

Approaches to rural broadband in Europe

August 2022

Benoît Felten, Karim Bensassi-Nour





About Plum

Plum is an independent consulting firm, focused on telecommunications, media, technology, and adjacent sectors. We apply rigorous analysis to address challenges and opportunities across regulatory, radio spectrum, economic, commercial, and technology domains.



About this document

This white paper by Plum Consulting, commissioned by Chorus, discusses the different approaches to rural broadband in Europe.

Contents

Executive Summary	4
1 Introduction	5
2 Rural Broadband is the next hurdle	7
3 The various approaches to rural broadband in Europe	9
3.1 Scope and scale	10
3.2 Funding	12
3.3 Concession models	14
3.4 Technology solutions	16
4 Conclusions	17

Executive Summary

Many European countries are now getting at a point in their Fibre to the Premises (FTTP) deployment where the only portions of the territory that remain uncovered are deep rural areas. In initial plans laid out a decade ago, these areas were considered very hard to reach and policy instruments in place aimed at delivering *some* broadband solution there, but not necessarily FTTP.

Now that rural is the last hurdle, policy goals have shifted. Countries like Spain, France or the UK are openly stating that their goal is to have fibre deployed to *every* premise in the country, and while they admit that it might not be achievable for a very small portion of households for topological reasons (small islands, mountain peaks...) the policy instruments are now in place to deliver this. When 80% or more of the population has access to gigabit broadband capacities at affordable prices, it becomes very hard to argue that rural citizens should be treated as second-class with worse and more expensive broadband.

EU rules determine that state funding can only be used when it does not distort competition. In a nutshell, it is focused on areas where quality broadband solutions (currently determined as at least 100Mbps download speed) don't exist and where private players have no intention to invest without subsidies. In addition, only wholesale projects can be publicly funded, in order to ensure service competition in rural areas.

Policy instruments vary from country to country depending on how much each government wishes (or can) rely on the private market and how granular the level of intervention. Indeed, there are four key aspects that define the policies put in place:

- **Scope and scale** can range from a national plan (such as in Ireland) aiming to fibre up all rural areas in a single contract to small scale local funded initiatives (such as the smaller tenders in BDUK's Project Gigabit). Overall, the scale tends to settle around regional projects as exemplified in France and Spain.
- **Funding** is predominantly national in Western Europe although some countries where broadband is underdeveloped (Poland or Italy) benefit from EU structural funds. Funding schemes tend to favor at-scale deployments led by private network operators, but many countries have voucher schemes to either address ultra-local issues or to finance temporary solutions while end-users in remote areas wait for fibre to be deployed.
- Subsidised tenders for broadband deployment are predominantly managed as **concessions** to network operators for periods of 15-25 years. Network operators are expected to make a profit, but compete in the tenders either on how little subsidies they are willing to accept or on how broad a deployment they are willing to invest in. In most cases, especially at a local or regional level, the infrastructure deployed remains the property of the government entity funding the project, but there are exceptions.
- While satellite and fixed wireless **access technologies** can be funded through aforementioned voucher schemes, policy makers now consider them to be temporary solutions deployed while end-users wait for fibre to arrive. Satellite could be a slightly longer-term solution for the very small portion of the territory where deploying fibre is deemed impossible, certainly less than 1% of the territory.

The overarching view of policy makers in these advanced broadband countries in Europe is that funding needs to be targeted at permanent solutions. This means that rural citizens in these countries will enjoy the benefits of the same high-capacity broadband solutions as their urban counterparts, and at the same price. The EU goals are to deliver near ubiquitous very high-capacity networks by 2030, but countries like Spain, France, Sweden or the Netherlands will no doubt have achieved 100% coverage way before that.

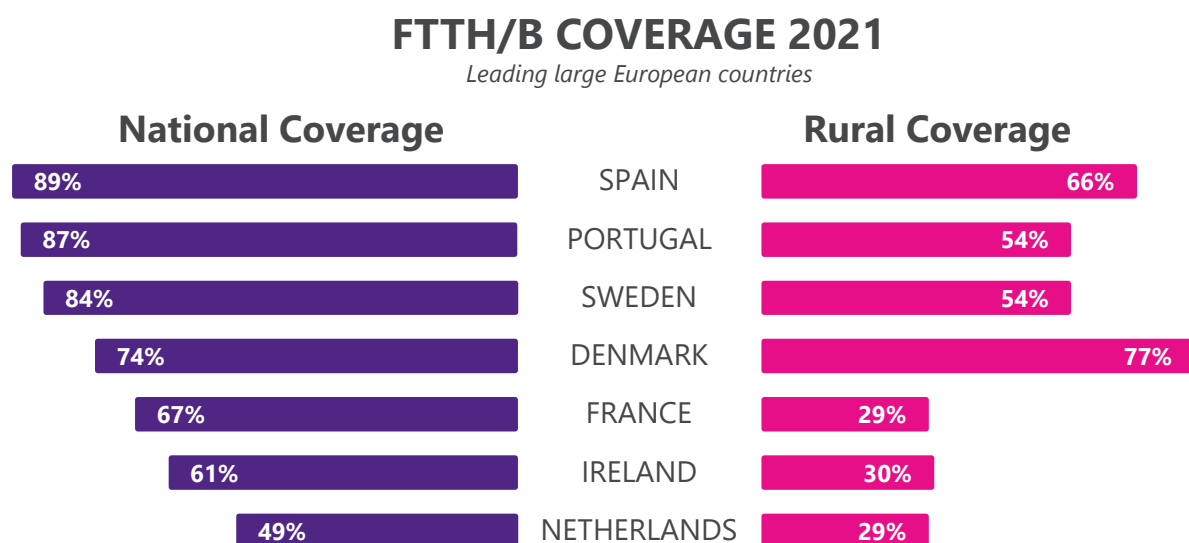
1 Introduction

When it comes to fibre to the premises (FTTP) deployment, Europe's progress has been uneven to say the least. While some Nordic countries were actively laying out fibre for residential customers in the early 00s, many others didn't wake up to the need for broadband upgrades until much later. From 2010 onwards, most countries in the European Union (EU) were actively pushing for FTTP however, and many of these – like Spain, Portugal or France – more than caught up with their Northern neighbors. The largest exceptions until recently were Italy, the UK and Germany, and while FTTP developments in the latter are still unclear, Italy and the UK have plans in place to catch up.

According to data by the FTTH Council Europe as published in its annual panorama, fibre was available to 48.5% of European countries (EU27 + UK) as of September 2021. 15 countries had passed the 50% coverage milestone at that date, and growth rates year on year are very high. In all of these countries, the key consideration going forward is increasingly about rural coverage as urban and suburban coverage is mostly done or underway.

As Figure 1.1 shows, if we focus on the leading countries in Western and Northern Europe, overall fibre coverage is in some cases close to 90% of households, and rural coverage itself is above 50% for a number of these countries.

Figure 1.1: National and rural FTTH/B coverage 2021¹



Source: FTTH Council Europe, Plum Consulting

Until recently, rural broadband and particularly the harder to connect portions of rural, were considered an exception to the national policy goals when it came to broadband. While it was generally agreed that some broadband solution had to be available to rural households, it was also accepted that available solutions would not and need not be as effective there as they were for the rest of the country. While there are still differences in approach from country to country on this topic, in the more advanced countries (and indeed increasingly at EU institution level) there is a perception that delivering sub-par broadband to rural citizens is no longer an acceptable goal.

¹ FTTH/B Coverage includes cable when the last amplifier is in the building, not when it's outside the building. This is irrespective of DOCSIS 4.0 implementation. As a consequence, the Netherlands gigabit coverage is likely underestimated in this representation.

Yet the issues around deep rural broadband connectivity remain the same: it's more complicated and costly to reach, the private market is less inclined to invest and the technology solutions that could deliver affordability tend not to deliver a high degree of quality or reliability. European studies tend to show that the cost to connect with FTTP increases dramatically when premises density falls below 500 premises per km².

A further incentive to address the issue in a more permanent way lies in the perspective of copper switch-off. While the extinction of copper was seen as a gradual long-term goal just a few years ago, a number of countries like France and Spain now have short term (a few years out) and ambitious plans to decommission the copper. This can only be done if there is an assurance that the most rural of customers currently relying on copper for communications – and (when possible) broadband – will have alternatives once the copper network is switched off.

The aim of this report is to examine the goals, approaches and policies put in place by the EU countries most advanced in deployment or most ambitious in targets when it comes to rural broadband connectivity. The issues may be the same everywhere, but the approaches vary.

In order to produce this report, Plum Consulting has examined FTTP coverage and adoption data in Europe and analysed public policies and the associated schemes for rural broadband, both through secondary sources and primary interviews with key experts and stakeholders in the countries discussed.

In order to clarify the terminology, in this report we will use the terms

- “deep rural” to mean those rural areas that are hard to reach on a commercial basis for network operators deploying FTTP;
- “advanced VHCN countries” to describe those large countries in Europe where very high capacity networks (VHCN) as defined by the European Commission are available to at least 50% of households. These include Spain, Portugal, Denmark, Sweden, France, Ireland, the Netherlands.

2 Rural Broadband is the next hurdle

Until 2018, there was a principle enshrined in the digital infrastructure policies of the EU: technology neutrality. This principle stated that while European institutions (and therefore national regulators) could set targets for the deployment of infrastructure, these targets should not favour one technology over another. This is why for a long time the targets were only expressed in terms of speeds (usually download speeds) and little else.

DG Connect, the EU directorate in charge of setting these targets and facilitating their achievement, changed this approach in 2018. It defined what it called **Very High Capacity Networks (VHCN)** as being *an electronic communications network which consists wholly of optical fibre elements at least up to the distribution point at the serving location* or any other solution delivering the same performance. From that point onwards, the emphasis of public policy for the deployment of fixed network services has been squarely focused on fibre to the premises (FTTP). The goal established by the EU² is to ensure that all Europeans households are covered by a gigabit network by 2030.

The reality of deployment is, as always, a little different. As shown in Figure 1.1, a number of countries are reaching very high levels of availability, with Spain being the leader amongst the largest countries, but Portugal, Sweden, Denmark and France are not far behind. All of these (and a number of the smaller countries as well) are getting within reach of 80-90% national coverage. Inevitably, for them, the focus is now shifting to the hardest parts to deploy, rural areas. While the private market took the brunt of the investment in fibre deployment in denser parts of the territory, all of these countries (and many more in Europe) are now facing the more difficult task of figuring out how the hardest to reach areas can be covered with high quality and reliable broadband as well. This will in many instances require some form of public subsidy or funding.

Frameworks for public intervention

Within the EU there are two accepted scenarios for public intervention in network deployment:

- The first one is for government (most often local) to coinvest alongside private players. This is called the “Market Economy Investors Principle” and basically posits that a public entity that invests in this way is subject to the same rules, risks and consequences as any other (private) investor. While this has been used in the past (for Amsterdam’s FTTP network, for example), it’s rarely if ever used any more.
- The second is for direct subsidies, and it follows the EU State Aid rules, designed to ensure such public funding does not distort competition. Essentially, this limits the use of state aid to solutions that will significantly improve broadband performance in areas where no commercial broadband solution currently meets the minimum performance thresholds set by the Commission.

Direct subsidies under State Aid rules is the predominant framework for intervention in fibre network deployment in Europe. It has been made a little bit more complex lately because while the ambitions and numerical targets are set by DG Connect (with the introduction of VHCN as a baseline in 2018), State Aid rules are managed by DG Competition. And the DG Competition rules are not quite up to date in that respect, so that the thresholds for public intervention are much lower in performance than those defined by VHCN (essentially, for DG Competition, state aid is allowed for solutions that offer download speeds of 100Mbps with an upgrade path to 1Gbps).

In addition, all such subsidies must go to wholesale networks. This means wholesale *only* networks, ie. operations that do not sell services to end-users (although they may in some cases sell a network subscription).

² European Commission, 2030 Digital Compass: The European way for the Digital Decade. September 2021. Available at: <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021DC0118>

The philosophy behind this obligation is to avoid the creation of service monopolies in rural areas where lack of competition on market terms would completely lock-in customers to a single service provider. The rules do not state at what layer the wholesale network needs to be open, so some models are passive (network operators leasing dark fibre to service providers) and some are active (network operators leasing capacity to service providers.)

While State Aid rules essentially limit public intervention to areas where no broadband solution that meets the criteria exists today (defined as “white areas”), the actual focus of intervention is very different in countries where deployment is well advanced compared to countries where it has yet to emerge. While the latter might be using subsidies to boost fibre deployment in low-density urban areas, the former are now squarely focused on hard-to-reach rural dwellings. This raises a number of specific issues:

- **Definition:** At EU level, “rural” definitions seem to vary. In general, they are tied to population density, but this still disregards large disparities. The main consequence is that while the word “rural” may be used in PR and general communication, it’s rarely used to define specific funding schemes or deployments.
- **Mapping:** While some European countries like Denmark or Ireland went through a very precise exercise of defining exactly what the hard-to-reach rural areas are, many other countries have not invested in such an exercise. They rely instead on a set of eligibility rules to determine, for each project that requires funding, whether it’s eligible or not. There is another issue with mapping and that is related to underlying, reusable infrastructure (essentially ducts and poles) which is theoretically mapped by incumbents but often inaccurate or not up to date. Since reusing existing infrastructure is often a way to reduce deployment costs (and therefore subsidies), this can be a significant problem.
- **Time horizon:** European national and local governments are stuck between a rock and a hard place when it comes to addressing rural broadband connectivity issues. On the one hand, they want to provide disconnected homes with *some* solution to connect *fast*. On the other hand, they’d like to address the issue once and for all, which takes time. In countries still focused on deploying VHCNs nationally, solutions for rural broadband tend to be quick to deploy and not very good in performance. For countries more advanced in national deployment, the focus is on addressing the issue in a more permanent way.
- **Private domain:** One issue that is specific to rural areas is the amount of deployment that needs to happen beyond the demarcation point between public and private domain. In denser areas, this is hardly an issue because we’re often talking about a few meters of fibre cable deployment. In rural areas it can be tens or hundreds of meters, sometimes even more. Who pays for that bit of the installation is an important parameter that can dramatically change actual availability.

3 The various approaches to rural broadband in Europe

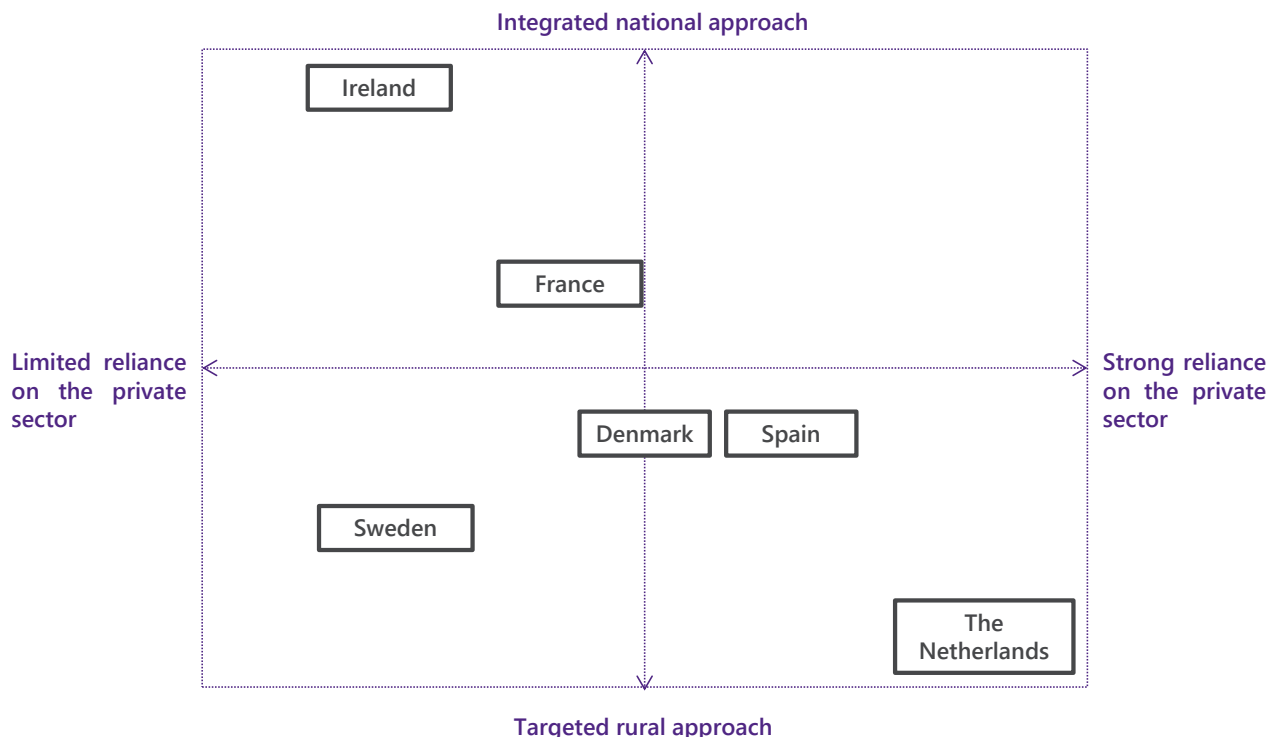
While the EU level policy frameworks (and their post-Brexit UK equivalents) create constraints and determine some aspects of rural broadband plans in European countries, there are still a lot of variations on how individual countries approach the issue. Even focusing only on the countries where FTTP deployment is advanced, we see a lot of different schemes put in place, although there are some commonalities.

One common thread amongst the most advanced European countries when it comes to deployment of VHCN is that alternatives to fibre broadband are considered to be temporary measures for deep rural. In countries that have passed the 50% mark in national VHCN availability, there is no example of a policy where fixed wireless or satellite solutions are considered long-term resources for deep rural. The only concession to this, made generally verbally but unwritten, is for super hard to reach dwellings, like small islands or mountain chalets, where it is considered that satellite is probably the only viable solution in the face of topological complexity and costs to fibre up in the tens of thousands of EUR per dwelling. A ballpark proportion of such dwellings in the mouths of policy makers is certainly below 1%, maybe even as low as 0.1%.

But even as those advanced VHCN countries seem to converge on the ultimate goal, there are many differences in implementation and how they decide to get there. Two key aspects seem to determine a lot of these variations:

- **The role of commercial initiatives:** Even accepting the fact that most of the targeted rural deployment (or hard-to-reach rural deployment) will not be covered on a purely commercial basis, the degree of reliance on private or commercial players varies from country to country. Some, like the Netherlands, anticipate that the vast majority of rural broadband will be deployed by private entities with no public subsidies involved. Others, like France, have had a framework in place for public funding for over a decade, that even applied initially to some not-very-hard-to-reach rural areas. Factors that determine the degree of reliance on the private market include political culture, degree of competition in the market and willingness to accelerate deployment.
- **An integrated national approach vs. a targeted rural approach:** Some countries address rural as a gradual extension of the national territory, therefore applying the same rules and schemes (mostly) to hard-to-reach rural that they applied to the rest of the country. This is the case in France, for example, where the country was initially divided into three “zones” with different rules in each depending on availability of infrastructure and degrees of competition. In this case, hard-to-reach rural is addressed using the same tools as the rest of the territory, with only a difference in degree in funding. At the opposite end is Ireland, which precisely identified hard to reach areas and implemented a dedicated national broadband plan to fibre up those communities with specific funding. The UK stands somewhere in between, with a rural broadband scheme targeting the hardest to reach and gradually expanding back towards easier to connect communities in the hope that commercial initiatives will have covered most of those by the time the hardest to reach is done.

Figure 3.1: Classification of countries according to the role of private initiatives and the type of policy approach to address rural broadband



Source: Plum analysis

Within the general frameworks put in place, the way each country approaches projects that require funding for broadband infrastructure to be deployed tend to vary based on scope, funding mechanisms, concession models and technology choices.

3.1 Scope and scale

There is only one country in Europe that seems to openly announce 100% FTTP coverage as its goal: Spain. In its *España Digital 2025* plan, the government states quite clearly that it wants to "guarantee an adequate digital connectivity for 100% of the population" and "aims at making the digital divide between rural and urban areas disappear". Its 2025 objective is to "have 100% of the population with a 100Mbps availability", but the goal, while expressed in technology neutral terms, is clearly to deploy fibre everywhere.

That said, talking to policy makers in other countries, it quickly becomes apparent that the advanced VHCN countries share the same goal, they're just not expressing it in quite the same way. The prevailing view seems to be that once you have fibre to the premises available to over 80% of households, it becomes difficult to argue that the remaining households should not be entitled to the same service at the same price. Another reason for this ambition is that the amounts of subsidies that were committed in the early days of deployment to reach the 80% thresholds have not been entirely spent: in the meantime, private players realised that proactive deployment was lucrative. Additionally, demand for FTTP has picked up: while anticipated at around 30-40% in early business models it's now often at 60-70%, which makes these business models a lot more viable on their own.

Obviously, the extent of deep rural needs will vary from country to country. Many factors are at hand to explain this: geography and topology, habitat density and density disparities, network history, etc. For example, Belgium and the Netherlands have historically had over 90% cable coverage. In the Netherlands, that cable plant has

been largely updated to the latest architectures and protocols and is gigabit ready. This means that the scope of public intervention to connect the deep rural households will be limited (it is estimated at around 25,000 premises by the Dutch government in a country of 8 million homes.) The Irish national broadband plan on the other hand aims at extending FTTP availability to 560,000 homes in a country of 2.4 million homes.

Table 3.1: The Irish National Broadband Plan

The Irish National Broadband Plan (NBP) was initiated in 2015 and contractualised for 25 years in 2019 to ensure the coverage of 22% of Irish premises which no commercial operator intended to serve. The bid was won by National Broadband Ireland (NBI), a dedicated private company owned by investments funds Asterion, Tetrad and Granahan McCourt. Its mandate is to serve around 560,000 premises (around 1.1m people) including over 54,000 farms, 44,000 non-farm businesses and 679 schools.

Three specificities of the NBP distinguish it from most other European initiatives:

- the fact that it covers the whole of hard-to-reach Ireland under a single contract;
- the inclusion in the funding of all private domain costs. It's estimated that 20% of the overall cost is in these final drops;
- At the end of the 25-year term contract, NBI will own the network assets.

NBI operates as a wholesale only network provider, and 39 service providers are currently offering broadband services over NBI's network. While home connections are only starting to pick up (around 15,000 premises are subscribed to NBI's network) detailed planning is done for half the footprint (around 300,000 premises) and deployment is now expected to speed up.

When the program was initially launched, there was a lot of political pushback from the opposition, but as the world (and Ireland) entered the pandemic, the criticism died down. The need for decent connectivity in rural Ireland became obvious to all.

Irrespective of scope though, there are also important differences in the scale of the publicly funded projects. While it could be argued that the scale will not ultimately make much difference to the end result provided that all of the areas to be covered are covered, the logistics of scale have an impact on private funding, timing and the interoperability of networks.

At one end of the spectrum, we have Ireland again: the national broadband plan aimed at addressing the whole deep rural connectivity issue through one single scheme. The entire area targeted by public funding was identified after private players (and particularly the incumbent) expressed their commitment to fibre deployment. A tender was issued to cover all of the identified premises through a single scheme as part of a 25-year contract. Britain's most recent funding scheme, Project Gigabit, has two tracks: one for large scale projects, at county level or above, and one for small scale projects where geographical or habitat specificities mean that blending it within a larger scale project would not make sense. Spain's scheme for deep rural broadband historically favoured small scale projects, but lately has shifted to encourage province wide bids.

At the other end of the spectrum, the *broadband pool* in Denmark is designed for small scale programs, as low as a few homes and ranging up to a few thousand. In order to benefit from the scheme, communities (often led by their local government entities) must solicit the funding but also contribute their own money (the state typically only contributes 60% of the gap funding, the remaining 40% must come from either local government or individuals). Most often, these successful bids are then handled by rural utilities that already serve nearby areas with fibre broadband and expand their network thanks to the gap funding.

3.2 Funding

There are essentially two sources of funding when it comes to financing national broadband deployment in the EU:

- EU structural funds that are allocated in priority to areas with underdeveloped infrastructure. Some structural funds can be allocated to fibre broadband deployment as is the case in Poland and Italy.
- National funds that countries are free to allocate provided they are approved by the European Commission in the context of EU State Aid guidelines.

Historically, a disproportionate amount of EU structural funds have gone to those Eastern European countries that have been lagging when it comes to digital infrastructure. Conversely, if we look specifically at advanced VHCN countries, a substantial part of the infrastructure subsidies tends to come from national funds (100% of the Irish NBP funding is national). There is a recent exception to that in the form of COVID recovery funds, a large envelope of European funding that can be used by countries in a variety of different ways. Several advanced VHCN countries have chosen to use at least part of those funds to address the deep rural issues: the pandemic lockdowns have shown how dependent our societies are on decent connectivity.

In most instances, the funds come from specifically designed digital infrastructure schemes, like BDUK in the UK or the Danish national broadband pool (bredbåndspuljen). In at least one instance however, Sweden, the funds come instead from the Agricultural Fund for Rural Development (EAFRD).

The prevailing philosophy when it comes to digital infrastructure projects is to consider subsidies as gap funding. The public intervention is supposed to make a project deemed unprofitable on pure market terms into a commercially viable one. Most deep rural projects are public private partnerships (PPP). With this in mind, there are generally two tender structures that are favoured:

- The first one is tenders issued on a specific territory and a well-identified number of premises. The tender is awarded on a number of criteria with a significant weight allocated to the lowest bidder, ie. the private network operator who will ask for the least amounts of public subsidies. This is the model established by the *réseaux d'initiative publics* (RIP) in France and similar programs exist in other countries.
- The second type of tender issued defines the targeted territory a little more loosely but attribute specific amounts of subsidies. The tender is then awarded on various criteria with the key one being how far each network operator bidding will reach in terms of coverage. This is how the Project Gigabit tenders are handled in the UK.

Table 3.2: Subsidy scheme for wireless connectivity in France

In France, the policy framework for high-speed broadband is called 'Programme France Très Haut Débit – (PFTHD)'. French government estimated the total investment for FTTP in France to 20 billion Euros and has earmarked 3.3 billion of public investment for subsidies to meet the PFTHD's gradual targets:

- to ensure that all citizens have access to high-speed broadband (>16 Mbit/s) or very high-speed broadband (>30Mbit/s);
- to provide all regions with state-of-the art digital infrastructure offering everyone access to very high-speed broadband by 2022 ; and
- to generalise optical fibre throughout the country by 2025.

Fibre networks are deployed by private operators in French urban areas which represent 55% of total premises. In rural areas, local authorities have the responsibility to provide very high-speed broadband within the 'Public initiative framework'.

As of 2021, only 29% of premises in rural areas are covered by fibre. To ensure effective access to high-speed broadband for people who do not yet have fibre, in 2018 the government launched a parallel subsidy scheme called 'Digital Cohesion of Territories System', to support connectivity via wireless technologies. The scheme's purpose is to allow premises in deep rural areas to have an immediate solution to access high-speed broadband while fibre is being deployed. The solution can be offered via either Fixed Wireless Access (FWA) Satellite or Wireless Local Loops (WLL).

Under this scheme, both households and businesses located in the 28,000 communities lacking fibre coverage can benefit from financial support up to 150 € for a service offering high-speed broadband (>16Mbit/s); up to 300 € for a service offering very high-speed broadband (> 30Mbit/s) and up to 600 € for a service offering very high-speed broadband if they are low income.

The financial support is supposed to cover equipment fees, installation fees and commissioning fees of the wireless solution selected by beneficiaries. It is paid directly to the service provider.

The core programs in each country aim to deploy networks at scale, to cover at least a few tens of thousands of premises (in the case of the smallest UK tenders) and sometimes up to several hundreds of thousands. In addition to these programs however, several countries also have voucher schemes targeted to end users as opposed to network operators. These schemes serve several purposes:

- aggregate demand in hard-to-reach areas so that the private market sees the potential for a commercial rollout;
- address the issue of connection costs and/or private domain deployment costs when they constitute a strong barrier to adoption; and
- offer short term solutions for connectivity when the perspective of FTTP deployment is still some time away.

The amounts of subsidies offered through these voucher schemes vary a lot. In the French scheme they are really designed as temporary measures and therefore relatively low level (between 150 and 600 EUR depending on the capacity of the solution and the beneficiary's financial situation) whereas in the BDUK scheme they can go as high as £ 3,500 to cover for high deployment costs to individual premises. In all instances, these vouchers are paid through the network operators ultimately connecting or serving the end-user.

One principle that is consistent across all of these schemes is never to subsidise the subscription, but only the connection costs, even for temporary solutions. So – while satellite subscriptions for example are significantly more expensive than regular fibre broadband subscriptions – digital infrastructure schemes would rather finance the installation of a satellite receiver while the end-user waits for a fibre connection than subsidise the subscription. And once fibre is available to that location, they would rather fund the excess cost to connect once and for all rather than allow the network or service providers to charge a higher rate than what is available in the rest of the country.

More generally, the funding schemes everywhere in Europe seem to be designed to find permanent solutions in as many cases as possible, even when connection costs are very high, knowing that once fibre is in place, no additional funding will be necessary for the foreseeable future. Full fibre, as the UK officials call it, is seen in many ways as a nation building exercise. The investment is considerable, but it's a once in a lifetime endeavor.

3.3 Concession models

Due to different utility models in Europe, some countries (generally in Northern Europe) still have a lot of publicly owned local utility companies while other countries don't. When local utility companies exist, publicly owned fibre networks exist as well. This is the case in Sweden, where numerous fibre networks are owned and managed by municipalities (with the precursor being Stokab in Stockholm), but also in some parts of Germany where utility companies (electricity, water or municipal utilities) have branched out into broadband infrastructure. There isn't an immediate correlation between local utilities and publicly owned utilities however. We also see cases of private utilities (particularly electricity companies) either deploying fibre to the premises under their own brand, as in Denmark, or co-owning a separate entity designed to deploy fibre, as in Italy.

That said, the prevailing model for deep rural deployment tends to be a concession model. Public private partnerships are favoured because the financial burden on public funds is lower, but also because the EU tends to view publicly owned telecom companies (at least on a large scale) with some suspicion. There are different concession models not only in different countries but sometimes in the same country, depending on the degree of freedom given by national digital infrastructure schemes.

What stays roughly the same though is the roles and responsibilities of the players involved:

- **Government entities issue tenders for specific areas to be covered with broadband.** It can be done either at national level through a government scheme (as in Ireland and the UK) or at local or regional government level (such as in France and Spain). The tenders are generally backed by high level economic analysis of costs and an understanding of available funding. When handled by local or regional governments, these can petition for national funding from the relevant funding schemes, but often also contribute from their own local or regional budgets if they deem it necessary.
- **Network operators bid to win the tenders,** after which they have to build, operate and maintain the network for a concession period of usually no less than 15 years. There is an expectation that the network operator must run a profit from the concession, even though this will likely materialise a number of years after the deployment starts due to the long-term nature of infrastructure business models.
- **Long-term investors finance these network operators** for the bulk of their funding (public subsidies typically only cover a small portion of the overall funding need). These long-term investors are often pension funds or aggregates of so-called "patient capital" funds that expect relatively low but steady returns on investment once the project starts to make profit.

There is one more type of player in the ecosystem however, that is not involved in the tender process: the service provider. Because of the state aid conditions, all of these subsidised networks must be wholesale so as not to create a regional service monopoly. This means that the network operator does not sell broadband services to the end users.

Table 3.3: Why Denmark is the leading EU country in rural fibre deployment?

As of 2021, fibre coverage in Denmark has reached 74% of premises nationally and 77% in rural areas. This makes Denmark the only country in Europe where rural fibre coverage is higher than national coverage. This comparatively strong performance in rural fibre deployment originates in some changes in utility regulation that date back 20 years. Following long and painful breakdowns in electricity provisioning due to winter storms, the Danish government forced utility companies to bury their networks to mitigate future damage. Many of the rural cooperative utility providers decided to bury fibre ducts alongside their utility ducts and became broadband providers. Since incumbent TDC was one of the last incumbents to commit to FTTP deployment in Europe, urban deployment of fibre lags that of rural areas.

The broadband pool

The broadband pool is a funding mechanism that provides support for local broadband projects in areas with poor coverage. 6% of all premises without access to VHCN are targeted by this scheme. The Fund is administered by the Danish Energy Agency. Its goal is to encourage potential customers to aggregate their needs to apply collectively for financial assistance. The grants that are provided are up to DKK 125,000. Since 2022, the broadband pool scheme allows customers to apply individually. Since 2018, the Danish government has spent DKK 100 million each year for this scheme.³

This is the prevailing scenario in Europe today for deep rural deployments, and while the details often vary, the general structure is similar from country to country. The underlying philosophy is that of course the private network operators must generate a profit. However, government entities walk a fine line to offer enough subsidies to incentivise private investment without burdening their budgets to excess. As has been mentioned already, national governments that were early on the FTTP bandwagon have generally spent less than anticipated because market conditions have improved over time:

- Network operators have gotten better at what they do and have been able to lower the cost to deploy and maintain their networks.
- End-users are educated to the benefits of broadband in general and fibre broadband in particular, which means that demand for service is both higher and faster to materialise once deployment is underway.

For both reasons, the levels of subsidies required to find the balance between private market profitability and fibre network availability is much lower now that it was ten years ago when some of these schemes started.

As we mentioned at the beginning of this report, it makes little sense to compare the amounts of subsidies per household in different countries because the situations are so different from one to the other. When national fibre building exercises have been undertaken however, or when they are envisaged, we can at least examine the orders of magnitude of this investment as a reference point:

- In the case of the Irish national broadband plan, the overall investment is roughly 6,500 EUR per premise included in the plan (around 550,000 premises, or roughly 22% of premises in the country.) Note that

³ <https://digital-strategy.ec.europa.eu/en/policies/broadband-denmark>

this includes all private domain deployment, an exception in these schemes as most European countries haven't so far decided to cover that cost entirely.

- In the case of the very hard-to-reach Netherlands plan, not yet implemented but being discussed, the anticipated cost would be around 13,200 EUR per premise but only over 19,000 premises, the hardest of the hard-to-reach.

Note that in both instances, this is still gap funding for a private rollout.

One key aspect that does vary from PPP to PPP is infrastructure ownership. In most concession models, after the contract ends, the infrastructure is owned by the local government subsidising the deployment. The concession is then put up for competition again through a tender process and either awarded to the initial network operator or to a new one. There are some instances however where, at the end of the concession, the infrastructure is ceded to the network operator that built the network. In this case, the local government assumes (rightly so, usually) that the network will keep operating after the PPP is over. Because of the residual value of the infrastructure itself, this is one way to keep the level of subsidies low compared to models where the infrastructure remains in the hands of the local government.

3.4 Technology solutions

As has been mentioned above, the combination of de facto technology constraints imposed by state aid rules and the ambition of the advanced VHCN countries mean that none of the long-term plans in this group of advanced countries consider solutions that are not fibre optic based. In practice, since cable technologies are not very wholesale compatible, and since cable operators themselves, when expanding their network footprints, tend to now deploy FTTP, this means fibre to the premises is the preferred solution. This doesn't mean however that there are no other technologies in the field.

Fixed wireless access (FWA) is seldom used although some deep rural projects are awarded funding to deploy in remote areas where fibre is unlikely to be available for some time. The issue, according to people in charge of funding schemes in various advanced VHCN countries is that FWA is constrained by a combination of factors: spectrum availability and household density. Below a certain density, the cost of deployment combined with the cost of the spectrum allocation make the business model non-viable. Above a certain density, because of the shared spectrum resource, performance degrades for all subscribers in the coverage area. Finding the sweet spot between those two is tricky and ultimately makes FWA a hard solution to apply to the rural connectivity problem. A number of countries, like the UK, will only approve funding for FWA solutions if the antennas are directly fibered up, which makes the deployment all the more costly.

Satellite – especially the recent low-orbit solutions – is seen as more of a long-term solution, although performance is still an issue. The advantage of satellite of course is that very little on-the-ground infrastructure is necessary to run the solution. An in-premises satellite antenna needs to be installed, which is potentially costly and requires a truck roll, but apart from that, any premise, provided it's located in a coverage area, can be connected. While not officially stated, it's likely that some of the very complicated connections (the 0.1% that were discussed at the beginning of this report) will be covered using satellite solutions. Ultimately, satellite solutions can be funded when they meet the funding criteria. For example, in the French *Guichet cohésion numérique des territoires* scheme, Starlink's solution has not been vetted because the company could not prove a sufficiently high sustained download throughput. Other satellite solutions like Xancom and Tel One have been vetted however.

4 Conclusions

When we examine the policies of European countries where VHCN coverage is the highest, it's immediately apparent that they have no intention to treat rural citizens any differently than the rest of the population when it comes to quality and pricing of broadband. While it might still take some time to reach full coverage of the population with VHCNs, that is clearly now the goal, and all the policies in place are aiming for that.

Of course, getting there will require a significant amount of public funding. However, many of these countries have realised that their spending on broadband has been lower than initially anticipated. This is because the private market, under the right business models, can in fact profitably cover a much larger part of the population than what models suggested a decade ago when broadband policies were first set-up.

While approaches to public funding of very high-capacity networks in rural areas vary, a number of constants emerge when we examine policies across multiple countries:

- funding schemes are increasingly targeted at large scale projects, at least at county/region level. This is a way to leverage economies of scale in network deployment and operations;
- smaller scale schemes exist – mainly in the form of vouchers targeted at end-users but paid to network operators – to address local issues more flexibly;
- wireless and satellite solutions are temporary measures aiming at delivering some broadband capability while fibre-based solutions are being deployed.

The key takeaway from this analysis is that European governments that are at the point where rural broadband is the last hurdle are looking now for permanent solutions. They might be costly in public funding but are seen as an investment that will last for decades to come. The EU aims for full VHCN coverage by 2030, but many of these countries will likely be there much earlier, with outlying households representing less than 1% of overall households.

© 2022 Plum Consulting London LLP, all rights reserved.

This document has been commissioned by our client and has been compiled solely for their specific requirements and based on the information they have supplied. We accept no liability whatsoever to any party other than our commissioning client; no such third party may place any reliance on the content of this document; and any use it may make of the same is entirely at its own risk.