetration (% population)      |           |           |            |            | 13.3%      |

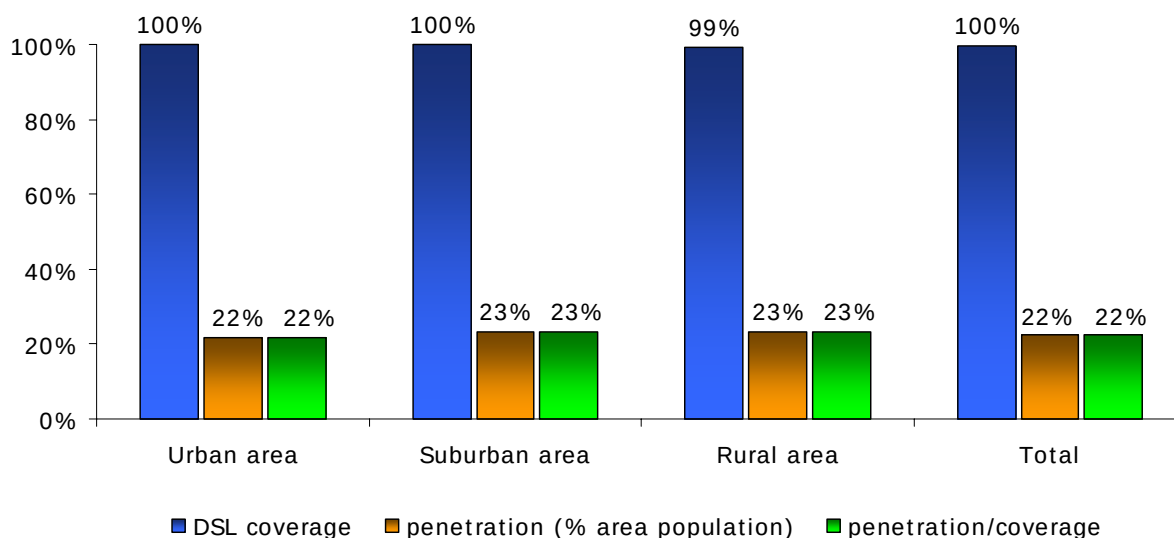
Broadband penetration has increased, with 28% of population, or over 60% of households, subscribing to a broadband service.

Most of the increase in coverage has benefited rural areas, with only a tiny portion of the population still not covered.

BT has maintained its dominance of the broadband retail market, although TalkTalk Carphone Warehouse's acquisition of Tiscali, completed in 2009, has narrowed the gap, with Carphone Warehouse enjoying a 24.7% share of the market, compared to 25.9% for BT .

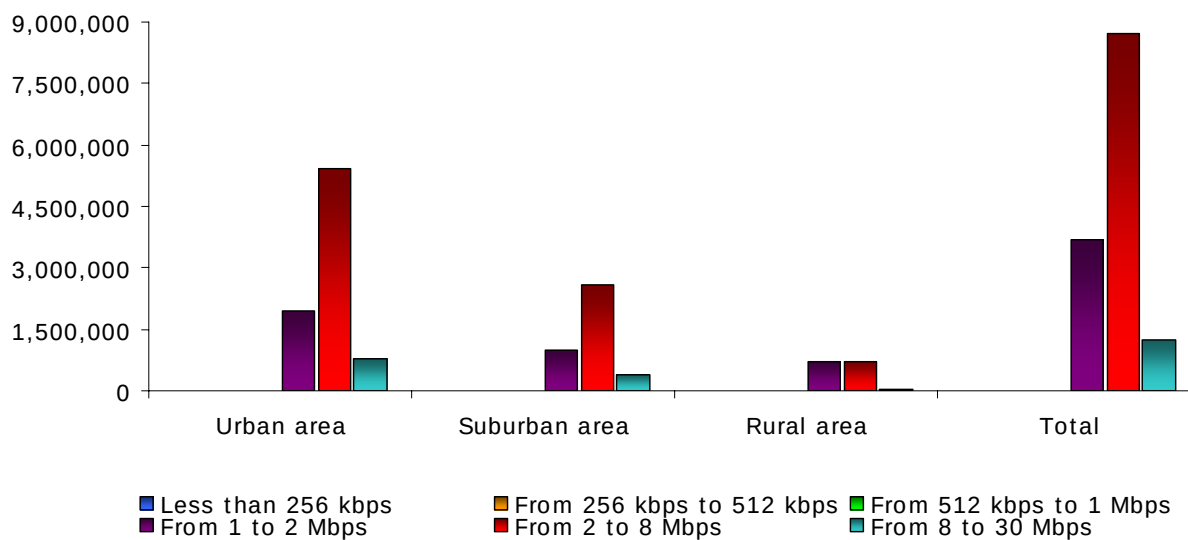
### 4.29.3. DSL coverage and take-up

#### Coverage and penetration



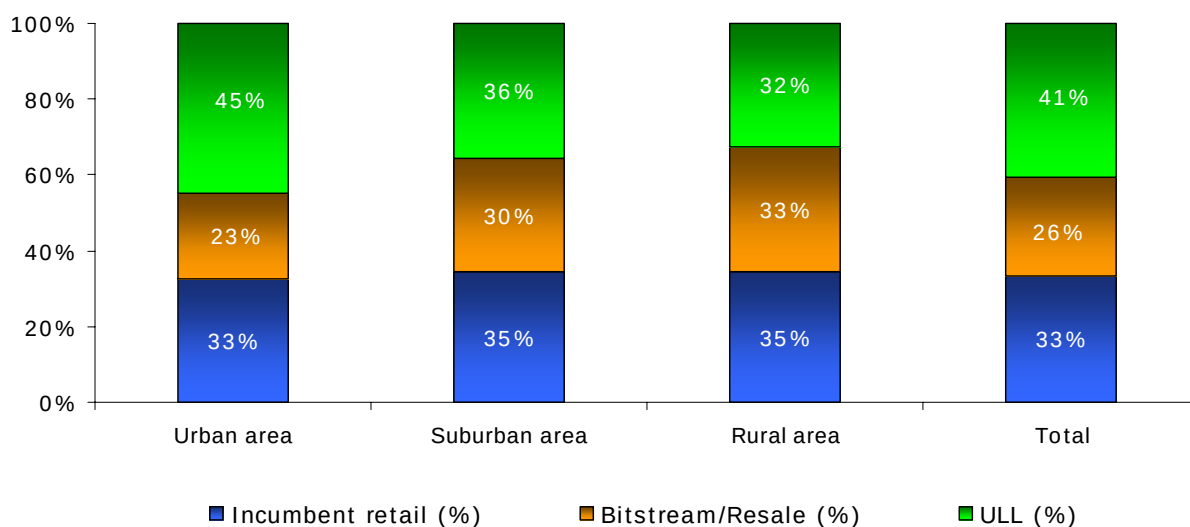
Rural area coverage has increased slightly, and is now close to 100%. DSL penetration in urban, suburban and rural areas in the UK is now comparable, the only difference between them being the actual (as opposed to the advertised) bandwidth available in rural areas, which is lower than in urban or suburban areas. DSL penetration has increased from 20.1% in 2007 to 22.3% in 2008.

#### Number of DSL connections by download rate



BT, along with other providers, has increased its customers' bandwidth, and services running at 2 to 8 Mbps became the benchmark in 2008, with over 64% of connections now in that range. Access speed is used as a point of differentiation between providers, along with the actual quality of the connection and price, but is no longer used as a form of product segmentation by BT whose solutions all deliver similar bandwidth.

## Percentage of DSL connections by type of provider



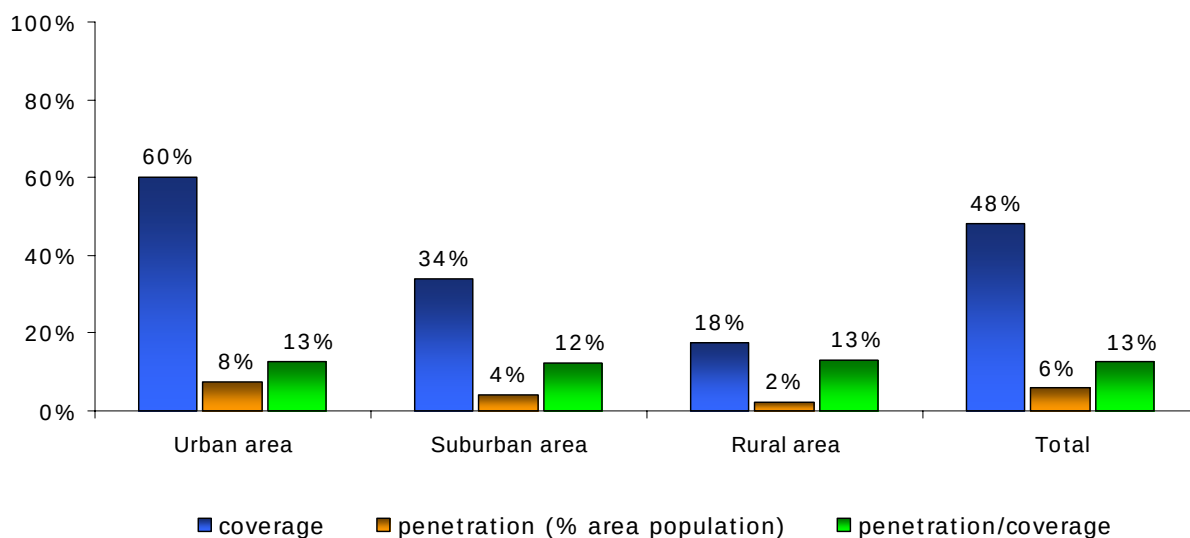
The steadily rise of Local Loop Unbundling (LLU), which was already noticeable last year, continued on through 2008, with the number of unbundled central offices increasing from 30% to 41% and, according to Ofcom, 84% of households connected to an unbundled local exchange. The wave of consolidations between ISPs, which began in 2007, also continued on through 2008. The LLU cost structure has spurred player consolidation, in a bid to achieve critical mass at the exchange level and to generate economies of scale. Competition in the marketplace has driven down broadband access prices and ushered in innovative pricing schemes, including free or discounted voice services bundled with a broadband connection.

The rise of LLU has not penalised the incumbent's market share, which held steady at around 26.3%.



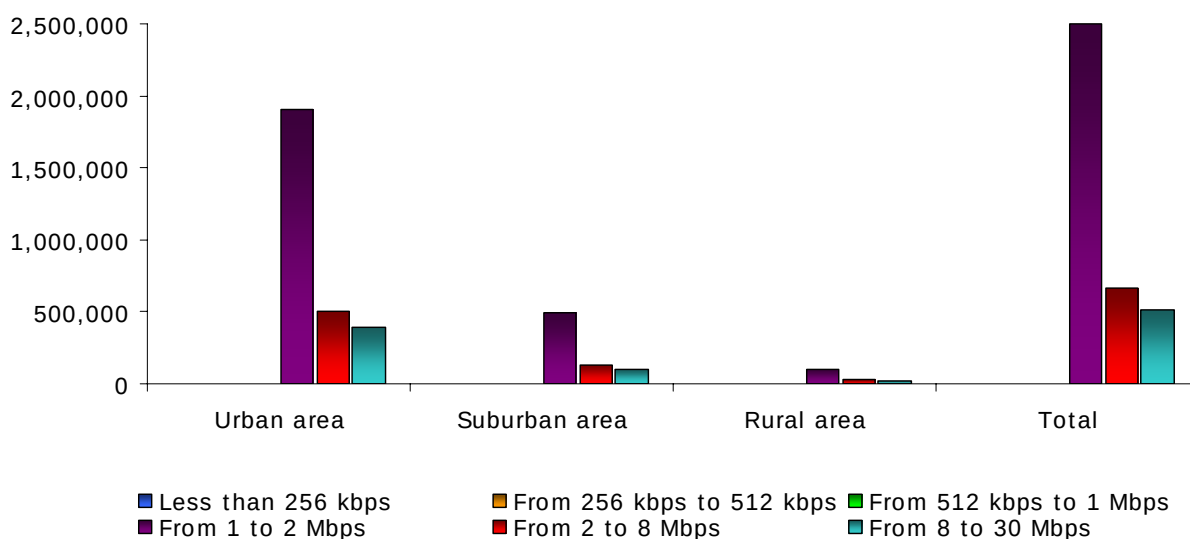
#### 4.29.4. Cable modem coverage and take-up

##### Coverage and penetration



Cable modem coverage remained stable and no significant investment has been made in increasing coverage. Cablecos' focus has been more on upgrading the existing infrastructure than on expanding coverage.

##### Number of cable modem connections by download rate



Virgin Media has continued to promote its ultra-fast broadband service, touting the benefits of optical fibre incorporated into the infrastructure between the exchange and the street cabinet as a major selling point. The access speed being promoted at the end of the year was a service running at 50 Mbps, upgraded from an earlier campaign promoting 20 Mbps access. Bandwidth and speed are now the central selling points in Virgin Media's marketing campaigns, moving away from its previous strategy of comparing its media content with the selection offered by Sky. However, historical subscriber base is migrating only slowly towards these higher speeds.

## 4.29.5. Other broadband access technologies

### FTTx

Although there have been several announcements related to optical fibre, and the issue of investment in NGAs has been well covered in government reports and much talked about within industry bodies, FTTx rollouts and take-up was limited in 2008. Several players, including the incumbent, planned to deploy FTTC (or, more rarely, FTTH) in 2009, with BT committing to a substantial investment. H2O networks, an alternative fibre operator, is also present although it targets business customers. The economic downturn has most likely had an adverse effect on initial investment plans.

### Wi-Fi

Wi-Fi hotspots are widely available across the country and many retailers in the hospitality sector provide a connection service, either for free, on a pay-as-you-go basis or even via subscription. Most provide the service through an established operator such as BT Openzone, the Cloud or a mobile operator (T-Mobile). One example is fast food chain, Prêt-à-manger, which launched a free service in 130 of its outlets in London via the Cloud in December 2008. The total number of hotspots is not well documented but there are in excess of 11,000 in the UK. The highest regional density is found in Wales, with 168 hotspots per 1 million residents.

### WLL/WiMAX

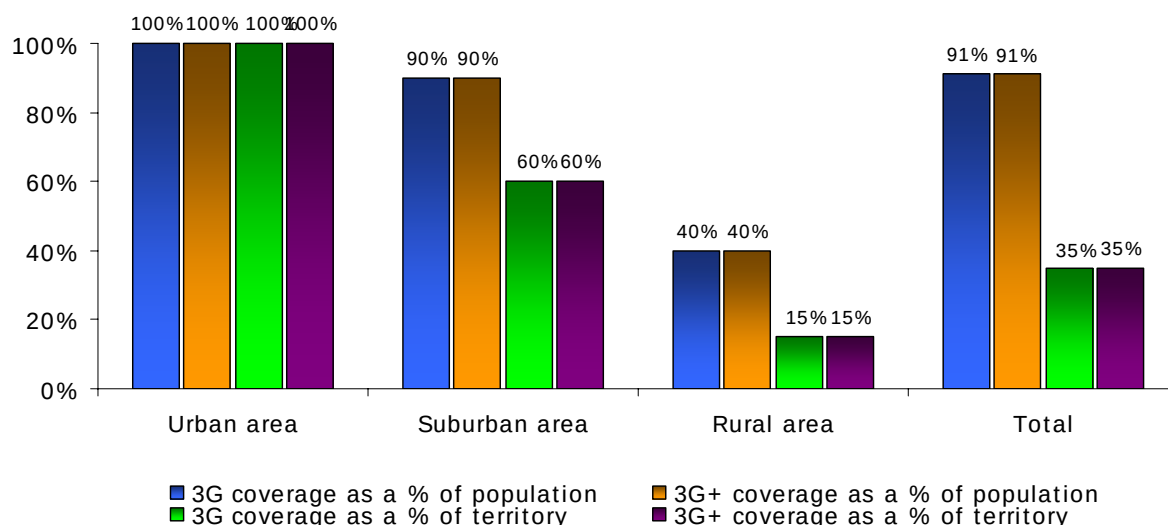
WiMAX has been widely deployed in the UK. The lack of traction for WiMAX technology is probably due to the spread of 3G, and available offerings target primarily businesses and SMEs.

### Satellite

Satellite broadband usage is confined to very remote areas where ADSL is not readily available. Prices tend to be slightly higher than for other fixed access technologies, while supplying less bandwidth, although subscribers do suffer less from network congestion. The adoption of broadband via satellite nevertheless remains marginal.

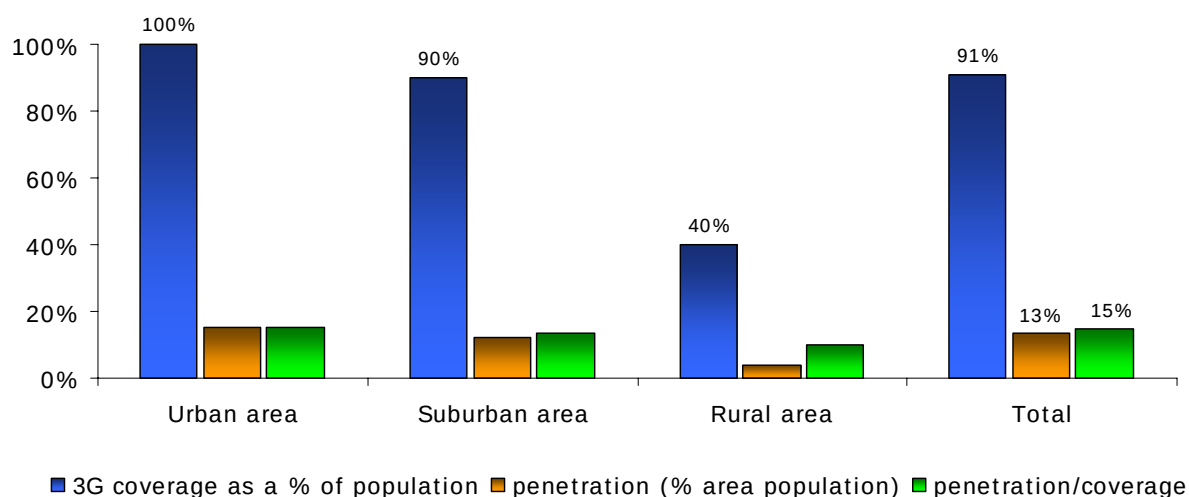
## 4.29.6. Mobile broadband coverage and take-up

### Coverage by technology



3G coverage in the United Kingdom reaches 91% of the population. This is according to operator 3, which is part of the Hutchinson Whampoa group. There is fierce competition between operators on this score, with all claiming to have excellent coverage. Operators offer the ability to assess their coverage at the local level, but will not provide national coverage figures.

### Penetration



Mobile broadband can now be considered a viable alternative to fixed line broadband, delivering similar bandwidth performance. Ofcom research indicates that there were 8.1 million mobile internet users at the end of 2008 while nearly 3 million households had a mobile broadband dedicated connection. The offering remained restricted to post-paid solutions but more innovative pricing schemes were being introduced late in the year, including a prepaid service with different data download packages. Overall, pricing is fairly close to fixed line services, albeit with caps on the amount of data that can be downloaded. Mobile broadband is being viewed more and more as an alternative or a complement to fixed line access.

## 5. Glossary

|        |                                                 |
|--------|-------------------------------------------------|
| 3G     | 3 <sup>rd</sup> (cellular) Generation           |
| (A)DSL | (Asymmetrical) Digital Subscriber Line          |
| BWA    | Broadband Wireless Access                       |
| DSLAM  | Digital Subscriber Line Access Multiplexer      |
| FTTx   | Fiber To The x                                  |
| FTTB   | Fiber To The Building                           |
| FTTC   | Fiber To The Curb                               |
| FTTH   | Fiber To The Home                               |
| FTTN   | Fiber To The Node                               |
| FTTP   | Fiber To The Premise                            |
| GPON   | Gigabit Passive Optical Network                 |
| HSPA   | High Speed Packet Access                        |
| HSDPA  | High Speed Downlink Packet Access               |
| HSUPA  | High Speed Uplink Packet Access                 |
| ISP    | Internet Service Provider                       |
| LAN    | Local Area Network                              |
| LLU    | Local Loop Unbundling                           |
| PC     | Personal Computer                               |
| PLC    | PowerLine Communication                         |
| POTS   | Plain Old Telephone Service                     |
| PSTN   | Public Switched Telephone Network               |
| RLAN   | Radio Local Area Network                        |
| SIM    | Subscriber Identity Module                      |
| UMTS   | Universal Mobile Telecommunication System       |
| VDSL   | Very High speed Digital Subscriber Line         |
| WiFi   | (the standard for) Wireless Fidelity            |
| WiMAX  | Worldwide interoperability for Microwave Access |
| WLAN   | Wireless Local Area Network                     |
| WLL    | Wireless Local Loop                             |