

**BEREC summary report on the outcome of a
BEREC internal workshop on the migration to
very high capacity networks and copper
switch-off with a focus on the needs of the
end-users**



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Executive Summary

Electronic communications network operators are rolling out fibre closer to the end-users and the importance of the copper-based access network is declining. Therefore, NRAs are increasingly confronted with the situation where the SMP operator wants to decommission its legacy copper-based access network and close e.g. main distribution frames (MDFs). The NRAs have to apply the provisions of Article 81 of the European Electronic Communications Code (EECC)¹, taking into utmost account the new European Commission Gigabit Connectivity Recommendation.

BEREC already held an internal workshop on 'Migration from legacy infrastructures to fibre-based networks' in 2019 and published a report on a consistent approach to migration and copper switch-off in 2022 as well as an opinion on the draft European Commission Gigabit Connectivity Recommendation including a section on the topic 'migration and copper switch-off' in 2023. Migration to very high capacity networks and copper switch-off is an important ongoing process, in particular also for end-users, and therefore, BEREC examined this topic further and held an internal workshop on 7 September 2023 in Brussels consisting of three parts.

Part 1 – Migration to very high capacity networks and copper switch-off with a focus on the needs of the end-users

During the first part of the workshop, Sweden, Norway, Spain, Slovenia and Luxembourg presented their market situation as well as the state of play regarding copper switch-off. Sweden, Norway and Spain are among the very few examples of European countries where the copper switch-off process is already very advanced, while in Slovenia and Luxembourg this process is still in an early stage. In these countries, the SMP operator has already closed MDFs as follows: In Sweden about 80%, in Norway about 40 % and in Spain about 30%. On the other hand, in Slovenia the rate of closed MDFs is at about 3% and in Luxembourg no MDFs have yet been closed, but e.g. street cabinets. The experiences show that many aspects have to be considered in order to ensure a smooth migration. However most relevant for end-users are (i) sufficient, reliable and timely information; (ii) the availability of an appropriate alternative end-user service in time, and (iii) whether they will be forcibly switched-off, if they do not migrate voluntarily before the switch-off date.

The presentations showed that NRAs provide information and guidance on their websites for the end-users. For example, in Spain this includes the publication of the list of MDFs with a committed switch-off date, news about the state of the copper switch-off process, a copper switch-off summary report and includes also answering questions from end-users. Another example is Luxembourg, where the NRA's campaign to inform end-users about the migration

¹ Directive 2018/1972/EC, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972>



and the copper switch-off includes an interactive web tool, providing inter alia address specific information on the switch-off timeline.

The presentations also showed that the availability of an appropriate alternative end-user service is particularly challenging in case of remote end-users in rural areas where fibre-based end-user services are not available and in countries or regions where due to topographical reasons for such locations even wireless coverage is difficult. Measures taken by the NRA to resolve such issues include, for example, in Norway, verification of mobile coverage, dialogue with end-users, in some cases postponement of disconnection and dialogue with organisations regarding electromagnetic hypersensitivity. In Sweden, the NRA helps households in white spots by examining whether access to networks is available and if necessary, procuring and funding a solution. In areas where alternative end-user services based on fibre are available, measures to ensure a short service interruption during migration include, for example, in Slovenia, that the SMP operator normally does not switch off a copper access line until a fibre connection is set up and the end-user service is only interrupted while the technician is at the customer premises.

The importance of forced migration differs in the presented countries. While Norway excludes the possibility of forced migration, the other case studies foresaw for forced migration to play a role. If a forced migration is allowed, it is important that (nearly) all end-users migrate to an alternative service before the switch-off date.

The presentations also showed that the NRAs of the countries where the switch-off process is already well advanced (Sweden, Norway, Spain) observe or monitor the migration process which allows to detect and respond to end-user issues already at an early stage.

Part 2 – Update on the rules set by the NRAs for the migration process and copper switch-off

The NRAs of Italy and Greece gave an update on the rules they have set for the migration process and copper switch-off since the publication of the above-mentioned BEREC Report in June 2022, including their rules regarding timing during the decommission process. In the presentation of the Italian NRA, the substitution matrix already implemented in Italy was of particular interest, as NRAs should establish a substitution matrix according to the new European Commission Gigabit Connectivity Recommendation (point 77).^{Error! Bookmark not defined.}

Part 3 – Increase of wholesale copper access prices during transition period

The European Commission gave an overview on the migration section of the forthcoming European Commission Gigabit Connectivity Recommendation with a focus on the measure 'Increase of wholesale copper access prices during transition period', which is foreseen in this recommendation as an option. The presentations of NRAs of Belgium and France followed. The Belgian NRA presented its view on this measure based on theoretical considerations and based on country specific circumstances. In its view for the Belgian situation, the possible negative side-effects outweigh any potential positive effects and, therefore, it sees no reason



to implement this measure in Belgium. The French NRA on the other hand already issued a public consultation on a new market 1 analysis decision which proposes to lift the wholesale pricing obligation on copper at a late phase of the migration and switch-off process, namely 6 months after commercial closure and where the final switch-off date is scheduled within 2 years. It results from the geographic modulation of the pricing remedy, which aims at taking into account the expected evolution in competitive situation over the period (2024-2028) of the new market 1 analysis decision.



1 Introduction

The requirements concerning the capabilities of electronic communications networks are constantly increasing and the response to that demand is to bring optical fibre closer to the end-user. Therefore, the importance of the copper-based access network is declining and NRAs are increasingly confronted with the situation where the SMP operator wants to decommission its legacy copper-based access network and close related network elements e.g. main distribution frames (MDFs).

The European Electronic Communications Code (EECC)¹ and the forthcoming European Commission Gigabit Connectivity Recommendation lay down rules and recommendations for the migration from legacy infrastructure and the decommissioning of the copper-based access networks. According to Article 81 of the EECC, SMP operators shall notify the NRA in advance and in a timely manner when they plan to decommission or replace parts of the network with a new infrastructure, including legacy infrastructure necessary to operate a network. The NRA has to ensure that the decommissioning process includes a transparent timetable and conditions, including an appropriate notice period for transition, and the NRA also has to establish the availability of alternative products of at least comparable quality if necessary to safeguard competition and the rights of end-users.

In 2019, BEREC had already held an internal workshop on 'Migration from legacy infrastructures to fibre-based networks', where NRAs could share their experiences on the migration process.² In June 2022, BEREC published a report on a consistent approach to migration and copper switch-off. This report shows that in 20 of the 32 European countries examined, the SMP operator has already announced that it plans to switch-off its legacy copper-based access network (e.g. close MDFs), in 13 countries the SMP operator has already closed copper-based network elements (e.g. MDFs), and in 17 countries the NRA has already set rules for the migration process and copper switch-off.³

The migration to fibre-based networks, e.g. very high capacity networks (VHCNs), and copper switch-off are important ongoing processes, in particular also for end-users. Therefore, BEREC examined this topic further and held an internal workshop on 7 September 2023 in Brussels consisting of the following three parts:

- Part 1: Country case presentations from Sweden, Norway, Spain, Slovenia and Luxembourg on the topic 'Migration to VHCNs and copper switch-off with a focus on the needs of the end-users';

² For a summary of the workshop, see BoR (19) 236, <https://www.berec.europa.eu/en/document-categories/berec/reports/berec-summary-report-on-the-outcomes-of-the-internal-workshop-on-the-migration-from-legacy-infrastructures-to-fibre-based-networks>

³ See BoR (22) 69, p. 3 <https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-a-consistent-approach-to-migration-and-copper-switch-off>



- Part 2: Presentations from the NRAs of Italy and Greece on the update of the rules set by them for the migration process and copper switch-off since the publication of the above-mentioned BEREC Report; and
- Part 3: Presentations from the European Commission and the NRAs of Belgium and France on the measure 'Increase of wholesale copper access prices during transition period' of the forthcoming European Commission Gigabit Connectivity Recommendation.

This report summarises the presentations given at the workshop.

2 Part 1 – Migration to VHCNs and copper switch-off with a focus on the needs of the end-users

This section summarises the country presentations from the NRAs of Sweden, Norway, Spain, Slovenia and Luxembourg on the topic 'Migration to VHCNs and copper switch-off with a focus on the needs of the end-users' of the first part of the workshop. The order of the countries follows the extent to which MDFs have already been closed (SE 80%, NO 40%, ES 30%, SI 3%, LU 0%) and, therefore, the experiences already gained with the copper switch-off.

2.1 Sweden

2.1.1 Current situation of the copper switch-off

The copper network in Sweden is owned and operated by companies within Telia Company group. Telia was founded as Televerket by the government in 1853. In 1993, the company was privatized. For almost 150 years the copper network was used for voice only. In the year of 2000, ADSL was offered publicly as the Home PC reform made one million Swedes get their first computer.

In January 2005, the cyclone Gudrun hit the southern part of Sweden. It's classified as the most serious natural disaster to hit Sweden in modern times. A large proportion of spruce forest fell in the storm. Overhead cables for electricity and telecommunications were demolished. The restoration of the cables was a difficult task. In several places a decision of putting the cables underground was taken. In the case of copper network, there were geographical areas where Telia did not want to restore the network.

Later in 2005, the Swedish NRA, PTS, put Telia under an obligation to meet reasonable requests for access to the public telephone network at an affordable price. Telia appealed against PTS's decision and a court annulled the decision in February 2007. Therefore, no service provider is obliged to provide universal service in Sweden, but there is a state aid measure administered by PTS. According to a Government Ordinance from 2018, PTS shall secure internet access to primary residential and permanent business premises, which cannot



obtain functional internet access (specified as a minimum download speed of 10 Mbps) from the market, at a cost for the connection of 5,000 SEK (500 euro), or less.

It has now been about 15 years since Telia began switching off the copper network. The switch-off has mainly been carried out in rural areas. Telia is the player with the most subscriptions within the copper network with market shares of approximately 75 percent for fixed telephony and internet via xDSL. Several other operators are active in Telia's network.

The switch-off began at the far end of sparsely populated areas, where customers were few and operating costs are high, as well as in areas that were hit by the storm Gudrun. It's obvious that people were suffering from losing communication network since there was no replacement for the copper network. Several problems with alarms and home care devices of elderly and disabled persons were identified. The government therefore got involved and gave PTS yearly assignments to keep an eye on the development and support the end-users with information.

The Swedish regulator PTS is now working on a government assignment to follow up the switching off of the copper network and the phasing out of 2G and 3G networks. The assignment instructs PTS to follow up on what information efforts are carried out by Telia and the MNOs. PTS must also follow which replacement solutions MNOs are offering. If necessary, PTS is obliged to report and propose measures to the government.

The phasing out of 3G has been going on since 2020 and is associated with the build out of 5G. The planned closing of 2G will happen in the end of 2025 in one organized activity. Soon after, in 2026, the copper network accesses will be totally decommissioned.

Key elements of the rules set by the NRA

On 21 April 2023, PTS decided to repeal the market obligations for local access to network infrastructure that had been applied to Telia's copper network. Therefore, as from that date no specific regulation is in place for the copper network.

Current situation of the copper switch-off

The absolute majority of Swedes have left the copper network for reasons other than Telia closing the copper network. Customers have chosen to switch technology to fibre or mobile solutions. About 90% of the copper lines are no longer active. At its height there were six million fixed subscriptions in Sweden (s. Table 1).

Table 1: Subscriptions on fixed telephony and fixed broadband 2000-2022

Year	2000	2022
Subscriptions on fixed telephony	6 million	1 million
Subscriptions on fixed broadband	120,000	4 million

The trend is very clear. In addition to these numbers, Swedes consume large amounts of mobile data.



Telia changed the migration process in 2022 from closing exchange by exchange to closing all remaining exchanges in selected municipalities. Telia has so far closed down 81% of all exchanges, which equals the same in MDFs. By the end of 2024 it will be 87%. 17 out of 290 municipalities are now copper-free. By the end of 2024, the forecast is that 96 municipalities will be copper-free. The plan is to close down the last ones in 2026.

The first municipalities that were completely switched-off were located in less populated areas. The experiences were evaluated and the process permanently changed in 2022, as explained. Most municipalities have been affected by the switch-off over the years. Sweden's inland and northern parts do not have many exchanges left except for towns and big cities. Next rounds will affect larger municipalities in more populated areas, which will bring new challenges and new knowledge. Although different market solutions are available near urban areas where this occurs, there are still challenges.

2.1.2 End-user aspects

Since many complaints were received in the early switch-off period, Telia developed their own process for how customers would be informed, migrated to other services, and the network closed down. It was also said that: All migration costs belong to Telia, it applies to the entire copper access network, few customers may receive a short grace period if upholding service is vital to public safety or the civil defence. Telia will inform PTS and other coordinators throughout the process. PTS and Telia will hold quarterly meetings discussing the general progress. Table 1 shows the migration process in place that is used and communicated publicly by different parts of Telia Company:

Table 2: The migration process in place

15 months before switch-off	Telia Wholesale - Information sent to other operators at least 15 months in advance
At a minimum 14 months before switch-off	Telia to inform their customers at least 14 months before the switch-off by mail with information on alternative solutions. Several reminders over the next months of what is happening
6 months before switch-off	Telia to inform their customers about contracts ending in six months' time
1 month before switch-off	Telia Wholesale to inform all remaining customers 1 month before dismantling
Switch-off	

There is a difference in the previous BEREC report regarding data from Telia and PTS regarding months specified in the migration process. This difference is unclear and PTS will investigate this further.

Problems arisen

Many problems have been dealt with over the years. The problems currently being addressed by Telia are the following.



The right information at the right time is a challenge. Telia continuously reviews how information is provided to their customers.

Offering communication solutions is sometimes a challenge in sparsely populated areas. Telia has installed many directional antennas to improve the possibility of connection, for example via FWA.

There are old technical solutions at companies and authorities which are dependent on copper networks. Their replacement is a challenge. Telia has developed solutions to bridge the gap to new products and network. In dialogue with the customers, Telia has to find out what the customer's communication needs look like and see what solutions are available.

To match the copper phase-out with a fibre rollout is a challenge. Coordination with city networks and fibre associations has not always been possible, not least considering the number of city networks in Sweden, and the risk of delays. Instead, Telia has stuck to the settled date to create predictability for everyone involved.

PTS has noted that as switch-off hits populated areas and cities, migrating older people, with or without disabilities, to fibre is a challenge. Older people who did not want to invest in a fibre connection some years ago now have few options. It was expensive for them then and is often more expensive now. The only solution available might be a mobile connection. Assistive technology is not always easy to replace both user-wise and quality-wise when connected via mobile network.

Problems resolved

Telia solves most problems internally. They inform and cooperate with operators, customers, stakeholders and coordinators. PTS and Telia have regular meetings to discuss issues.

PTS follows and observes how Telia manages their process and how society is affected by the switch-off. Over the years, reports have been made, for example "Universal services - Right to telephone service" and "Mapping and analysis of the Swedish market for security alarms". At the time of writing this summary report, no new reports were pending.

PTS helps households in white spots by examining whether access to networks is available and if necessary, procuring and funding a solution. There are currently approximately 15 installations in Sweden, with no more than that since 2010. In southern Sweden, satellite is now an acceptable replacement solution when there is no other communication network available.

As the technology shift is happening right now, to accomplish the government assignment, PTS arranges quarterly meetings with four MNOs in Sweden. The meetings address the present closing of 3G, as well as the planned 2G closing in 2025, and discuss the phasing out in relation to other topics.



Communication with the public

Sweden has today several networks being switched-off with parallel timelines. Therefore, PTS has a close collaboration with Telia and the other MNOs, the industry association TechSverige (a member organization for companies of all sizes within the tech sector), and SKR (Swedish Association of Local Authorities and Regions). Together and individually, activities are carried out, such as arranging and participating in webinars, and to keep contact with the media.

Annually, PTS organizes and facilitates a publicly streamed meeting with the operators and other stakeholders. At the meeting, phasing out plans are presented and discussed. The meeting is open for the public to ask questions via chat. PTS also addresses important issues, such as making a procurement in time or to make an inventory of IoT and subscriptions in use.

PTS uses different ways of communicating information to the public and the stakeholders about the phasing out of the different networks. PTS website is kept updated with FAQs, as well as material from previous web meetings. PTS also has a hotline for people experiencing problems with communication networks, and the switch-off sometimes is identified as the source of the problem.

Consumer rights

In Sweden, several organisations give information and support to consumers. Telia and other operators have their own customer services and they help to provide the best solutions for their customers.

On a governmental level PTS and The Swedish Consumer Agency help consumers that complain. PTS receives mail and phone calls from Swedes that claim a lack of communication infrastructure. The Swedish Consumer Agency informs about the switch-off and guides the consumers in different aspects. They are also responsible for an industry agreement with the telecom industry.

The Swedish Telecom Advisors (Telekområdgivarna) provide impartial and free assistance to consumers on TV, telephone and broadband subscriptions. According to their data, consumers are able to locate and access the online information provided and there is a decrease in the demand for counselling.

Swedes have heard about the copper network switch-off for many years now. There is probably a bit of fatigue among those who have already found other and better solutions. But there are many reasons to persist in talking about the ongoing switch-off process. The people who are now affected are not many in number but are as a group perhaps not the most digitally savvy. The digital divide is a big challenge for the remaining copper network consumers and therefore the society.



2.2 Norway

2.2.1 Current situation of the copper switch-off

Overview

The decline in the Norwegian copper network started already in 2008. For the most part, it has been a customer driven migration toward fast speed broadband. The number of xDSL subscriptions have been declining rapidly over the last 4 years, while subscriptions based on fibre have had a similar increase in numbers. Fixed wireless access has also to some extent replaced xDSL subscriptions. The number of subscriptions based on HFC is quite steady, but slowly declining.

As of today, 96% of all households in Norway have access to at least 100 Mbit/s. Telenor, the incumbent, phased out their last customer in the copper network by 31 December 2022. Today only Telenor's access buyers have end-users left in the copper network. As of May 2023, only approx. 28.000 end-users are left in the copper network.

Regulatory backdrop

In December 2018 Telenor was designated as an SMP operator on national level in Norway, both in Market 3a and 3b. In addition, several obligations on Telenor came into effect, such as obligations regarding access and pricing.

Shortly after this, in January 2019, Telenor announced its decision to phase out the copper network by the end of 2022 and replace copper access with fibre or wireless broadband access. This decision had not been communicated publicly when the Norwegian NRA, Nkom, made its decisions in Market 3a and 3b in late December 2018.

In Nkom's view, Telenor's decision to decommission the copper network had "significant potential" to impact the competition in the Norwegian broadband markets in a negative way.

This led to an amendment to Nkom's decisions from December 2018; the so called "Copper Decision". In 2020 Telenor was instructed to maintain access to the copper-based access network for a period of up to 5 years from the effective date of the Copper Decision, which is until the 2nd of September 2025. Nkom also mandated Telenor to develop a proposal for a migration plan from the copper-based infrastructure, because no prior dialogue or agreement with access buyers was in place so they could safeguard their interests. In addition, Nkom's assessment was that Telenor's one-sided decision deviated from the process outlined by the Commission in the NGA Guidelines from 20th of September 2010 (NGA 2010/572/EU).

The failed migration plan

In the context of trying to develop a migration plan, several meetings were held during the spring of 2021 with Telenor, the access buyers and Nkom. In August 2021 Telenor forwarded



a proposal for a migration plan to Nkom. But Nkom concluded that it could not approve the migration plan-proposal presented by Telenor, mainly because it did not sufficiently address the interests of the access buyers and it was not specific enough to create sufficient predictability for the access buyers.

The Copper decision – still in force

The 2020 Copper Decision applies until 2nd of September 2025, with two small exceptions from the obligation to maintain access the copper network: (1) circumstances beyond Telenor's control and (2) faults in copper accesses resulting in high repair costs. However, Telenor still wants a quicker shut-down of the copper network and Nkom has to some degree accommodated Telenor regarding "POTS-only sites" and "Empty exchanges".

Nkom issued a decision on 21st of April 2022 allowing Telenor to shut down and physically remove their 586 sites used only for Plain Old Telephone Service ("POTS only sites"). Nkom's assessment was that decommissioning of such sites would not affect the competition in the broadband market as these sites were not equipped to supply broadband services.

In a decision of 21st of April 2022 Nkom also terminated the access obligation to empty copper exchanges. Empty exchanges are defined as (1) Local exchanges that are no longer equipped for production of xDSL-services, or (2) exchanges with unused equipment as no xDSL-customers are connected to the exchange. Certain requirements were set. Exchanges that have been empty since before 1st of July 2022 may be decommissioned after a 1-month notice period, while exchanges that became empty after that date or become empty in the future may be decommissioned after a 3-month notification period as long as no access seekers order services and serve end-customers via the exchange during those 3 months. At the date of the decision there were a total of 1,133 empty exchanges, representing approximately 1/3 of the total number of copper exchanges (3,406). The notification period for these exchanges has now passed, and they have been shut down. The decision also included exchanges with five or fewer accesses. These may be decommissioned if Telenor offers existing access seekers relevant replacement products in line with certain requirements set by Nkom. Telenor has informed Nkom that they don't intend to take advantage of this possibility.

Nkom has also accepted a request from Telenor to conduct a geographically limited test project in a small valley called Tufsingdalen, involving the replacement of copper cables one to one with fibre cables in shared poles used for both electricity and telecommunication. In Norway there is a legal arrangement which governs the shared use of such poles on fixed terms and conditions. However, such approval will entail a certain processing time and administrative process, and there are also some exceptions that give the infrastructure owner the right to refuse applications under certain conditions.

So instead, by replacing copper one-to-one with fibre, there is no need for a lengthy approval process from the infrastructure owner, and Nkom recognized that such one-to-one



replacement of copper with fibre in shared poles, would contribute to an efficient transition to a new fibre network. However, it was crucial for Nkom that Telenor's wholesale customer was taken care of in a way that they did not suffer any harm during the transition to the new infrastructure.

So as part of the agreement, Telenor offered the local wholesale customer a cost-free VULA connection to the Optical Distribution Point (ODP) in Rørros, where they were co-located, with regular access prices and terms. To carry out the test project within the necessary timeframes, no formal exceptions were made from the obligations in the Copper Decision. This meant that Telenor's obligations in the Copper Decision to maintain access to the copper network until 2nd of September 2025 would still apply in Tufsingdalen also if, against all presumptions, any wholesale customer were to request such access. The experiences from the test project in Tufsingdalen will be taken into consideration in Nkom's further handling of the copper switch-off in Norway.

Facts and figures

As of May 2023, there were approximately 28,000 remaining end-users in the copper network in Norway, all serviced by access buyers. Telenor migrated their last copper customers in 2022, mainly to fibre and FWA, and no longer serve customers over copper. A larger proportion of businesses are holding on to their copper lines compared to households. The reason may be that they do not see FWA as a suitable replacement product to cover their more advanced needs.

The technology mix in Norway developed over the last five years (2018-2022) as follows:

- Sharp decline in copper subscriptions
- Substantial growth in fibre subscriptions
- The evolution of FWA. Starting out in 2019, FWA has been an important part of Telenor's migration out of the copper network. Still expected to grow but limited due to the high fibre footprint.

Telenor originally had about 4,500 exchanges in the copper network. About 3,000 are to be completely shut down and removed by Telenor, while 1,500 sites will be reused in a modernized network. Decommissioning of a site/exchange always includes closing the MDF at the site.

About 1,800 sites/exchanges are already closed. This represents approximately 40% of the original number of exchanges. Most of them have been closed this fall as a result of the decision on empty exchanges. Telenor is expected to continue to notify exchanges for decommissioning as soon as they have been emptied, and the number of closed exchanges to increase steadily as 2025 approaches.



The migration has mainly been customer driven, and no forced migrations have taken place. Telenor is still not allowed to close exchanges/MDFs to which end-users are still connected. The Copper Decision states that Telenor is to retain the network until September 2025. At that time any remaining customers will be forced out of the network if they are connected to alternative technology or not, as the whole network will be shut down.

2.2.2 End-user aspects

Telenor is not allowed to shut down exchanges/MDF's (used for copper purposes) where end-users are still connected. This must be seen in the context of the Copper Decision, as mentioned above.

The authorities (Nkom and Ministry) have followed up Telenor's migration from copper to new platforms in regular meetings. End-user aspects has been a fixed item on the agenda in those meetings. Telenor has also had an extensive dialogue with municipalities in order to ensure a smooth transition. Information to end-users has been an important factor for both Telenor and authorities. Nkom has in this context focused on guidance and information on Nkom's homepage and in social media.

The number of problems that have arisen in the migration process was relatively low. However, a few customers have not been satisfied with the replacement solution. They have speed and capacity issues and/or coverage issues related to mobile solutions. Furthermore, the elderly part of the population prefers a fixed telephone (and number). Another problem has been that the replacement solution has not been ready in time.

The measures to resolve such problems have been to verify mobile coverage "on site", including sending out expert teams to address special challenges with regards to coverage; trying to find the optimal spot for mounting the antenna for FWA. Furthermore, dialogue with customers according to a predetermined plan has been important, including extra information to elderly customers about replacement solutions for the "plain old telephone". Regarding timing issues, Telenor has postponed disconnection of the copper line in some cases; even in cases where the customer is waiting for fibre connections from other operators. Dialogue with representatives/organizations for persons suffering from electromagnetic hypersensitivity has also been a part of the copper switch-off information process.

2.3 Spain

2.3.1 Current situation of the copper switch-off

The fixed broadband access market in Spain has experienced a significant and disruptive change in the last 10 years (see Figure 1). Not only the commercial aspects (with convergent bundled offers increasingly dominating the market) but also the means of accessing end-users. In this regard, copper access peaked in 2014, and has experienced an accelerated



decline since then, substituted by FTTH access. The transition from ADSL based copper lines to FTTH was direct, without intermediate steps such as VDSL2 with vectoring.

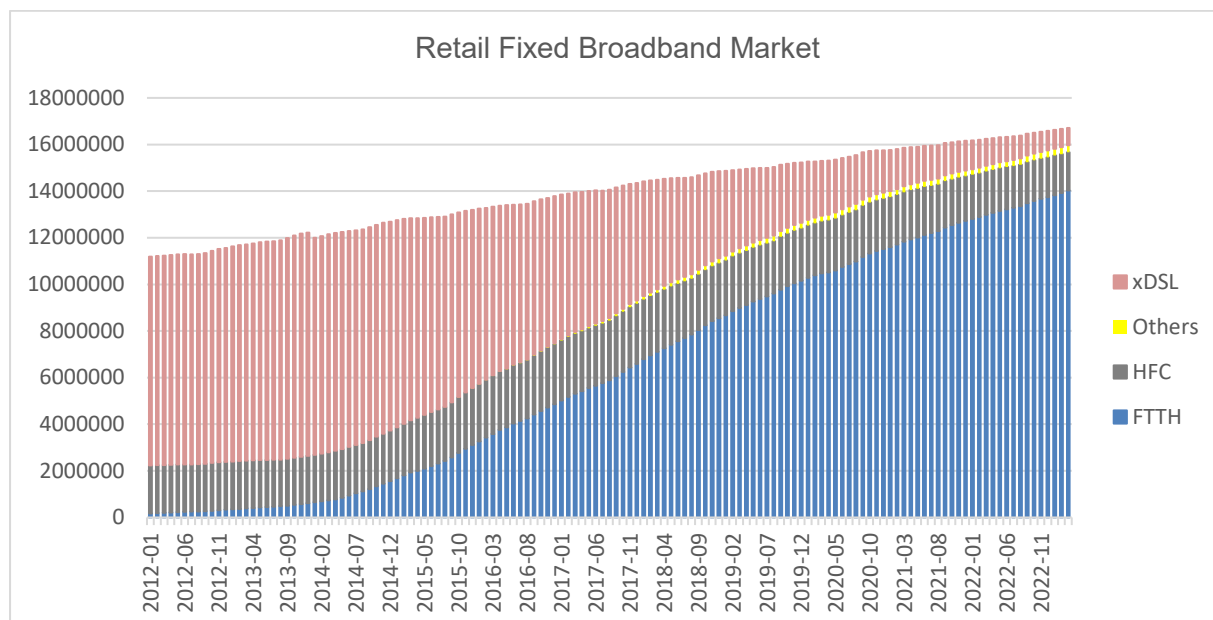


Figure 1: Retail fixed broadband market

There are several operators deploying FTTH, including the incumbent (which has announced zero retail copper customers for April 2024), with alternative network operators (ANOs) making active use of the duct/pole access obligation. This has been one of the aspects that led to a geographical segmentation in the fixed broadband wholesale market reviews of 2016 and 2021, resulting in competitive municipalities (ca. 70% of the population) and non-competitive municipalities. The end result is that less than 5% of fixed broadband customers are still on copper in 2023.

The Spanish NRA, CNMC, already defined in 2009 a set of rules for copper switch-off, which were updated in 2016 and 2021. The core part of the switch-off framework is the following:

- The SMP operator, Telefónica, notifies each MDF closure to operators and CNMC.
- Minimum notice period depends on wholesale access service: 2 years if ULL (it was 5 years till 2021), 1 year if bitstream, 6 months if no wholesale connections. During this time full access obligations apply.
- After notice period: 6 months guard period. No new customers allowed. Customers still on copper must migrate.
- After guard period: no customers allowed on copper (for any operator). Dismantling of equipment (DSLAM, etc.) in ULL exchanges can begin.

The first exchanges (or MDFs) were switched off in 2015. Since then, more and more exchanges were scheduled for switch-off. Telefónica announced in April 2023 the switch-off of all remaining MDFs. As a result, all copper MDFs have now a committed switch-off date or are already switched off. Some of the sites where the MDFs are located are to be closed, while others remain as optical nodes (ODF) in the new network.

Most of the switched off MDFs are smaller ones, with few copper lines and no ULL operators, whereas the ULL MDFs are generally much larger. Only recently have the first ULL MDFs been switched off. The summary (as of September 2023) is shown in Table 3 below:

Table 3: Summary table

Notice period	Notified MDFs	Already switched-off
6 months (no services)	468	73
1 year (BSA)	6,645	2,096
2 years (ULL)	577	0
5 years (ULL)	835	61
Total	8,525	2,230

Note: Data as of September 2023

By end of 2023, a total of 34% of all MDFs will be already switched off. By end of 2024, the amount will be over 91%.

However, because the MDFs switched off so far are mostly small (i.e., with few copper pairs), their share of copper pairs represents a smaller percentage of the total. It will be in 2024 when a significant amount of ULL MDFs will be switched off, and therefore the share of switched off copper pairs will rise abruptly, as can be seen in Figure 2 below.

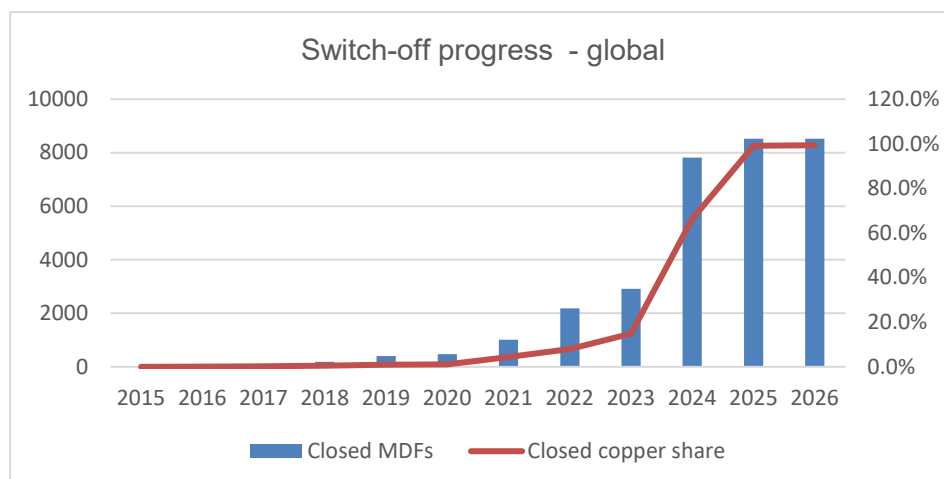


Figure 2: Switch-off progress - global

2.3.2 End-user aspects

As mentioned in the previous section, end-users have massively migrated to the newly deployed FTTH networks. Several factors have made it possible; among others, the high bandwidth gap between the ADSL2 and the FTTH accesses (as there was no VDSL2 intermediate step). The bandwidth dependency on the length and state of the copper pairs also plays a role, as FTTH users get a guaranteed speed, unlike copper users. Additionally, and due to this dependency, some copper pairs are not suited for IPTV, while all FTTH accesses are. Moreover, operators have adopted a price policy where both access types (copper and FTTH) have the same retail price.

Given the above facts, users voluntarily migrate to FTTH long before copper switch-off. It is also worth mentioning that migration to FTTH does not require any upfront payments. Therefore, only few customers are cut off when the MDF is switched off. In the case that a user has to be disconnected at the end of the switch off period because they did not migrate from copper, the end-user can still maintain the fixed phone number by migrating during the first month after disconnection. In areas where FTTH is not deployed, users are migrated to FWA (mainly rural areas).

In this context, one of the key aspects to ensure a smooth transition and avoid conflicts for end-users is the availability of information about the transition to FTTH and the copper switch-off process. Several mechanisms are used to ensure this, from the operators and from CNMC.

Operators inform their customers about an upcoming switch off in their MDF and propose their migration to products based on a new access network, which will generally be FTTH (via own fibre deployment, regulated access, or commercial agreements). Some operators inform their customers via multiple channels, such as letters, SMS and special communications in the bills. General information regarding the copper switch-off is also provided in their web pages.

CNMC also plays a role in informing end-users. It publishes the list of MDFs with committed switch off dates on its web page, so that every end-user (or other bodies, such as municipalities) can be informed. This is important as a measure to avoid potential fraud, with end-users being told (wrongly) that their MDF will close soon and therefore they have to migrate. It also publishes information about the status of copper switch off in its blog, as an informal communication channel to end-users; this information is often echoed in other technological web sites and newspapers, helping to spread the information about the ongoing process. Finally, CNMC helps by answering questions from end-users (though the competence for end-user matters lies within the Ministry of Economical Affairs and Digital Transformation). The availability of a scheduled switch-off date for all MDFs triggered the



publication by CNMC of a report⁴, covering a summary of the switch-off process and its state in July 2023.

2.4 Slovenia

The legislative basis for migration to VHCNs and copper switch-off is laid down in the Slovenian Telecommunications Act, where two basic provisions are set. As a first provision, the Telecommunications Act stipulates that the SMP operator has to notify the regulator in writing before disconnecting or replacing parts of the network. The second provision of the Act stipulates that the regulator must ensure that the process of disconnecting or replacing the copper network with optical fibres includes the following: timetable, deadlines for switching to another network, and comparable alternative products.

Obligations are determined in more detail in final decisions on the relevant markets 1 and 3b:

- The SMP operator must publish information about: (i) switch-off of individual copper loops, 6 months in advance, (ii) termination of the MDF location, 2 years in advance, (iii) if there are no ANOs at the MDF location, the deadline for announcing its termination is 6 months in advance.
- The SMP operator can terminate an MDF location or switch-off individual copper loops at location not sooner than 5 years from the start of the use of co-location by the ANO, earlier only in case agreement is reached with the ANO.
- The SMP operator has to assure that each ANO's subscriber can at least be connected to a technically equivalent product.
- The SMP operator has to provide regular maintenance of the operating copper network until any ANO's subscribers are still using it.
- The SMP operator is allowed to terminate its copper network also in case it is not being replaced by its own optical network, insofar as there is at least technologically equivalent open broadband network available in the area.

2.4.1 Current situation of the copper switch-off

Some positive impacts of copper switch-off are:

- The utilization of the SMP operator's fibre network is increasing and is currently 45%.

⁴ <https://www.cnmc.es/sites/default/files/4815954.pdf>



- By closing copper MDFs the topology of the SMP operator's network is being changed because fibres are concentrated closer to the backbone edge and they cover greater distances.
- The access to co-location spaces for ANOs is easier but there is less (or no) fibre unbundling possibility because current networks are mostly built in Point-to-MultiPoint (P2MP) topology.
- The operators also expect to gain more space in the existing ducts after pulling copper wiring out.
- With every subscriber switched to fibre the country is approaching the gigabit society goals.

Closure of MDF locations

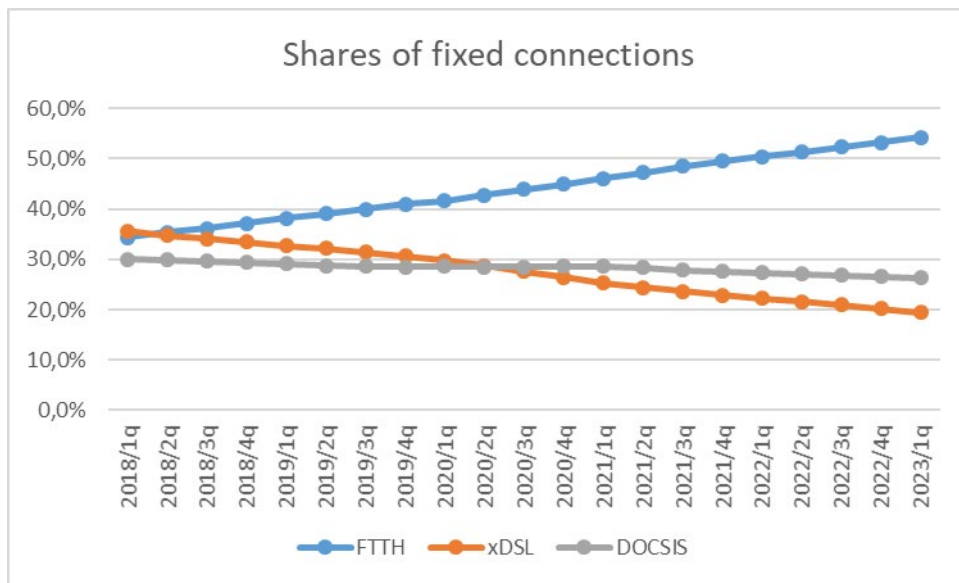
The SMP operator's strategy is to completely replace copper lines and not to introduce any temporary solutions like shortening of the loop (vectoring), which brings in another complicated and pricey solution.

Currently, 32 MDFs were already closed by the SMP operator which represents a bit less than 4%. Another 46 are planned for January 2024.

From 2018 until the time of writing this summary report, the total number of xDSL connections was reduced by 37.8%, while the number of unbundled connections was reduced by 57.2%.

Figure 3 shows the shares of active connections of fibre, copper, and coaxial cable networks from 2018 to the first quarter of 2023. Throughout the period the sum of fibre and copper technologies is around 70-75%, while the coaxial cable connections remain between 30% and 25%. It can be concluded that copper connections are being mostly replaced by optical infrastructure and to a smaller extent also cable connections.

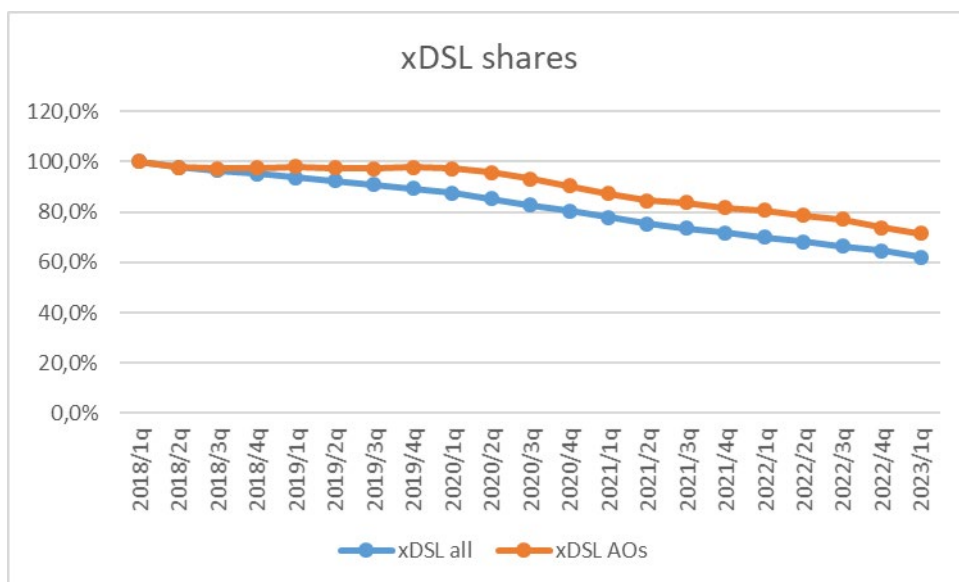




Source: AKOS, 2023

Figure 3: Shares of fibre (FTTH), copper (xDSL), and coaxial (DOCSIS) cable connections.

Figure 4 shows the decline of the copper lines from the beginning of 2018. The decline of ANOs xDSL lines is lower (orange line is less steep) in the first period, which means that ANOs abandoned the copper technology with slower pace than the SMP operator, but later the rate is comparable with all xDSL lines.



Source: AKOS, 2023

Figure 4: Shares of copper lines from 2018 to 2023



Pulling out copper cables

In case of free air copper cables on poles, those are not being removed by the SMP operator, but are used as carriers for the optical cables. If the SMP operator needs space in ducts, the copper wiring is being pulled out. But pulling out unused copper cables is expensive and represents also a risk for newer fibre cables in the ducts because cables could be interlaced and when pulled out they could damage existing optical cables. It is therefore questionable if the SMP operator would be prepared to pull out old copper cables on the request of ANO.

SMP operator's plans for copper switch-off

The replacement of the copper network by fibre is a priority for the SMP operator. According to its plans from 2020, 200 MDFs (around 22%) are to be closed until the end of 2026, which is 40 MDFs per year. They have started with smaller MDFs of capacities less than 100 connections and followed by medium ones. Among the first 30 MDFs that were decommissioned there were locations with capacities between 40 and 500 users. In addition, closure of all 60 street cabinets was also planned. No date approximation has been published about the complete copper network switch-off. Renewed plans are being expected to be announced before the end of the year 2023.

SMP operator's issues and complaints regarding copper switch-off

The SMP operator sees the notice period of 2 years for termination of individual co-locations as too long. A big issue is that their MDFs very often cover some distant subscribers where laying fibre is unprofitable and where there is also no open network available. So, closure of the MDFs is hindered. The SMP operator also proposed symmetrical regulation in areas where ANOs' networks exist.

The SMP operator comments that sometimes neighbours do not allow the passing of fibre through their territory and therefore the fibre cannot be connected to a small amount of households.

The SMP operator also argues it has no efficient leverage to force subscribers to switch to a parallel fibre network and it suggested to charge subscribers a fee where both types of networks are available and subscribers are not using the better one. But, according to regulation, the SMP operator has the possibility to switch any copper loop to fibre network after a 6-month notice period for ANOs, while it has no limitation for its own subscribers.

The SMP operator further argues that in multi-apartment buildings a 50% consensus is needed for deploying new house wiring, which is hard to achieve. The SMP operator also demands the possibility to charge ANOs if they ignore the transition time deadline. The SMP operator would also like to receive more detailed switching rules to be set by the regulator.



2.4.2 End-user aspects

According to the data obtained from the market, in general end-users are being served well and on time. The coordination between the SMP operator and the ANOs is working well in most cases. There are some issues on rare occasions which require some unexpected installation work by technicians. But such cases delay the time of switching for a few hours or a day at most and represent no big issue. Normally, the SMP operator keeps the service on copper active until the fibre connection is set up and all administration is arranged. As a result, the internet service is unavailable only during the time the technician is setting up the installation and modem at the customer premises.

Up to the time of writing this summary report, the end-users were not charged any fee for switching. Usually upon the installation they are offered a 2-year binding contract.

The difference between the regulated wholesale price of copper (which is much lower) and of fibre connections could represent a potential problem as ANOs may not be interested in the transition to fibre. On the contrary, ANOs claim they are interested in switching to fibre because of less maintenance costs and a possibility to sell higher-speed fibre-based connections to their end-users.

There is another potential advantage for end-users through the process of switching to fibre. It reopens the competition for each end-user. All the operators have a possibility to offer higher speeds, better TV schemes or discounts to end-users.

In some cases, end-users do not want to switch to fibre because they refuse any building intervention in their apartments. The SMP operator has been generally using a soft approach in such cases, trying to persuade them one by one, offering them free installation and better services. The NRA has no information if the forced switch-off has been implemented at any location until the time of writing this summary report.

Conclusion

The determination of the Slovenian SMP operator to close its copper network is strong, but more precise dates will be known after the renewal of their switch-off plan. In the vast majority of cases, the end-users did not have any bad experience concerning the switch to fibre. But there are still some unknowns concerning the end-users who persistently insist on maintaining their copper connection and thus stop the MDF closures and the potential pulling out of unused copper cables.

The Slovenian SMP operator has the renewal of its copper switch-off activity in plan, which could bring some changes in politics and speed up the closure of the MDFs. The NRA will react according to its competences with the aim of keeping relative satisfaction with the current practices.



2.5 Luxembourg

2.5.1 Current situation of the copper switch-off

Considering the market situation at the end of 2022, Luxembourg is almost entirely covered by VHCNs, with nearly full NGA coverage. Luxembourg has a very wide coverage of VHCN with 96% in total, corresponding to 80% coverage of fibre to the premises (FTTP) and 90% of DOCSIS 3.1, allowing speeds of up to 1 Gbps. The coverage percentage of 5G is 90%.

With a total surface of around 2,600 square kilometres, the Grand Duchy of Luxembourg has approximately 660,000 inhabitants and around 280,000 households as of December 2022. This leaves less than 5% of households with access only to copper networks. The connectivity target of Luxembourg is therefore to cover by 2030 those households that currently do not have access to 100 Mbps.

The 100% state-owned incumbent operator POST is the only operator that deploys a large-scale fibre network to households in Luxembourg. POST holds a market share of 60%, while the landscape of ANOs remains fragmented.

The Luxembourg NRA, ILR, has set the rules for the process of fibre migration and copper switch-off at wholesale level for individual accesses through the market analyses for markets M3a/2014⁵ and M3b/2014⁶ from 2019⁷. The 2019 market analyses foresee that the SMP operator shall announce on its website and by registered letter to the beneficiary(ies) of the access(es) concerned:

- The definitive switch-off of individual accesses on which a service is provided, with a notice period of five (5) years. However, this period may be shortened on the basis of bilateral agreements with the concerned access beneficiaries. The operator identified as having significant market power must notify the ILR of these bilateral agreements within fifteen (15) days of signing them;
- The definitive closure of individual accesses on which no service is provided, with a notice period of one (1) year.

In practice, the provisions of ILR's market analyses imply that if both fibre and copper networks are present at a given location, ANOs must consult the "vertical inhouse cabling" database. If the vertical inhouse cabling is available, POST must provide fibre access and is no longer obliged to provide copper access. If the vertical inhouse cabling is not available, ANOs are

⁵ <https://legilux.public.lu/eli/etat/leg/rilr/2019/03/13/a181/jo>

⁶ <https://legilux.public.lu/eli/etat/leg/rilr/2019/03/13/a180/jo>

⁷ It is worth mentioning that the first rules for the process of fibre migration and copper switch-off were defined in the market analyses for M4/2007 and M5/2007 in 2014. In the market analyses round for M3a/2014 and M3b/2014 in 2019, ILR further increased the flexibility in allowing the switch-off of copper not only at a site level (MDF/DF) but also for individual accesses.



free to choose access in fibre or in copper until the order. Finally, if the status of the vertical inhouse cabling is not known, ANOs are free to choose access in fibre or copper until the very last stage of the line installation.

Since the entry into force of these market analyses, the share of activated fibre lines on the Luxembourgish broadband market increased, between 2018 and 2022, from 35% to 59%. Consequently, a decrease in the penetration of activated copper lines is observed during the same period, from 55% to 30%.

At the end of 2022, 50% of households have no more access to a copper network, compared to less than 1% in 2018. This evolution is due to the switch-off of copper lines and new fibre-only deployments in the case of new buildings in areas where fibre is available.

A stagnation of activated cable lines can be observed over the last five years. To date, cable lines are not widely used for internet access in Luxembourg, even if the cable coverage, which reaches 90% of households, has been upgraded to DOCSIS 3.1, allowing speeds of up to 1 Gbps. This situation could however change in the future, as a new shareholder acquired the main cable operator in December 2022.

One of the characteristics of the copper switch-off in Luxembourg is the very low granularity of the process. The switch-off can be operated at a MDF, a street cabinet and even at an individual network termination point/address level. Some street cabinets, individual copper network termination points, poles and overhead networks, aging copper cables, etc. have already been closed. Nevertheless, no entire MDF has been totally closed at this stage even if in some MDFs, the switch-off is well advanced. The first entire MDF is expected to be closed during the next round starting in March 2024. The objective is to accelerate the switch-off of copper networks in order to complete the process by 2030, using accompanying measures towards the end-users at a retail level.

2.5.2 End-user aspects

Even if the fibre migration has evolved positively in the past five years, operators are encountering two main issues in the process of fibre migration:

Firstly, some technical issues such as inhouse vertical cabling, elevators, alarms, private branch exchange (transition All-IP) hinder the fibre migration. Inhouse vertical cabling appears as the most important barrier to change technologies.

Secondly, convincing the remaining end-users to migrate to fibre is a challenge for operators. 63% of households have opted for advertised speeds of 100 Mbps and above. 100 Mbps products are also offered on copper (VDSL technology) which does not require additional work of inhouse vertical cabling. And even if the operators currently do not apply any price differentiation between copper and fibre, certain old broadband contracts based on legacy networks are, in some cases, less expensive than current fibre offers.



Given those constraints, operators have asked ILR to support them to accelerate the migration to fibre networks.

Creation of a new platform MyILR.lu

ILR developed a collaborative approach towards end-users in 2022 with the launch of a new information portal dedicated to consumers: MyILR.lu⁸. ILR's objective is to adopt a collaborative approach to support, to raise awareness and to better inform consumers. As the market is entering a new phase of maturity, empowering consumers is becoming one of the regulator's priorities. The aim of creating the portal is to meet the European Electronic Communications Code's objective of harmonising and strengthening end-users' rights, while taking account of market developments. Consumers are taking an active part in regulation by using the tools made available to them, such as a network performance measurement tool (checkmynet.lu⁹), a network mapping tool, or a tool to register a mediation online. Through various media channels (newspaper, social networks, flyers, etc.), ILR has communicated the address of the myILR.lu website to the public.

The copper switch-off topic is part of the collaborative approach towards end-users. On the front page of MyILR.lu, end-users can check the date of disconnection of their line.

The “Is your connection ready for the transition?” campaign encourages end-users to switch to a very high-speed network. A short demonstration was given during the workshop to show concretely how this tool can be used to find out the status of the copper network at an address. Two situations may arise: either there is no copper at the address, or the tool provides a date for the switch-off of the copper line. In this case, advice is provided to help the consumer make the technology transition. In this campaign, a technologically neutral approach has been followed.

Collaborative work with the operators

ILR has launched a cooperative project with the operators to agree on the process of copper phase out and on the way to communicate with the clients in that context. During these multilateral meetings, the following process has been established:

Operators are required to notify their customers, by letter, six months before the commercial disconnection of the copper line. A joint letter has been drawn up by the operators. A flyer drafted by the ILR is also to be attached to the letter. The flyer enables the customer to find out when its copper line will be disconnected in consulting the MyILR.lu website. The flyer

⁸ www.myilr.lu

⁹ www.checkmynet.lu



explains the reasons for the change in technology and describes the benefits of a VHCN network as well as the possible technical solutions.

A second registered letter needs to be sent six weeks before the planned commercial disconnection date if a customer still has an offer provided on the copper network. The joint text drawn up by the operators should also be used in this context as well as the flyer provided by the ILR.

It should be noted that the process described above defines the common minimum requirements that each operator must meet regarding its customers prior to the commercial disconnection of lines. Each operator is free to contact its customers further about the copper switch-off process.

The first commercial disconnection date (1st batch of addresses) for the copper network is scheduled for March 1, 2024. Every year until 2030, copper lines will be commercially disconnected on March 1. The operator is responsible for disconnecting the copper lines of customers concerned by the switch-off of their copper line.

Technical disconnection will take place three months after commercial disconnection, on June 1, 2024, for the first year. Technical disconnection means that the copper line is definitively switched-off, which implies that no line restoration will be possible. POST Technologies, the department of the incumbent POST which is responsible for implementing and maintaining fixed and mobile telecommunication networks as well as all related technical solutions, is responsible for the technical disconnection.

The steps described above will be repeated every year until the copper network is completely disconnected by 2030.

An evaluation process of this disconnection mechanism has been planned after the first exercise in 2024. The aim is to analyse whether the process has worked well or whether it needs to be improved.

Coordination with a new created governmental entity: MyConnectivity.lu

ILR is in coordination with MyConnectivity.lu¹⁰, a new structure created in December 2021 which aims to accelerate and improve the connectivity of households and businesses in Luxembourg. MyConnectivity.lu is an economic interest group created jointly by the Ministry, and LU-CIX, the Luxembourg Internet Exchange, based on a not-for-profit membership association. This new entity aims to develop and support the Internet and data centre ecosystem in Luxembourg by providing the national peering infrastructure and by promoting the national and European ICT community.

¹⁰ <https://myconnectivity.lu/en/>



MyConnectivity.lu supports the ILR in the communication efforts with regards to the copper phase out campaign such as organisation of roadshows throughout the country. MyConnectivity.lu is also working on a new label for the real estate sector informing about the connectivity level of multi-dwelling buildings and homes, and on a vertical inhouse cabling in the multi-dwelling unit's toolkit.

3 Part 2 – Update on the rules set by the NRAs for the migration process and copper switch-off

This section summarises the presentations from the NRAs of Italy and Greece on the update of the rules set by them for the migration process and copper switch-off since the publication of the BEREC Report on a consistent approach to migration and copper switch-off in June 2022.³ The presentation of the Italian NRA also includes information on the measure “substitution matrix” already applied in Italy, which the NRAs should establish according to the new European Commission Gigabit Connectivity Recommendation.

3.1 Greece

The procedure presented by the Greek NRA, EETT, is included in detail in its Market Analysis Decision 1063/02/30-01-2023, defining the SMP and related measures for Market 1 in Greece.

OTE's access network, is still the only network with full geographic coverage of the entire Greek territory. In order to provide services to end-users, the largest ANOs still rely heavily on OTE's network, through ULL access and co-location services- either physical or remote- in the local exchange centres (LEXs). However, in recent years, the development of technology and investment in access networks has led to the introduction of alternative infrastructures, changing the architecture of the network. As early as 2012, fibre started replacing the copper from the outdoor cabinet to the exchange centre, active equipment has also moved closer to the end-user and respective services offered in these cases ensure greater speed and better quality. Also, in the last years, upgrades to access network, mainly with the introduction of very high speed digital subscriber lines (VDSL) vectoring technology into the fibre to the cabinet (FTTC) architecture network, as well as development of FTTH networks with the fibre reaching the end-user, led to commercially offered broadband speeds of up to 200 Mbps.

The copper switch-off procedure presented includes rules for the migration from traditional SMP's copper network to next generation networks with either FTTC/VDSL architecture through vectoring, or FTTH/GPON. In particular, EETT shall examine certain conditions that have to be met for a partial copper switch-off (e.g. at specific outdoor cabinets of a LEX) or complete copper switch-off (at a specific LEX). These conditions examine the network's readiness (both technical and regulatory) for the migration, at the time of OTE's notification of such an intent.



Specifically, conditions for technical readiness require that full NGA coverage is achieved for all existing copper-based end-user connections, as well as availability of network resources to cover at least 60% of end-users served by the traditional network. Also, availability of the appropriate wholesale products which enable the access seekers to offer similar or better services (in terms of characteristics and QoS) to the ones offered by the SMP, should be ensured.

If these criteria are met, i.e. technical readiness is ensured, then specific parameters related to regulatory readiness are examined in order for the copper switch-off procedure to begin. The first parameter, P1, defined as the maximum number of subscribers in a LEX with co-location who are affected by the switch-off (partial or complete) of the copper network per year, should be less than 25% of the total subscription base (both OTE and of ANOs). EETT considers that setting parameter P1 in relation to the number of affected subscribers, facilitates the planning of the transition from traditional technologies, while at the same time it protects the level of competition. LEX's without co-location are not restricted by parameter P1, since ANOs are not affected by the migration.

The process of moving to fibre-based networks is technologically imperative since they are clearly more efficient; their management is easier for the operators and the services offered are superior in terms of their specifications and the quality offered to the end-user. However, such a transition cannot be carried out in case the majority of subscribers are still served from the traditional network. Therefore, EETT considers that parameter P2a, defined as the percentage of already migrated subscribers, should be checked and should be more than 50% of the total subscriber base (of OTE's and of alternative providers or 85% of OTEs subscribers). In case of migration to FTTH, parameter P2b, defined as the percentage of already connected buildings in case of migration to FTTH, should also be more than 50%.

In order for the migration to be effective and transparent, timely notification to all parties involved - access seekers as well as the end-user - has also to be ensured. Therefore, in case the criteria set by parameters P1 and P2 are met, the copper switch-off procedure can commence and OTE should notify the affected ANOs and EETT accordingly. Parameters P3, P4, P5 are then set, related to various time restrictions.

P3 is defined as the time from the notification till the completion of the switch-off. Parameter P4 is defined as the time until discontinuation of serving new requests for the copper network (commercial switch-off). Finally, P5 is set as the time between the notification and the subscriber's forced migration. Specific values are predefined for parameters P3-P5 within EETT's procedure, based on specific cases distinguished, according to (i) whether at a specific LEX there is co-location or not, (ii) the type of wholesale services provided by OTE and (iii) the number of subscribers affected by the decommissioning of copper in a specific LEX. Depending on these different scenarios, time from the notification till the completion of the process, can vary from 6 months when there is no co-location, to 36 months for partial or total decommissioning of copper network in a LEX with co-location and more than 5,000 active



connections. A detailed table regarding the values of parameters P3-P5, according to the various scenarios identified, is included within EETT's procedure. In addition, values for parameters P3-P5 are defined separately for LEXs with an achieved migration of more than 75%, in which case the values in the example mentioned above vary from 6 months to 24 months respectively.

EETT's procedure differs in areas of state funded projects such as Rural - a project related to rollout for white areas - or the UFBB project (Ultrafast Broadband) in Greece - which aims at accelerating deployment of broadband internet in Greece in cases where operators have no plans to make the necessary upgrades due to lack of profitability. Where these projects are deployed, copper switch-off cannot take place between the outdoor cabinet and the end-user.

Also, the procedure specifies that OTE is not allowed to migrate to FTTC, in the LEXs in which, an FTTH coverage of at least 60% of the total subscriber's base is foreseen by providers (OTE and ANOs), within their binding three-year plans submitted to EETT.

The copper switch-off procedure also includes provisions related to the distribution of the costs related to the migration. In essence, three categories of costs are identified. EETT's procedure defines that OTE will bear all costs related to the deactivation of legacy wholesale product, while the ANOs will bear the costs for activation of the new wholesale products. On the other hand the one-off migration fee, set per subscriber, is split between OTE and the ANOs.

EETT is currently in the process of determining all the necessary information to be submitted on a periodical basis by OTE and the ANOs, regarding the status of the access network, as well as appropriate parameters in order to monitor the process. Once the public consultation related to this monitoring process is concluded, and the process is published, a working group made up of the operators involved in the copper switch-off process and coordinated by EETT will be dealing with all issues related to the above process.

3.2 Italy

In Italy, the NRA (Agcom) originally set the rules for the copper network switch-off in 2015, following indications included in the 2010 NGA Recommendation. In 2016, a technical forum among stakeholders and Agcom was held to analyse migration procedures, wholesale substitution services, migration costs; at the end of the forum, a switch-off trial was launched.

In 2017, the Italian fixed SMP operator (TIM) published its plan for the decommissioning of the legacy network, later updated in 2018; and the plan was approved by Agcom in 2019, together with some rules for the migration process and copper switch-off, which were still in force at the time of writing this report.

In July 2023, Agcom launched a consultation on a proposal for the new regulation of the migration process, which was proposed in the framework of the access market analysis review (2024-2028).



3.2.1 Update on the rules set by the NRAs for the migration process and copper switch-off

TIM decommissioning Plan

TIM proposed a plan for the decommissioning of local exchanges (switch-off of legacy network) in May 2017, updated in August 2018; the plan consists of closing more than 6,000 local exchanges (LEXs) from the total (more than 10,000). When a LEX is switched-off, its cabinet areas are connected to a different LEX and copper cables (and services) from the LEX to the cabinets are switched-off with the migration of copper services to FTTC services.

In most cases the migration will be towards the FTTC network, except for residual lines where it will be based on a FWA solution; as the coverage of FTTH networks increases, the migration will gradually also involve such networks.

The original plan – when published – foresaw the completion of the process by the end of 2023. Under the current public consultation, TIM is requested to update the timeline of the original plan.

Market conditions in Italy (2019 vs 2023)

The new proposal of regulation under consultation considers the different conditions of the Italian market for access services in 2023 as compared to 2019:

- Since 2019, the FTTC coverage of TIM's network improved significantly, but also the progress in FTTH network deployment was significant. Alternative Open Fibre networks and the new TIM co-investment project in FTTH networks (named FibreCop) resulted in an increase in VHCN coverage from 30% (2019) to 54% (2022). Consequently, the migration process may be accelerated, and notice periods may be shortened.
- A new State Aid project under the National Resilience and Recovery plan set a new deadline (2026) to reach 1 Gbps download coverage in Italy. Under this assumption, a complete decommissioning of copper network is possible in the next years.
- A national Law (2021) modified the Italian Code of Communication by introducing the obligation for end-users to not hamper technological upgrades of the access network aimed at improving network performance and efficiency. This allows operators introducing “end of sale” and “end of service” of retail and wholesale services.
- As the State Aid project in white areas has progressed, it is no longer needed to wait for its completion and the notice period may be shortened.

Regulatory conditions in Italy (2019 Vs 2023)

The main regulatory points addressed in the Italian regulation are the following: decommissioning process, conditions for the announcement, notice periods, technical and



forced migration stages, services' substitutability matrix, economic measures for the migration, discrimination and transparency conditions.

The decommissioning process defined by regulation is represented in Figure 5 below (in the new proposal the red blocks have been added):

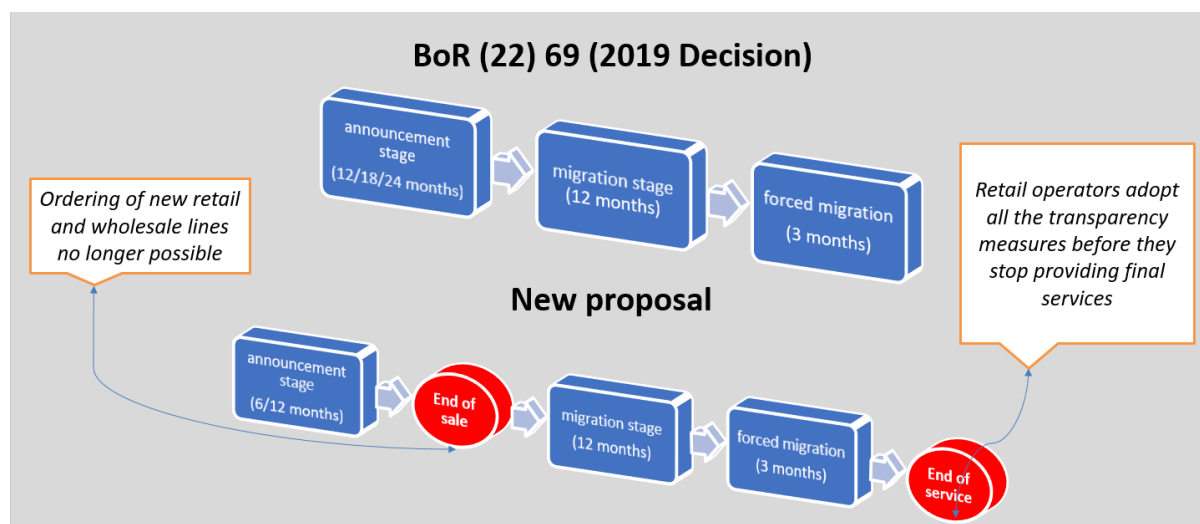


Figure 5: Decommissioning process

According to the current regulation, before announcing the intention of switching-off a LEX, 100% NGA coverage (including FWA, if necessary) and 60% of NGA retail take-up in the areas subject to the switch-off must be reached. After TIM has submitted (to Agcom) a set of candidate-LEXs to be decommissioned, Agcom verifies the fulfilment of the above conditions. After Agcom's approval, the list of LEXs is published and the "announcement stage" starts.

In the new proposal under consultation, the list of LEXs is published by TIM at the same time of the submission to Agcom, and the announcement stage automatically starts (notice period).

Then, Agcom verifies the fulfilment of the above conditions: if for some LEXs the conditions are not satisfied, such LEXs are removed from the list and the announcement stage for them is stopped until a new submission is provided by TIM.

The notice periods are set in the following manner. After the achievement of NGA coverage and NGA take-up conditions, local exchanges start to be switched-off (technical migration process) after a minimum period of:

- 24 months in the white areas,
- 18 months in other areas with ULL services,
- 12 months in other areas with only bitstream or WLR services.

In the new proposal under consultation, considering the different market conditions, the notice periods are shortened to i) 12 months in areas with ULL services, ii) 6 months in other areas with only bitstream or WLR services. Moreover, it is proposed that after the 6/12 months period, end of sale of services is applied by TIM.

The technical migration process – which starts when the notice period ends – must be completed within 12 months. After this period, customer lines can be forcibly migrated to NGA after TIM gives 3 months' prior notification to the customer (forced migration process).

In the new proposal, it is specified that TIM and ANOs give 3 months' prior notification to the customer (forced migration process), under Code of Communication provisions, without modifications of the contractual conditions, allowing functionally-equivalent services at the same prices (end of service). TIM retail and ANOs provide transparency to the final customers about the process at least 6 months before the end of service date (a stakeholder forum may be considered to agree on this process).

As for the economic measures for the migration, the regulation in force sets some migration incentives as a result of the cost analysis (assessed within the technical forum):

- One-off wholesale costs (activation and de-activation fees) covered by TIM;
- TIM also covers additional cost for decommissioning of co-location sites where ANO(s) is/are present, for co-location in new LEXs and for interconnection equipment to migrate customers;
- Wholesale price of the NGA “substituting” service is equalized, during the migration period, to the wholesale price of the “substituted” copper service until the switch-off of the local exchange is realized.
- In non-ULL areas, ANOs able to migrate their customers to NGA networks in 12 months from the approval of market analysis (early migration) will benefit of the same legacy wholesale price for new services (if lower).

The new proposal under consultation includes all these provisions, except the last one.

Under non-discrimination and transparency obligations, Agcom monitors the migration process and TIM guarantees the respect of the published decommissioning plan (penalties may be enforced by Agcom).

In the new proposal under consultation, every six months TIM must publish the list of LEXs that will likely be announced for decommissioning in the following semester, considering the behaviour of the parameters (coverage and take-up).



3.2.2 Substitution matrix

In application of Art. 81 of EECC “The national regulatory authority [...] establishes the availability of alternative products of at least comparable quality providing access to the upgraded network infrastructure substituting the replaced elements if necessary to safeguard competition and the rights of end-users”, following a technical forum and a switch-off trial with operators on technical details of the migration, a wholesale services substitution matrix was set in 2019 by Agcom.

In 2019, two versions of the matrix were considered: i) the Multi-Service Access Node (MSAN) case, when MSANs are installed in the street cabinets to provide POTS services at customer site, and ii) the Full-VoIP case, when only VoIP services are provided after the switch-off. The wholesale services’ substitution matrix identifies for each legacy service the corresponding destination service (landing service when the switching process is concluded). Some of the services are not replicated after the migration.

Table 4: Wholesale substitution matrix (MSAN case) – 2019 regulation in Italy

MSAN case	
Source (legacy) service	Destination service
ULL	VULA or Bitstream FTTCab VDSL naked
Shared Access	
Co-location (LEX)	Co-location (LEX)
SLU	SLU
Co-location (Cabinet)	Co-location (Cabinet)
Bitstream ADSL ATM shared with POTS/WLR	Bitstream ADSL Ethernet shared with POTS/WLR
Bitstream ADSL ATM shared with ISDN/WLR	Bitstream ADSL Ethernet shared with POTS/WLR
Bitstream ADSL ATM naked	Bitstream ADSL Ethernet naked
Bitstream ADSL Ethernet shared with POTS/WLR	Bitstream ADSL Ethernet shared with POTS/WLR
Bitstream ADSL Ethernet shared with ISDN/WLR	Bitstream ADSL Ethernet shared with POTS/WLR
Bitstream ADSL Ethernet naked	Bitstream ADSL Ethernet naked
Bitstream symmetric ATM	
Bitstream symmetric Ethernet	Bitstream FTTCab VDSL (naked) symmetric

MSAN case	
Source (legacy) service	Destination service
CS/CPS on POTS	CS/CPS on POTS
CS/CPS on ISDN	CS/CPS on POTS
WLR POTS	WLR POTS
WLR ISDN BRA	Alternative solutions available: - VoIP IMS - Virtual PBX - Virtual PBX Trunking - Gateway ISDN/VoIP
WLR ISDN PRA	Not replicable
Analog leased line (< = > 2 Mbit/s)	Fibre leased line (Ethernet) or VDSL Bitstream

Table 5: Wholesale substitution matrix (FULL-VoIP case) – 2019 regulation in Italy

FULL-VOIP case	
Source (legacy) service	Destination service
ULL	VULA or Bitstream FTTCab VDSL naked
Shared Access	
Co-location	Co-location
SLU	SLU
Co-location (Cabinet)	Co-location (Cabinet)
Bitstream ADSL ATM shared with POTS/WLR	Bitstream VDSL Ethernet naked
Bitstream ADSL ATM shared with ISDN/WLR	Bitstream VDSL Ethernet naked
Bitstream ADSL ATM naked	Bitstream VDSL Ethernet naked
Bitstream ADSL Ethernet shared with POTS/WLR	Bitstream VDSL Ethernet naked
Bitstream ADSL Ethernet shared with ISDN/WLR	Bitstream VDSL Ethernet naked
Bitstream ADSL Ethernet naked	Bitstream VDSL Ethernet naked
Bitstream symmetric ATM	Bitstream FTTCab VDSL (naked) symmetric
Bitstream symmetric Ethernet	
CS/CPS su POTS	Not replicable
CS/CPS su ISDN	Not replicable
WLR POTS	Not available
WLR ISDN BRA	Not available
WLR ISDN PRA	Not available
Analog leased line (< = > 2 Mbit/s)	Fibre leased line (Ethernet) or VDSL Bitstream

In the new proposal under consultation, only the FULL-VoIP case is considered:

Table 6: Wholesale substitution matrix (FULL VoIP case) – 2023 proposal of regulation in Italy.

FULL-VOIP case	
Source (legacy) service	Destination service
ULL	VULA, co-location at OLT site
Shared Access	
Co-location	Co-location
SLU	SLU
Co-location (Cabinet)	Co-location (Cabinet)
Bitstream ADSL ATM shared with POTS/WLR	Bitstream NGA*
Bitstream ADSL ATM shared with ISDN/WLR	Bitstream NGA*
Bitstream ADSL ATM naked	Bitstream NGA*
Bitstream ADSL Ethernet shared with POTS/WLR	Bitstream NGA*
Bitstream ADSL Ethernet shared with ISDN/WLR	Bitstream NGA*
Bitstream ADSL Ethernet naked	Bitstream NGA*
Bitstream symmetric ATM	Bitstream NGA symmetric*
Bitstream symmetric Ethernet	
CS/CPS su POTS	Not replicable
CS/CPS su ISDN	Not replicable
WLR POTS	No longer regulated
WLR ISDN BRA	No longer regulated
WLR ISDN PRA	No longer regulated
Analog leased line (< = > 2 Mbit/s)	Fibre leased line (Ethernet)

* Service regulated until June 2025 – proposal under consultation

4 Part 3 – Measure ‘Increase of wholesale copper access prices during transition period’ of the forthcoming European Commission Gigabit Connectivity Recommendation

This section summarises the presentations from the European Commission and the NRAs of Belgium and France on the measure ‘Increase of wholesale copper access prices during transition period’ of the forthcoming European Commission Gigabit Connectivity Recommendation.

4.1 European Commission

Ștefan Tăbăreanu, case handler in Unit B3, DG Connect, briefly presented some key provisions of the migration section included in the forthcoming Gigabit Recommendation. The scope of these provisions is the full-scale migration from copper to VHCN. Consequently, all other situations, as for instance upgrades to copper networks, migration from copper to non-VHCN, even very localized migration from copper to VHCN, etc., are not covered by the provisions of the upcoming Gigabit Recommendation.

There are two cumulative conditions under which the NRAs should allow the copper switch off, if they are necessary to safeguard competition and the rights of end-users: (i) availability of an alternative access product of at least comparable quality and (ii) the SMP operator’s commitment to a notice period. For the first condition, it was stressed that the alternative access product does not necessarily need to be provided by the SMP operator. The alternative access product could be provided by one or several ANOs. In any event, the provision of the alternative access product could be the result of regulatory imposed obligations, co-investment commitments, cooperative arrangements, or purely commercial agreements. As for the second condition, it was highlighted that the notice period should not, in principle, exceed 2 to 3 years. Based on national circumstance, a shorter notice period could be considered, especially when all parties involved in the migration process (SMP operator and alternative access seekers) agree.

The Commission’s representative underlined the crucial role the NRAs play in the migration process, from setting a substitution matrix between the access products on the new and legacy network to ensuring a full transparency of the migration process. Special attention was given to the NRAs’ duty of setting the VHCN coverage threshold before removing the access obligation. The said coverage threshold does not necessarily need to be a full 100% since, in practice, there could be many situations justifying a lower percentage bar, especially in remote, rural areas. At the same time, the NRAs’ duty of ensuring against discriminatory practices is especially relevant whenever the alternative access products are provided by the same SMP operator. In this case more than in others the SMP operator has incentives to favour its retail arm over the ANOs.



Whenever the conditions for the copper switch off are met NRAs may consider, inter alia, a progressive relaxation of the price control obligations, if in place. According to the Commission's representative, the upcoming Gigabit Recommendation is aiming at fostering the migration process by allowing the copper price increase. In this respect the price signal is deemed as the most expedient and efficient incentive, both at wholesale and retail level. The cumulative conditions envisaged by the forthcoming Gigabit Recommendation for allowing the copper price increase were listed. It was stressed that several of these conditions are, in fact, safeguards for preserving the competitive outlook of the concerned market. Allowing the copper price increase should not be taken for granted, but instead should be carefully implemented with a view of not undermining competition on the market.

In the final part of its presentation the Commission's representative mentioned a few practical topics suitable for reflection both at national and European level.

The first topic covered the nature of the copper price increase solution during the migration process. It focused on the optional nature of the copper price increase solution. The Gigabit Recommendation was drafted with a view of providing a backing to NRAs that, based on their national circumstances, find it suitable to proceed accordingly. The copper price increase was not regarded as a universally valid solution. Nevertheless, it was stressed once again that allowing a copper price increase should always be associated with safeguards for preserving competition.

The second topic covered the relationship between the copper price increase and the other possible solution to be implemented, namely the copper price stability. It was underlined that no solution is better than another. Each solution has its pros and cons. The copper price increase solution was considered better suited for those markets where the migration towards VHCN has already started, especially if ANOs play a relevant role in this respect, and where strong incentives are still needed to complete the migration process as soon as possible. For markets less advanced towards VHCN, with an SMP operator in a strong competitive position, it was considered probably safer to keep the copper price stable during the most if not the whole migration process.

The third topic revolved around the question whether there are legal solutions for ensuring the SMP operator switches-off the copper network in the notified timeframe. The prospect of putting regulation back in place and the application of fines, if national law provides for them, were mentioned in this regard. However, the disadvantage of these solutions is their lengthy implementation. Putting in place a claw-back mechanism by which ANOs can be compensated for any extra payment to the regulated price if the copper network were not switched off at its due time, was suggested as a possible more efficient approach. This approach has already been envisaged by the French NRA. At the same time, it was underlined that for more serious infringements (e.g., retail arm of the SMP operator still enjoying low-price copper inputs while ANOs have been largely forced to move to more costly alternative access products) competition law provisions remain fully applicable.



Finally, the last topic concerned the scope of the alternative access, whether it refers to price equivalence in addition to quality equivalence. In this regard the evolution of the applicable provision, Article 81 of the EECC, during the legislative process was briefly reminded. While initially the said provision contained a reference to comparability of prices between the access products on the new and legacy network this reference was later removed by the EU legislators. Consequently, price equivalence was not regarded as a condition for the copper switch-off by the Commission representative.

4.2 Belgium

The Belgian NRA, BIPT, opened its presentation with the statement that the topics presented reflected a more theoretical approach to a potential increase of copper access prices during the transition period because the BIPT currently has a very limited practical knowledge of copper switch-off.

Indeed, while the SMP operator Proximus has been rolling out its fibre network since 2017, only in the past few months the copper was switched off in the first three fibre zones. As far as the BIPT is aware, no issues with this copper switch off has been reported, but the BIPT will monitor this closely and ask Proximus proactively for an update on any issues that have come up with the actual copper switch-off.

Since there were no issues reported, the BIPT has not seen any need for any specific measure in order to improve fibre migration.

The BIPT continued its presentation with the statement that it is of the utmost importance that Point 81 of the draft Gigabit Recommendation remains a fully optional measure. During the BEREC workshop, it became clear that each country has its own specificities when it comes to fibre rollout and copper switch-off and that thus, the NRA is best suited to determine the appropriate remedies (if any) in order to improve fibre migration if any problems on this matter would emerge.

Nonetheless, the BIPT sees many potential issues if the copper rental fee would be increased.

First of all, fibre roll out is a strategic process where the business case whether to roll out or not, should not be dependent on any additional financial benefits for the network operator. The BIPT is of the opinion that ANO resources should be better spent trying to promote fibre connectivity instead of paying the network operator additional fees.

Customers of ANOs are already migrating to the fibre network without any additional financial penalty. Customers are fully aware of the benefits of fibre services (and if they are not aware, both the BIPT and Proximus provide an overview of these benefits to the customers on their websites¹¹). Specifically for Belgium, there is an alternative coax network rolled out which

¹¹ BIPT fibre info: <https://www.glasvezelinfo.be/en/general-information/possibilities-offered-fibre>



covers practically the entirety of Belgium. Customers who do not want to migrate to fibre, have the option to switch their services to the coax network (FWA services are also a possibility but are less used in Belgium). Furthermore, due to the “Easy Switch” process, customers can switch operators easily with a minimum of administrative steps and without any termination fee.¹² Thus, it is up to the fibre network operator to convince its customers (with lower prices or special promotions) to migrate to the fibre network (“carrot approach”). A “stick approach” would not work in this context because the customers will simply switch to a competitor’s service on the coax networks.

The BIPT further sees other possible problems, for example, what would happen if the fibre roll out or copper switch-off phase is delayed (by the network operator or other external factors)? A clawback mechanism needs to be introduced which could cause discussions (and possible litigations) between the ANOs and the network operator, leading to additional work for the NRA to investigate and find a solution. On a similar note, extensive work will also be required from the NRA in order to keep a complete up-to-date view of all roll-out plans, delays and price increases on a highly detailed level.

On a financial level, it is clear for the BIPT that a temporary price increase of the copper rental fee would cause either a margin squeeze or an increase of retail prices, which would be against the objective of the EECC. It is unclear for the BIPT how a price increase would not “lead to excessive retail prices” or “not allow for margin squeeze” in the Belgian context (safeguards c and d of Point 81 of the draft Gigabit Recommendation).

The BIPT concluded that there is no proven effect on fibre migration “willingness” when copper prices are increased and sees potential issues on both operational and financial level. The potential negative side-effects outweigh any potential positive effects. At this point, within the current context of fibre rollout and copper switch off, the BIPT sees no reason to introduce this measure in Belgium.

4.3 France

In France, Orange, as the incumbent national operator, has significant market power for passive access to high and very high capacity networks, in particular for access to the copper local loop. It has access obligations relating to the copper local loop (full and partial unbundling, access to the local loop and related resources and services).

The French NRA, Arcep, is currently working on the 7th market 1 analysis cycle (2024-2028) in a significantly different context from the one in Belgium, in particular due to the higher advancement in fibre rollout in France. In the public consultation issued by Arcep on 29th of June 2023 relating to a draft market 1 analysis decision, geographic modulation of the pricing

¹² <https://www.bipt.be/consumers/switching-fixed-operators>



remedy is considered to take into account the expected evolution in competitive situation over the next cycle resulting in the following three cases:

- Cost orientation remains where competitive status has not evolved due to the lack of significant alternative infrastructure to copper;
- Non-excessivity applies in case of lines where competitive status evolved but without justifying withdrawing the pricing remedy;
- No pricing obligation applies in case of lines in municipalities that went in commercial closure for more than 6 months and for which area-level switch-off has been announced by Orange to happen within 2 years. In the public consultation, it is envisaged that for those lines, Orange has the non-discrimination obligation to carry out a price replicability test if it applies wholesale prices above those with a non-excessivity obligation.

5 List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
ADSL2	Asymmetric Digital Subscriber Line transceivers 2
ANO	Alternative Network Operator
BEREC	Body of European Regulators for Electronic Communications
BRA	Basic Rate Access
BSA	Bit Stream Access
CPS	Carrier Pre-Selection
CS	Carrier Selection
DOCSIS	Data Over Cable Service Interface Specification
DSLAM	Digital Subscriber Line Access Multiplexer
EECC	European Electronic Communications Code
FTTB	Fibre To The Building
FTTC	Fibre To The Cabinet
FTTH	Fibre To The Home
FWA	Fixed Wireless Access



GPON	Gigabit-capable Passive Optical Network
HFC	Hybrid Fibre Coax
IPTV	Internet Protocol TeleVision
ISDN	Integrated Service Digital Network
LEX	Local EXchange
MDF	Main Distribution Frame
MNO	Mobile Network Operator
MSAN	Multi-Service Access Node
NGA	Next Generation Access
NRA	National Regulatory Authority
ODF	Optical Distribution Frame
ODP	Optical Distribution Point
OLT	Optical Line Termination
P2MP	Point-to-MultiPoint
POTS	Plain Old Telephone Service
PRA	Primary Rate Access
QoS	Quality of Service
SLU	Sub-Loop Unbundling
SMP	Significant Market Power
SMS	Short Message Service
TV	TeleVision
ULL	Unbundled Local Loop
VDSL2	Very high speed Digital Subscriber Line 2
VHCN	Very High Capacity Networks
VoIP	Voice over Internet Protocol



VULA	Virtual Unbundled Local Access
WLR	Wholesale Line Rental
xDSL	x (all types of) Digital Subscriber Line

