Study on National Broadband Plans in the EU-27

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1 Abstract – Key Findings (English)

The main purpose of this updated study is to reassess the likelihood of reaching the Gigabit Society 2025 and Digital Decade 2030 connectivity objectives in the light of the latest developments in terms of connectivity policies, regulations and investments, at European and national levels. Thanks to the ambitious national broadband plans (NBPs), to the public and private investments and the engagement of the telecommunications sector, the EU made good progress towards reaching the connectivity targets in the recent years. Achieving the **Gigabit Society 2025** and **Digital Decade 2030 targets** might become **challenging for some of the Member States, especially in relation to the 2025's target of download speeds of 100 Mbps upgradable to 1 Gbps for all.** The Member States' **NBPs highly differ regarding their structure and approach**. However, all Member States have an overall strategic approach for the deployment of broadband networks that is implemented and deliver in practice. There are a variety of **factors that influence the success of broadband roll-out** in a given country. **Successful NBPs consider their respective starting positions and describe concrete measures** that take advantage of the individual strengths and define measures to mitigate the disadvantages. The NBPs of the Member States usually set one or two foci out of the following action lines: **Demand Side measures, Supply Side measures, Regulatory and Organizational measures, Transparency measures**. **There is no one-size-fits-all solution** for broadband strategies across Europe. The NBPs are very peculiar to the needs of the individual Member States, while some measures, however, can be easily adapted to be applied across multiple Member States, under similar conditions.

2 Abstract – Key Findings (French)

L'objectif principal de cette étude actualisée est de réévaluer la probabilité d'atteindre les objectifs de connectivité de la Société européenne du gigabit 2025 et de la Décennie numérique 2030 en considérant des derniers développements en termes de politiques, de réglementations et d'investissements en matière de connectivité, aux niveaux européen et national. Grâce aux ambitieux plans nationaux haut débit (NBPs), aux investissements publics et privés et à l'engagement du secteur des télécommunications, l'UE a bien progressé vers la réalisation des objectifs de connectivité au cours des dernières années. Atteindre les objectifs de la Société européenne du gigabit 2025 et de la Décennie numérique 2030 pourrait devenir un défi pour certains États membres, en particulier en ce qui concerne l'objectif de 2025 de vitesses de téléchargement d'au moins 100 Mbps extensibles à 1 Gbps pour tous. Les NBPs des États membres diffèrent largement en termes de structure et d'approche. Toutefois, tous les États membres ont une approche stratégique globale pour le déploiement des réseaux à large bande, qui est mise en œuvre et appliquée dans la pratique. Divers facteurs influencent le succès du déploiement du haut débit dans un pays donné. Les NBPs réussis considèrent leurs positions de départ respectives et décrivent des mesures concrètes qui tirent parti des atouts individuels et définissent des mesures pour atténuer les désavantages. Les NBPs des États membres fixent généralement un ou deux axes parmi les lignes d'action suivantes : mesures du côté de la demande, mesures du côté de l'offre, mesures réglementaires et organisationnelles, mesures de transparence. Il n'existe pas de solution universelle pour les stratégies en matière de haut débit en Europe. Les NBP sont très spécifiques aux besoins de chaque État membre, tandis que certaines mesures peuvent toutefois être facilement adaptées pour être appliquées dans plusieurs États membres, dans des conditions similaires.

3 Executive Summary (English)

The purpose of the updated study (November 2023) was to estimate the likelihood that the Member States and the Union as a whole will reach the Gigabit Society 2025 and Digital Decade 2030 connectivity objectives.

The original study on National Broadband Plans (NBPs) in the EU-27 (SMART 2014/0077) was conducted between November 2015 and September 2016. The first update of the study (SMART 2019/0007) was carried out between July 2020 and February 2021. The second update (VIGIE 2021 – 488) was carried out in October-December 2023. For our analysis, we mainly relied on information obtained from the European Commission and National authorities available by October 2023. Furthermore, we reached out to key stakeholders and practitioners from the 27 Member States to gain insights concerning the actual implementation of the national broadband plans in each respective country.

To assess the probability of reaching the Gigabit Society 2025 and Digital Decade 2030 connectivity objectives we applied a mix of quantitative elements (DESI 2023 indicators, Digital Decade report 2023, data from the 5G Observatory) as well as qualitative estimations (overall performance of the MS in the last years, current and planned broadband rollout measures & funding schemes foreseen in the NBPs, main challenges in broadband rollout, situation of the telecommunication market and other macroeconomic indicators, etc.).

The categorization of the probability of reaching a target could not be done in a definitive matter within the framework of this study. The possible variables (investment behaviour by the private sector, new public funding opportunities, development of the macro-economic situation, evolution of interest rates, consumer preferences, etc.) are too vast to make precise estimations. Thus, the probability represents more an estimation under the assumption that all known factors remain the same and planned measures are implemented as intended. There is still room for changes of behaviour that might heavily influence the probabilities displayed here, including in a positive way.

Overall, the study presented shall give an overview on the current status of the Member States regarding their connectivity targets and measures defined within their NBPs and the actual practical implementation processes.

The main results of the study are as follows:

1) Despite ambitious national broadband plans and extensive investments in broadband infrastructure, **reaching 2025 connectivity targets will be challenging for most Member States**.

The picture is **more optimistic when it comes to the 2030 targets**, where we expect the majority of MS to reach the target or get close to it.

2) The Member states' **NBPs highly differ regarding their content**. All Member States however have an overall strategic approach for the deployment of broadband networks that is implemented in practice.

3) There are a variety of **conditions that influence the success of broadband roll-out** in a given country. **Successful NBPs consider their respective starting positions and describe concrete measures** that take advantage of the individual strengths and define measures to mitigate the effect of disadvantages.

4) The NBPs of the Member States usually set one or two foci out of the following spheres: **Demand Side measures, Supply Side measures, Regulatory and Organizational measures, Transparency measures**.

5) **There is no one-size-fits-all solution** for broadband strategies across Europe. The NBPs seem not to be re-usable without significant adaptations, while some measures can be applied across many Member States under similar conditions.

If Europe does not want to lag behind at global level, broadband development needs to speed up even further. In this regard, the provision and exploitation of gigabit networks and internet services is crucial for Europe's future economic development and competitiveness as well as for the progress and cohesion of society as a whole. With the Digital Agenda 2020, the Gigabit Society 2025 as well as Digital Decade 2030 targets, the European Commission has set up a progressive framework for the digital transformation of Europe. For the Union to fully take advantage of this framework and thus to realise the full potential of the digital transition, all relevant stakeholders need to maximise their efforts. Member States have to provide appropriate incentives and means for increasing investment whilst local actors and the digital industry need to make use of these instruments efficiently. In that sense, Member States should build on existing successful measures, but be more ambitious, not only in terms of incentives and means, but also, especially with regard to the new European targets for 2030, thereby ensuring Europe's future economic and social progress.

Our estimations concerning the probability of meeting the Gigabit Society 2025 and Digital Decade 2030 targets respectively are summarised as follows. The detailed analysis is outlined in the Member States reports (chapter 7.2).

EU-27 MS	GS 2025 Access to 1 Gbps for all main economic drivers	GS 2025 Access to download speeds of 100 Mbps upgradable to 1 Gbps for all	GS 2025 Uninterrupted 5G coverage for all urban areas and major roads and railways	Digital Decade 2030
	Probability	Probability	Probability	Probability
Austria	low	low	high	medium
Belgium	low	low	low	low
Bulgaria	high	medium-low	high	high
Croatia	medium	low	high	medium
Cyprus	high	low	high	medium
Czech Republic	medium	low	high	medium-low
Denmark	high	high	high	high
Estonia	high	medium	medium-high	high
Finland	high	low	high	medium
France	high	medium	high	high
Germany	low	low	high	medium
Greece	low	low	high	low
Hungary	high	high	high	high
Ireland	high	medium	high	high
Italy	high	low	high	medium-high
Latvia	high	high	high	high
Lithuania	high	medium	high	high
Luxembourg	high	high	high	high
Malta	reached	reached	reached	high
Netherlands	high	medium	high	high
Poland	high	low	medium	medium
Portugal	high	high	high	high
Romania	high	high	medium	high
Slovakia	high	medium	high	medium-high
Slovenia	high	medium	high	high
Spain	high	medium	high	high
Sweden	high	low	high	high

Table 1 Probability of achievement of Gigabit Society 2025 and Digital Decade 2030 targets in EU-27 Member States

Connecting the socio-economic drivers to gigabit networks by 2025 is a priority and the solid backbone networks are expanding, yet there is still room for improvement for some of the Member States. Most Member States realised the importance of connecting centres of education, business parks and public administrations. For this objective to be attained, an even stronger focus on these socio-economic drivers is necessary.

Providing access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households by 2025 will be much more challenging in the EU. Currently, most Member States would

struggle to meet this objective. The planned extensive investments in future proof fibre networks will help deliver the gigabit connectivity. Yet, some Member States are still dependent on technologies where it is not sure, if 100 Mbps that can be upgraded to 1 Gbps can deliver reliable gigabit speeds for the majority of users. Also, the existing urban rural divide and difficult topography in many MS will make covering 100 % of households very challenging.

Regarding the 5G target (uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways), the perspectives are good and most MS have high probability of reaching the target. Commercial roll-out of 5G is in full speed and there is room for optimism in the EU. For some MS uninterrupted service along major roads and railways may be a challenge.

The fibre rollout is catching-up with expectations, and the planned public and private investments for the next years are quite ambitious. Majority of the MS have high or medium probability of reaching the Digital Decade 2030 target of gigabit for all, and the overall outlook for the EU is quite positive. The probability to reach Digital Decade 2030 connectivity target is assessed as high for 16 Member States. Nine Member States (Austria, Croatia, Cyprus, Czech Republic, Finland, Germany, Italy, Poland and Slovakia) have medium probability of reaching the 2030 target, and for two Member States (Belgium and Greece) the probability is estimated as low.

The factors that may be slowing down the progress towards achieving Digital Decade's gigabit for all target are e.g. low FTTP coverage, low level of digital skills, low subscription rates for gigabit speeds, difficult topography, challenging and cost-intensive rollout in the rural and remote areas, barriers to investment process (legal, administrative, financial and technical), high broadband prices, not extensive enough investment plans, high DOCSIS 3.1. market share, low population density, high number of mobile-broadband-only users etc.

Concerning the content of the NBPs, we have seen very different approaches. It is however striking that those countries with favourable conditions for market-driven roll-out (e.g. high population density, high demand, high degree of urbanization, extensive cable networks) are often less concrete regarding the measures described in their respective NBPs. They usually rely on strategic approaches that define the overall framework under which competition shall take place. These countries often trust in market forces for further broadband coverage. In these cases, an NBP is mainly designed to provide for a level playing field, meaning that fair competition can take place. Contrarily, those countries with more difficult starting positions are often advanced concerning the detailed definition of the measures described. According to their respective economic capabilities, they try to implement more

supply, demand or transparency measures regarding existing infrastructures. The different NBPs then usually incorporate measures accordingly in a single strategy document, guidelines, legislation etc.

However, what we learned from practitioners across Europe is that the overall national strategy does not have to be part of a single document to be effective. As long as there is political determination to reach certain targets with certain measures, also a collection of different measures and documents can still lead to positive results. Most important, concerning the actual implementation, it seems that responsible actors (usually at local level) are attached to the strategic targets and feel involved more than the national level. Generally speaking, the involvement of local actors is especially important when countries of usually larger size have significantly lower rural coverage and need demand aggregation and bottom-up initiatives.

There are several conditions that influence the success of broadband roll-out. Some of these are competition, demand side activities and digitisation of a society, skills, the availability of state aid and financial instruments, an efficient regulatory framework, population density and urbanization rate, availability of ducts and upgradable networks as well as willingness to pay and affordability. This list is not comprehensive. Thus, it is difficult to evaluate the "success" of NBPs in an absolute manner. They can only be assessed in the specific circumstances of the Member States. If the conditions described above are negative, defining an NBP to counter these conditions is a lot more challenging than writing an NBP within an environment that favours roll-out anyway. However, what is missing within some NBPs, is the consideration of what the actual situation in a country is. Countries could improve their NBPs by analysing the respective environments in a better way. The NBPs can therefore not be evaluated by analysing a specific aspect such as achieving the connectivity targets, but rather if the NBP is well adjusted to local needs and conditions.

The adjustments described above are at least partly reflected by the thematic focus of the NBP. We recognize four different spheres of influence where NBPs can define measures (regarding demand, supply, organizational and regulatory approach as well as transparency). The Member States are somewhat evenly distributed regarding their approaches and foci within the spheres of influence. However, one has to bear in mind that this focus only represents how well-defined measures are, meaning if they are underpinned by clear responsibilities and plans of their implementation. The foci, however, do not tell anything about the actual feasibility of the plans.

This also leads to the final conclusion: there is no one-size-fits-all approach concerning a "best" broadband strategy. All Member States have unique starting positions that make results hardly transferrable. The member states differ regarding their governmental structures as well as regarding the degree

of involvement of local and regional actors. The size of a country as well as autonomous regions and federal structures often directly influence the steering modalities and capabilities. Furthermore, macroeconomic aspects matter as much as socio-economic aspects. Economic hardships decrease investments and demand alike, worsening the situation in crisis-struck countries. Other aspects include the role of the incumbent and the quality of existing infrastructures. In some countries, mobile technologies are an important aspect of connectivity and partly substitute fixed networks. All of these factors and several others can and will influence the state of connectivity within given countries, making it difficult to transfer approaches. It is therefore most important to regard NBPs in the same way as the countries they are developed for: unique.

Current policies and initiatives in the EU (Next Generation EU, RRF, Digital Decade Policy Programme, CEF2 Digital, Gigabit Infrastructure Act, Connectivity Toolbox, multi-orbital space connectivity for EU, State Aid guidelines and BCO Network) will have a huge impact on the rollout of the broadband technologies.

4 Executive Summary (French)

L’objectif de l’étude actualisée (novembre 2023) était d’estimer la probabilité que les États membres et l’Union dans son ensemble atteignent les objectifs de connectivité de la Société européenne du gigabit 2025 (la Gigabit Society 2025) et de la Décennie numérique 2030.

L'étude originale sur les plans nationaux pour le haut débit (NBP) dans l'UE-27 (SMART 2014/0077) a été réalisée entre novembre 2015 et septembre 2016. La première mise à jour de l'étude (SMART 2019/0007) a été réalisée entre juillet 2020 et février 2021. La deuxième mise à jour (VIGIE 2021 – 488) a été réalisée en octobre-décembre 2023. Pour notre analyse, nous nous sommes principalement appuyés sur les informations obtenues auprès de la Commission européenne et des autorités nationales disponibles en octobre 2023. Par ailleurs, nous avons contacté les principales parties prenantes et praticiens des 27 États membres pour obtenir des informations sur la mise en œuvre réelle des plans nationaux pour le haut débit dans chaque pays respectif.

Pour évaluer la probabilité d'atteindre les objectifs de connectivité de la Gigabit Society 2025 et de la Décennie numérique 2030, nous avons appliqué un mélange d'éléments quantitatifs (indicateurs DESI 2023, rapport de la Décennie numérique 2023, données de l'Observatoire 5G) ainsi que des estimations qualitatives (performance globale des États membres au cours des dernières années, les mesures actuelles et prévues de déploiement du haut débit et les programmes de financement prévus dans les NBP, les principaux défis liés au déploiement du haut débit, la situation du marché des télécommunications et d'autres indicateurs macroéconomiques, etc.).

La catégorisation de la probabilité d’atteindre un objectif n’a pas pu être effectuée de manière définitive dans le cadre de cette étude. Les variables possibles (comportement d'investissement du secteur privé, nouvelles opportunités de financement public, évolution de la situation macro-économique, évolution des taux d'intérêt, préférences des consommateurs, etc.) sont trop vastes pour permettre des estimations précises. Ainsi, la probabilité représente davantage une estimation sous l’hypothèse que tous les facteurs connus restent les mêmes et que les mesures planifiées sont mises en œuvre comme prévu. Il reste encore de la place pour des changements de comportement qui pourraient fortement influencer les probabilités affichées ici, y compris de manière positive.

Dans l'ensemble, l'étude présentée donnera un aperçu de l'état actuel des États membres en ce qui concerne leurs objectifs et mesures de connectivité définis dans leurs NBP et les processus de mise en œuvre pratiques réels.

Les principaux résultats de l’étude sont les suivants :

1) Malgré des plans nationaux de haut débit ambitieux et des investissements considérables dans les infrastructures à haut débit, il sera difficile pour la plupart des États membres d'atteindre les objectifs de connectivité pour 2025. Le cas est plus optimiste en ce qui concerne les objectifs de 2030, où nous attendons que la majorité des États membres atteignent l'objectif ou s'en rapprochent.

2) Les NBP des États membres diffèrent fortement quant à leur contenu. Tous les États membres ont toutefois une approche stratégique globale pour le déploiement des réseaux à large bande qui est mise en œuvre dans la pratique.

3) Diverses conditions influencent le succès du déploiement du haut débit dans un pays donné. Les NBP réussis considèrent leurs positions de départ respectives et décrivent des mesures concrètes qui tirent parti des atouts individuels et définissent des mesures pour atténuer l'effet des désavantages.

4) Les NBP des États membres fixent généralement un ou deux axes parmi les domaines suivants : mesures du côté de la demande, mesures du côté de l'offre, mesures réglementaires et organisationnelles, mesures de transparence.

5) Il n'existe pas de solution universelle pour les stratégies en matière de haut débit en Europe. Les NBP ne semblent pas être réutilisables sans des adaptations significatives, alors que certaines mesures peuvent être appliquées dans de nombreux États membres dans des conditions similaires.

Si l'Europe ne veut pas être à la traîne au niveau mondial, le développement du haut débit doit encore s'accélérer. À cet égard, la fourniture et l'exploitation de réseaux Gigabit et de services Internet sont cruciales pour le développement économique et la compétitivité futurs de l'Europe ainsi que pour le progrès et la cohésion de la société dans son ensemble. Avec l'Agenda numérique 2020, la Gigabit Society 2025 ainsi que les objectifs de la Décennie numérique 2030, la Commission européenne a mis en place un cadre progressif pour la transformation numérique de l'Europe. Pour que l'Union puisse tirer pleinement parti de ce cadre et exploiter ainsi tout le potentiel de la transition numérique, toutes les parties prenantes concernées doivent maximiser leurs efforts. Les États membres doivent fournir des incitations et des moyens appropriés pour accroître les investissements, tandis que les acteurs locaux et l'industrie numérique doivent utiliser efficacement ces instruments. En ce sens, les États membres devraient s'appuyer sur les mesures existantes efficaces, mais être plus ambitieux, non seulement en termes d'incitations et de moyens, mais aussi, notamment en ce qui concerne les nouveaux objectifs européens pour 2030, garantissant ainsi le futur progrès économique et social de l'Europe.

Nos estimations concernant la probabilité d'atteindre respectivement les objectifs de la Gigabit Society 2025 et de la Décennie numérique 2030 sont résumées comme suit. L'analyse détaillée est présentée dans les rapports des États membres (chapitre 7.2).

EU-27 EM	GS 2025 Accès à 1 Gbps pour tous les principaux moteurs économiques	GS 2025 Accès à des vitesses de téléchargement de 100 Mbps extensibles à Gbps pour tous	GS 2025 Une couverture 5G ininterrompue pour toutes les zones urbaines et les principaux axes routiers et ferroviaires	Décennie numérique 2030
	Probabilité	Probabilité	Probabilité	Probabilité
Autriche	faible	faible	haute	moyenne
Belgique	faible	faible	faible	faible
Bulgarie	haute	moyenne-faible	haute	haute
Croatie	moyenne	faible	haute	moyenne
Chypre	haute	faible	haute	moyenne
République tchèque	moyenne	faible	haute	moyenne-faible
Danemark	haute	haute	haute	haute
Estonie	haute	moyenne	moyenne-haute	haute
Finlande	haute	faible	haute	moyenne
France	haute	moyenne	haute	haute
Allemagne	faible	faible	haute	moyenne
Grèce	faible	faible	haute	faible
Hongrie	haute	haute	haute	haute
Irlande	haute	moyenne	haute	haute
Italie	haute	faible	haute	moyenne-haute
Lettonie	haute	haute	haute	haute
Lituanie	haute	moyenne	haute	haute
Luxembourg	haute	haute	haute	haute
Malte	atteinte	atteinte	atteinte	haute
Pays-Bas	haute	moyenne	haute	haute
Pologne	haute	faible	moyenne	moyenne
Portugal	haute	haute	haute	haute
Roumanie	haute	haute	moyenne	haute
Slovaquie	haute	moyenne	haute	moyenne-haute
Slovénie	haute	moyenne	haute	haute
Espagne	haute	moyenne	haute	haute
Suède	haute	faible	haute	haute

Table 2 Probabilité de réalisation des objectifs de la Gigabit Society 2025 et de la Décennie numérique 2030 dans les États membres de l'UE-27

Connecter les moteurs socio-économiques aux réseaux gigabits d'ici 2025 est une priorité et les réseaux de base solides se développent, mais il reste encore des progrès à faire pour certains États

membres. La plupart des États membres ont pris conscience de l'importance de relier les centres d'éducation, les parcs d'activités et les administrations publiques. Pour que cet objectif soit atteint, il est nécessaire de se concentrer encore plus sur ces facteurs socio-économiques.

Fournir un accès à des vitesses de téléchargement d'au moins 100 Mbps extensibles à 1 Gbps pour tous les foyers d'ici 2025 sera beaucoup plus difficile dans l'UE. Actuellement, la plupart des États membres auraient du mal à atteindre cet objectif. Les investissements considérables prévus dans des réseaux de fibre optique évolutifs contribueront à assurer la connectivité gigabit. Pourtant, certains États membres restent dépendants de technologies pour lesquelles il n'est pas sûr que 100 Mbps, extensibles à 1 Gbps, puissent fournir des vitesses gigabit fiables à la majorité des utilisateurs. En outre, la fracture urbaine-rurale existante et la topographie difficile dans de nombreux États membres rendront très difficile la couverture de 100 % des ménages.

Concernant l'objectif 5G (couverture ininterrompue du haut débit sans fil 5G pour toutes les zones urbaines et les principales routes et voies ferrées), les perspectives sont bonnes et la plupart des États membres ont une forte probabilité d'atteindre l'objectif. Le déploiement commercial de la 5G bat son plein et l'optimisme est permis au sein de l'UE. Pour certains États membres, un service ininterrompu le long des routes et des voies ferrées principales peut constituer un défi.

Le déploiement de la fibre rattrape les attentes et les investissements publics et privés prévus pour les prochaines années sont assez ambitieux. La majorité des États membres ont une probabilité élevée ou moyenne d'atteindre l'objectif du gigabit pour tous de la décennie numérique 2030, et les perspectives globales pour l'UE sont plutôt positives. La probabilité d'atteindre l'objectif de connectivité de la décennie numérique 2030 est jugée élevée pour 16 États membres. Neuf États membres (l'Autriche, la Croatie, Chypre, la République tchèque, la Finlande, l'Allemagne, l'Italie, la Pologne et la Slovaquie) ont une probabilité moyenne d'atteindre l'objectif de 2030, et pour deux États membres (la Belgique et la Grèce), la probabilité est estimée comme faible.

Les facteurs susceptibles de ralentir les progrès vers la réalisation de l'objectif du gigabit pour tous de la Décennie numérique sont par exemple : faible couverture FTTP, faible niveau de compétences numériques, faibles tarifs d'abonnement aux vitesses gigabit, topographie difficile, déploiement difficile et coûteux dans les zones rurales et isolées, obstacles au processus d'investissement (juridiques, administratifs, financiers et techniques), prix élevés du haut débit, plans d'investissement pas assez étendus, part de marché de DOCSIS 3.1. élevé, faible densité de population, nombre élevé d'utilisateurs du haut débit mobile uniquement, etc.

Concernant le contenu des NBPs, nous avons vu des approches très différentes. Il est toutefois frappant de constater que les pays présentant des conditions favorables à un déploiement axé sur le marché (par exemple, forte densité de population, forte demande, degré élevé d'urbanisation, réseaux câblés étendus) sont souvent moins concrets en ce qui concerne les mesures décrites dans leurs NBPs respectifs. Ils s'appuient généralement sur des approches stratégiques qui définissent le cadre global dans lequel la concurrence doit avoir lieu. Ces pays font souvent confiance aux forces du marché pour étendre leur couverture haut débit. Dans ces cas-là, un NBP est principalement conçu pour garantir des conditions de concurrence équitables, ce qui signifie qu'une concurrence loyale peut avoir lieu. À l'inverse, les pays dont la situation de départ est plus difficile sont souvent avancés en ce qui concerne la définition détaillée des mesures décrites. Selon leurs capacités économiques respectives, ils tentent de mettre en œuvre davantage de mesures d'offre, de demande ou de transparence concernant les infrastructures existantes. Les différents NBPs intègrent alors généralement les mesures en conséquence dans un seul document stratégique, des lignes directrices, une législation, etc.

Cependant, ce que nous avons appris des praticiens de toute l'Europe, c'est qu'il n'est pas nécessaire que la stratégie nationale fasse partie d'un document unique pour être efficace. Tant qu'il existe une volonté politique d'atteindre certains objectifs avec certaines mesures, un ensemble de mesures et de documents différents peuvent également conduire à des résultats positifs. Plus important encore, concernant la mise en œuvre effective, il semble que les acteurs responsables (généralement au niveau local) soient attachés aux objectifs stratégiques et se sentent davantage impliqués qu'au niveau national. D'une manière générale, l'implication des acteurs locaux est particulièrement importante lorsque les pays, généralement de plus grande taille, ont une couverture rurale nettement inférieure et ont besoin d'une agrégation de la demande et d'initiatives ascendantes.

Plusieurs conditions influencent le succès du déploiement du haut débit. Certains d'entre eux sont la concurrence, les activités liées à la demande et la numérisation d'une société, les compétences, la disponibilité d'aides d'État et d'instruments financiers, un cadre réglementaire efficace, la densité de population et le taux d'urbanisation, la disponibilité de conduits et de réseaux évolutifs ainsi que la volonté de payer et que les services sont abordable. Cette liste n'est pas compréhensible. Il est donc difficile d'évaluer le « succès » des NBPs de manière absolue. Ils ne peuvent être évalués que dans les circonstances spécifiques des États membres. Si les conditions décrites ci-dessus sont négatives, définir un NBP pour contrer ces conditions est beaucoup plus difficile que d'écrire un NBP dans un environnement qui favorise de toute façon le déploiement. Cependant, ce qui manque dans certains NBPs, c'est la prise en compte de la situation réelle d'un pays. Les pays pourraient améliorer leurs NBPs en

analysant mieux leurs environnements respectifs. Les NBPs ne peuvent donc pas être évalués en analysant un aspect spécifique tel que la réalisation des objectifs de connectivité, mais plutôt si le NBP est bien adapté aux besoins et aux conditions locales.

Les ajustements décrits ci-dessus se reflètent au moins en partie dans l'orientation thématique du NBP. Nous reconnaissons quatre sphères d'influence différentes dans lesquelles les NBPs peuvent définir des mesures (concernant la demande, l'offre, l'approche organisationnelle et réglementaire ainsi que la transparence). Les États membres sont répartis de manière assez égale en termes d'approches et de priorités au sein des sphères d'influence. Il convient toutefois de garder à l'esprit que cette priorité concerne seulement la question si les mesures sont bien définies, c'est-à-dire si elles sont étayées par des responsabilités et des plans clairs pour leur mise en œuvre. Toutefois, les priorités ne disent rien sur la faisabilité réelle des projets.

Cela nous amène également à la conclusion finale : il n'existe pas d'approche universelle concernant la « meilleure » stratégie en matière de haut débit. Tous les États membres ont des positions de départ uniques qui rendent les résultats difficilement transférables. Les États membres diffèrent en ce qui concerne leurs structures gouvernementales ainsi que le degré d'implication des acteurs locaux et régionaux. La taille d'un pays ainsi que les régions autonomes et les structures fédérales influencent souvent directement les modalités et capacités de pilotage. En outre, les aspects macroéconomiques sont tout aussi importants que les aspects socio-économiques. Les difficultés économiques diminuent à la fois les investissements et la demande, aggravant ainsi la situation dans les pays frappés par la crise. D'autres aspects incluent le rôle de l'opérateur historique et la qualité des infrastructures existantes. Dans certains pays, les technologies mobiles constituent un aspect important de la connectivité et remplacent en partie les réseaux fixes. Tous ces facteurs et plusieurs autres peuvent influencer et influenceront l'état de la connectivité au sein de pays donnés, rendant difficile le transfert d'approches. Il est donc très important de considérer les NBP de la même manière que les pays pour lesquels ils sont développés : uniques.

Les politiques et initiatives actuelles dans l'UE (Next Generation EU, RRF, Programme politique de la décennie numérique, CEF2 Digital, Gigabit Infrastructure Act, Connectivity Toolbox, connectivité spatiale multiorbitale pour l'UE, lignes directrices en matière d'aides d'État et réseau BCO) auront un impact considérable sur le déploiement des technologies à large bande.

5 Introduction

Broadband connectivity is of strategic importance for technological innovation and economic growth across sectors and, as such, forms a key ingredient of social and regional cohesion within the European Union (EU). The Digital Agenda for Europe (hereinafter DAE or Digital Agenda), Connectivity for a European Gigabit Society[1] strategy 2025 and Digital Decade 2030 provide a central policy framework in this regard.

The DAE represented one of the flagship initiatives of the EU in the context of the Europe 2020 strategy, devised to deliver smart, sustainable and inclusive growth and render the EU globally more competitive in the long-run. The DAE's overall aim was thereby "to deliver sustainable economic and social benefits from a digital single market based on fast and ultra-fast internet and interoperable applications".[2] This is of utmost importance as the future economy will be knowledge-based with the internet at its centre. Against this background, the EU set two overarching broadband targets to be met by its member states by 2020:[3]

- all Europeans should have access to internet speeds higher than 30 Mbps,
- and 50% or more of European households should be able to obtain subscriptions above 100 Mbps

Event though the DEA 2020 targets were not fully met, most EU Member States were close to reaching them. On the EU level, 90,1% of population had access to 30 Mbps, and 40,6% subscribed to 100 Mbps or more by the end of 2020.[4]

The Gigabit Society measures provide a central policy framework till 2025. Reaching the common EU broadband targets for 2025 is of utmost importance for achieving the Gigabit Society:

- by 2025 all schools, transport hubs and main providers of public services as well as digitally intensive enterprises should have access to internet connections with download/upload speeds of 1 Gigabit of data per second,
- all European households, rural or urban, should have access to networks offering a download speed of at least 100 Mbps, which can be upgraded to 1 Gigabit, and

[1] https://digital-strategy.ec.europa.eu/en/policies/broadband-support
[2] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245&from=EN
[3] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0472&from=EN, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245&from=EN
[4] DESI 2022, with data from 2021.

- all urban areas as well as major roads and railways should have uninterrupted 5G wireless broadband coverage, starting with fully-fledged commercial service in at least one major city in each EU member state already by 2020.

The Digital Decade was launched in March 2021[5] and set a connectivity target defined as Gigabit for everyone and all populated areas covered by 5G by 2030.

In this light, the DAE, Gigabit Society and Digital Decade strategies envisage a number of measures to foster the deployment of networks required to meet its central objectives as well as to support substantial investments required in the upcoming years. At EU level, investments in high-speed broadband are supported through a variety of policy, regulatory and financing as well as funding measures. These include a mix of funding, regulatory and guidance measures.

Funding/Financing initiatives:

- The European plan for Investment supported by the European Fund for Strategic Investment (EFSI);[6]
- The European Structural and Investment Funds (ESIFs) for the 2014-2020 and 2021-2027 periods;
- The Connecting Europe Facility (CEF2)[7];
- The Connecting Europe Broadband Fund by the European Commission and the European Investment Bank (EIB) supporting the financing of broadband network infrastructure;
- The long-term budget for 2021-2027 period together with Next Generation EU and the Recovery and Resilience Facility (RRF).

Regulatory measures:

- The Cost Reduction Directive[8];
- The Guidelines on State aid for broadband networks[9];
- The Telecoms Single Market (TSM) Regulation (EU) 2015/2120[10];

[5] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en
[6] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/economy-works-people/european-fund-strategic-investments_en
[7] https://digital-strategy.ec.europa.eu/en/activities/cef-digital
[8] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex%3A32014L0061
[9] https://digital-strategy.ec.europa.eu/en/policies/broadband-state-aid
[10] https://eur-lex.europa.eu/eli/reg/2015/2120/oj

- The Digital Single Market Strategy;
- The European Communications Code[11] to help achieve the Gigabit Society investment objectives;
- The Digital Decade policy programme[12];
- The Gigabit Infrastructure Act.[13]

Policy guidance and support:

- The EC Guide to high speed broadband investment[14];
- The Support for Broadband rollout website[15];
- The Connected Communities Initiative[16];
- The 5G for Europe[17] action plan for the fifth generation of telecommunications systems;
- The European network of national Broadband Competence Offices (BCOs)[18].

At national level, most Member States (MS) have gradually adopted and updated their National Broadband Plans (NBPs) and 5G strategies, devised to integrate all relevant aspects to develop an effective broadband policy and resources enabling policy makers and public authorities to properly plan public interventions in the telecommunications sector. The implementation of the NBPs plans thereby usually falls within the competence area of the MS' responsible ministries.

Besides financing from the private sector, national projects for network roll-out are also funded from national public funds and from the EU, via the European Regional Development Fund and the European Agricultural Fund for Rural Development. Noteworthy is that there are considerable differences between Member States in terms of net amounts and percentages of ERDF and/or EAFRD funds earmarked for broadband deployment. The CEF (Connecting Europe Facility) and the EFSI (European Fund for Strategic Investment) provide additional financial instruments (e.g. guarantees, loans, equity) to support innovative business models. The European Structural and Investment Funds also encourage the use of financial instruments for broadband deployment. [19]

[11] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.321.01.0036.01.ENG
[12] https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade
[13] https://www.consilium.europa.eu/en/press/press-releases/2023/12/05/gigabit-infrastructure-act-council-adopts-position-for-faster-deployment-of-high-speed-networks-in-the-eu/
[14] https://digital-strategy.ec.europa.eu/en/news/broadband-investment-guide
[15] https://digital-strategy.ec.europa.eu/en/policies/broadband-support
[16] https://digital-strategy.ec.europa.eu/en/news/connected-communities-initiative
[17] https://digital-strategy.ec.europa.eu/en/library/europes-5g-action-plan
[18] https://digital-strategy.ec.europa.eu/en/policies/bco-network
[19] http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=9990

A staff working document by the European Commission on the Implementation of National Broadband Plans posits that broadband dynamics are necessarily shaped by idiosyncratic factors such as local geography and roll-out costs, the competitive situation in the national broadband market, the general legal framework, various socio-economic factors and differing attitudes towards the scope and design of state intervention[20]. Taking it from there, the paper argues that forms of national implementation will continue to vary, despite the uniformity imposed by EU legislation and coordination measures such as the common regulatory and state aid frameworks. These observations underline, at the very minimum, that a "one-size-fits-all" solution is unlikely to evolve.

Overall, Member States need to devise appropriate strategies and instruments in order to reach set targets. Notably, progress with respect to reaching the high-speed broadband targets of the Gigabit Society and Digital Decade is variable, with some Member States lagging behind and others being in an advanced stage of implementing their national strategies. Providing a succinct picture of recent developments across countries will thus be vital as a means to identify deficiencies and point out ameliorative measures where necessary.

5.1 Objective of the study

The absence of a universally applicable "recipe" in the area of broadband development inherently raises the question about what kind of specific strategies Member States pursue (i.e. National Broadband Plans) and through what means and within what period they aim at meeting the Gigabit Society and Digital Decade targets, or their own respectively. The DAE 2020 targets and feasibility achieving them was covered by previous versions of the study (2017 and 2021) and are not subject in this update. In this light, the task is to examine the current state of affairs concerning broadband development in the EU-27 Member States. Thus, the focus of the study is rather on the actual implementation processes than on political statements or the content of official documents.[21]

Correspondingly, the main objective is to review the national broadband plans of the Member States, the assessment of their feasibility and evaluation of the likelihood of achieving the EU's connectivity targets as well as the identification of main trends across Member States.

[20] http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=914

[21] Minutes from the project-related inception meeting that took place on 3rd of November 2015 in Brussels.

5.2 Methodology and Procedure

The overall methodological approach for this study is an inductive one, meaning that we gather several single observations and derive generally applicable patterns from these observations.

In order to be able to provide a cohesive picture of the process of broadband development in all Member States, we defined a mixed methodology, combining quantitative and qualitative elements to be the most appropriate approach. While the quantitative approach is being applied to provide a sound understanding of the status quo across Europe, the qualitative approach will deliver insights for current and future developments. A key characteristic of qualitative methodology is its ability to deliver a "thick analysis" which allows for an in-depth examination of processes and (expected) outcomes by relying on rich and dense information concerning specific cases.[22] In addition, statistical figures are included in the analysis where available to provide for context and support the validity of the qualitative findings. Likewise, different visualization tools are utilized to facilitate understanding. The form of gathered data will to a certain degree determine the way of presentation.

In collecting the necessary data, we adopted multiple tools including desk-research, surveys and interviews with leading experts from each (or groups of) Member States in the area of broadband development. The surveys and interviews thereby followed a semi-structured design which allowed to identify salient issues and challenges in the deployment of broadband infrastructure in each Member State. Given its topicality and reliance on first-hand information, a potential challenge is information scarcity and data validity. While validity issues can never be completely ruled out in a research context where information is gathered through unofficial channels as well, the authors of the present study have tried to minimize error potential and strengthen accuracy by triangulating information from different sources.

The information gathered accordingly is subsequently used to write up comprehensive reports on each Member State. To allow for comparability, each Member State section thereby follows a predefined structure. It begins with a short country profile containing information on general economic, demographic and geographic conditions. Next follows an outline of the Member States' National Broadband Plans. In order to provide for background, each country's NBP is contextualised – where applicable – in terms of preceding efforts, targets and/or strategies devised to promote the deployment of broadband infrastructure. After all, a country with a proven track record in promoting high speed networks

[22] Janet M. Box-Steffensmeier, Henry E. Brady, and David Collier (Ed.) (2008): The Oxford Handbook of Political Methodology: Oxford University Press.

in the past might on average fare better in meeting the connectivity targets than others. Not only infrastructural endowments matter in this respect, but also policy-related and administrative preparations and experiences. Accordingly, we seek to provide a holistic picture. Then an assessment of the practical implementation and broadband roll-out process is undertaken. This includes an analysis of the steering modalities (e.g. centralized vs. decentralized), the convergence of networks, sources of funding and financing, cost-reduction measures, mapping tools, and major or outstanding projects. Each country report closes with a feasibility assessment of the country's NBP, focusing on the likelihood of reaching the Gigabit Society and Digital Decade targets.

To assess the probability of reaching the Gigabit Society 2025 and Digital Decade 2030 connectivity objectives we applied a mix of quantitative elements (DESI 2023 indicators, Digital Decade report 2023, data from the 5G Observatory) as well as qualitative estimations (overall performance of the MS in the last years, current and planned broadband rollout measures & funding schemes foreseen in the NBPs, main challenges in broadband rollout, situation of the telecommunication market and other macroeconomic indicators, etc.).

When estimating probabilities of reaching the EU connectivity objectives, we also looked into the methodology and estimations provided by the EU-level baseline and projected trajectories[23] for the attainment of the digital targets set under the Digital Decade Policy Programme 2030. The methodology applied for the estimation of trajectories[24] and the methodology developed by aconium for this report (estimating probabilities if the connectivity objectives are to be met) are not identical, serve different purposes yet go hand in hand and deliver coherent overall picture.

The categorization of the probability of reaching a target could not be done in a definitive matter within the framework of this study. The possible variables (investment behaviour by the private sector, new public funding opportunities, development of the macro-economic situation, evolution of interest rates, consumer preferences, etc.) are too vast to make precise estimations. Thus, the probability represents more an estimation under the assumption that all known factors remain the same and planned measures are implemented as intended. There is still room for changes of behaviour that might heavily influence the probabilities displayed here, including in a positive way.

Before proceeding with the Member State reports, we shall briefly discuss definitions relevant to broadband and bandwidth and, successively, present the EU's connectivity targets.

[23] https://digital-strategy.ec.europa.eu/en/library/communication-establishing-union-level-projected-trajectories-digital-targets
[24] https://publications.jrc.ec.europa.eu/repository/handle/JRC133748

6 Towards high connectivity in the EU

6.1 Definitions and objectives

There is no standard definition for broadband. However, broadband is a term generally used synonymously with fast connections to the internet. The EU more specifically defines broadband in terms of "high speed telecommunications systems, i.e. those capable of simultaneously supporting multiple information formats such as voice, high-speed data services and video services on demand."

The European Union therewith follows conventional practice of defining broadband in terms of data transmission rates (i.e. the amount of data that can be transmitted across a network connection in a given period of time). It should be noted, however, that such definitions need to consider that bandwidth demand is dynamic. Requirements for internet applications are continuously increasing and infrastructure standards steadily improving to face growing demand. A bandwidth-based (or data transmission speed-based) definition of broadband can therefore only be relative to a particular moment in time in a particular place.[25]

DIGITAL AGENDA FOR EUROPE

The Digital Agenda for Europe formed one of the seven pillars of the Europe 2020 strategy, set out to outline a path to maximise the social and economic potential of information and communication technology (ICT). The initiative underlined the importance of broadband deployment to promote social inclusion and competitiveness in the EU. It was based on the premise that services and applications were increasingly made available in an interoperable and borderless internet environment. In response, demand for higher speeds and capacity was spurred creating the business case for investments in faster networks. The deployment and take-up of faster networks in turn opened the way for innovative services exploiting higher broadband speeds.[26]

With regard to broadband targets, the DAE in principle distinguished three broadband categories, 2, 30, and 100 Mbps, referring to basic broadband, fast and ultra-fast broadband, respectively. Towards

[25] In addition, it should be kept in mind that internet speed is primarily an indicator measuring transfer rates of a broadband connection. Equally important, depending on the application used, may be "latency" as yet another important aspect. For instance, if a cloud service is running on a remote server, not only a high bandwidth but also the latency is of great importance (especially if access to the cloud occurs often). If each time you click it takes two or three seconds before an action is executed, user satisfaction decreases. Latency also plays a big role in telephony. If it takes too long for voice data packages to be transferred, it may become difficult to make a simple conversation work.

[26] See URL: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245&from=EN

achieving the roll-out of high-capacity networks across the EU, the Digital Agenda stipulated that Member States had to meet two major broadband targets by 2020[27]: on the one hand, provide all Europeans with internet speeds higher than 30 Mbps; and on the other hand, have 50 % or more of European households take up internet subscriptions higher than 100 Mbps.

Connectivity for a European Gigabit Society

Delivering on its Digital Single Market strategy, the Commission adopted on 14 September 2016 a set of initiatives and legislative proposals, the Connectivity for a European Gigabit Society strategy, to place the EU at the forefront of internet connectivity. In order to address future broadband needs, the Commission set new higher targets and proposed that:

- by 2025 all schools, transport hubs and main providers of public services, as well as digitally intensive enterprises should have access to internet connections with download/upload speeds of 1 Gigabit of data per second,
- all European households, rural or urban, should have access to networks offering a download speed of at least 100 Mbps, which can be upgraded to 1 Gigabit, and
- all urban areas as well as major roads and railways should have uninterrupted 5G wireless broadband coverage, starting with fully-fledged commercial service in at least one major city in each EU member state already by 2020.

Europe's Digital Decade

The EU is pursuing a "human-centric, sustainable vision for digital society throughout the digital decade to empower citizens and businesses".[28] The secure and sustainable digital infrastructure is one of the four pillars of digital transformation in Europe, other being Skills, Digital transformation of businesses and Digitalisation of public services. The Digital Decade policy sets out an ambitious target of providing Gigabit for everyone and covering all populated areas by 5G by 2030. The framework for the Digital Decade includes the Digital Decade policy programme, the Digital Decade targets, the objectives, the multi-country projects and the Digital Decade rights & principles. This all should lead to reaching an overall EU's goal is for Europe to be the most connected continent by 2030.

[27] The DAE's initial interim target for achieving basic broadband (>2mbps) has been analysed at length by the Commission Staff Working Document on the Implementation of National Broadband Plans, Brussels, 23.3.2012, SWD(2012) 68 final/2

[28] https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade

6.2 Gauging Progress: Key Indicators

Broadband development can be gauged by resorting to different indicators. Indicators likely to be of most interest to policy makers are usually availability, demand, quality and pricing.[29] Importantly, these parameters relate to local retail access rather than to wholesale and backbone markets.[30] Other than that, broadband development also bears important socio-economic implications. Social effects include better access to public services and health, whereas economic effects for instance revolve around improved innovation capacity and productivity of businesses.

In particular, indicators such as fixed and mobile broadband coverage and take-up rates as well as socio-economic facets thereof (e.g. digital inclusion and provision of digital public services) deliver valuable information regarding broadband development and overall digital progress. A highly informative, in-depth analysis of such indicators in Europe is provided by the Digital Scoreboard of the European Commission[31], measuring the progress of the European digital economy via the Digital Economy & Society Index (DESI). Hence, the aim of this section is to give a brief overview of some of the key findings of the DESI regarding broadband development in Europe and to partially elaborate on them, in order to provide some context regarding the current status of attainment of the Gigabit Society and Digital Decade targets, thereby creating a solid basis for the subsequent analysis of NBPs in the EU.

6.2.1 Fixed broadband Indicators

If we have a closer look at availability of Next Generation Access (NGA) speeds, the European picture is mixed. The 100 % coverage with 30 Mbps or more has not been achieved yet. Despite the average NGA coverage of 90,13 %, a significant number of households across Europe, mainly in rural and remote areas, cannot subscribe to these bandwidths. The figure depicts NGA broadband coverage as a supply-side indicator calculated in terms of the percentage of households served by NGA networks. Here, NGA is understood to include technologies such as FTTH, FTTB, Cable Docsis 3.0 and xDSL with a

[29] Additional indicators which may also be useful for monitoring and analysis include monetary-based statistics such as broadband revenues

[30] Cf. The World Bank (Ed.) (2012): Broadband Strategies Handbook. Tim Kelly, Rossotto Carlo Maria. Coordinated by Telecommunications Management Group, Inc., P. 77

[31] https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts

data download rate of at least 30 Mbps. The remaining not covered areas are often costly, difficult and time-consuming for infrastructure rollout.

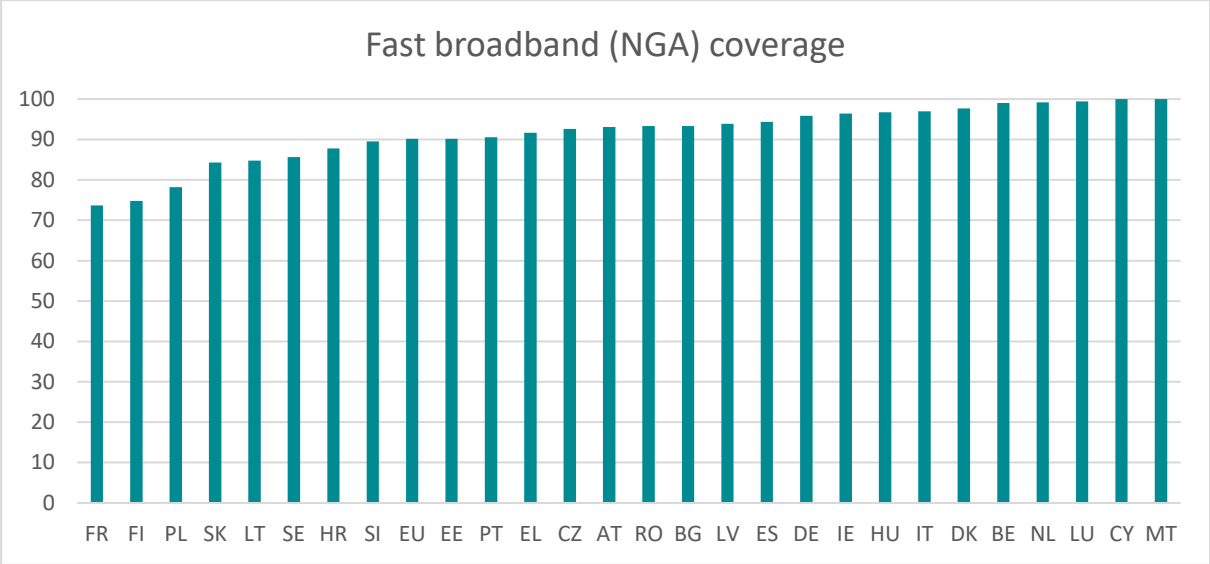


Figure 1 NGA coverage across Europe, percentage of households (DESI 2022)

The fixed VHCN (Very High Capacity Networks), FTTP (Fibre to the premises) and 5G availability will play major role in achieving the Gigabit Society and Digital Decade targets.

The total VHCN (Very High Capacity Networks, 100 Mbps or more) coverage in EU is growing and is at 73,42 % due to availability of FTTH, FTTB and Cable DOCSIS 3.1 technologies. The fixed VHCN coverage increased by 13,6% over the last two years.

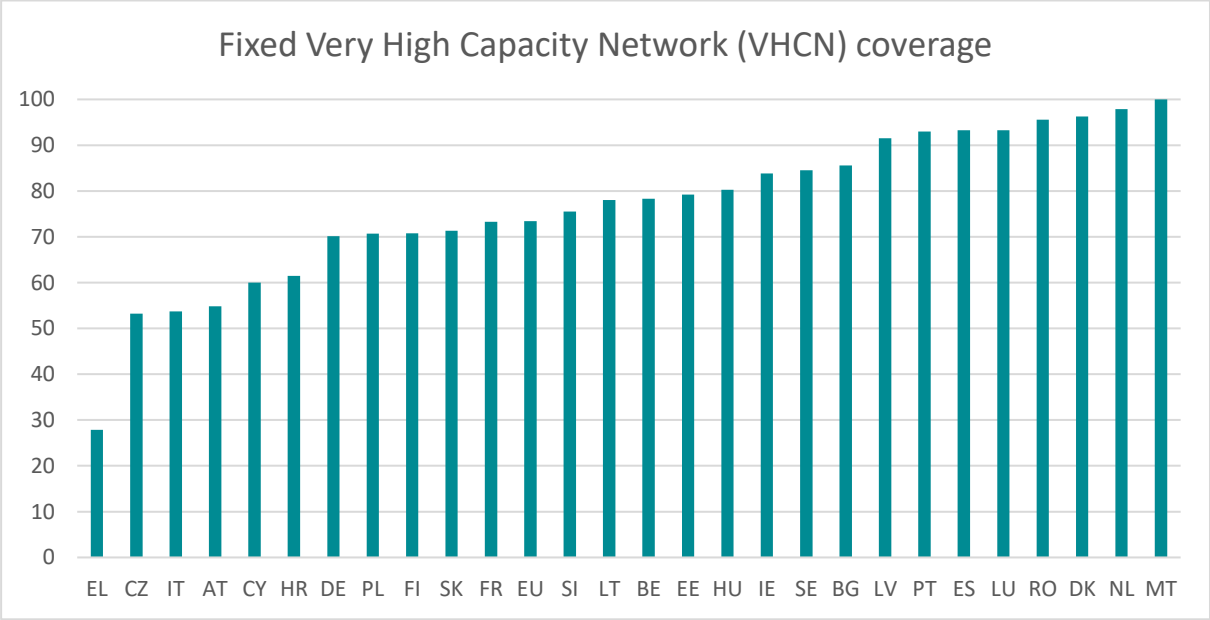


Figure 2 Fixed Very High Capacity Network (VHCN) coverage. Percentage of households covered by any fixed VHCN. DESI 2023

The increase in take-up of fixed VHCN (21,65% over the last two years) is accelerating, and reached 55,08% in the EU. The gap between the fixed VHCN coverage and take-up diminished in the recent years towards 18 points in the EU on average.

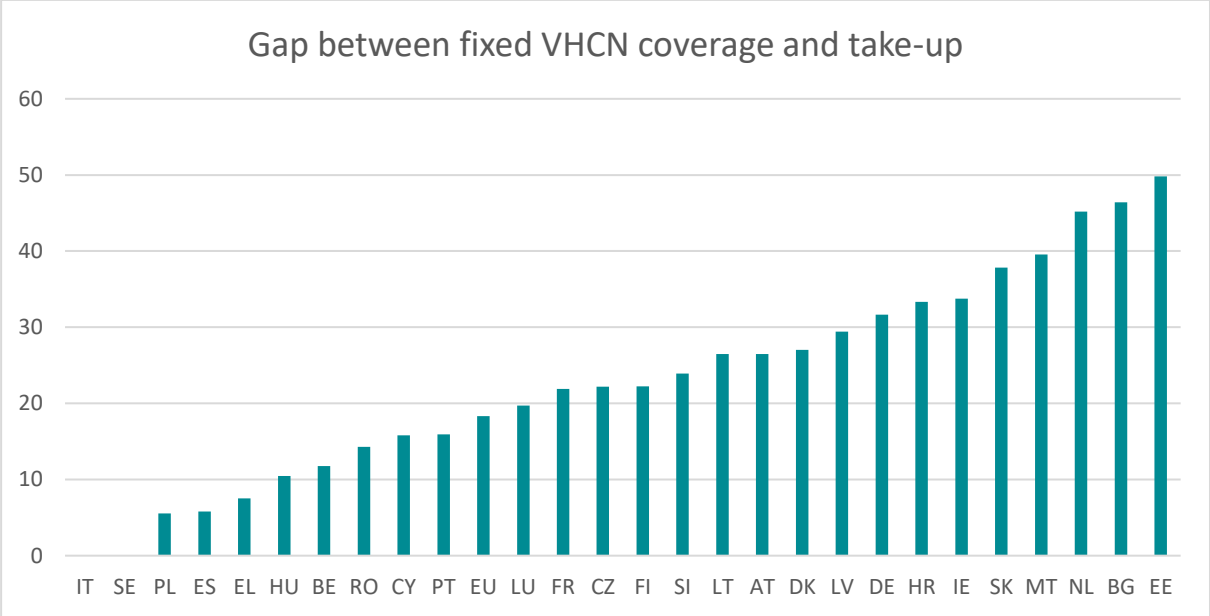


Figure 3 Gap between the Fixed Very High Capacity Network (VHCN) coverage and at least 100 Mbps fixed broadband take-up. DESI 2023

The FTTP coverage in Europe is growing steadily. Yet the EU average is still at only 56.5 %. The situation with rural FTTP coverage is even more challenging as rolling out FTTP infrastructure in many rural and remote areas in Europe proved to be very costly and time intensive.

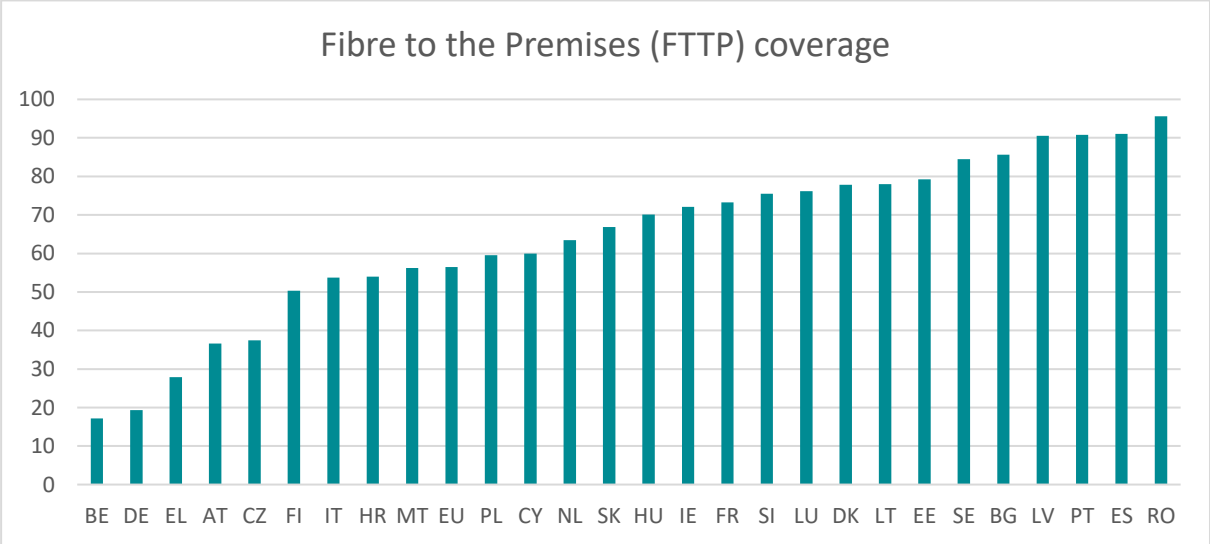


Figure 4 Fibre to the Premises coverage in EU MS, as a percentage of households, DESI 2023

Demand and socio-economic factors are some of the key challenges regarding the achievement of both Gigabit Society and Digital Decade targets in rural, remote and difficult areas. The rural areas are still lagging significantly behind in NGA, fixed VHCN or FTTP coverage and take-up.

6.2.2 Mobile network indicators

Other indicators, that are meaningful to observe, are the mobile network indicators. Mobile networks are often a complementary and sometimes even substitute fixed networks in areas where fixed networks are extraordinary costly to deploy. Although there is a variety of non-fixed technologies (e.g. WLAN, WiMAX, Satellite, radio relay), most reliable data exists concerning the major technologies (5G and LTE). The following section will thus briefly show the current state of mobile broadband connectivity.

Few mobile technologies can be considered a substitute for fixed technologies as most mobile technologies work as a shared medium and therefore divide their capabilities by the number of active users at the same time. However, some mobile technologies (e.g. LTE and 5G) have at least currently technical capabilities that let them compete with some fixed technologies in some markets. For example, in Finland, Austria, Italy and some other countries, there is a significant number of persons that uses mobile broadband only, meaning that these persons do not see an added value in fixed technologies and/or that they live in areas with no access to fixed broadband.

The overall 5G coverage in EU increased substantially in the last years, measured as the average coverage of telecom operators in each country, and in total is very good with EU average at 81,2 %.

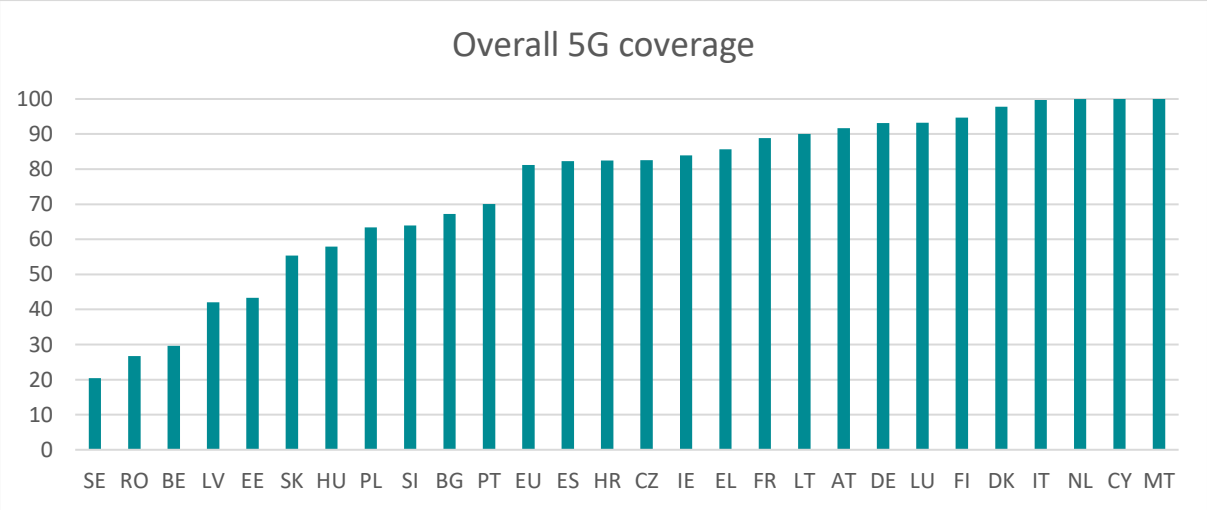


Figure 5 5G coverage, Percentage of populated areas with coverage by at least one 5G mobile network, DESI 2023

The mobile broadband take-up in the EU, measured as the number of mobile data subscriptions per 100 people, has been constantly rising across Europe, from 73,3 % in 2017 towards 86,5 % in 2023. The rising number of mobile devices is the main driver of this swift development. While there are more and more devices that use SIM-cards, it is not surprising that the overall take-up rate will further increase. However, it is difficult to estimate the actual number of mobile users, as the number of SIM cards does not necessarily mean the number of persons owning a SIM-card. We often see that people have several SIM-cards (e.g. for private mobile phone, a business mobile phone, a tablet). This will be increased by future IoT tendencies. This phenomenon can be observed if we analyse mobile penetration rate on national level.

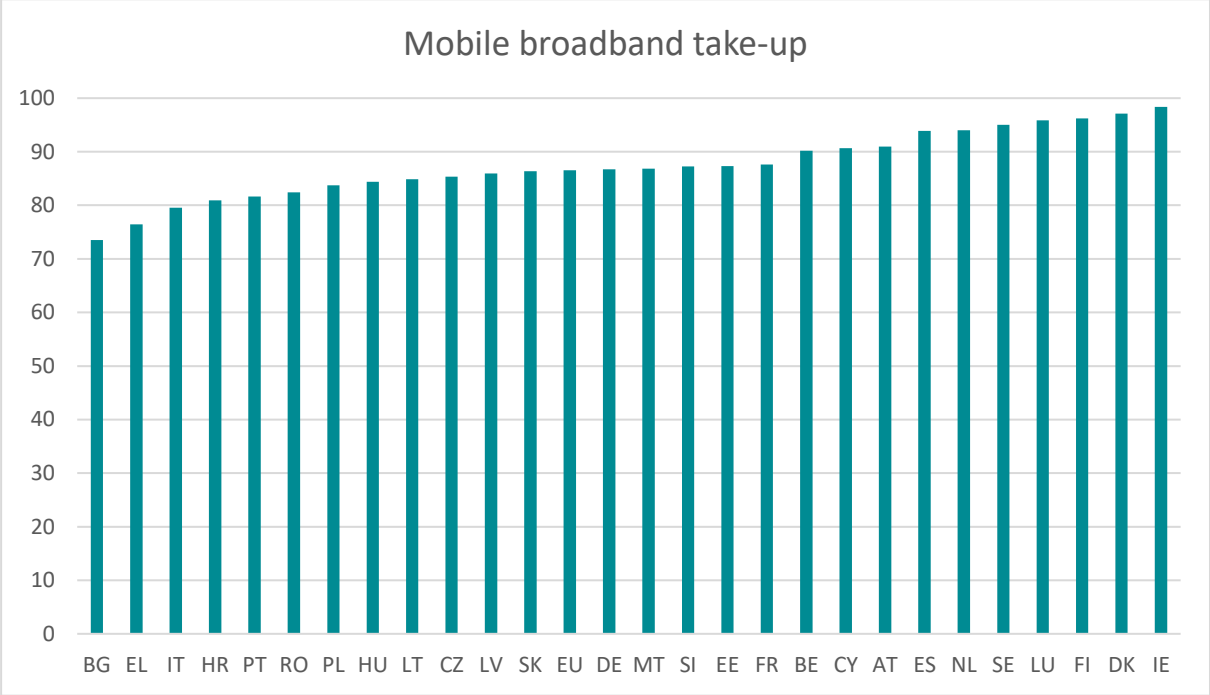


Figure 6 Number of mobile data subscriptions per 100 people. DESI 2023

Yet, the 5G readiness is still quite a challenge in Europe, with only on average 68,24 % of spectrum made available. The indicator measures an amount of spectrum assigned and ready for 5G use within the 5G pioneer bands. These bands are 700 MHz (703-733 MHz and 758-788 MHz), 3.6 GHz (3400-3800 MHz) and 26 GHz (1000 MHz within 24250-27500 MHz). All three spectrum bands have an equal weight.

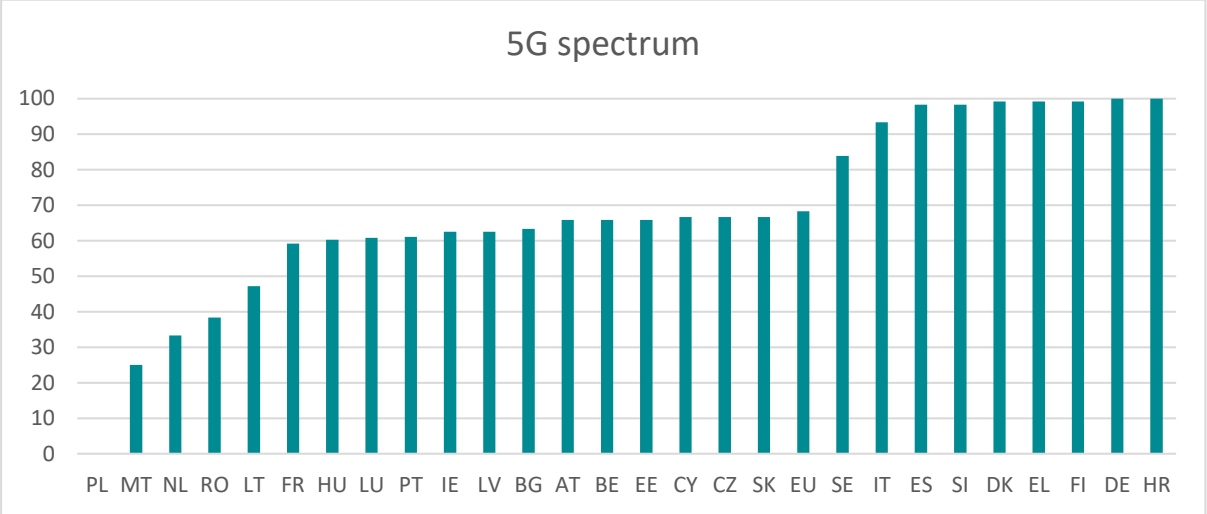


Figure 7 5G spectrum. The amount of spectrum in % assigned and ready for 5G use. DESI 2023.

6.2.3 Socio-Economic Indicators

Besides the connectivity indicators, there are also socio-economic indicators that are valuable for assessing the status quo and possibly even the future chances of meeting the connectivity targets. Especially considering the demand side, it is useful to examine several aspects, considering the impact of demand on take-up and coverage alike. These indicators express the overall digitization of a society; however, these factors do not solely define the whole scope of the demand side sufficiently. Especially factors such as affordability are at least equally important.

- digital inclusion

Digital inclusion means especially the regular use of internet and digital services across the Member States, but also a number of persons that have never used the Internet. These indicators are well suited to estimate how and if the use of internet has become a tool of everyday life. The common use of digital services directly influences the demand for broadband subscriptions, while the use by persons that have never used the internet correlates with affordability, publicly available WLAN, etc. The level of internet use as well as the level of digital skills are increasing in Europe. The EU target for basic digital skills by 2030 is 80% of population, compared to 53,92% in DESI 2023.

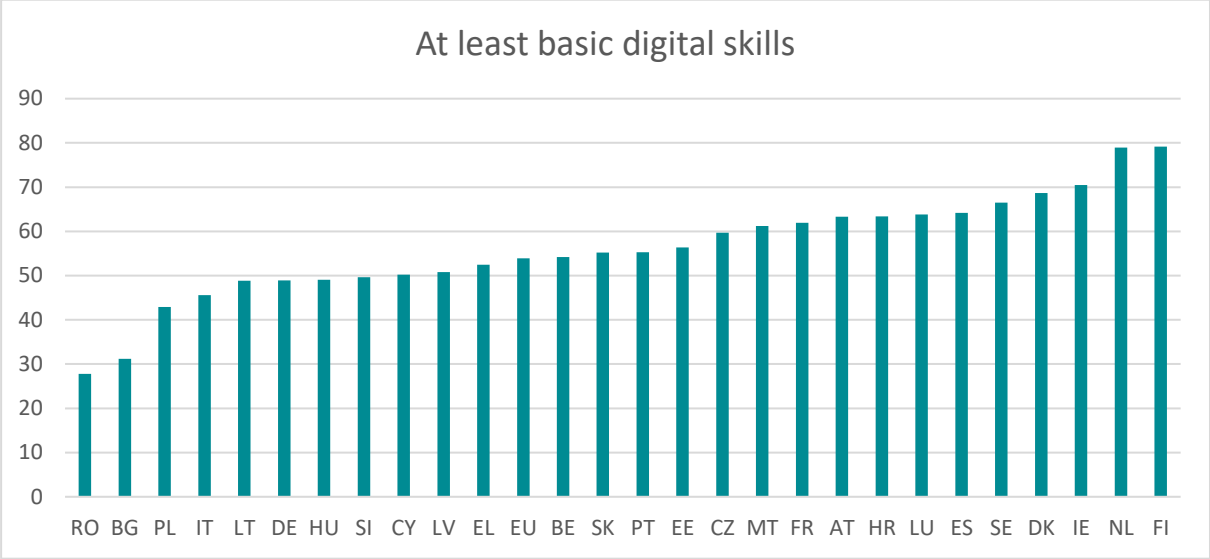


Figure 8 Individuals with 'basic' or 'above basic' digital skills in each of the following five dimensions: information, and data literacy, communication and collaboration, problem solving, digital content creation and safety. DESI 2023.

- digital public services

The use of digital public services is another suitable set of indicators for evaluating the demand side activities of national broadband strategies. The number of people using eGovernment (Citizens interacting online with public authorities) and the amount of returned filled forms directly show if digital services are designed well enough to substitute the traditional administrative procedures. As traditional administrative processes are often linked to burdensome procedures (especially time and commuting), there can be a strong incentive to use digital services instead. The number of e-Gov users in Europe is growing slowly, but steadily, reaching 74,2% in DESI 2023 (compared to 100% EU target for 2030).

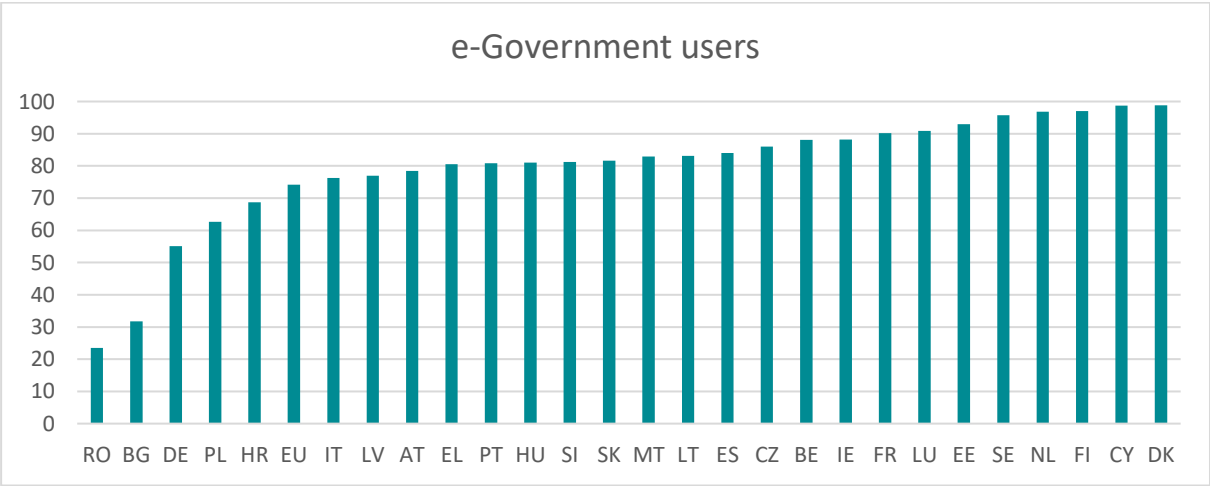


Figure 9 Individuals who used the Internet, in the last 12 months, for interaction with public authorities on websites or on mobile applications. DESI 2023.

7 Implementing the Digital Agenda 2020, Gigabit Society 2025 and Digital Decade 2030

7.1 The national broadband plans

Since the adoption of the Digital Agenda for Europe (DAE) 2020 targets in 2010, the Member States have gradually adopted and updated their National Broadband Plans (NBPs). They are devised to integrate all relevant aspects of an effective broadband policy and resources enabling policy makers and public authorities to properly plan public interventions in the telecommunications sector.

A large majority of MS has demonstrated notable progress in implementing their NBPs. Some NBPs are integrated within broader strategic approaches, others are documents specifically dedicated to broadband deployment. In some countries, multiple official documents drafted by different national authorities exist that specify aspects related to such broadband developments.

7.1.1 NBPs: Differing approaches

Declared targets in NBPs are, first and foremost, guideposts whose practical feasibility and actual success depends on the utilisation of appropriate means, including legal measures and financial resources. Therefore, it is of pivotal importance that Member States have the necessary resources and tools in place, rather than merely policy targets, to facilitate the effective roll-out of broadband infrastructure on their territories.

For the actual implementation of the National Broadband Plans, the national (or regional governments in some cases) define a variety of measures. Often, the NBPs differ within two dimensions: operational and strategic NBPs. While strategic NBPs often describe intentions and targets at an abstract level, operational NBPs add indicators, responsibilities and timeframes to clarify their measures.

Of course, a clear distinction between strategic and operational is usually not possible, as strategic NBPs include operational aspects and vice versa. From an evaluator's perspective, NBPs with a strong focus on operational implementation are favourable. Especially the description of responsibilities and means of measurement are useful to find causalities and correlations. However, a majority of NBPs is characterized by strategic elements. They usually elaborate overall plans and measures without defining how they actually want to implement these measures.

7.1.2 Probabilities of achievement of connectivity targets

Based on the current connectivity and take-up rates (DESI 2023) as well as the theoretical and practical implementation of the NBPs (examined within the following country sections), we expect the following probabilities for the EU-27 to achieve the Gigabit Society and Digital Decade targets. We differentiate between low probability, medium probability and high probability to classify each country.

Targets	Gigabit Society 2025			Digital Decade 2030
	Access to 1 Gbps for all schools, transport hubs & main providers of public services &digitally intensive enterprises	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	Connectivity: Gigabit for everyone
EU-27 MS	Probability assessment	Probability assessment	Probability assessment	Probability assessment
Austria	low	low	high	medium
Belgium	low	low	low	low
Bulgaria	high	medium-low	high	high
Croatia	medium	low	high	medium
Cyprus	high	low	high	medium
Czechia	medium	low	high	medium-low
Denmark	high	high	high	high
Estonia	high	medium	medium-high	high
Finland	high	low	high	medium
France	high	medium	high	high
Germany	low	low	high	medium
Greece	low	low	high	low
Hungary	high	high	high	high
Ireland	high	medium	high	high
Italy	high	low	high	medium-high
Latvia	high	high	high	high
Lithuania	high	medium	high	high
Luxembourg	high	high	high	high
Malta	reached	reached	reached	high
Netherlands	high	medium	high	high
Poland	high	low	medium	medium
Portugal	high	high	high	high
Romania	high	high	medium	high
Slovakia	high	medium	high	medium-high
Slovenia	high	medium	high	high
Spain	high	medium	high	high
Sweden	high	low	high	high

Table 3 Probability of achievement of EU connectivity targets in MS.

For most Member States, the probability of achieving the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" target is assessed as high or medium. The target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" will prove much more challenging for many MS: the probability is low for 10 MS and only six MS (Hungary, Latvia, Luxembourg, Malta, Portugal and Romania) have high probability. The assessment for the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is very positive, as most MS have high probability of reaching the target. Sixteen MS have high probability of reaching the Digital Decade 2030 target of gigabit for all and 5G in all populated areas, and the overall outlook for the EU is quite positive, due to catching-up fibre rollout as well as ambitious planned public and private investments.

7.2 Broadband Development in practice: Member State Reports

In what follows, Member States' national broadband strategies shall be analysed on a case-by-case basis. A few countries among the EU-27 that maintain a single strategy document as point of reference, though there is a variety of documents throughout Europe that were included within the upcoming chapter. The synopses presented below draw upon multiple sources. These sources, which are predominantly pertinent official documents, vary rather remarkably in content and scope. Some NBPs are very comprehensive and specific, others merely state ambitions or targets. Table below lists these main guiding documents we took into consideration for analysis of each and every country.

After having reviewed key features of the NBPs, the practical implementation process is examined for each Member State, taking into consideration issues such as steering modalities, convergence of networks and the role of mobile and satellite technologies, funding and financing instruments, cost-reduction measures, GIS/mapping tools, and notable roll-out projects. Often, these practical assessments are based on unofficial discussions with key stakeholders in each country and own expertise. Each Member State report closes with an evaluation, a comparison between targets and actual performance, and an assessment of the feasibility of meeting the connectivity targets.

Table 4 National Broadband Plans in MS - main documents

Country	Year	Title
Austria	2019	Breitbandstrategie 2030
Belgium	2021	National plan for fixed and mobile broadband
Bulgaria	2020	National Broadband Infrastructure Plan for Next Generation Access "Connected Bulgaria"
Croatia	2021	National Plan for Broadband Development 2021-2027
Cyprus	2021	Broadband Plan of Cyprus 2021-2025
Czech Republic	2021	National Plan for the Development of Very High Capacity Networks
Denmark	2021	Broadband Strategy 2021
Estonia	2021	Digital Agenda 2030
Finland	2018	Digital infrastructure strategy 2018
France	2020	France Très Haut Débit
Germany	2022	Gigabit Strategy
Greece	2021	National Broadband Plan 2021-2027
Hungary	2021	National Digitization Strategy 2021-2030
Ireland	2021	National Broadband Plan
Italy	2021	Strategy for Ultra Broadband Towards the Gigabit Society
Latvia	2021	Electronic communications sector development plan for 2021-2027
Lithuania	2021	Plan for the ultra-fast broadband development 2021-2027
Luxembourg	2021	Ultra-high-speed broadband strategy 2021-2025
Malta	2022	Malta Diġitali 2022-2027
Netherlands	2021	Dutch Digitalisation Strategy 2021
Poland	2020	National Broadband Plan 2025
Portugal	2022	National Strategy for Connectivity in Very High Capacity Electronic Communication Networks for 2023-2030
Romania	2023	Reference framework in the field of broadband network development in Romania
Slovakia	2021	National Broadband Plan
Slovenia	2023	Gigabit infrastructure development plan until 2030
Spain	2020	Digital Spain 2025 Agenda
Sweden	2016	A Completely Connected Sweden by 2025 – a Broadband Strategy

7.2.1 Austria

Austria facts & figures	
Degree of self-governance:	Federation (federal parliamentary republic)
Population:	9,104,772 (2,3 % of EU-27)[I]
Population density:	108.5 per km^2 (EU average: 109 per km^2)[I]
Size:	83,871 km^2
Topography:	Largely mountainous country (Alps, only 32 % below 500 meters)
Fixed Very High Capacity Network (VHCN) coverage	54,83 % of households (EU average: 73,42 %)
FTTP coverage:	36,62 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 5 Austria facts & figures

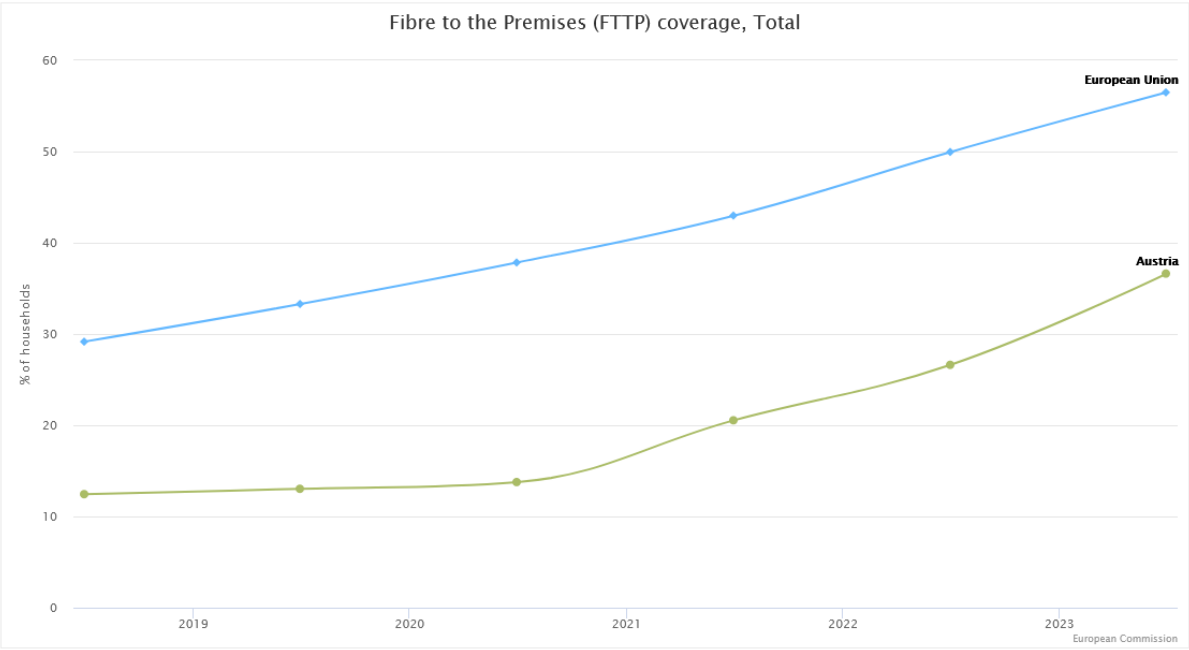


Figure 10 Percentage of households covered by FTTH and FTTB. Austria in comparison to EU. DESI 2023.

7.2.1.1 *Key Features*

National Broadband Plan

Austria's National Broadband Plan (NBP) "Breitbandstrategie 2030"[32] is generally in line with the Gigabit Society and Digital Decade targets. It builds on the previous broadband strategy "Breitbandstrategie 2020" and aims at full coverage of symmetric Gigabit connections throughout the country by 2030.

In addition to the long-term objective, the 2030 strategy also includes five concrete interim goals:

- Phase 1: Full-coverage of ultra-fast broadband connections (100 Mbps) by the end of 2020
- Phase 2: Market launch of 5G in all capital cities by the end of 2020
- Phase 3: Austria as 5G pilot country until the beginning of 2021
- Phase 4: 5G services on major traffic connections by the end of 2023
- Phase 5: Nationwide Gigabit connections, including nationwide coverage of 5G, by the end of 2025

National Broadband Plan of Austria: key facts	
Main strategic document	Breitbandstrategie 2030
Targets	▪ 5G services on major traffic connections by the end of 2023 ▪ Nationwide Gigabit connections, including nationwide coverage of 5G, by the end of 2025 ▪ full coverage of symmetric Gigabit connections throughout the country by 2030

Table 6 NBP Austria key facts

Austria's 5G Strategy[33] was issued in April 2018 and aims at achieving the rollout of the 5G mobile communications standard with optimised framework conditions, and aims at harnessing the associated opportunities for citizens, the economy, industry and science. In the first phase, first pre-commercial 5G trial installations were implemented by mid-2018. In the second phase, the rollout of 5G in all provincial capitals is planned. A third phase will bring 5G service availability to main traffic routes by the end of 2023 and a nationwide 5G availability by the end of 2025.

[32] https://data.breitbandbuero.gv.at/PUB_Breitbandstrategie-2030.pdf

[33] https://data.breitbandbuero.gv.at/PUB_5G-Strategie.pdf

Funding programmes and support measures

The funding program "Breitband Austria 2020" provided important financial means for broadband roll-out, but broadband deployment in the remaining rural areas is extremely burdensome.

In April 2021 the government announced that EUR 1.4 billion will be invested in the deployment of fibre in underserved regions in the frame of the Initiative Broadband Austria 2030[34]. The funds derive from the Recovery and Resilience Facility (EUR 891 million), the proceeds of the 5G spectrum auctions (EUR 389 million) and additional EUR 166 million from the national budget. This measure addresses the Austrian backlog in the deployment of rural gigabit capable access networks and therefore supports the objectives of the Austrian Broadband Strategy 2030 and the EU Gigabit connectivity objectives.

Connectivity is addressed in the Recovery and Resilience Plan (RRF) by supporting widespread deployment of gigabit-capable access networks and accounts for the largest share of the digital-related expenditure of the plan, recognising the need to increase coverage with fixed VHCN in rural areas. The funds from RRF will support roll-out of gigabit enabled access networks to 200,000 households (reaching a total coverage of 50% of households), with a budget of EUR 891 million. Austria's RRP has a total value of EUR 4.5 billion.

The broadband atlas ("Breitbandatlas")[35] is the central information medium on the current broadband supply situation in Austria and serves primarily as initial information on broadband supply for private households. All data from the broadband atlas is available for download on Open Data Austria[36].

Austria has set up a broadband competence office in early 2013[37], located in the Federal Ministry of Finance (Bundesministerium für Finanzen). It functions as a coordination and service centre for municipalities, cities, states and operators.

A task force, the Internet Infrastructure Austria 2030 Platform (Plattform für Infrastrukturausbau PIA 2030)[38], has been established to accelerate VHCN deployment and coordinate the interaction be-

Main Challenges for connectivity in Austria:

- Low (36,6 % of households) Fibre to the Premises (FTTP) coverage
- Low (0%) At least 1 Gbps broadband take-up
- Strong fixed-to-mobile substitution

[34] https://breitbandfoerderung.gv.at/
[35] https://breitbandatlas.gv.at/
[36] https://data.gv.at/breitbandatlas
[37] https://breitbandbuero.gv.at/
[38] https://www.bmf.gv.at/themen/telekommunikation-post_2/breitband/pia2030.html

tween the federal government, states, municipalities, cities, the public, authorities and the private sector, as well as help further develop legal, regulatory and technical measures in the context of broadband deployment.

In sum, Austria opts for a market-driven network roll-out and intends to confine the use of public funds to where they are absolutely necessary, in particular, for the rural areas with the least chance of benefiting from private sector-based investments.

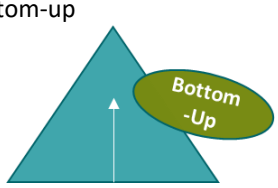
Organizational Steering	Main Players
▪ Broadband development usually steered bottom-up 	▪ Federal Ministry for Finance (Bundesministerium für Finanzen) ▪ Broadband Competence Office (Breitbandbüro) ▪ Austrian Regulatory Authority for Broadcasting and Telecommunications RTR (Rundfunk- und Telekom Regulierungs-GmbH) ▪ Regional/state authorities

Figure 11 Organizational Steering & Main Players Austria

7.2.1.3 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Austria is a country with a highly developed and efficient infrastructure, offering excellent connectivity in terms of transportation, communication, and public services. Internet and Telecommunications infrastructure is well expanded to cover the current needs. Austria has widespread access to high-speed broadband internet. The regional and state authorities have invested in expanding broadband infrastructure to rural areas. Mobile coverage is excellent in Austria, with 4G and 5G networks available in most urban and rural areas. Wi-Fi hotspots are common in urban areas, including cafes, restaurants, hotels, and public spaces.

Austria's broadband plan and related initiatives are driving progress in improving fibre coverage in rural and underserved areas. The Broadband Strategy 2030 includes ambitious targets, addresses the high costs of fibre rollout and intends to incentivise the take-up of higher bandwidths. Public policy

and the expected government funding scheme will play an important role in further improving connectivity in Austria.

Austria is advanced in implementation of the connectivity toolbox, high number of best practices is implemented, many obstacles in broadband rollout (e.g. single information point, rights of way) are tackled during implementation of the toolbox. Austria's commitment to implementing a connectivity toolbox and addressing obstacles in broadband rollout is a positive step toward ensuring that the country has robust digital infrastructure.

When it comes to Fixed Very High Capacity Network (VHCN) coverage (54,8%), Austria is lagging behind by almost 20 points compared to the EU Average (73,4%). The gap between "Fixed Very High Capacity Network (VHCN) coverage, DESI 2023" (54,8%) and "At least 100 Mbps fixed broadband take-up, DESI 2023"(28,34%) is 26,5% - which close to EU average of 24%. Both take-up of “At least 100 Mbps fixed broadband” (28,34%) as well as coverage (54,8%) raised by approximately 16% since DESI 2021. Austria made significant progress in rural areas, a challenge for this mountainous country, where VHCN coverage has increased by 11 percentage points, from 16% in DESI 2022 to 27% in DESI 2023.

The private operators invest primarily in FTTX. Private network deployment by Austria’s three main telecom operators remains focused on urban areas and continues to be slowed down by lengthy decentralised permit granting procedures. Austria is still very far from a 100% coverage of gigabit connectivity with FTTP and is currently covering many households with DOCSIS 3.1 (40%). “Fibre to the Premises (FTTP) coverage” (36,62%) is 20 points behind the EU average of 56,50%. Very low (0%)“At least 1 Gbps broadband take-up”, compared to EU average of 13,76%, may call for demand generation measures and reflect conservative approach towards subscribing to high speed contracts. Even where gigabit internet is available, Austrian end-users opt for lower speeds or mobile connections with comparable speeds. According to the Austrian authorities, about one third of Austrian households are mobile only, and this percentage remained unchanged from the previous year.

Austria has made significant strides in mobile connectivity and 5G coverage, positioning itself as a frontrunner in this area. Overall 5G coverage is according to DESI 2023 at 91,71%, above the EU average of 81,19%, and increased substantially since DESI 2021 (50,02%). The jump is even more strongly felt in populated rural areas, where 5G coverage rose from 36% in 2021 to a remarkable 69% in 2022. As operators continue to invest in and roll out 5G in the 3.6 GHz and 700 MHz bands, the goal of nationwide coverage of 5G by the end of 2025 is in reach.

While Austria has made progress in expanding high-speed internet access, there are still challenges to overcome. Considering all above, the **probability is low** that Austria reaches the Gigabit Society targets

by 2025 “Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises” and “Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households”. The probability is **high** that Austria reaches the “Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways” target by 2025.

Achieving gigabit-speed internet access for all households in Austria by the year 2030 is an ambitious goal and depends on various factors, including government policies, private sector investments, technological advancements, and infrastructure development. Austria has a history of prioritizing digital infrastructure, and the achievement of gigabit speeds for a significant portion of the population is within reach. However, ensuring coverage for all households, particularly in remote and rural areas, will likely require concerted efforts and resources. Considering low FTTP coverage, low subscriptions for gigabit speeds and challenging mountainous topography, yet strong commitment of authorities and telecom operators, probability is medium that Digital Decade’s “Gigabit for everyone” aim is met by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	low
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium

Table 7 Probability of achievement of connectivity targets in Austria

7.2.2 Belgium

Belgium facts & figures	
Degree of self-governance:	Federation (constitutional popular monarchy and federal parliamentary democracy)
Population:	11,754,004 (2.6 % of EU)[I]
Population density:	380.5 per km^2 (EU average: 109 per km^2)[I]
Size:	30,528 km^2
Topography:	Coastal plain in the north-west, central plateau and uplands in the south (Ardennes)
Fixed Very High Capacity Network (VHCN) coverage	78,3 % of households (EU average: 73,42 %)
FTTP coverage:	17,16 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 8 Belgium facts & figures

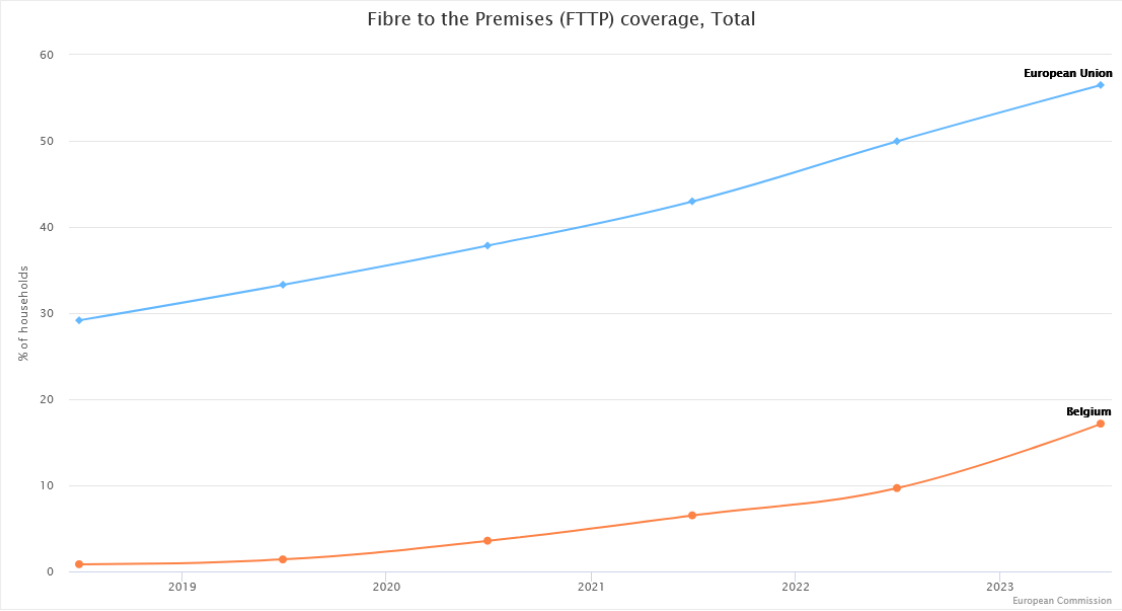


Figure 12 Percentage of households covered by FTTH and FTTB. Belgium in comparison to EU. DESI 2023.

7.2.2.1 *Key Features*

Digital Belgium[39] delineated five priorities:

- Digital infrastructure,
- Digital confidence and digital security,
- Digital government,
- Digital economy, and
- Digital skills and jobs.

National Broadband Plan of Belgium: key facts	
Main strategic document(s):	Digital Belgium, National plan for fixed and mobile broadband
Targets:	▪ create support for fibre and 5G rollout ▪ eliminate 'white zones', or areas in Belgium where fast fixed internet is not yet available ▪ availability of at least 100 Mbps, upgradeable to gigabit speed, by 2025

Belgium's Federal Council of Ministers launched on 30 April 2021 a national plan for fixed and mobile broadband[40], which is to eliminate the remaining white areas where high speed services are unavailable (estimated 138.000 households). Under the plan, the white areas (estimated 2% of territory) will be mapped as a first step to facilitating the deployment of high speed services, for example by stimulating investment by operators. In addition, a special government unit with responsibility for implementing the plan and monitoring progress will be set up, while a Broadband Competence Office will deal with all relevant issues relating to the cooperation between public and private stakeholders and support implementation of the EU Connectivity Toolbox. The plan is built around 5 axes:

- mapping network coverage and identifying white areas,
- facilitating the rollout of broadband by creating a temporary national BCO that will coordinate more extensively the cooperation between public authorities and operators or investors, as well as the implementation of the EU Connectivity Toolbox,
- encouraging investment in the white areas without fast internet,
- creating support for fibre and 5G rollout,
- the establishment of a cell Broadband within the FPS Economy.

By reducing administrative burdens and lowering roll-out costs of network operators, the government is stimulating the roll-out of new broadband technologies (fibre & 5G). For example, every house that

[39] https://economie.fgov.be/en/themes/online/strategy-european-digital/digital-belgium-digital-agenda
[40] https://economie.fgov.be/en/themes/online/broadband-competence-office/broadband-initiatives

is being built or renovated in the future will need to be fibre ready. Moreover, a proactive 5G framework is to ensure Belgium is ready when the Internet-of-everything is rolled out.

Digital Wallonia[41] sets the framework for the Walloon Government's actions in terms of Wallonia's digital transformation. Digital Wallonia is structured around eight cross-disciplinary challenges that form its framework and its key elements for all the decisions made and the measures taken within the five themes of Digital Wallonia: Digital sector, Digital business, Skills and education, Public Services and Smart and connected territory. One of the challenges is "Giga Region - Super-fast broadband for everyone as the bedrock of digital initiatives".

Main Challenges for gigabit connectivity in Belgium:

- Low (17,16 % of households) Fibre to the Premises (FTTP) coverage
- Low (3,1%) at least 1 Gbps broadband take-up
- Coordination between national, regional and local authorities

Funding programmes and support measures

As part of the national broadband plan, a call for projects was launched in December 2022 to promote fixed Internet access infrastructures in the "white areas" of the Belgian territory. With a budget of EUR 40.7 million, the call covers up to 50% of the cost of installing very high capacity networks (VHCN) in currently underserved areas. The regional government of Wallonia launched a similar project in the course of 2022 for a budget of EUR 12.2 million.

Belgium's Recovery and Resilience Plan allocates EUR 1.6 billion (i.e. 27%) of its total financial allocation to digital services, of which EUR 1.4 billion is expected to be spent on achieving the Digital Decade targets. The plan includes measures focusing on digital skills, digital infrastructure and connectivity, cybersecurity, and the digitalising of public services. In particular, measures will support the upgrade of ICT infrastructure in schools and/or educational institutions, digital training courses, the 5G roll-out, the 5G auction and the revision of the legislative framework on radiation standards in the three regions.

At federal level, the Belgian government has launched a 5G pilot funding programme to support promising test cases. With a budget of over EUR 24 million, the programme has already attracted more than 20 proposals.

[41] https://www.digitalwallonia.be

The BIPT provides a mapping system[42] for broadband (per technology) showing where Internet access is available at a particular speed. In this way, areas where high-performance infrastructure is not yet present (white areas) and additional measures are necessary can be identified.

In addition, BIPT launched fibreinfo.be, a website which provides information on fibre deployment in Belgium to all stakeholders. The website aims to be a central and neutral information point.

In its roadmap to implement the Connectivity Toolbox, Belgium announced plans to assess the need for permit exemptions, identify opportunities to further digitalise permit application procedures, provide guidance to local entities that would not apply cost-based fees, further improve the digital availability of information, mainly by strengthening synergies between different sources, and encourage access to the physical infrastructure of public bodies. The implementation of the toolbox and best practices is progressing well.

The Belgian Competition Authority, in collaboration with the BIPT, will examine agreements between telecommunications operators aimed at pooling the deployment of fibre infrastructures[43] in Belgium to ensure that the cost savings achieved by the operators benefit end-users, consumers and businesses alike.

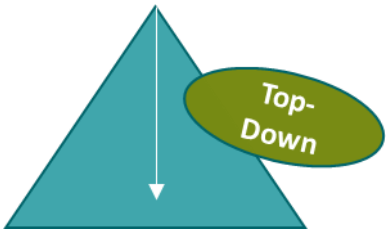
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Deputy Prime Minister and Minister of Public Administration, Public Enterprises, Telecommunication and the Postal Services ▪ FPS Economy ▪ Belgian Institute for Postal Services and Telecommunications (BIPT) ▪ Regional & local authorities

Figure 13 Organizational Steering & Main Players Belgium

[42] https://www.bipt-data.be/en

[43] https://www.belgiancompetition.be/sites/default/files/content/download/files/20231016_Press_release_43_BCA.pdf

7.2.2.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

The overall circumstances within the Belgian broadband market are highly in favour of a market driven broadband deployment. Belgium's central location in Europe, strong economy, and investment in infrastructure contribute to its high level of connectivity. However, challenges remain, particularly related to digital inclusion, ensuring that all citizens, including those in rural areas, have access to high-speed internet and digital services. Nevertheless, Belgium's overall connectivity reflects its commitment to maintaining a high standard of living and facilitating economic activity in the heart of Europe.

Belgium has made significant progress towards reaching connectivity targets. The availability of 100 Mbps or more (VHCN) is steadily increasing (78,3 %, slightly ahead of the EU average). Belgium already has a comparably high household penetration rate of 66,51 % with 100 Mbps or more. The gap between "Fixed Very High Capacity Network (VHCN) coverage, DESI 2023" (78,3%) and "At least 100 Mbps fixed broadband take-up, DESI 2023"(66,51%) is low at 11,77% - which is much less than the EU average of 24%. Both take-up of “At least 100 Mbps fixed broadband” (66,51%) as well as coverage (78,3%) raised by respectively 12% and 10,8% since DESI 2021.

Yet, the FTTP coverage is low in Belgium (17,16 %, DESI 2023). Most part of the coverage of 100 Mbps and more is achieved by cable Docsis 3.1, and it is very unsure if this technology will allow for upgrade to 1 Gbps. Any measures to increase coordination, transparency concerning infrastructures or decrease costs of transaction will be crucial to facilitate the roll-out of ultra-fast networks even further.

The joint venture of the telecom operators is expected to help accelerate fibre rollout in Belgium. As the availability and rollout of fibre seems to be the major obstacle on the way to achieving gigabit speeds, this puts a lot of pressure on operators.

Belgium significantly advanced in 5G rollout. Overall 5G coverage increased from 4,43% in DESI 2021 towards 29,63% in DESI 2023. Despite progress on overall 5G coverage in Belgium is still far from the EU average (81,19%). Moreover, coverage with the 3.4-3.8 GHz band is very low (6% vs 41% EU average) due to the late finalisation of Belgium’s spectrum auction in July 2022 (700MHz and 3.6 GHz bands with 20-year usage rights).

Therefore, the probability that Belgium reaches the Gigabit Society targets by 2025 is rather **low**.

Achieving gigabit-speed internet access for all households in Belgium by 2030 will be heavily influenced by the availability and deployment of fibre-optic networks well-suited to providing gigabit-speed internet due to its high data transmission capacity and reliability. While challenges exist, a combination of government support, private sector investment, and technological advancements can contribute to

the realization of this ambitious goal. Belgium has a long way ahead when it comes to fibre rollout. The challenges posed by providing of funding and coordination will be substantial. Probability is **low** that the Gigabit for everyone by 2030 target is reached.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	low
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	low
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	low

Table 9 Probability of achievement of connectivity targets in Belgium

7.2.3 Bulgaria

Bulgaria facts & figures	
Degree of self-governance:	Unitary state (parliamentary democracy)
Population:	6,447,710 (1.4 % of EU)[I]
Population density:	62.5 per km^2 (EU average: 109 per km^2)[I]
Size:	110,370 km^2
Topography:	Northern lowlands (Danube plain), highlands in the south (Balkan and Rhodope Mountains)
Fixed Very High Capacity Network (VHCN) coverage	85,6 % of households (EU average: 73,42 %)
FTTP coverage:	85,6 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 10 Bulgaria facts & figures

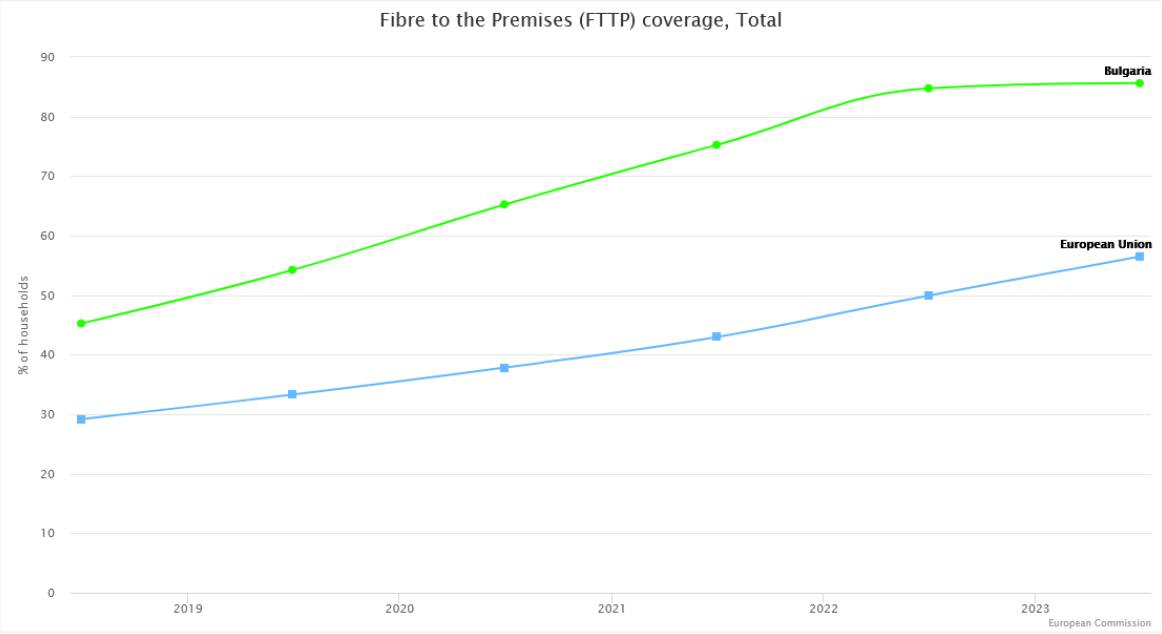


Figure 14 Percentage of households covered by FTTH and FTTB. Bulgaria in comparison to EU. DESI 2023.

7.2.3.1 *Key Features*

National Broadband Plan

The National Broadband Infrastructure Plan for Next Generation Access "Connected Bulgaria" and the Policy in the field of electronic communications were adopted in August 2020. The National Development Program Bulgaria 2030 introduced priority 8 Digital connectivity aiming at building a modern and secure digital infrastructure as a basis for offering more digital services. Also, the Digital Transformation of Bulgaria for the period 2020-2030, approved in July 2020, aims at deploying networks with a very high capacity. State budget and the EU funds will be used to help reach the set aims.

National Broadband Plan of Bulgaria: key facts	
Main strategic document(s):	• National Broadband Infrastructure Plan for Next Generation Access "Connected Bulgaria" • National Development Program Bulgaria 2030
Targets:	▪ 52 % coverage by the Fixed Very High Capacity Network ▪ 33 % take-up of at least 100 Mbps fixed broadband ▪ 50 % 5G readiness ▪ gigabit-symmetric access networks throughout the country by 2030

Table 11 NBP Bulgaria key facts

The National Broadband Infrastructure Plan for Next Generation Access "Connected Bulgaria"[44] outlines the steps to provide digital infrastructure for the provision of various services. The measures envisage improving access to high-speed Internet in less populated regions and developing the high-speed mobile Internet in the country. Of key importance for the digitisation of the Bulgarian economy and public services will be investments for the introduction of 5G networks. The plan sets out the need for targeted investments in technological development, completion of the necessary infrastructure and guaranteed network and information security. The main priority fields in the plan are:

- Broadband infrastructure - accelerated building of broadband infrastructure, incl. for the needs of the state administration
- Very high-speed infrastructure – creating conditions for very high-speed networks' deployment
- Spectrum efficient use - establishing conditions for building NGA networks
- Improving coverage in settlements located in peripheral, sparsely populated and rural areas

[44] https://www.mtitc.government.bg/en/category/46/updated-national-broadband-infrastructure-plan-next-generation-access-connected-bulgaria-and-updated-policy-field-electronic-communications-have-been-adopted

- Bridging the Digital divide
- Network security

The updated Policy in the field of electronic communications[45] aims to ensure the provision of modern and quality electronic communications services by creating conditions for the development of a competitive market as part of the EU internal market. Priority is the deployment and use of very high-capacity networks, the provision of fifth generation services, effective and sustainable competition, the security of networks and services, as well as advantages for end-users, including equivalent access to the services of people with disabilities.

Main Challenges for gigabit connectivity in Bulgaria:

- Low (0,76 %) At least 1 Gbps broadband take-up
- Low digital literacy & skills of the population
- Strong rural-urban digital divide
- Administrative delays in the investment process
- Non-unified administrative requirements for building high-speed networks

The Priority 8 Digital connectivity of the National Development Program Bulgaria 2030[46] aims to build a modern and secure digital infrastructure as a basis for offering more services through digital management. The goal is to build very high capacity networks, which will form a platform for providing a variety of digital value-added services while ensuring that no part of the country or a society group will be left without adequate digital connectivity. The focus of the priority is on deploying high-speed networks, especially broadband in rural areas, effective assignment of the spectrum for wireless broadband and 5G, accelerated development and take-up of broadband-dependent services such as cloud, IoT, etc. as well as the development of digital skills and services.

The Digital Transformation of Bulgaria for the period 2020-2030[47] approved in July 2020 aims at deploying networks with a very high capacity to ensure that no part of the country or a group in society is left without adequate digital connectivity, and provide better access of the enterprises to diverse, high-quality and innovative digital services. Digital connectivity shall contribute to providing access to all major drivers of socio-economic development, such as schools, hospitals, transport centres, major public service providers, etc.

Funding programmes

[45] https://www.mtitc.government.bg/en/category/46/updated-national-broadband-infrastructure-plan-next-generation-access-connected-bulgaria-and-updated-policy-field-electronic-communications-have-been-adopted

[46] https://www.minfin.bg/en/1394

[47] https://www.mtitc.government.bg/sites/default/files/digital_transformation_of_bulgaria_for_the_period_2020-2030_f.pdf

According to the Priority 8 of the National Development Program Bulgaria 2030, use of the state budget and EU funds is foreseen.

Broadband support measures

The Bulgarian Recovery and Resilience Plan (RRP) amounts to EUR 6.27 billion. 25.8% of it (EUR 1.6 billion) is devoted to the digital transformation, of which EUR 1.01 billion is expected to contribute to the Digital Decade targets. In the context of the first payment request, Bulgaria has achieved 11 milestones and targets. Several of them were related to measures in the digital area, such as reducing spectrum fees, legislative changes implementing recommendations under the Connectivity Toolbox, and awarding contracts to develop the TETRA system and radio relay network. Regarding the second payment request, Bulgaria is expected to achieve 66 milestones and targets out of the 346 in total in the Bulgarian plan.

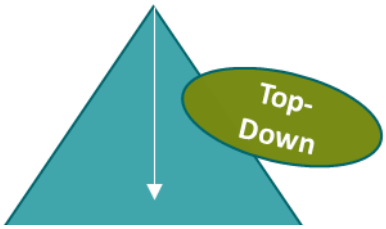
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of Transport and Communications (MTC) ▪ Ministry of e-Governance ▪ Communications Regulation Commission (CRC)

Figure 15 Organizational Steering & Main Players Bulgaria

7.2.3.2 Feasibility Assessment

Bulgaria is a country located in South-eastern Europe, and it has a well-developed and growing connectivity infrastructure. The internet penetration rate is high, with a significant portion of the population having access to the internet. Broadband services, including DSL, cable, fibre-optic, and wireless, are widely available in urban and rural areas. Many providers offer high-speed internet services. Bulgaria has a well-developed mobile network infrastructure. Several mobile network operators provide 2G, 3G, and 4G/LTE services, and some have also rolled out 5G networks. Wi-Fi is prevalent in urban

areas, including cafes, restaurants, hotels, and public spaces. Many cities also offer free Wi-Fi in public areas. The country has a modern telecommunications system, and both landline and mobile phone services are readily available. International calls and data roaming are also accessible.

While Bulgaria continues to perform well in connectivity both on very high-capacity network (VHCN) and fibre to the premises (FTTP), the uneven distribution of digital infrastructure in rural areas requires further attention. Furthermore, the uptake of digital public services is still low and targeted measures are needed, in particular to minimise the administrative burden placed on companies. Significant efforts should be made in the promotion of digital skills.

The main source of NGA coverage is existing cable network infrastructure. Within urban areas, there is a widespread availability of such networks provided by alternative operators. The incumbent competes with these networks via the deployment of FTTP technologies. As a result, there is potent infrastructure based competition within urban areas. However, in rural areas, there is considerably less competition. Here, copper-based infrastructures are still dominant. Even though Bulgaria made considerable efforts, creating incentives for the deployment of new infrastructures as well as providing public funding, fully covering these areas is an extremely difficult task. Therefore, coverage is the main challenge Bulgaria will face in the next few years. The situation is further complicated by a low demand from a substantial part of the population, as only 31,18% of population has at least basic digital skills. Thus, we see a digital divide between urban areas, where high-end infrastructures compete and rural areas, where establishing broadband connectivity still remains a challenge.

Substantial investments have been made in state-owned fibre backbone infrastructure. The over 7,000 km of backbone infrastructure is used by the state administration to provide e-services. Since the end of 2019 all of the ministry's 28 regional departments (RED) and more than 3,000 schools are connected. The network has also been used to develop high quality wi-fi that can be used free of charge on school property.

The FTTP coverage is at 85,6 % (DESI 2023) and increased by 10 points compared to DESI 2021. Therefore, the probability that Bulgaria reaches the "access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is estimated as **high**. The gap between the "Fibre to the Premises (FTTP) coverage, DESI 2023" and "At least 1 Gbps broadband take-up, DESI 2023" is very high at 84,85 points. The gap between "Fixed Very High Capacity Network (VHCN) coverage, DESI 2023" and "At least 100 Mbps fixed broadband take-up, DESI 2023" is high with 46,41 points. These may be indicators of low demand and necessity for measures to increase digitals skills and demand generation measures.

The Fixed Very High Capacity Network (VHCN) coverage, DESI 2023, is at 85,6%. Yet, due to rural urban divide, all the efforts and investment may be not enough to ensure reaching the target "access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households"; here the probability is estimated as **medium-low**.

In terms of 5G, Bulgaria made significant progress in the last two years and scores with 67,22% below the EU average (81,19%) of overall 5G coverage. Mobile broadband take-up remains at 73,49 % below the EU average of 86,53 %. The National Regulatory Authority issued provisional authorisations to major mobile network operators (MNOs) for the major 5G bands. One of the MNOs active in Bulgaria, has completed an upgrade towards a fully autonomous 5G network. The new network will offer higher capacity, higher speeds and reduced latency. Reaching the target "uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is estimated as **high**.

Achieving widespread Gigabit (1 Gbps) internet access for everyone in Bulgaria by 2030 is an ambitious but realistic goal, depending on a variety of factors and actions taken by both the government and private sector. With high and still increasing Fibre to the Premises (FTTP) coverage, investments by operators and governmental measures probability is **high** that Bulgaria will reach this target.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium-low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 12 Probability of achievement of connectivity targets in Bulgaria

7.2.4 Croatia

Croatia facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	3,850,894 (0.9 % of EU-27)[I]
Population density:	70.7 per km^2 (EU average: 109 per km^2)[I]
Size:	56,694 km^2
Topography:	Adriatic Basin with 1,246 islands, mountain chain along the coast (Dinaric Alps), Pannonian Basin in the east
Fixed Very High Capacity Network (VHCN) coverage	61,5 % of households (EU average: 73,42 %)
FTTP coverage:	53,95 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 13 Croatia facts & figures

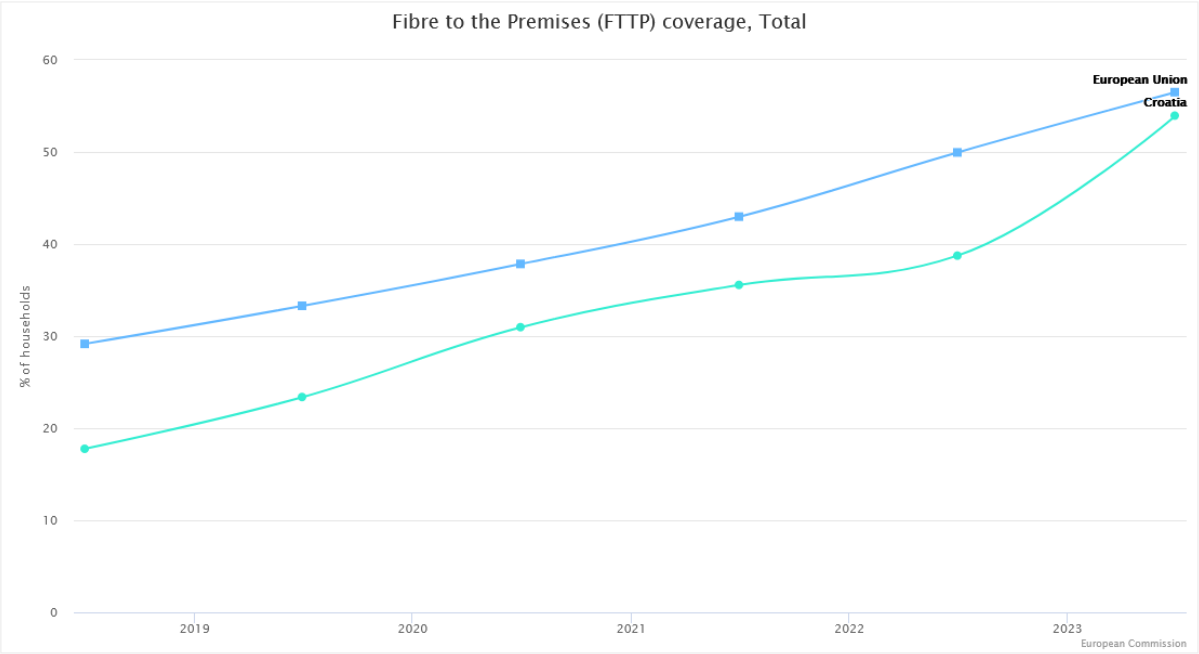


Figure 16 Percentage of households covered by FTTH and FTTB. Croatia in comparison to EU. DESI 2023.

7.2.4.1 *Key Features*

National Broadband Plan

The government of the Republic of Croatia adopted the National Plan for Broadband Development 2021-2027 in March 2021. The plan responds to the European Gigabit Society objectives 2025, partially the 2030 digital targets and the 5G for Europe Action Plan. The Croatian plan aims to provide connectivity with download speeds of at least 100 Mbps to all households, while providing government offices and public buildings such as schools and health facilities with symmetric connections of at least 1 Gbps. It also seeks 5G networks in all main cities and towns and along major highways.

National Broadband Plan of Croatia: key facts	
Main strategic document(s):	National Plan for Broadband Development 2021-2027[48]
Targets:	▪ download speeds of at least 100 Mbps to all households ▪ providing government offices and public buildings such as schools and health facilities with symmetric connections of at least 1 Gbps ▪ 5G networks in all main cities and towns and along major highways.

Table 14 NBP Croatia key facts

Funding Programmes

The National Framework Programme for the Development of Broadband Backhaul Infrastructure in Areas Lacking Sufficient Commercial Interest for Investments (ONP) [49] is a national (umbrella) broadband state aid scheme. Besides general state aid rules, ONP also brings guidelines for local municipalities for implementation of individual projects within ONP. The total estimated (maximum) funding at the national level for the framework programme amounts to EUR 257.9 million, of which EUR 123.1 million is to be financed from ERDF and the remaining EUR 134.8 million to be covered by the EIB loan.

[48] https://mmpi.gov.hr/promet/elektronicke-komunikacije-126/dokumenti-8279/8279
[49] https://mmpi.gov.hr/promet/elektronicke-komunikacije-126/dokumenti-8279/8279

Main Challenges for gigabit connectivity in Croatia:

- rural-urban digital divide,
- topographic (mountainous areas) challenges,
- low demand for connectivity,
- long-lasting permit-granting process for the roll-out of electronic communication infrastructure.

Both sources of funding (ERDF and EIB loan) represent grants for public authorities at local and regional level (cities, municipalities and counties). It is expected that the contribution of private funds in co-financing NGA broadband networks during the implementation of the Programme will amount to EUR 120 million. The average annual budget of the Programme in 2016 - 2023 amounts to EUR 31.5 million. The Croatian Regulatory Authority for Network Industries (HAKOM) has been determined as a holder of the ONP.

The national programme for broadband backhaul infrastructure (NP-BBI) covers state aid measures for backhaul portion of NGN network in white areas and aims at developing the national NGN broadband backhaul, as a network segment interconnecting NGA networks and national core networks. The Programme was endorsed by the European Commission and is being carried out through a public investment model. The passive fibre infrastructure is designed, built and retained in permanent public ownership. After the infrastructure is built, it will be offered to operators on the market at equal terms. Based on the results of public consultations, the Programme aims to cover at least 540 settlements, which are initially prioritised and set as targeted settlements (at least 25% of population), located in suburban and rural areas of Croatia. The overall estimated (maximum) budget of the measure is EUR 101.4 million, of which EUR 86.2 million (85%) will be funded by ERDF and the remaining EUR 15.2 million (15%) by national funds. The annual budget of the scheme amounts to EUR 14.5 million for the period 2017-2023.

Within the new Partnership agreement and new Operational programme “Competitiveness and Cohesion”, two activities are proposed for the period 2021-2027:

- Next generation broadband infrastructure scheme[50]: Construction of a next generation broadband ‘backhaul’ infrastructure, along with connections to end-users, will support access speeds of 100 Megabits per second (Mbps). The scheme covers 540 priority settlements which each have more than 1.000 inhabitants, plus around 5.800 smaller settlements. All the places covered by the investment are demographically, socially and economically below the national average. Around 5.650 km of fibre will be installed. Where possible, existing ducts will be used,

[50] https://ec.europa.eu/regional_policy/en/projects/Croatia/croatia-gets-next-generation-broadband-with-major-infrastructure-scheme

though it is estimated that new ducts will be required for approximately 45% (about 2.450 km) of the deployed fibre. The scheme is split into two units: one covers construction of the next generation network backhaul infrastructure; the other covers connection of public administrations to the fibre infrastructure. Total investment for the scheme is EUR 129,1 million, with the EU's European Regional Development Fund contributing EUR 86,2 million through the "Competitiveness and Cohesion" Operational Programme for the 2014-2020 programming period. The investment falls under the priority "Use of Information and Communication Technologies". Croatia contributes EUR 42,5 million.

- Investments in the deployment of very high capacity networks in NGA white and grey NGA areas to end users in accordance with the Program for support of the Digital Connectivity, with Croatia's contribution of EUR 57,5 million.

Broadband support measures

The Croatian Recovery and Resilience Plan amounts to EUR 6.3 billion and EUR 1.3 billion (20%) is devoted to the digital transformation in line with the Digital Decade Targets. Croatia has achieved multiple milestones and targets related to digital, e.g.:

- the digitalisation of government and public administration services provided to the business sector via a new digital platform for the on-line payment of the seven most frequent and cost-intensive compulsory business fees in Croatia.
- the adoption of three legal acts which address the administrative burden and regulatory barriers hampering the construction of broadband networks, including streamlining the licensing/authorisation process.

The Croatian Recovery and Resilience Plan includes connectivity measures to strengthen connectivity as a cornerstone of the digital transition of society and the economy. Worth around EUR 106 million, they aim to provide VHCN connectivity services in line with the EU Gigabit Society objectives 2025:

- 100 Mbps services to 100,000 Croatian households (700,000 inhabitants) in 20 projects in as many local government units, to overcome in particular the connectivity barrier to teleworking and distance learning, especially in rural areas and among vulnerable groups such as students from disadvantaged families or those with disabilities,
- 1 Gbit services to all major socio-economic drivers such as schools, universities, research centres, transport hubs, hospitals, public administrative authorities and businesses.

- Other RRF investments of about EUR 20 million will target: (i) building passive electronic communications infrastructure to provide access to VHCN and 5G services in rural and sparsely populated areas where there are no the market conditions to attract private investment'; and (ii) 5G coverage in urban areas and the main terrestrial transport routes (5G corridors). About 55% of the households covered by these measures are in rural areas, 26% are in suburban areas, and only 19% in urban areas. About EUR 400,000 will be invested in reform activities on reduction of barriers and guidelines for construction and permit granting as well as harmonisation procedures.

In its roadmap to implement the Connectivity Toolbox, Croatia addresses the main obstacles to efficient VHCN deployment, such as planning restrictions, faster procedures to rights of way, and the need to establish a coordination body for permit handling and draw up guidelines for application of fees.

HAKOM has developed and updates a central mapping tool, Interactive GIS portal[51], which provides information about the availability of broadband access, a consolidated plan of mobile communications infrastructure as well as publications of intents for deployment and bandwidth speeds.

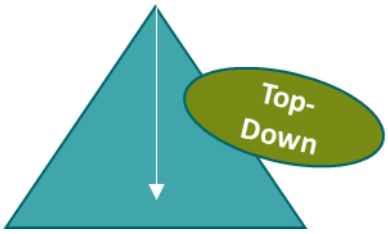
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of the Sea, Transport and Infrastructure (Directorate for Air Traffic, Electronic Communications and Postal services) ▪ Ministry of Regional Development and EU Funds ▪ The Croatian Regulatory Authority for Network Industries (HAKOM)

Figure 17 Organizational Steering & Main Players Croatia

7.2.4.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

Croatia has a well-developed internet infrastructure with a good level of connectivity in urban areas. The country is a popular tourist destination, and most tourist areas offer good internet and mobile

[51] http://bbzone.hakom.hr/

network coverage. Yet, in many remote or rural areas, internet and mobile coverage is less reliable or slower. The achievement of connectivity targets in Croatia will be challenging. There is a serious rural urban digital divide. Topographic (mountainous areas) and demographic challenges alike lead to economically not feasible areas. The Croatian government has initiatives in place to expand broadband access to underserved areas, particularly in rural regions, to bridge the digital divide.

Although "At least 100 Mbps fixed broadband take-up" increased by almost 20 points from DESI 2021 to DESI 2023, it is with 28,15% one of the lowest in EU (EU average 55,08%). The Gap between "Fixed Very High Capacity Network (VHCN) coverage, DESI 2023" and "At least 100 Mbps fixed broadband take-up, DESI 2023" is 33 points. Only 80,65 % of the population uses the internet on a regular basis. These indicators show that demand might not be strong enough and hereby create uncertainty concerning new investments in broadband networks.

Fixed Very High Capacity Network (VHCN) coverage, DESI 2023, is at 61,5% (EU 73,4%) and increased by 15% since DESI 2021. Fibre to the Premises (FTTP) coverage, DESI 2023, is with 53,95 % close to EU average of 56,50 %, increased by 18 points since DESI 2021. Though the aggregated coverage is increasing steadily, the rural and remote areas are still substantially lagging behind in NGA (51.9% vs. a total average of 87.9%), in FTTP (13.7% vs. a total average pf 53.9%), and in VHCN (19% versus a total average of 61.5%,).

Though the FTTP coverage in Croatia is getting close to EU average and the growth in recent years was quite good – yet considering the lower starting point (compared to EU average) covering the whole country will be a challenge. There are significant gaps between the coverage and take-up. This might be due to relatively high prices and low level of digital skills and awareness; it may indicate that the demand is relatively weak and will not be driving the rollout.

A very substantial improvement was made in 5G coverage with an increase of 48 points, reaching 82.5%, slightly above over EU's average (81%). Mobile take-up is at 81% versus the EU average of 87%. Rural areas have lower 5G coverage with 73.5% compared to total average of 82.5%. During 2022 Croatia also made progress in the field of spectrum licencing of three 5G pioneer bands including coverage obligations for 700 MHz, 3.6 GHz, and 26 GHz, and in assigning spectrum licenses with spectrum caps at national and regional level.

Taking all these factors into consideration it is likely that further rollout of 5G and Gigabit-ready networks will take time. The probability of Croatia reaching the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is assessed as **medium** and "Access to download speeds of at least 100 Mbps that can be upgraded to 1

Gbps for all European households" as **low**. Yet, probability of reaching "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is assessed as **high**.

The FTTP coverage is increasing steadily. Assuming that the level of digital skills and demand for connectivity will grow in Croatia, and that the national funding schemes are implemented successfully, the chances for providing gigabit speeds for all are increasing. The probability is **medium** that this target Gigabit for everyone by 2030 is met in time.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	medium
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium

Table 15 Probability of achievement of connectivity targets in Croatia

7.2.5 Cyprus

Cyprus facts & figures	
Degree of self-governance:	Unitary state (presidential republic)
Population:	920.701 (0.2 % of EU)[I]
Population density:	97,7 per km^2 (EU average: 109 per km^2)[I]
Size:	9,251 km^2
Topography:	Mountain ranges in the south-west (Troodos Mountains) and north (Kyrenia Mountains), central plain (Mesaoria)
Fixed Very High Capacity Network (VHCN) coverage	60 % of households (EU average: 73,42 %)
FTTP coverage:	60 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 16 Cyprus facts & figures

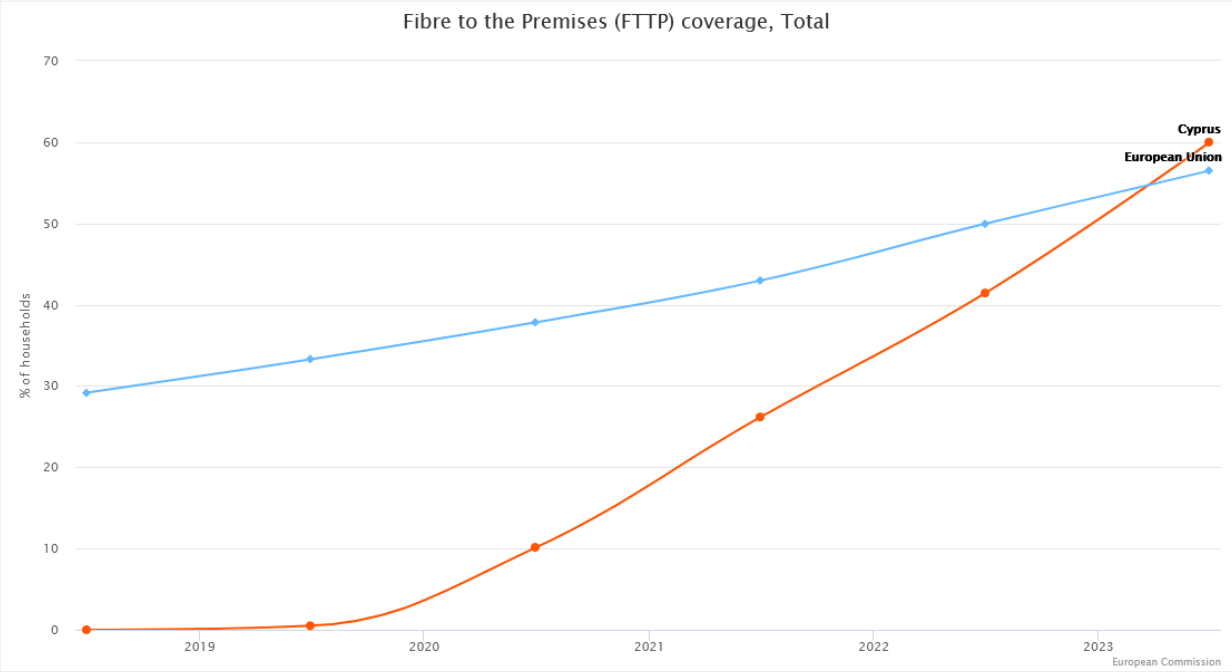


Figure 18 Percentage of households covered by FTTH and FTTB. Cyprus in comparison to EU. DESI 2023.

7.2.5.1 *Key Features*

National Broadband Plan

The Department of Electronic Communications of the Deputy Ministry of Research, Innovation and Digital Policy announced the Broadband Plan of Cyprus 2021-2025[52] in November 2021. It is a roadmap that aims to strengthen and develop new infrastructure, technologies and connectivity services. The plan includes a set of interventions at legislative and regulatory level, but also actions of practical support for the development of broadband infrastructure, and sets the following connectivity targets, to be achieved by 2025:

- Gigabit connectivity for all main socio-economic drivers,
- All premises in organized communities (urban or rural) to have access to internet connectivity offering a download speed of at least 100 Mbps, upgradable to 1 Gbps,
- 100% of the population living in organized communities (urban or rural), and all major terrestrial transport paths to have uninterrupted 5G coverage with a download speed of at least 100 Mbps,
- 70% of households to have an internet connection (take-up) with a download speed of at least 100 Mbps.

National Broadband Plan of Cyprus: key facts	
Main strategic document(s):	Broadband Plan of Cyprus 2021-2025
Targets:	▪ Gigabit connectivity for all main socio-economic drivers ▪ download speed of at least 100 Mbps, upgradable to 1 Gbps for all premises in organized communities (urban or rural) ▪ uninterrupted 5G coverage with a download speed of at least 100 Mbps for whole population living in organised communities (urban or rural), and all major terrestrial transport paths ▪ Take-up at 70% of all households with download speeds of at least 100 Mbps

Table 17 NBP Cyprus key facts

[52] https://dec.dmrid.gov.cy/dmrid/dec/ws_dec.nsf/broadband_en/broadband_en

Main Challenges for gigabit connectivity in Cyprus:

- rural-urban digital divide,
- topographic (mountainous areas) challenge.

The Deputy Ministry of Research, Innovation and Digital Policy (DMRID) is also responsible for implementing the Digital Strategy for Cyprus 2020-2025[53] that is to accelerate its digital transformation. The strategy, adopted in June 2020, is set to contribute to economic growth and productivity and it aims to (i) achieve the digital transformation of the public sector (e-government); (ii) promote the digital transformation of the private sector; (iii) facilitate high-speed network connectivity; (iv) promote an accessible and inclusive society that has the skills to embrace the national digital transformation; and (v) promote innovation in line with the country's level of digital maturity.

In order to achieve these targets, the government partially relies on structural funds, and counts as well on CEF2 Digital. In addition, the private sector has plans on VHCN and 5G roll-out in the following years, which is likely to increase coverage in both fields.

The transposition by Cyprus of the European Electronic Communication Code (March 2022), gives telecom operators clearer rights, greater flexibility, facilitates the sharing of network equipment and is expected to accelerate private investments.

Funding programmes and support measures

Cyprus' Recovery and Resilience Plan (RRP) commits EUR 282.2 million (23%) to the digital transition; from that EUR 261.9 million are expected to contribute to the Digital Decade targets. Multiple milestones and targets are expected to contribute to the Digital Decade targets in the coming years, for example measures to expand very high capacity networks and implement a new cloud policy for government IT systems and services relevant for digitalisation of public services.

The plan is to dedicate EUR 35 million from the RRF to expand VHCN in underserved areas. Another preparatory measure will be to identify and address bottlenecks and barriers to the rapid deployment of VHCN. The subsequent investments are to provide at least 44 000 premises in areas of no interest to private investors with fixed VHCN upgradable to gigabit or mobile network coverage.

Cyprus has also introduced plans to increase take-up. The government has launched an investment scheme to incentivise take-up of gigabit connectivity under the national RRP. The new voucher scheme will offer households, without a subscription to a connection providing at least a 100 Mbps download speed, a voucher of EUR 120 to cover part of the set-up cost and the first 12 months of the monthly

[53] https://www.dmrid.gov.cy/dmrid/research.nsf/planning01_el/planning01_el?OpenDocument

subscription for a connection with a download speed of at least 200 Mbps. The scheme is set to run from 2023 to 2025 and is expected to benefit around 82 000 households.

Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of Research, Innovation and Digital Policy (Department of Electronic Communications) ▪ Office of the Commissioner of Electronic Communications and Postal Regulation (ΓΕΡΗΕΤ/OCECPR)

Figure 19 Organizational Steering & Main Players Cyprus

7.2.5.2 Feasibility Assessment

The progress made Cyprus in connectivity over the last year is substantial. Major cities and towns in Cyprus have good broadband coverage, including cities like Nicosia, Limassol, Larnaca, Paphos, and Famagusta. Rural areas may have more limited options, and the availability of high-speed broadband services may vary. There is a continuing digital divide in Cyprus. The level of at least basic digital skills is at 50% slightly below the EU average of 54%. Internet use is with 89% close to EU average.

Cyprus has made efforts to improve the quality of its broadband services, but the level of customer support and service quality may vary among providers. The increase by 33,8 points from DESI 2021 to DESI 2023 in "Fixed Very High Capacity Network (VHCN) coverage" (60%) and the increase in "Fibre to the Premises (FTTP) coverage" (60%) go hand in hand. The Fibre to the Premises (FTTP) coverage is slightly above the EU average of 56,50, the Fixed VHCN coverage is below the EU level (73,4%).

The at least 1 Gbps broadband take-up is very low at 0,92 %. The gap between the Fixed VHCN coverage (60%) and at least 100 Mbps fixed broadband take-up (44%) is 16 points.

Two years after the allocation of spectrum in 2021, Cyprus has nationwide 5G coverage. Mobile broadband take-up (91%) and the 5G coverage (100%) are ahead of EU average.

The FTTP coverage increased considerably in the last years, as well as 5G coverage. Authorities have put demand stimulating measure (voucher scheme) in place, as well as started measures to reduce

barriers in rollout and plans for investments in broadband infrastructure. Also, the private sector has plans broadband roll-out in the coming years, which is likely to further increase coverage. The probability is **high** that the targets "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" and "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" are met by 2025. yet, due to still persisting rural-urban divide and challenging topography, the probability is **low** that the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is achieved by 2025.

Yet as the rollout of broadband has still a long road ahead, and covering some of the remaining rural and remote areas may be challenging and cost-intensive, the probability is **medium** that Cyprus can provide Gigabit for everyone by 2030.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium

Table 18 Probability of achievement of connectivity targets in Cyprus

7.2.6 Czech Republic

Czech Republic facts & figures	
Degree of self-governance:	Unitary state (parliamentary representative Republic)
Population:	10,827,529 (2.4 % of EU-27)[I]
Population density:	136,1 per km^2 (EU average: 109 per km^2)[I]
Size:	78,868 km^2
Topography:	Two mountainous regions, Bohemia in the west, Moravia in the east, river basin in Bohemia (Elbe and Vltava rivers)
Fixed Very High Capacity Network (VHCN) coverage	53,2 % of households (EU average: 73,42 %)
FTTP coverage:	37,44 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 19 Czech Republic facts & figures

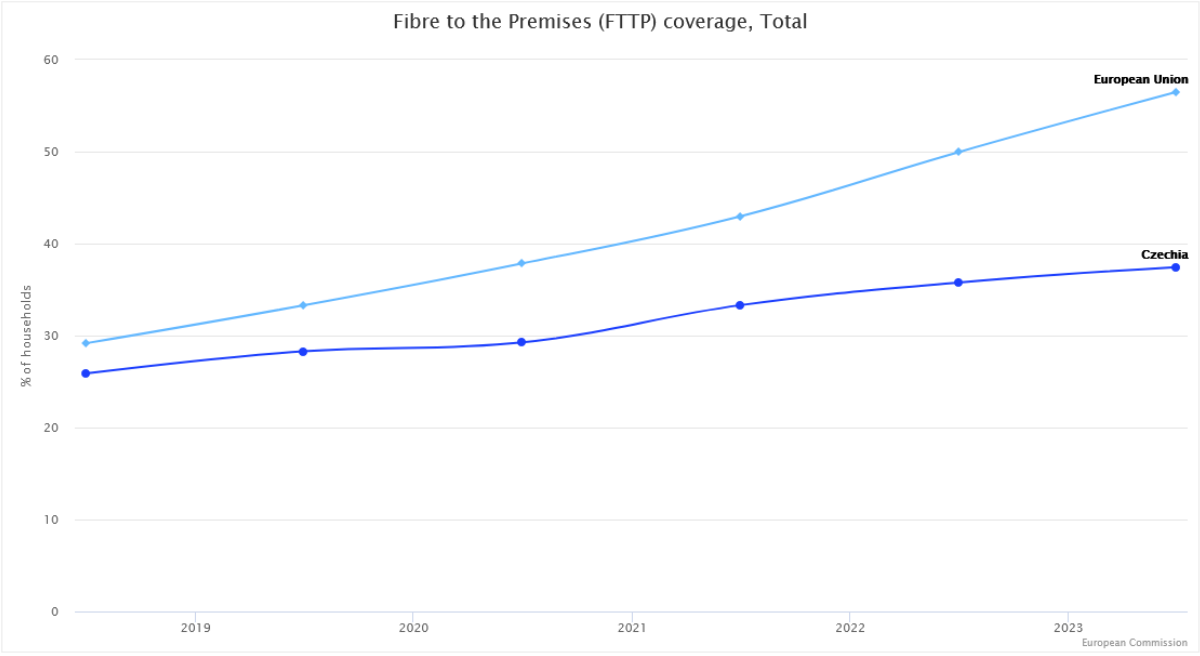


Figure 20 Percentage of households covered by FTTH and FTTB. Czech Republic in comparison to EU. DESI 2023.

7.2.6.1 *Key Features*

National Broadband Plan

The National Plan for the Development of Very High Capacity Networks[54] and Digital Czech Republic[55] define the strategic approach of the Czech Republic to the construction of broadband networks. The National Plan for the Development of Very High Capacity Networks was approved on 1 March 2021. The plan indicates the necessary preconditions facilitating investment in very high capacity networks as well defining strategic procedures for the construction of these networks and, at the same time, provides direct support from public sources while minimizing interference in the market. The plan also sets strategic goals and priorities for the development of VHCN:

National Broadband Plan of Czech Republic: key facts	
Main strategic document(s):	National Plan for the Development of Very High Capacity Networks
Targets:	▪ access to download speeds of at least 100 Mbps, with possibility to upgrade to 1 Gbps for all households, ▪ access to gigabit speeds (symmetrical) for businesses, state administration, local self-governments and socio-economic entities.

Table 20 NBP Czech Republic key facts

1. Construct of a robust, secure and reliable infrastructure for electronic communications (VHCN) primarily for all socio-economic drivers as well as areas with no such infrastructure.
2. Create conditions for ensuring high-speed internet access via the VHCN in both rural and urban areas:
   - access to download speeds of at least 100 Mbps, with possibility to upgrade to 1 Gbps for all households,
   - access to minimum gigabit speeds (symmetrical) for businesses, state administration, local self-governments and socio-economic entities.
3. Create suitable conditions for construction of non-public VHCN networks

[54] https://www.mpo.cz/cz/e-komunikace-a-posta/elektronicke-komunikace/koncepce-a-strategie/narodni-plan-rozvoje-siti-nga/narodni-plan-rozvoje-siti-s-velmi-vysokou-kapacitou--259858/

[55] https://digitalnicesko.gov.cz/vize/

4. Create suitable conditions for high-speed Internet access for households in rural areas with extremely difficult possibilities to operate electronic communications networks, e.g. in areas where the expected operating revenues do not cover operating costs for operators.
5. Create suitable conditions for connecting municipalities to VHCN
6. Ensure optimal development of 5G networks in all urban and rural areas and along the main transport corridors.
7. Create suitable conditions for further coverage of the territory of the Czech Republic by mobile services in sparsely populated areas.
8. Create suitable conditions for the coverage of railway corridors, including tunnels, by mobile networks.
9. Provide targeted support from public funds for the roll-out of VHCN in accordance with the principle of technological neutrality in white areas where operators do not plan to invest in such infrastructure.
10. Look for possibilities to cover the operating costs, especially of socio-economic drivers.

The Czech Republic has already developed a backbone optical infrastructure network to the level of district cities, so further development and potential subsidy support will be directed primarily at the absent backhaul connections and access parts of the networks. For this reason, support from public sources will be directed to the two hierarchically lowest levels of the network, to create interconnection points that would have sufficient capacity to ensure strategic goals, and to build access networks with parameters of VHCN networks (ideally using optical infrastructure).

Digital Czech Republic was adopted in 2018 and is composed of a set of concepts that ensures long-term prosperity of the Czech Republic in the environment of the ongoing digital revolution. This strategy consists of the top goals of three partial strategies: (1) Interaction of the Czech Republic in the European Union in the digital agenda field, (2) Digital public administration and (3) The preparation and interaction of the Czech Republic's society and economy for the consumption of digitalisation.

The strategic document Implementation and Development of 5G Networks in the Czech Republic[56] was approved in January 2020. It sets out a national strategy of 5G deployment in the coming years. It is part of the Digital Czech Republic concept and the Innovation Strategy of the Czech Republic 2019-2030.

Funding programmes and support measures

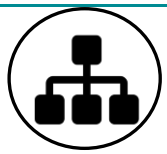
[56] https://www.mpo.cz/assets/cz/e-komunikace-a-posta/elektronicke-komunikace/koncepce-a-strategie/narodni-plan-rozvoje-siti-nga/2020/1/Implementace-a-rozvoj-siti-5G-v-CR-EN.pdf

The National Plan for the Development of Very High Capacity Networks estimates an investment gap for backhaul and access networks is at CZK 15.3 billion (EUR 0.58 billion). Based on the 75% co-financing rate, the planned public support is circa CZK 11.5 billion. The plan foresees both supply and demand side measures. Used of funds from several funding sources is foreseen: Integrated Regional Operational Program (IROP) 2021-2027, Connecting Europe Facility Program (CEF 2), Digital Europe Programme, Just Transformation Fund (JTF), InvestEU and RRF.

The share of Czechia's RRP allocated to digital priorities is 22%, (amounting to EUR 1.56 billion) of which EUR 1.475 billion is expected to contribute to the Digital Decade targets. The main investments focus on boosting digital skills and supporting the digitisation of enterprises. So far, Czechia has rolled out new curricula with more IT classes, invested in new digital equipment for schools, as well as defined interoperability standards for the healthcare systems. Czechia launched a Central European Digital Media Observatory, to identify and investigate disinformation in Central Europe. Milestones and targets that are meant to be met in 2023 include measures to digitalise the justice system and implement a common platform to communicate with the state administration.

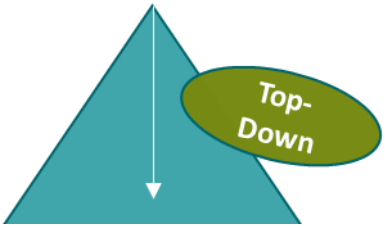
Main Challenges for gigabit connectivity in Czech Republic:

- strong urban-rural divide
- low FTTP coverage (37 %)
- very low 1 Gbps broadband take-up (1,3%)
- very fragmented telecom market
- lengthy building permits procedures
- high prices of mobile offers



Organizational Steering

- Broadband development usually steered top-down



Main Players

- Ministry of Industry and Trade (Department of Electronic Communications)
- Ministry of the Interior
- Ministry of Transport
- Czech Telecommunication Office

Figure 21 Organizational Steering & Main Players Czech Republic

7.2.6.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

The Czech Republic has been working to expand and improve broadband infrastructure to ensure better connectivity for its citizens. This includes efforts to provide both fixed-line and mobile broadband services, particularly in rural and underserved areas. The deployment of fibre-optic networks has been a focus, as it offers high-speed and reliable internet connections. Both public and private entities have been investing in broadband infrastructure. Czech Republic is progressing well in enhancing digital skills of the population. The Internet use is with 90% close to the EU average, 60% of population has at least basic digital skills (EU 54%).

Increase in "Fixed Very High Capacity Network (VHCN) coverage", from DESI 2021 to DESI 2023 by 20 points is above the EU average of 13,6 points, yet the overall coverage by VHCN is with 53,2% still substantially below the 73,4% in the EU. The increase of past years is a result of accelerated DOCSIS 3.1 deployment (mainly in urban areas), with 34.9% of households now covered by this technology.

Telecom operators' efforts by to provide customers with faster connections may result in better coverage and take up in the coming years. Joint investment project in FTTH between operators are under way. Modernisation of the cable network to DOCSIS 4.0 over the next 5 years, involving the deployment of new technologies and the replacement of network elements along with the expansion of the optical infrastructure, is planned.

In spite of all efforts made, the progress of rollout of Fibre to the Premises (FTTP) from DESI 2021 to DESI 2023 is very low with 4,13 points (EU 13,52 points). In addition, the overall FTTP coverage of 37,44% is much lower compared to the EU 56,5%. The rollout of high speed connectivity is even more of a challenge in rural areas due to limited commercial incentives to deploy such networks. FTTP rollout would have to speed up considerably to provide gigabit connectivity for all by 2030.

5G deployment is rushing ahead. Increase in "Overall 5G coverage", DESI 2021 to DESI 2023, is remarkable from 0% to 82,6%, slightly above EU average. 66,67% of the 5G spectrum has been assigned, but the 26 GHz bandwidth has not awarded yet. Under the National Recovery Plan (NRP), the government is planning to improve 5G network coverage in rural areas. The NRP also contains plans for coverage of railway corridors with 5G signal on the trajectory Prague - Ostrava and Česká Třebová – Brno routes. This measure could accelerate the development of more robust 5G networks.

Fragmentation of the telecom market, complex administrative procedures and lengthy building permit procedures pose difficulties and cause delays in further rollout by the Telecom operators.

There is a clear progress towards gigabit connectivity targets in Czech Republic, yet time and lots of efforts will have to invested in the coming years.

The probability of reaching the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is set as **medium**. Reaching the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households" by 2025 is rather unlikely, and the probability is therefore set as **low**. Due to significant progress and planned measures, the probability of reaching "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is at **high**.

Providing gigabit internet access to everyone by 2030 in a country, especially in a geographically diverse country like the Czech Republic, is a significant and ambitious goal. Whether the Czech Republic can achieve this goal by 2030 depends on several factors, including government policies, investments, and the pace of broadband infrastructure development. Considering performance of FTTP rollout in the past years and planned measure, the probability is **medium-low** that target is reached by 2030.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	medium
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium-low

Table 21 Probability of achievement of connectivity targets in Czech Republic

7.2.7 Denmark

Denmark facts & figures	
Degree of self-governance:	Unitary state (constitutional monarchy with a representative parliamentary system)
Population:	5,932,654 (1.3 % of EU-27)[I]
Population density:	139.5 per km^2 (EU average: 109 per km^2)[I]
Size:	42,924 km^2
Topography:	Peninsula of Jutland with rolling plains and dunes in the north as well as 442 named islands (74 inhabited)
Fixed Very High Capacity Network (VHCN) coverage	96,3 % of households (EU average: 73,42 %)
FTTP coverage:	77,86 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 22 Denmark facts & figures

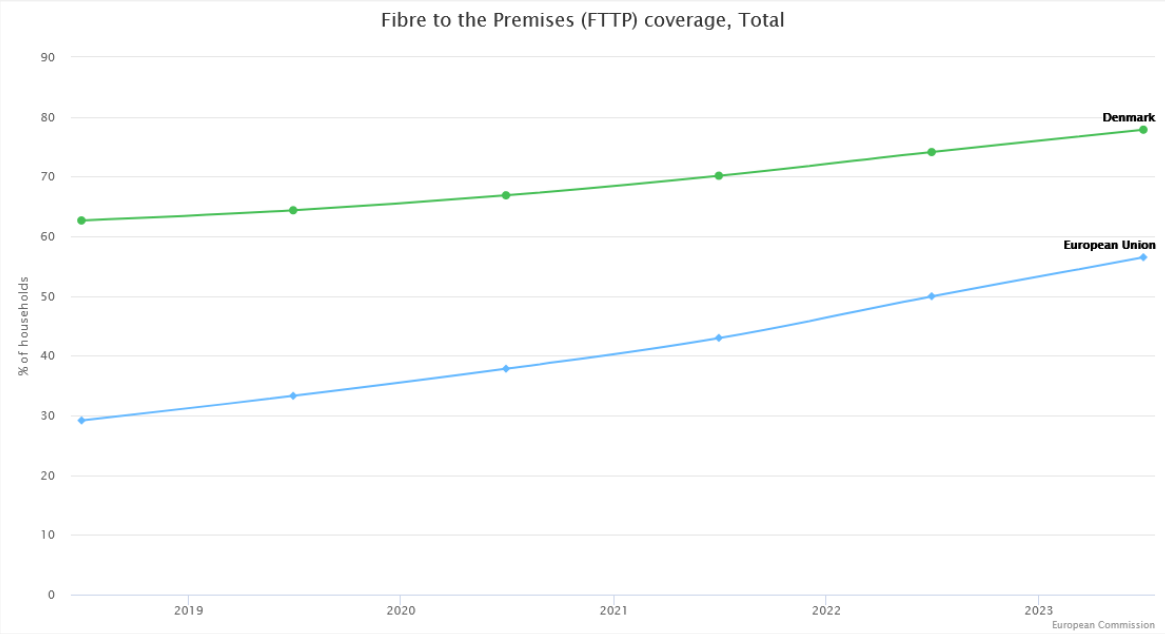


Figure 22 Percentage of households covered by FTTH and FTTB. Denmark in comparison to EU. DESI 2023.

7.2.7.1 *Key Features*

National Broadband Plan

Denmark's broadband strategy was agreed in 2021. The goals in the strategy are to: a) cover all households and businesses by 100/30 Mbps connection by 2025, b) cover 98% of households and businesses by 1 Gbps download speeds by 2025 and c) identify the needs and demand for gigabit speeds by 2030.

National Broadband Plan of Denmark: key facts	
Main strategic document(s):	Broadband Strategy 2021
Targets:	▪ 100% coverage by 100/30 Mbps by 2025 ▪ 98% coverage by 1 Gbps download speeds by 2025

Table 23 Denmark key facts

The central government, regions and municipalities have agreed on the Digital Strategy 2022-2025[57]. The strategy includes initiatives, which are to remedy worker shortage, support climate change mitigation and digital inclusion

The national regulatory authority, the Danish Energy Agency (DEA), expects most postal addresses in Denmark to receive access to very high-speed broadband through commercial rollout. Some white spots (mainly in rural areas) will remain, at least within the next years.

The Danish Energy Agency has also published a 5G Action Plan for Denmark[58] focusing on four main topics as the chief cornerstones for a successful roll-out and utilisation of 5G: frequencies, roll-out, regulation and use cases.

Main Challenges for gigabit connectivity in Denmark:

- 60% gap between the FTTP coverage and at least 1 Gbps broadband take-up
- Coverage of white spots in the rural areas

The investment climate in Denmark has improved, with investment both in fibre and 5G increasing. Fibre roll-out by (regional) energy utilities (typically owned by their users) continues.

Funding programmes and support measures

Denmark's primary focus is on the roll-out of high-speed network infrastructure based on private investments mainly through a market-based roll-out and technological neutral regulation, supported by limited public grants in rural non-commercially viable areas. A key role is reserved for municipalities in coordinating and promoting the process in cooperation with telecommunication operators. Public

[57] https://en.digst.dk/strategy/the-joint-government-digital-strategy/
[58] https://ens.dk/en/our-responsibilities/telecom/5g-denmark

funding is reserved for areas with poor broadband coverage. The National Broadband Fund (Bredbåndspuljen), established in 2016, aims at local population aggregating their demand to apply for financial assistance collectively. The fund focusses on less populated areas and offers grants for rolling-out broadband. EUR 13.5 million has been allocated to the National Broadband pool in 2022 and 2023.

Digital in Denmark Recovery and Resilience Plan (RRP) allocated 25% of the funds to the digital transformation. The Danish plan supports the broad digital strategy designed to promote a digital transformation of all sectors of society.

The Danish Energy Agency monitors broadband development via the mapping tool (Tjekditnet)[59]. It is an interactive mapping of offered and technically possible speeds, available technologies and providers of subscriptions at an address level for all Danish addresses including businesses, households, public buildings and holiday homes. The mapping covers both fixed access and mobile coverage. Aggregated data on coverage at municipal or regional level is also available.

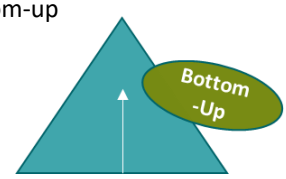
Organizational Steering	Main Players
▪ Broadband development usually steered bottom-up 	▪ Danish Energy Agency within the Ministry of Climate, Energy and Utilities ▪ Danish Business Authority under the Ministry of Industry, Business and Financial Affairs ▪ Danish Agency for Digital Government under the Ministry of Finance ▪ Local & regional authorities

Figure 23 Organizational Steering & Main Players Denmark

7.2.7.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Denmark is a frontrunner in the field of connectivity. Denmark has high broadband penetration, with a significant percentage of the population having access to high-speed internet services. The country has made considerable efforts to expand broadband access to both urban and rural areas. 96% of population is using internet and 69% of individuals have at least basic digital skills.

[59] https://tjekditnet.dk/

Investment in the telecommunications sector continued to grow, reaching a total of around EUR 1.45 billion. The investments in fixed broadband and mobile infrastructure translates into extensive coverage. Since 2021, fibre has been the dominant technology on the Danish fixed broadband market, with around 1.1 million subscriptions in 2022.

In general, Denmark has a very good coverage with high-speed broadband (96,3 % Fixed Very High Capacity Network (VHCN) coverage and 77,86% FTTP coverage). There is a strong bottom-up movement driven by the deployment of infrastructures by utility providers. However, there are still white spots with poor coverage. Most of these white spots are in the rural areas.

Nordic Investment Bank NIB and the incumbent telecoms operator TDC NET have signed a EUR 110 million loan agreement to finance the company's fibre rollout investments in 2022–2024. TDC NET announced an ambitious investment programme for its network company to connect one million addresses to fibre by 2025.

The current roll-out of fibre and the roll-out plans of the utilities mean that there will be overlap, so a number of households will have the choice between different fibre infrastructures.

Fixed VHCN coverage is impressive 96,3 %, yet the raise in the last two years was quite moderate with 2,4%. Whilst this is already a very impressive figure, putting Denmark ahead of most other European countries, fully covering the remaining few percent of the country will still be a difficult and costly process.

Even if the at least 100 Mbps fixed broadband take-up (69,26 % of households) is above the EU average, the 27 % gap between the Fixed VHCN coverage and take-up may indicate slightly insufficient demand. The at least 1 Gbps broadband take-up is with 18,66 % above the EU average 13,76, yet there is still a 60% gap between the FTTP coverage and at least 1 Gbps take-up.

The overall 5G coverage in Denmark is at 97,84 %, and increased by 17,84 % in the last two years. 5G was launched by TDC in September 2020, by Telenor mid-November 2020. Denmark has assigned all 5G pioneer bands. This indicates that the country has successfully implemented its 5G Action Plan.

Covering the remaining white spots is usually costly and challenging. Yet considering the recent pace of the rollout, investment plans by plans Telekom operators, agility of mobile operators in 5G rollout and already high FTTP coverage the probability is **high** that Denmark may achieve the Gigabit Society targets by 2025.

Achieving gigabit-speed internet access for all households in Denmark by the year 2030 is an ambitious goal and depends on various factors, including government policies, private sector investments, technological advancements, and infrastructure development. However, ensuring coverage for all households, particularly in remote and rural areas, will likely require concerted efforts and resources. Considering high FTTP coverage, higher than EU average subscriptions for gigabit speeds, strong commitment of authorities and telecom operators, higher than the EU average coverage of remote areas, probability is **high** that Digital Decade's "Gigabit for everyone" aim is met by 2030.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	high
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 24 Probability of achievement of connectivity targets in Denmark

7.2.8 Estonia

Estonia facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	1,365,884 (0.3 % of EU-27)[I]
Population density:	30.9 per km^2 (EU average: 109 per km^2)[I]
Size:	45,227 km^2
Topography:	Shallow coastline with 1,520 islands and moraine landscape in the south
Fixed Very High Capacity Network (VHCN) coverage	79,2 % of households (EU average: 73,42 %)
FTTP coverage:	79,2 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 25 Estonia facts & figures

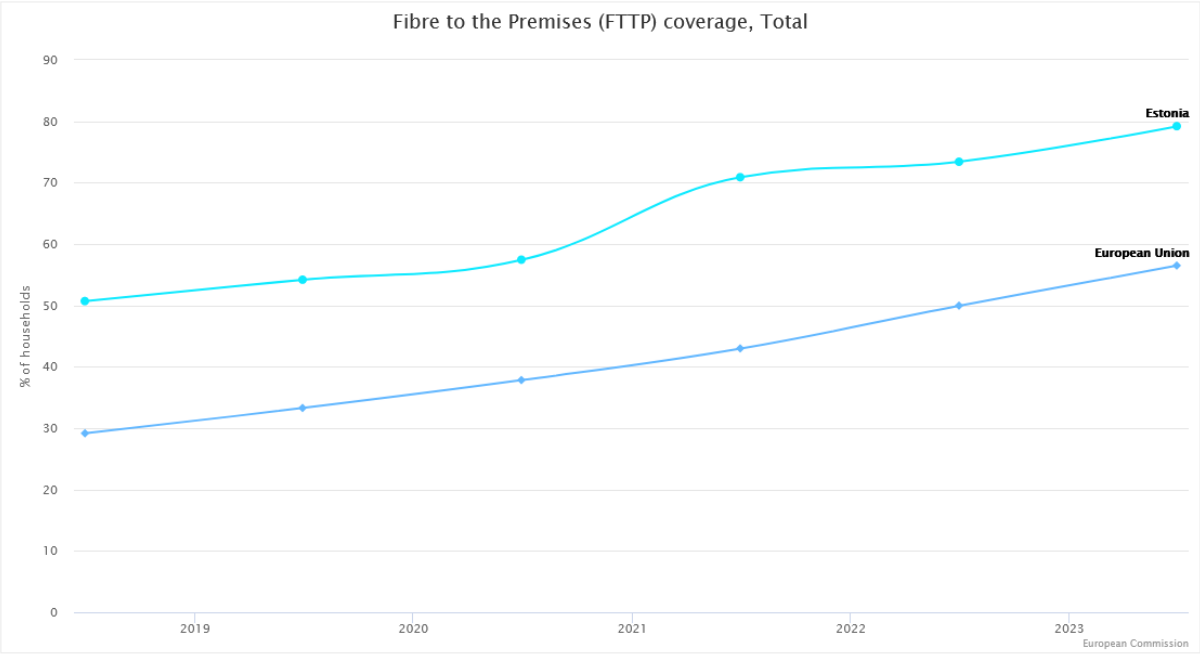


Figure 24 Percentage of households covered by FTTH and FTTB. Estonia in comparison to EU. DESI 2023.

7.2.8.1 *Key Features*

National Broadband Plan

National Broadband Plan of Estonia: key facts	
Main strategic document(s):	Digital Agenda 2030
Targets:	▪ 100% coverage by VHCN upgradable to 1 Gbps by 2030

Table 26 NBP Estonia key facts

Estonia's Digital Agenda 2030 was adopted on 7 October 2021. The strategy is in line with the Gigabit Society connectivity targets. The overall objective of the strategy is to achieve high-speed, reliable, and affordable electronic communications connections in the country by 2030, irrespective of the location. To implement the vision, three specific goals have been set:

- digital government, i.e. the use of digital solutions in the public sector,
- electronic communication, i.e. connectivity, and
- national cyber security.

By 2030, ultrafast, reliable and affordable telecommunications connections should be available in Estonia irrespective of the location, making it possible to create and use innovative services. All should have access to connections of at least 100 Mbps which can be increased up to 1 Gbps. The government will support the development of very high capacity access networks in rural areas where telecommunications companies do not invest under the conditions of competition, promote innovative investment and cooperation models for developing communication infrastructure and will ensure consistent and efficient supervision of the functioning of the market

The support will also be granted to a) establish core infrastructure in the main transport corridors in Estonia, allowing for uninterrupted 5G coverage, b) secure coverage of selected residential and business areas with 5G and c) necessary preparations for the adoption of 6G when the relevant technology arrives on the market.

With its 5G roadmap[60], Estonia would like to achieve 5G connectivity in major cities by 2023 and along transport corridors by 2025. A dedicated working group on 5G has been set up at ministry level. Work is ongoing to assess business use and find the financing model for the 5G deployment. The authorities are also committed to cooperating on 5G corridors with Latvia and Lithuania in the framework of the Via Baltica project. The Baltic States would like to map the electronic communications infrastructure alongside the corridor and to identify infrastructure gaps.

[60] https://www.mkm.ee/sites/default/files/eesti_5g_teekaart.pdf

Funding programmes and support measures

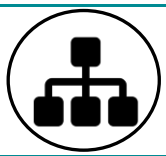
The Estonian Recovery and Resilience Plan (RRP) dedicates EUR 208 million (24%) to the digital transformation. The entire amount is expected to be spent on the efforts to achieve the Digital Decade targets. Substantial digital investments include EUR 93 million to upgrade digital government services drawing on the latest technologies, EUR 58 million to support 230 SMEs in their digital transition and EUR 24 million to deploy very high capacity networks in rural areas.

In addition, to support construction of VHNC networks in rural areas, EUR 45 million from the ERDF have been allocated to build VHCN in rural areas between 2023 and 2027.

In 2009, the Ministry of Economic Affairs and Communications and the Estonian Association of Information Technology and Telecommunications (ITL) founded the Estonian Broadband Development Foundation (ELASA). Members of the Supervisory Board of the Foundation include a representative of the Ministry of Economic Affairs and Communications (MKM). The purpose of the Foundation is to implement the EstWin[61] project and to give all residential houses, businesses and authorities a chance to connect to a broadband network. The roll-out of the high-speed middle-mile networks to sparsely populated areas, which were unlikely to be covered by market-driven deployment, involves laying 6.273 km of fibre-optic cables and the construction of 2.510 network access points. These investments are intended to stimulate complementary deployments of last-mile connections by commercial telecom operators. EstWin is funded inter alia from European Structural and Investment Funds (ESIF). The implemented and planned parts of the network are visualised on the online map[62].

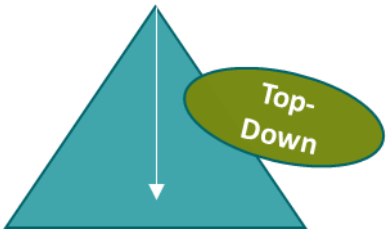
Main Challenges for gigabit connectivity in Estonia:

- low take-up (29,4%) at least 100 Mbps fixed broadband
- 79 points gap between the FTTP coverage and at least 1 Gbps broadband take-up
- overall 5G coverage (43,3%) much below EU average
- challenging topography (islands)

	
Organizational Steering	Main Players
▪ Broadband development usually steered top-down	▪ Ministry of Economic Affairs and Communications (MKM)

[61] https://www.elasa.ee/

[62] https://ela12.elasa.ee/elakaart/



- The Estonian Broadband Development Foundation (ELASA)
- Consumer Protection and Technical Regulatory Authority (TTJA)
- Estonian Association of Information Technology and Telecommunications (ITL)
- Republic of Estonia Information System Authority (RIA)

Figure 25 Organizational Steering & Main Players Estonia

7.2.8.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

Estonia is known for its advanced and widespread connectivity, particularly in terms of digital infrastructure and internet access. Estonia's focus on digitalization and connectivity has made it a leader in the field and a model for other countries looking to develop advanced digital infrastructure and services. It has also contributed to the country's economic development and reputation as a tech-savvy and innovative nation.

Overall Estonia's market for electronic communications is slightly cheaper than the EU average. Broadband prices in the fixed and converged baskets are also lower than the EU average. The digital skills of the population are slightly above EU average. Internet is used by 90% of population and 56% have at least basic digital skills.

Estonia's fixed market is characterised by a strong presence of fibre. The FTTP coverage is at optimistic 79,2 %, and increased by 8,3% in the last two years. The Estonian wideband infrastructure network (EstWin) project delivered 6.273 km of backhaul network by Nov 2023.

Yet the take-up of VHCN and FTTP is lagging much behind the increase of coverage. The at least 100 Mbps fixed broadband take-up is low at 29,4%, the at least 1 Gbps broadband take-up is close to zero with 0,1%.

Estonia's weak performance on 5G coverage shows that further efforts are needed. Due to late award of spectrum, the overall 5G coverage is with 43,3% much below the EU average (81,2%). However, recent improvements in 5G spectrum assignment will improve the 5G coverage over the coming years.

The authorities are committed to cooperating on 5G corridors with Latvia and Lithuania in the framework of the Via Baltica project. High affinity and demand towards mobile technologies in younger generation and new businesses may result in high future demand for 5G and speed up its roll-out.

The overall development in connectivity in Estonia is rather positive, with weakness in fixed broadband take-up, rollout of 5G and challenges related to covering rural and remote areas (islands). The demand for broadband maybe not enough to provide enough impulse for rollout by telecom operators.

The probability of Estonia reaching the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" target by 2025 is estimated as **high**. The probability of reaching the "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is set as **medium** . The probability for the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" target is **medium-high**.

Estonia has long tradition is digitalisation of the country and is known in the world as a strong digital society. The FTTP rollout is progressing well, the government has set targets and measures for digitalisation in the next years, digital skills of the population are high and still increasing. These are good preconditions for reaching the Digital Decade targets. The probability is **high** that Estonia can provide Gigabit for everyone by 2030.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	medium-high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 27 Probability of achievement of connectivity targets in Estonia

7.2.9 Finland

Finland facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	5,563,970 (1.2 % of EU-27)[I]
Population density:	18.2 per km^2 (EU average: 109 per km^2)
Size:	338,440 km^2
Topography:	Dominated by lowlands (Coastal Finland and Finnish lake district with extensive forests), uplands in the north (Lapland)
Fixed Very High Capacity Network (VHCN) coverage	70,8 % of households (EU average: 73,42 %)
FTTP coverage:	50,34 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 28 Finland facts & figures

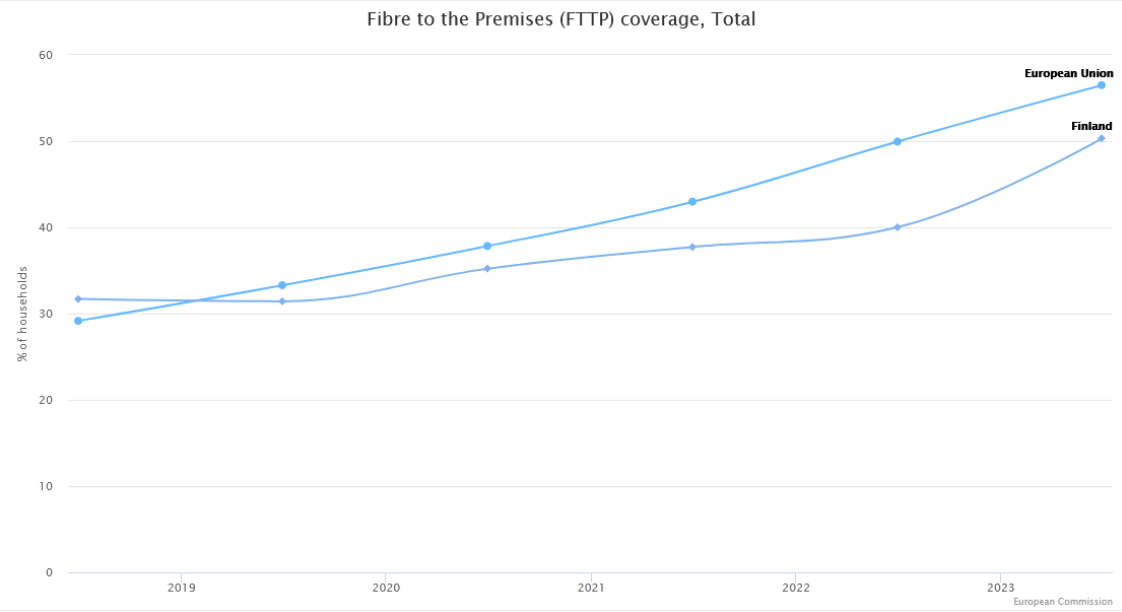


Figure 26 Percentage of households covered by FTTH and FTTB. Finland in comparison to EU. DESI 2023.

7.2.9.1 *Key Features*

National Broadband Plan

Finland has adopted a proactive stance on broadband development at an early stage. This is reflected in a series of policy and strategy statements and initiatives, not counting concomitant working papers, reports or alike. The Finnish Government opts for a competition-driven, fibre-based network roll-out, with a special focus on and assistance for underserved areas (via public funds). Especially with regard to the latter, Finnish authorities advise local municipalities on how to set up entities dedicated to deploying broadband, e.g. by joint venture of multiple municipalities or in partnership with private operators. In terms of investments, funding is expected to come from state and municipalities.

National Broadband Plan of Finland: key facts	
Main strategic document(s):	Digital infrastructure strategy 2018
Targets:	▪ all households should have access to at least 100 Mbps connections by 2025 ▪ It should be possible to increase the speed of the connection to 1 Gbps ▪ 5G should be rollout out

Table 29 NBP Finland key facts

Main Challenges for gigabit connectivity in Finland:

- gap (47,23 %) between the FTTP coverage and take-up
- Fibre to the Premises coverage with 50,34 is lower than EU average
- Low population density
- High number of mobile-broadband-only users

The Digital infrastructure strategy, published in October 2018[63] by the Ministry of Transport and Communications, determines objectives for the development of the digital infrastructure in Finland by 2025 as well as the methods for achieving this objective. By 2025 all households should have access to at least 100 Mbps connections. It should be possible to increase the speed of the connection to 1 Gbps. The entire 3.5 GHz spectrum is taken into national use for wireless broadband from the beginning of 2019. Cost-efficient construction of optical fibre networks will be facilitated by streamlining the regulation on the placement of telecommunications cables. The permit procedure related to the placement of cables will be developed in connection with the drafting of the Highways Act.

[63] https://www.lvm.fi/en/-/digital-infrastructure-strategy-turning-finland-into-the-world-leader-in-communications-networks-985076

Finland's digital compass[64] implements the targets set in the EU's Digital Compass, but also includes complementary national targets and themes. Finland's compass revolves around four cardinal points: skills, secure and sustainable digital infrastructures, the digital transformation of businesses, and the digitalisation of public services.

The universal service broadband speed was set to 5 Mbps as from October 2021. This promotes digital inclusion and equal opportunities for all residents, bridging the digital divide.

Funding programmes and support measures

The contribution to digital objectives in Finland's Recovery and Resilience Plan (RRP) amounts to EUR 525.7 million, representing 28.9% of the total RRP allocation. Out of this amount, 379 million is expected to contribute to the Digital Decade targets. The RRP focuses on reforms and investments in digital public services, digital skills and the digital transition of the economy to exploit the full potential of the digital transformation. The plan sets out support measures for the digital transition with e.g. investments of EUR 32 million in high-speed broadband infrastructure, or EUR 32 million to invest in the digitalisation of continuous learning. Implementation of the RRP started after its adoption in October 2021.

Organizational Steering	Main Players
▪ Broadband development usually steered bottom-up 	▪ Ministry of Transport and Communications ▪ Ministry of Agriculture and Forestry ▪ Finnish Food Authority ▪ Finnish Transport and Communications Agency (Traficom) ▪ The Finnish regulatory authority (FICORA) ▪ Local & regional authorities

Figure 27 Organizational Steering & Main Players Finland

[64] https://valtioneuvosto.fi/en/-//10623/government-report-on-the-digital-compass-sets-the-course-for-finland-s-digital-transformation

7.2.9.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

The Finnish authorities favour a competition-driven, fibre-based network roll-out assisted by public funds for underserved areas and advice for local municipalities on how to deploy broadband networks.

Finland has consistently led the way in the realm of digital transformation for an extended period and is anticipated to play a significant role in realizing the objectives of the Digital Decade. Finland has implemented digital strategies and policies, including the early adoption of 5G technology, the establishment of robust e-Government services, and has a population with extensive digital skills. Nonetheless, additional actions are required to attain the gigabit connectivity goals.

The current VHCN coverage is 70,8 %. The gap of 22 points between VHCN coverage and take-up (48,5%), as well as the 47 points gap between the FTTP coverage and at least 1 Gbps take-up may indicate rather moderate to low pressure from demand side to increase the coverage. Increasing connectivity throughout whole of Finland is difficult. Especially in sparsely populated areas in North and West Finland, the costs of connection per household are relatively high. In these areas, wireless solutions (often via mobile broadband) have a significant importance and are often regarded a substitute for fixed networks. Finland is lagging behind in rural areas and the digital divide is not easy to close. The current investments will contribute to the development of high-end networks within these areas and lead to a further increase, but reaching full coverage, especially considering Finland's difficult geographic circumstances, still constitutes a major challenge.

In Finland we see a relatively high willingness to pay for broadband services (especially initial costs), while broadband subscription prices are relatively low. Hence, we could conclude that neither affordability nor coverage is really an issue in Finland. To achieve higher coverage within Finland, supply side measures and transparency measures may help.

The three main operators in Finland compete in both the fixed and the mobile markets. All three are also investing intensely in fibre networks. Several national and regional players have invested in fibre networks given that there are around 120 telecom companies that own regional or local networks.

According to the Digital infrastructure strategy 2018, Finland aims to achieve at least the minimum gigabit connectivity objectives set by the Commission for 2025. The probability is **high** that Finland achieves the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises". The FTTP coverage, crucial for achieving gigabit speeds, is at quite low at 50,3 % of households. Closing the rural-urban digital divide will be challenging in Finland, therefore the probability is **low** that the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is achieved by 2025.

Finland is known for its affinity towards mobile services. The auctioning of 5G bands started already early on, which resulted in an excellent overall 5G coverage of 94,7%. Therefore, the probability is **high** that Finland achieves the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways".

Considering Finland's consistent progress towards digitalisation and rollout of broadband infrastructure, ambitious aims set by the Finland's digital compass, high level of digital skills, yet low FTTP coverage especially in the rural and remote areas so common in Finland, the probability is **medium** that the Gigabit for everyone target is met by 2030.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium

Table 30 Probability of achievement of connectivity targets in Finland

7.2.10 France

France facts & figures	
Degree of self-governance:	Unitary state (semi-presidential republic)
Population:	68,070,697 (15,2 % of EU-27)[I]
Population density:	106.9 per km^2 (EU average: 109 per km^2)[I]
Size:	633,187 km^2
Topography:	Mountain ranges in the north-east (Vosges) south-east (Alps) and south (Pyrénées), four river basins and a plateau, island Corsica and oversea territories
Fixed Very High Capacity Network (VHCN) coverage	73,3 % of households (EU average: 73,42 %)
FTTP coverage:	73,25 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 31 France facts & figures

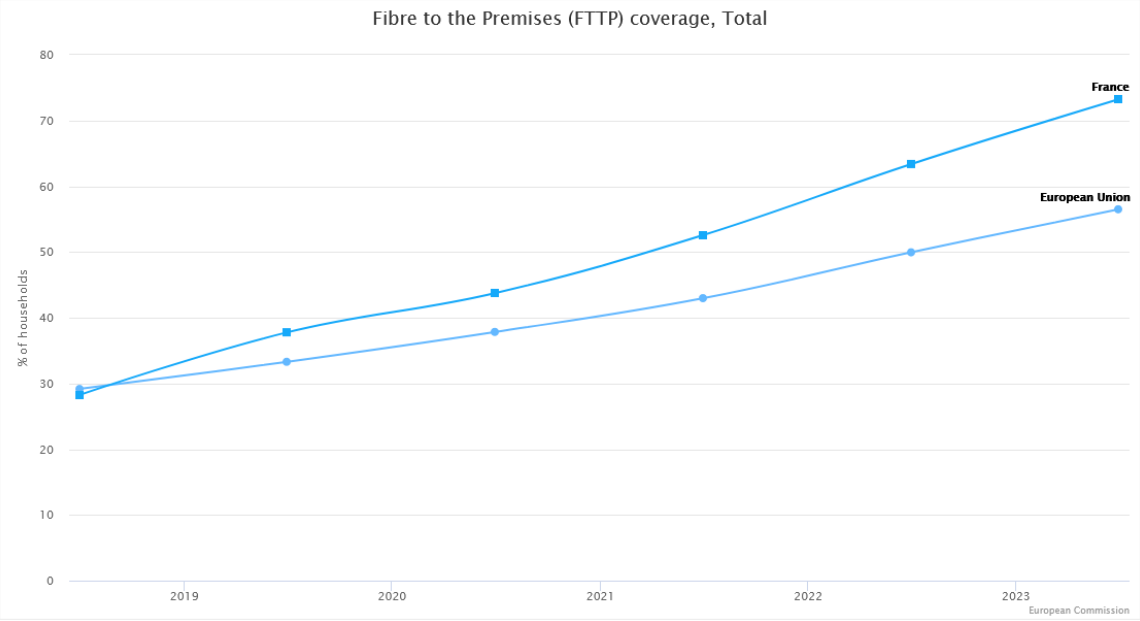


Figure 28 Percentage of households covered by FTTH and FTTB. Austria in comparison to EU. DESI 2023.

7.2.10.1 *Key Features*

National Broadband Plan

National Broadband Plan of France: key facts	
Main strategic document(s):	France Très Haut Débit
Targets:	▪ fibre for all by 2025

Table 32 NBP France key facts

The French government published und updated its National Broadband Plan (NBP) entitled "France Très Haut Débit"[65]. In devising the strategy, wide consultations with stakeholders, investigations and analyses were conducted. With its broadband plan, France commits to covering the entire territory with fibre for all by 2025.

French officials expect that the national strategy will require the mobilisation of private and public investments of up to EUR 20 billion.

Overall, France predominantly opts for establishing and widening its broadband network infrastructure by FTTH technology. Public initiative networks play a central role in this context. According to the plan, private operators, local authorities and the state are expected to share the required investments. In more isolated areas, satellite, mobile and wireless networks are viewed as a viable solution to expand broadband coverage. Public aid is only eligible for areas where private companies do not plan any infrastructure investments in the mid-term. The Fund for the Digital Society (Fonds pour la société numerique)[66] provides a combination of public loans and funding to support the roll-out of ultrafast broadband by the French government. Infrastructure projects that are eligible include works on backhaul networks (FTTN), passive fibre optic networks (FTTH), customer access (FTTH), access for public institutions (education, health, public administration), support for Wi-Max and/or satellite receivers as well as feasibility studies for planned roll-out projects.

Main Challenges for gigabit connectivity in France:

- urban-rural digital divide,
- vast territory and difficult topographic conditions,
- 5G spectrum readiness.

France's NBP is comparably operational: It defines a lot of concrete measures, underpinned by timeframes, responsibilities and monitoring procedures. There are several managerial and organizational measures (e.g. project controlling, highlighting the relevance of local authorities, central task

[65] https://agence-cohesion-territoires.gouv.fr/france-tres-haut-debit-53

[66] https://www.banquedesterritoires.fr/fonds-pour-la-societe-numerique

forces) as well as supply side measures. The roll-out will highly depend on the success of several large-scale FTTH projects. However, although supply is gaining momentum and more and more FTTB/H projects are implemented, pushing operators to switch to future-proof technologies continues to be a challenge. There are also major challenges concerning the digital divide: Wireless solutions (5G and satellite) are considered to be crucial for the supply of rural areas in order to bridge the digital divide, but at the current state, it remains unsure to what extent they will be able to substitute fixed networks.

France published its roadmap for 5G in July 2018[67] that sets targets for 2020/2025, and foresees:

- launch of several 5G pilot projects in a variety of regions, and hosting some of the world's pioneer industrial 5G applications,
- allocation of new 5G frequencies and a commercial rollout in at least one major city by 2020,
- provision of 5G coverage of the main transport routes by 2025.

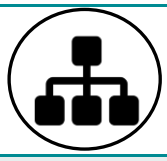
The roadmap also includes the work programme for the Regulatory Authority for Electronic Communications and Post (Arcep) and sets four priorities for actions:

- free up and allocate radio frequencies for 5G networks,
- foster the development of new uses,
- support the deployment of 5G infrastructures,
- ensure transparency and dialogue over 5G rollouts and keep the public informed.

Funding programmes and support measures

France assigned EUR 3.3 billion to the implementation of the plan Très Haut Débit. Additional EUR 240 million were allocated to boost connectivity in rural areas as part of the France's Recovery and Resilience Plan. The French Recovery and Resilience Plan amounts to EUR 40.3 billion. 22% of it (i.e. EUR 8.1 billion) is devoted to digital transformation.

Created in November 2011, the Digital Observatory[68] collects and interprets broadband mapping data to assess the impact of digital technologies in the economy and to compare France with other countries of the European Union.

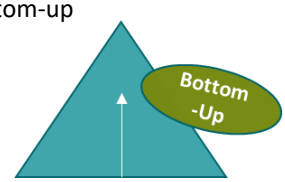


Organizational Steering

Main Players

[67] https://en.arcep.fr/news/press-releases/p/n/france-establishes-its-roadmap-for-5g-and-launches-four-priority-courses-of-action.html
[68] https://observatoire.numerique.gouv.fr/

- Broadband development usually steered bottom-up



- Ministry of Economy, Finance and Industrial and Digital Sovereignty
- National Agency for Territorial Cohesion
- Regulatory Authority for Electronic Communications and Post (Arcep)
- Regional and County governments

Figure 29 Organizational Steering & Main Players France

7.2.10.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

France has a relatively well-developed digital infrastructure with widespread access to high-speed internet. The country has been investing in expanding its broadband and mobile networks, and many areas have access to high-speed fibre-optic internet connections. The French government had also been promoting the deployment of 5G networks, which were gradually being rolled out in major cities.

Level of at least basic digital skills is at 62% and 90% of individuals use internet regularly. The high level of skills is a positive factor in driving take-up in France.

The Fixed Very High Capacity Network (VHCN) coverage is with 73,3% very close to EU average. The growth is the last two years (20,7%) was substantial and steady. The demand is moderately driving the rollout (gap of 21,9 % between VHCN coverage and take-up). The FTTP coverage is way beyond the EU average at 73,25% high. On top of that the at least 1 Gbps broadband take-up is with 40% is significantly higher than the EU average of 13,8%. The gap between the FTTP coverage and take up is at 33,3%. The pace of progress in FTTP deployment slowed in Q2 2023, while fibre subscription growth remained steady. The probability is **high** that France reaches the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" target.

The rural-urban divide is narrowing down as the FTTP coverage in rural and remote areas reached 45.7%. However, as the remote regions require particular attention, the pace of deployment of fibre to the home (FTTH) has slowed down in some regions, including in some densely populated areas. The coverage of remaining rural and remote areas will be challenging. France has made significant progress in recent years, yet reaching full VHCN and FTTP coverage may become costly and take some time.

Due to vast territory to be covered and given the France's difficult topographic conditions in some parts of the country, reaching the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households" by 2025 can considered to be a very ambitious task and the probability is estimated as **medium**.

5G rollout has been prepared by the Government and the national regulatory authority, Arcep. In December 2019 the Government launched a call for tender for 3.4 – 3.8 GHz band. This is in line with France's 5G roadmap, with over three quarters of the 3.4 – 3.8 GHz band to be awarded, enabling 5G commercial services to be launched in France's major cities. The 3.5 GHz auction was completed in October 2020. 5G was launched by SFR in November 2020, by Bouygues Telecom and Orange France in December 2020. The overall 5G coverage rocketed to 88,83%, above the EU average of 81,2%.

Given the current development, probability is **high** that France achieves "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" by 2025.

Overall, France has identified its deficiencies and envisioned necessary and suitable measures which will have a considerably positive effect on broadband roll-out. The implementation of the France Très Haut Débit shows very positive results, as the broadband coverage is steadily increasing. According to Arcep, the coverage by fibre in the Metropolitan France reached 83% in Q2 2023.[69] Fibre to the home (FttH) networks are becoming the new infrastructure of reference in France for delivering electronic communication services, and fixed internet access in particular. Therefore, the probability is **high** that the Gigabit for everyone target is met by 2030.

Gigabit Society 2025 and Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 33 Probability of achievement of connectivity targets in France

[69] https://en.arcep.fr/news/press-releases/view/n/fixed-broadband-and-superfast-broadband-market-070923.html

7.2.11 Germany

Germany facts & figures	
Degree of self-governance:	Federation (federal parliamentary republic)
Population:	84,358,845 (18.8 % of EU-27)[I]
Population density:	235.5 per km^2 (EU average: 109 per km^2)[I]
Size:	357,376 km^2
Topography:	Northern European Plain in the northern third of the country, hill ranges in middle Germany, mountain ranges in the south (Alps)
Fixed Very High Capacity Network (VHCN) coverage	70,1 % of households (EU average: 73,42 %)
FTTP coverage:	19,32 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 34 Germany facts and figures

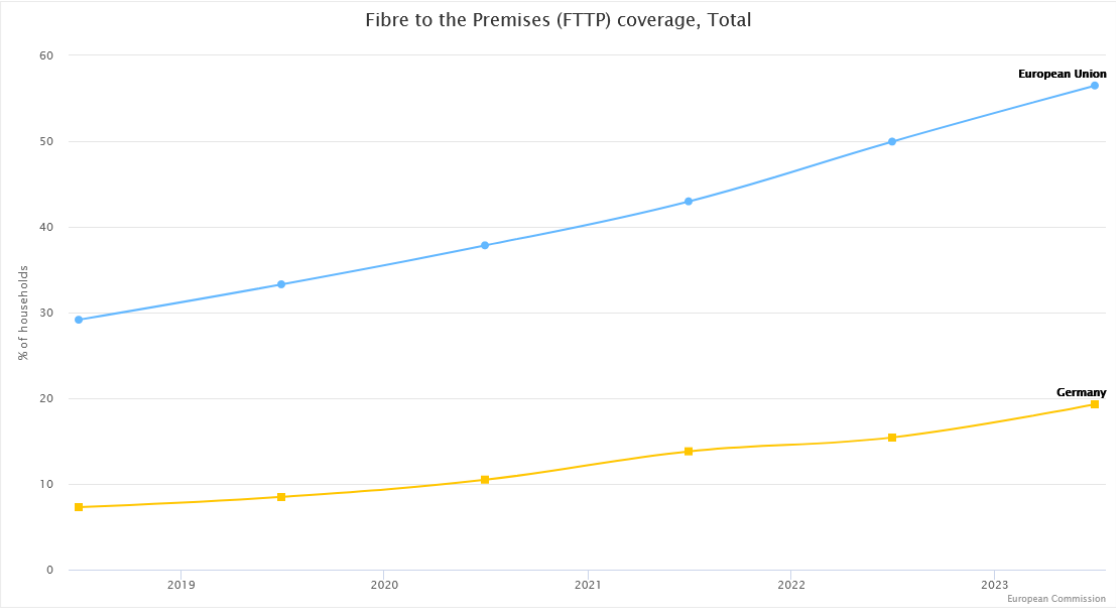


Figure 30 Percentage of households covered by FTTH and FTTB. Germany in comparison to EU. DESI 2023.

7.2.11.1 *Key Features*

National Broadband Plan

In the coalition agreement of the German Federal Government 2021[70], digital infrastructure is one of the national priorities. The goal is the nationwide supply of FTTH and 5G. The commercial expansion has priority. Investments in the spots where the need to catch up is greatest will be prioritised, especially white areas. Open Access under fair conditions and net neutrality are the underlying principles. Where necessary, funding by means of vouchers will be initiated.

National Broadband Plan of Germany: key facts	
Main strategic document(s):	Gigabit Strategy, July 2022
Targets:	▪ coverage with fibre of 50% of all households and companies by 2025 ▪ uninterrupted wireless voice and data services for all end users nationwide by 2026 ▪ nationwide supply with FTTH and the latest mobile communications technologies of all areas where people live, work and travel by 2030

Table 35 NBP Germany key facts

The overarching goal of the Gigabit Strategy[71], published in July 2022, is the nationwide, energy- and resource-efficient supply with FTTH and the latest mobile communications technologies of all areas where people live, work and travel - even in rural areas, by 2030. Increased incentives for self-sufficient expansion and better framework conditions for subsidies are planned. As a first step, an increase in the supply with fibre optic connections to 50% of all households and companies by the end of 2025 is planned. In mobile communications, uninterrupted wireless voice and data services for all end users nationwide by 2026. The Gigabit Strategy foresees measures that will simplify, speed up and digitise permit granting, strengthen use of alternative deployment methods, provide more transparency and improved legal framework.

The federal Digital Strategy[72] for Germany, launched in August 2022, aims at nationwide coverage with fibre optic connections, digitalisation of administrative services for a modern and inclusive state and

[70] https://www.bundesregierung.de/breg-de/service/gesetzesvorhaben/koalitionsvertrag-2021-1990800
[71] https://www.bundesregierung.de/breg-de/themen/digitalisierung/gigabitstrategie-2017464
[72] https://digitalstrategie-deutschland.de/

innovations from business and research for the benefit of all people by 2030. The strategy foresees that by 2025 half of all households and businesses have connectivity by fibre.

The federal government has developed a framework for action with the 5G Strategy for Germany[73], which was launched in summer 2017, in order to support network expansion and the development of 5G applications at an early stage. The strategy sets the framework conditions and five fields of action for the roll-out of 5G networks in Germany by 2025:

- Promotion of network roll-out,
- needs-based provision of frequencies,
- promotion of cooperation between the telecommunications and user industries,
- coordinated and targeted research,
- early initiation of 5G in cities and communities.

In November 2019, the German government has approved a mobile communications strategy[74]. The aim of the strategy is to ensure nationwide supply of mobile voice and data services.

Funding programmes and support measures

With its mobile communications strategy[75], the Federal government has announced major plans to improve its mobile coverage. The Federal Government is working with countries and municipalities to implement a mix of different measures. This includes:

- the creation of transparency regarding the actual supply situation as well as monitoring of the mobile network expansion,
- the identification of infrastructure and properties that the Federal Government can provide for the construction of masts,
- the provision of EUR 1.1 billion for the development of up to 5,000 unpowered areas,
- relieving local authorities of the implementation of the support program in order to ensure effective and cost-effective expansion,
- the identification of acceleration potentials in mobile network expansion in cooperation with countries and municipalities.

[73] https://www.bmvi.de/SharedDocs/EN/publications/5g-strategy-for-germany.html
[74] https://www.bundesregierung.de/breg-de/themen/digitalisierung/mobilfunkstrategie-1694814
[75] https://www.bundesregierung.de/breg-en/service/archive/mobilfunkstrategie-1694814

The Telekommunikationsgesetz (TKG)[76] was amended in December 2021 and introduced the right of all citizens to the availability of voice communication services and internet access services.

As a central information point, the broadband atlas[77] shows broadband penetration and availability. Furthermore, the Bundesnetzagentur has launched a nationwide infrastructure atlas[78] to facilitate the use of synergies in infrastructure deployment. The atlas contains spatial data about the infrastructure of companies and institutions, such as geo-data about fibre optic lines, empty ducts, radio towers and masts as well as radio stations. These services are offered under the umbrella of the Gigabit Register (Gigabit-Grundbuch) as a central point to collect, prepare and make available all key information on telecommunications infrastructure in Germany.

The German Recovery and Resilience Plan (RRP) RRP focuses on digital investments. From a total budget of EUR 26.4 billion, more than 50% is allocated to digitalisation.

Federal funding programme (Förderprogramm zum Breitbandausbau)[79] supports network expansion to provide high-speed broadband networks in underserved areas. The support of the federal state permits nationwide expansion of minimum 1 Gbps connections in areas that were previously underserved. The maximum amount of federal funding per project is EUR 30 million. Combination with other funding programmes, e.g. from the federal states, is possible and can be added to cover the remaining co-financing.

In addition, there is also a plethora of regional broadband strategies on state-level ("Länderstrategien"). These differ both with regards to broadband targets and preferred technologies. Regional differences also exist in regard to funding programmes for digital infrastructure projects, funded partially through the second digital dividend funds and supplemented by public sources.

Overall, Germany opts for a technology-mix in realising its national broadband targets with preference towards fibre networks. Mobile networks are explicitly stated as a viable technology to facilitate country-wide broadband coverage. In particular, Germany expects increased accessibility and higher data-transfer

Main Challenges for gigabit connectivity in Germany:

- Significant urban-rural digital divide
- Wide gap (31.7 %) between the VHCN coverage (70.1 %) and take-up (38,5 %)
- Very low (19.3 %) Fibre to the Premises coverage
- High price sensitivity of the population

[76] https://bmdv.bund.de/DE/Themen/Digitales/Breitbandausbau/Telekommunikationsgesetz-TKG/telekommunikationsgesetz-tkg.html
[77] https://gigabitgrundbuch.bund.de/cln_111/GIGA/DE/_Home/start.html
[78] https://gigabitgrundbuch.bund.de/GIGA/DE/Infrastrukturatlas/start.html
[79] https://bmdv.bund.de/DE/Themen/Digitales/Breitbandausbau/Breitbandfoerderung/breitbandfoerderung.html

speeds from 5G technologies. Fibre-based network projects (FTTB/FTTH) are primarily initiated by local and regional actors.

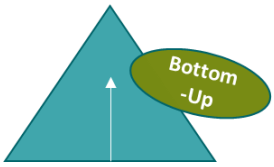
Organizational Steering	Main Players
▪ Broadband development usually steered bottom-up 	▪ Federal Ministry for Digital and Transport ▪ Federal Ministry of Economic Affairs and Climate Action ▪ Federal Gigabit Bureau ▪ State level competence centres & authorities ▪ Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (Bundesnetzagentur)

Figure 31 Organizational Steering & Main Players Germany

7.2.11.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Broadband in Germany has seen significant development and expansion in recent years, but there are still some challenges and variations in service quality and availability across the country.

The level of the at least basic digital skills is with 49% slightly below the EU average. 90% of the individuals use internet. Broadband prices in Germany are lower than the EU average.

The gap between the Fixed VHCN coverage and take-up is 31,66 %, there seems to be less incentives from demand side on the roll-out. The Fixed VHCN coverage is with 70,1% close to the EU average, the recent growth rates are encouraging. Yet the big part of VHCN is provided through cable networks or using the DSL. Take-up of 100 Mbps and more is low with 38,48%.

On the one hand, Germany lags behind in fibre to the premises (FTTP) coverage (19,32 % versus an EU average of 56,5 %) and the progress is very slow (only 5,5% increase during the last two years). On the other hand, the implementation of projects under the Federal funding programme is gaining speed. The funding programme supports both gap funding for operators as well as regional/local authorities that wish to invest in passive infrastructures, promoting FTTC and FTTP deployment alike. Both

measures combined will lead to a significantly increased coverage in the coming years. There are also several funding mechanisms at state level.

The probability is **low** that Germany reaches the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" by 2025. Partly due to significant urban-rural digital divide, reaching the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households" will be even more challenging – the probability is estimated as **low**.

Vodafone and Deutsche Telekom launched 5G in July 2019, Telefonica in October 2020. Various research projects for automated driving (including in urban test fields and on motorways) and for integrating 5G into industrial communications networks were performed. The overall 5G coverage skyrocketed in the last years towards 93,2%, 12 points above the EU average. The big part of the 5G spectrum was made available to operators through the auctions.

As Germany has quite extensive territory with plenty of major transport routes in rural, remote and difficult areas, the full expansion of 5G will take time. Yet, due to successful 5G rollout in recent years, the probability is estimated as **high** that Germany reaches the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways".

Slow progress of the FTTP rollout so far, vast territory, yet ambitious aims set by the strategies as well as hopes towards broadband projects supported by the federal broadband funding programme create a mixed picture. The probability is **medium** that Germany an provide Gigabit for everyone by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	low
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium

Table 36 Probability of achievement of connectivity targets in Germany

7.2.12 Greece

Greece facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	10,394,055 (2.3 % of EU-27)[I]
Population density:	81.3 per km^2 (EU average: 109 per km^2)[I]
Size:	131,957 km^2
Topography:	Mountainous, peninsular mainland, 227 inhabited islands
Fixed Very High Capacity Network (VHCN) coverage	27,8 % of households (EU average: 73,42 %)
FTTP coverage:	27,85 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 37 Greece facts & figures

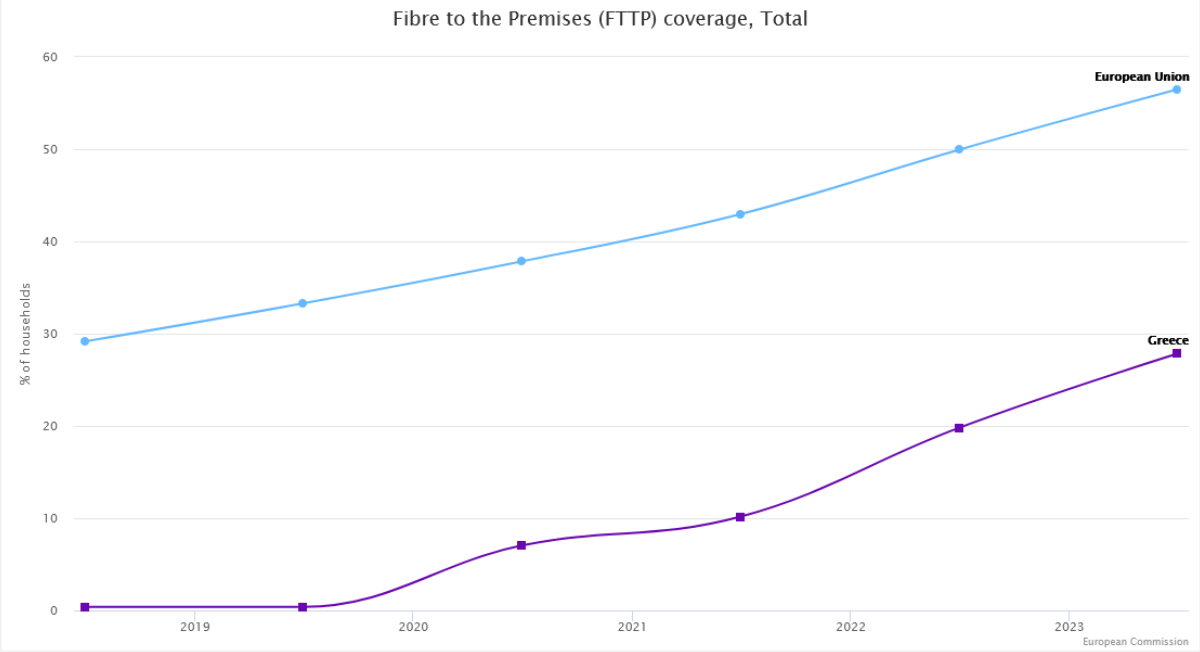


Figure 32 Percentage of households covered by FTTH and FTTB. Greece in comparison to EU. DESI 2023.

7.2.12.1 *Key Features*

National Broadband Plan

The National Broadband Plan 2021-2027[80] aims to promote the use of fixed very high capacity and 5G networks as catalysts and accelerators of the country's digital transformation. The plan has two main objectives: accelerate private investment by removing administrative barriers to create an investment-friendly environment and ensure the wide availability and adoption of very high capacity broadband services.

The National Broadband Plan sets the following connectivity and penetration targets to be achieved by 2027:

- Gigabit connectivity for all major socio-economic drivers,
- All buildings (urban or rural) have access to internet connectivity with a download speed of at least 100 Mbps, which can be upgraded to 1 Gbps,
- 100% of the population living in organized communities (urban or rural) and all major land transport routes have uninterrupted 5G coverage with a download speed of at least 100 Mbps,
- 50% of households to have internet connection (penetration) with download speed of at least 100 Mbps.

National Broadband Plan of Greece: key facts	
Main strategic document(s):	Digital Transformation Bible 2020-2025, National Broadband Plan 2021-2027
Targets:	▪ Gigabit connectivity for all socio-economic drivers ▪ Uninterrupted 5G coverage in all urban areas and all major land transport routes ▪ At least 100 Mbps, upgradable to 1 Gbps for all by 2025 ▪ 50% of households have subscriptions with download speed of at least 100 Mbps

Table 38 NBP Greece key facts

The Digital Transformation Bible 2020-2025[81], introduced by the Greek Ministry of Digital Governance[82], outlines the strategy, guiding principles, the strategic axes, the horizontal and vertical interventions that will lead to the digital transformation of the Greek society and economy. Through collaborations with stakeholders from the public and private sector as well as with the research & aca-

[80] https://mindigital.gr/wp-content/uploads/2021/10/%CE%95%CE%B8%CE%BD%CE%B9%CE%BA%CF%8C-%CE%95%CF%85%CF%81%CF%85%CE%B6%CF%89%CE%BD%CE%B9%CE%BA%CF%8C-%CE%A3%CF%87%CE%AD%CE%B4%CE%B9%CE%BF-2021_27.10.21.pdf

[81] https://digitalstrategy.gov.gr/

[82] https://mindigital.gr/

demic community and the civil society, the strategy describes the objectives but also the implementation measures of the digital transformation strategy. The interventions and the actions of the strategy are an open and dynamic, and will continue to be co-formed and updated annually in cooperation with the competent bodies of public administration.

The Greek Digital Transformation strategy sets seven objectives:

1. Safe, fast, and reliable access to the Internet for all
2. A digital state offering better digital services to the citizens for all life events
3. Development of digital skills for all citizens
4. Facilitate the transformation to digital enterprise
5. Support and strengthening of digital innovation
6. Making productive use of public administration data
7. Incorporating digital technologies to all economic sectors

The key interventions of Digital Transformation incorporate a series of actions and projects organised in six strategic axes: Connectivity, Digital Skills, Digital State, Digital Business, Digital Innovation, Integration of Technology in every sector of the economy.

The Connectivity axis acknowledges the Gigabit Society objectives. The enhancement of mobile and fixed broadband and the achievement of ultra-high speed internet access are expected to lead to further development of the Greek digital economy. Fibre optic and 5G networks are the main challenges of the next decade. For this reason, the primary goal of the national broadband strategy is to encourage investment in next generation networks.

Main challenges for gigabit connectivity in Greece:

- Low Fibre to the Premises coverage (27,9%)
- Low Fixed VHCN coverage (27,8%)
- 0% at least 1 Gbps broadband take-up
- Difficult geographical conditions and low population density in the many uncovered areas

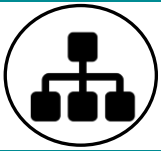
The private sector is expected to account for the large majority of the investments in broadband. Public intervention is primarily focusing on securing the investment environment that will make such investments viable in other areas where market failure has been identified. However, it requires the continuous monitoring of progress achieved and adapting to relevant actions.

Funding programmes and support measures

So far 16 measures and actions are planned under the Connectivity axis of the Digital Transformation Bible, i.a.:

- Broadband Voucher (Superfast Broadband - SFBB). The action has a budget of EUR 50 million per year and aims to stimulate demand and support citizens through vouchers to acquire an Internet connection of at least 100 Mbps, upgradable to 1 Gbps (scheduled)
- Development of Ultra-Fast Broadband Infrastructure (Ultra-Fast Broadband - UFBB). The action aims at the deployment of infrastructures providing Internet connections of at least 100 Mbps bandwidth upgradable up to 1 Gbps to 2.400.000 citizens (residential and business users) (ongoing).
- Development of broadband networks in "white" rural areas - Rural Broadband. The objective is the development and operation of high speed public broadband infrastructure in white rural and island areas of the country, provided technological neutrality and the prospect of their utilization by private sector telecommunications providers. Through the infrastructure developed under the action, 525.000 citizens in 5.077 settlements in rural and border mountainous and island areas of the country gained access to services at a speed of at least 30 Mbps (ongoing).
- WiFi4GR - Development of public wireless broadband internet access points. This actions supports the supply, installation, configuration, connection and commissioning of wireless access points WiFi (Hotspots) in various areas of cultural and tourist interest with scattering throughout the country. It is estimated that the project will cover approximately 3,200 wireless access areas throughout the territory (scheduled).
- Granting of Radio Spectrum Use Rights in the 700 MHz, 2 GHz, 3400-3800 MHz and 26 GHz radio frequency bands (scheduled).
- Action Plan for the development of fifth generation (5G) networks (scheduled).

The Greek Recovery and Resilience Plan (RRP) commits EUR 7.1 billion (23.3%) to the digital transformation.

	
Organizational Steering	Main Players
▪ Broadband development usually steered top-down	▪ Ministry of Digital Governance ▪ Hellenic Telecommunications and Posts Commission (HTPC)

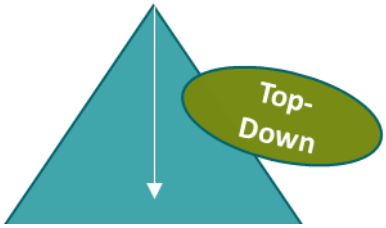


Figure 33 Organizational Steering & Main Players Greece

7.2.12.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

The achievement of connectivity targets constitutes a major challenge, especially considering the country's low population density in the many un-covered areas and challenging geography. Internet is used by 82% of the population and 52% have at least basic digital skills.

The Fixed VHCN coverage increased by 17,7 points in the last two years, yet it is still at the very low 27,8%. The same situation is with FTTP coverage, which is with 27,85% only half of the EU average.

Furthermore, the overall penetration rates remain rather low, partly due to affordability, partly due to the digital divide and levels of digital illiteracy in Greek society. The take-up of Fixed VHCN is growing (17,6 points in the last two years), yet remains with 20,3% significantly lower than EU average of 55,1%. The take-up of gigabit speeds is at 0%.

The Greek Digital Transformation Bible 2020-2025 identifies major issues in broadband rollout and clearly defines strategies and measures to tackle them. However, notwithstanding the large efforts made, Greece' s resources are limited. The operators face delays in rolling out infrastructure partly due to issues with permit granting.

Having in mind the indicators and main challenges listed above, the probability is **low** that Greece meets the Gigabit Society targets "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprise" and "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households".

Greece is a frontrunner in mobile networks and making the 5G bands available. The overall 5G coverage skyrocketed to 85,68%, and over 99% of spectrum was available to operators. The multi-band auction incl. 700 MHz, 3.4-3.8 GHz and 26 GHz spectrum was completed in December 2020[83]. The probability is **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met.

[83] https://5gobservatory.eu/public-initiatives/national-5g-plans-and-strategies/#1533565760052-892598e5-15f1

Despite the country's difficult overall situation in connectivity, the rollout in the recent years was very impressive and further substantial progress is expected. Yet probability is **low** that the target "Gigabit for everyone" is met by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	low
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	low

Table 39 Probability of achievement of connectivity targets in Greece

7.2.13 Hungary

Hungary facts & figures	
Degree of self-governance	Unitary state (parliamentary representative republic)
Population:	9,597,085 (2.1 % of EU-27)[I]
Population density:	106.4 per km^2 (EU average: 109 per km^2)[I]
Size:	93,011 km^2
Topography:	Great Hungarian Plain, North Hungarian Mountains, Austrian foothills in the west
Fixed Very High Capacity Network (VHCN) coverage	80,3 % of households (EU average: 73,42 %)
FTTP coverage:	70,09 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 40 Hungary facts & figures

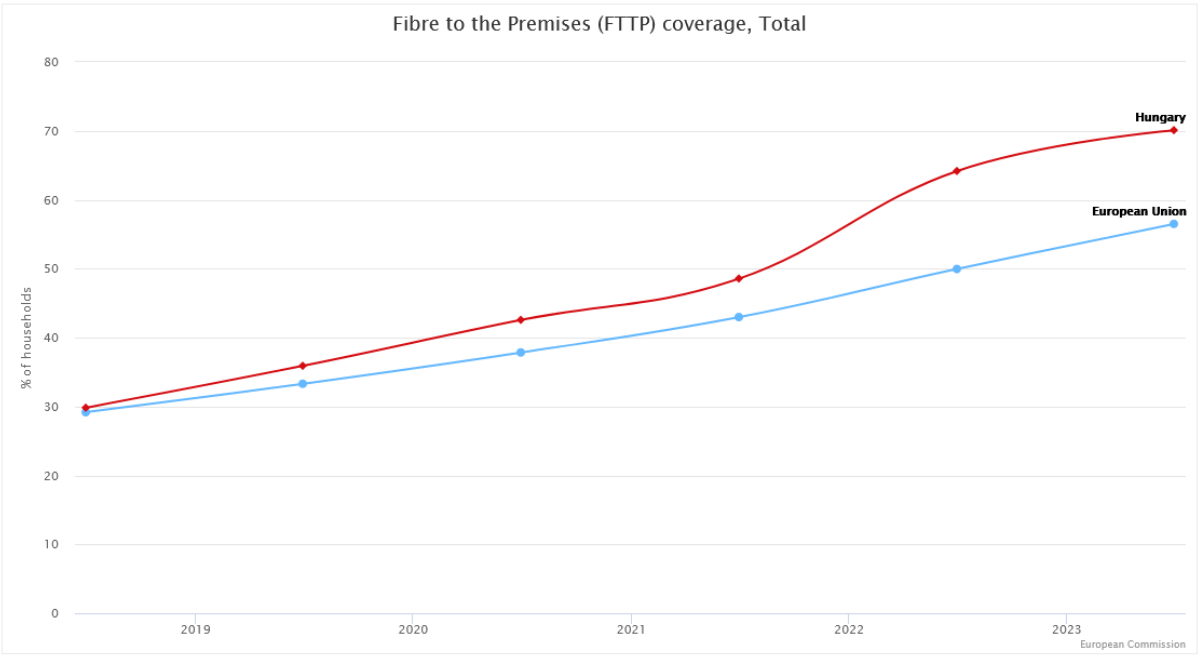


Figure 34 Percentage of households covered by FTTH and FTTB. Hungary in comparison to EU. DESI 2023.

7.2.13.1 *Key Features*

National Broadband Plan

The Hungary's National Digitization Strategy 2021-2030, announced in June 2021, was prepared by the Ministry of Innovation & Technology and the Ministry of the Interior. The strategy is based on the four pillars: digital infrastructure, digital skills, digital economy and digital state and sets targets to be achieved by 2030:

National Broadband Plan of Hungary: key facts	
Main strategic document(s):	National Digitization Strategy 2021-2030
Targets:	▪ 95 % coverage with gigabit networks by 2030

Table 41 NBP Hungary key facts

- 95% of households covered by gigabit networks,
- less than 2% share of people without digital skills in the 16-71 age group
- more than 30% of processes in the enterprises are digitalised
- 90 % of inhabitants use e-government services.

The strategy outlines infrastructural, educational and economic support measures. To ensure the availability of wired and wireless digital infrastructure with adequate service capability and quality, the strategy foresees development of gigabit networks, digital infrastructure of educational and higher education institutions, further development of the national telecommunications backbone network, wireless communication for professional organizations, expanding supercomputing capacity as well as encouraging development of 5G networks.

Development of Gigabit capable networks will include a wide variety of implementation measures:

- planning and implementation of a nationwide "Gigabit Hungary 2030" network development programme, connected to 5G, in order to have an Internet connections with speeds of at least 1 Gbps available by end-2030,
- clarification of infrastructure and network sharing under competition law and regulation of access to optical and radio networks, in particular the sharing of passive (and partly active) infrastructure elements,
- transposing the European Electronic Communications Code into national law,
- reviewing and, if necessary, amending the rules for the construction of telecommunication networks,
- alleviating the reporting and administrative burdens on service providers,
- reviewing the quality and consumer protection regulations for communications services, reviewing standards, formulation of minimum requirements,
- review of the Communications Regulation to better support policy objectives related to digitization, micro- and macro-level competitiveness,

- updating national standards for the electronic communications networks,
- positioning digital networks as a critical infrastructure for the general public.

Encouraging the development of 5G networks will need further multiple actions:

- strengthening and expanding the activities of the 5G Coalition,
- launching a strategic agreements between the service providers and the government to accelerate state-of-the-art fixed & mobile and converged technology developments,
- development of R&D&I support scheme in line with digital infrastructure development, especially 5G,
- development of Széchenyi István University 5G Center of Excellence,
- contribution to the construction of EU 5G corridors,
- preliminary analysis of 6G technology.

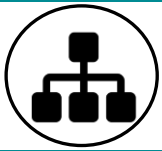
Main Challenges for gigabit connectivity in Hungary:

- reliability of mapping data,
- urban-rural divide,
- low involvement of local and regional actors in broadband roll-out.

Funding programmes and support measures

The National Infocommunication Strategy 2014-2020 included major actions for broadband development, supported by state aid as well as by private investments. In the frame of the "Economic Development and Innovation Operational Programme 2014-2020 (GINOP)", largely financed by EU-funds, Hungary has set up a substantial funding mechanism, the "Superfast Internet Programme" (SZIP), thereby making around EUR 250 million of state aid available for NGA roll-out in economically less attractive, primarily rural, areas. The majority of projects deployed FTTH (fibre to the home), enabling Gigabit speeds. SZIP intended to cover almost 410,000 households with broadband networks.

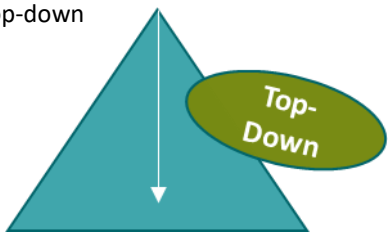
Hungary's Recovery and Resilience Plan (RRP) commits 30% of its allocation to digital measures (EUR 1.7 billion). The plan includes a comprehensive package to promote the digital transformation of the economy and society. Most components contain measures on digital transition. Significant measures are planned to improve the digital equipment and skills in primary, vocational and higher education. The plan contains measures related to the digitalisation of public administration and of the health, transport and energy sectors.



Organizational Steering

Main Players

- Broadband development usually steered top-down



- Ministry of Technology and Industry
- Governmental Information Technology Development Agency (KIFÜ) under the Ministry of Technology and Industry.
- The Ministry of Interior
- The National Media and Infocommunications Authority

Figure 35 Organizational Steering & Main Players Hungary

7.2.13.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

The level of digital skills and internet use in Hungary are close to the EU average: 88% of individuals regularly use internet and 49% have at least basic digital skills.

The rollout of broadband networks is progressing quite well in Hungary. Fixed very high capacity network (VHCN) coverage continued to grow from 48,6% in DESI 2021 to 80,3% in DESI 2023, above the EU average. The FTTP coverage is increasing and reached 70,1 % (DESI 2023).

Demand for broadband services in Hungary is quite high. The gap between Fixed Very High Capacity Network (VHCN) coverage and at least 100 Mbps fixed broadband take-up is only 10 points, fifth lowest value in EU. Take-up of at least 100 Mbps fixed broadband is at 69,8% and take-up of at least 1 Gbps broadband is 29,8%, both exceeding the EU average and putting some pressure on the broadband rollout.

Considering the recent progress and the efforts of the Superfast Internet Programme (SZIP), the probability is **high** that Hungary reaches the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" target. The majority of projects under the SZIP deployed FTTH technology, laying ground for speeds foreseen by the Gigabit Society strategy. The probability is **high** that the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is reached by 2025. Yet, due to still present rural-urban divide and complexity of covering the remaining parts of the country, this will require substantial efforts and funds.

The 5G multiband auction took place in March 2020. Magyar Telecom, Vodafone Hungary and Telenor Hungary won 15-year licences. Operators complain about the conditions set by electricity companies to access their infrastructure for the purpose of construction of telecommunication networks. The time and cost implications of these processes constitute a significant difficulty in the development of

both the fixed line and mobile networks. The dynamics are high in the development of the mobile market. Th overall 5G coverage is at 57,9% (increase by 50,6 points in the last two years) and 60,3% of 5G spectrum was made available for operators. The probability is **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met.

Overall, the outlook for Hungary's future connectivity development is positive. High coverage by FTTH networks, good speeds of the broadband rollout and high take-up rates are excellent success indicators. Being optimistic, the probability is **high** that Gigabit for everyone is available by 2030 in Hungary.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	high
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 42 Probability of achievement of connectivity targets in Hungary

7.2.14 Ireland

Ireland facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	5,194,336 (1.2 % of EU)[I]
Population density:	73.3 per km^2 (EU average: 109 per km^2)[I]
Size:	69,797 km^2
Topography:	Coastal mountain ring, low plains at the center
Fixed Very High Capacity Network (VHCN) coverage	83,8 % of households (EU average: 73,42 %)
FTTP coverage:	72,07 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 43 Ireland facts & figures

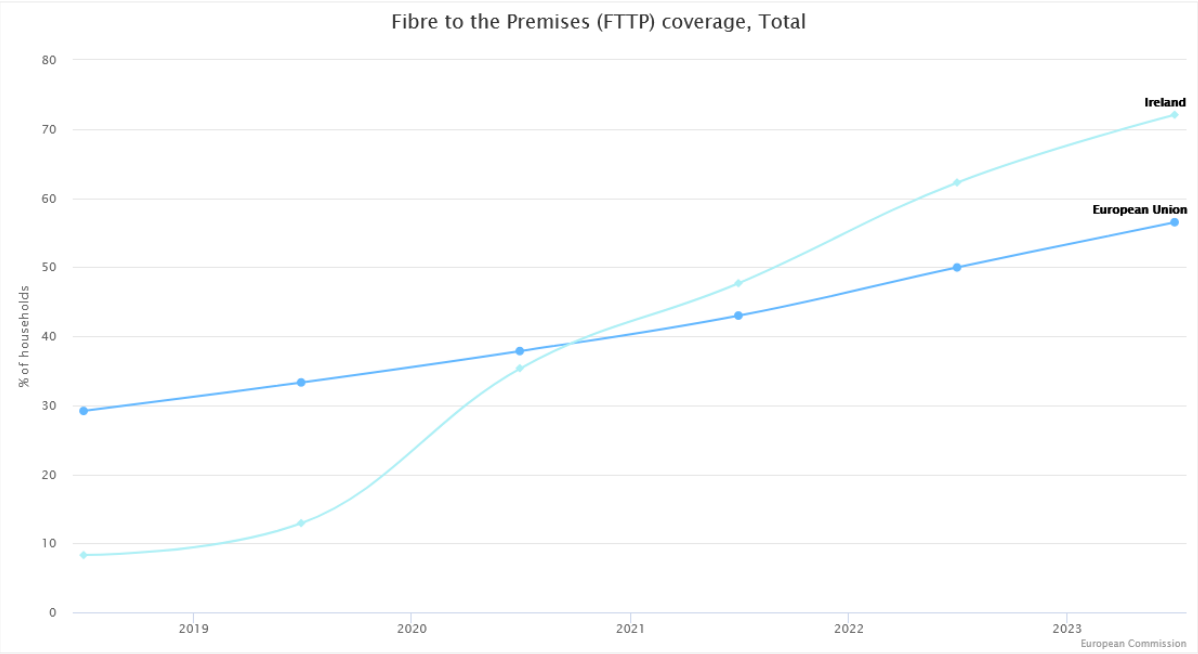


Figure 36 Percentage of households covered by FTTH and FTTB. Ireland in comparison to EU. DESI 2023.

7.2.14.1 *Key Features*

National Broadband Plan

The Irish Government's National Broadband Plan (NBP)[84] was updated in 2021. The Irish NBP is the government's initiative to deliver high speed broadband services to all premises in Ireland. This is to be delivered through investment by commercial enterprises coupled with intervention by the State in those parts of the country where private companies have no plans to invest. These areas are particularly difficult to cover given that Ireland has one of the lowest population densities in Europe (73,3 people per km²). The total planned investment across counties is EUR 2.143 billion (ex. VAT and contingencies) over 25 years. The state intervention will involve co-funding with the private sector. The State Intervention area includes:

National Broadband Plan of Ireland: key facts	
Main strategic document(s):	National Broadband Plan Harnessing Digital – The Digital Ireland Framework
Targets:	▪ by 2026 all premises have access to high-speed broadband (minimum 150 Mbps) ▪ all households and businesses covered by Gigabit network by 2028 ▪ all populated areas covered by 5G by 2030

Table 44 NBP Ireland key facts

- over 560,000 premises,
- 1.1 million people,
- over 65,000 farms,
- 44,000 non-farm businesses,
- 679 schools.

The NBP is to significantly contribute to removing the existing digital divide between urban and rural communities in Ireland.

[84] https://www.gov.ie/en/publication/c1b0c9-national-broadband-plan/

The aims of the government with respect to digital connectivity are also set out in the national digital strategy, Harnessing Digital – The Digital Ireland Framework, published in 2022. The strategy is to drive the digital transition across the Irish economy and society. The ambition is making connectivity available to everyone, including through the National Broadband Plan, Remote Working Hubs and Broadband Connection Points, with a target of having all Irish households and businesses covered by Gigabit network no later than 2028 and all populated areas covered by 5G no later than 2030.

Main Challenges for gigabit connectivity in Ireland:

- Gaps between the VHCN and FTTP coverage and take-up much broader than the EU average
- Low at least 1 Gbps broadband take-up (7,5%)
- Rural-urban connectivity gap
- Broadband prices higher than EU average

Funding programmes and support measures

Following a lengthy procurement process launched in December 2015, the government signed the contract for the implementation of the national broadband plan in November 2019. The contractor, National Broadband Ireland (NBI)[85], will build a predominantly fibre-based network with minimum download speed of 150 Mbps. It is anticipated that the network will involve a total of 140,000km of fibre cable and over 1.5 million poles from networks throughout the country with over 15,000 kilometres of underground duct networks for fibre cable, to cover 96% of Ireland's land mass. Where possible, overhead lines and existing poles will be used to lay/hang the fibre cables. The services will be offered by NBI to all broadband retail providers from the largest to the smallest, on a non-discriminatory basis. As per Feb 2023, the NBP Programme is running some 12 months behind schedule.

The interactive High Speed Broadband Map[86] shows the areas in the State which are included in the National Broadband Plan (NBP) as well as areas targeted by commercial operators. The Map, updated on a quarterly basis, is colour coded and searchable by address and Eircode (national postcode system in Ireland).

Ireland's Recovery and Resilience Plan (RRP) amounts to EUR 989 million. Of this, 32% (i.e. EUR 312 million) is allocated to the digital transformation. Ireland is e.g. planning to connect primary schools to broadband network by installing routers in at least 750 schools.

[85] https://nbi.ie/

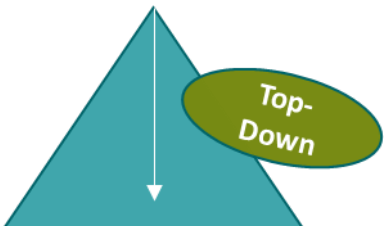
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Department of the Environment, Climate and Communications ▪ Commission for Communications Regulation

Figure 37 Organizational Steering & Main Players Ireland

7.2.14.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Connectivity in Ireland has seen significant improvements in recent years. The country has invested in modernizing its telecommunications infrastructure, including broadband and mobile networks. Urban areas generally have robust connectivity, with high-speed broadband widely available. However, there are still some rural areas facing challenges in terms of connectivity, and efforts are ongoing to address this issue.

Irish population is regularly using internet (95% of population) and have a good level (70%) of at least basic digital skills.

Ireland scores well on broadband with 83,8% Fixed VHCN and 72,1% FTTP coverage. Though the increase in Fixed VHCN coverage was modest (0,6%), the FTTP coverage increased by 24,4% in the last two years. Yet, the demand side is currently not strong enough to drive further rollout. The gaps between VHCN (33,74 points) and FTTP (64,60 points) coverage and take up are much above EU average. Broadband prices in Ireland are higher than the EU average.

Private operators had announced a range of investment plans. E.g. Eir plans roll out fibre to a further 1.6 million premises, bringing their fibre deployment to some 1.9 million premises. SIRO completed the first phase of its fibre deployment and has passed more than 430,000 premises with gigabit services and it has announced plans to extend its network to an additional 320,000 premises. Virgin Media

is offering 250Mbps as a standard offering with 500Mbps and 1Gbps available to many of their customers across the more than 1 million premises.

Ireland's geography and population distribution prevents market players from deploying broadband countrywide and highlights the need for state intervention in underserved areas. This challenge is being mitigated by the National Broadband Plan, aiming at high-speed broadband access to all premises in Ireland via a combination of commercial investment and State aid intervention. This is a step in the right direction, and the probability is **high** that the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is met. As for reaching the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" by 2025, the probability is **medium**.

Ireland has already made 62,5% of 5G spectrum available to operators. The overall 5G coverage increased substantially by 53,5 points in the last two years towards solid 83,9%. Mobile broadband prices tend to be higher in Ireland than the EU average. The probability is **high** that Ireland reaches the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" by 2025.

Achieving gigabit speeds nationwide in Ireland by 2030 is an ambitious goal, but it's not entirely implausible. Considering the planned investments by private operators as well as efforts by the National Broadband Ireland, the probability is **high** that the Gigabit for everyone is provided by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 45 Probability of achievement of connectivity targets in Ireland

7.2.15 Italy

Italy facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	58,850,717 (13.1 % of EU-27)[I]
Population density:	198,6 per km^2 (EU average: 109 per km^2) [I]
Size:	302,073 km^2
Topography:	Mountain ranges in the north (Alps) and central peninsular (Apennine Mountains), Po Valley and two large islands (Sardinia and Sicily)
Fixed Very High Capacity Network (VHCN) coverage	53,7 % of households (EU average: 73,42 %)
FTTP coverage:	53,7 % of households (EU average: 56,5 %)

[I] 2023, Eurostat.

Table 46 Italy facts & figures

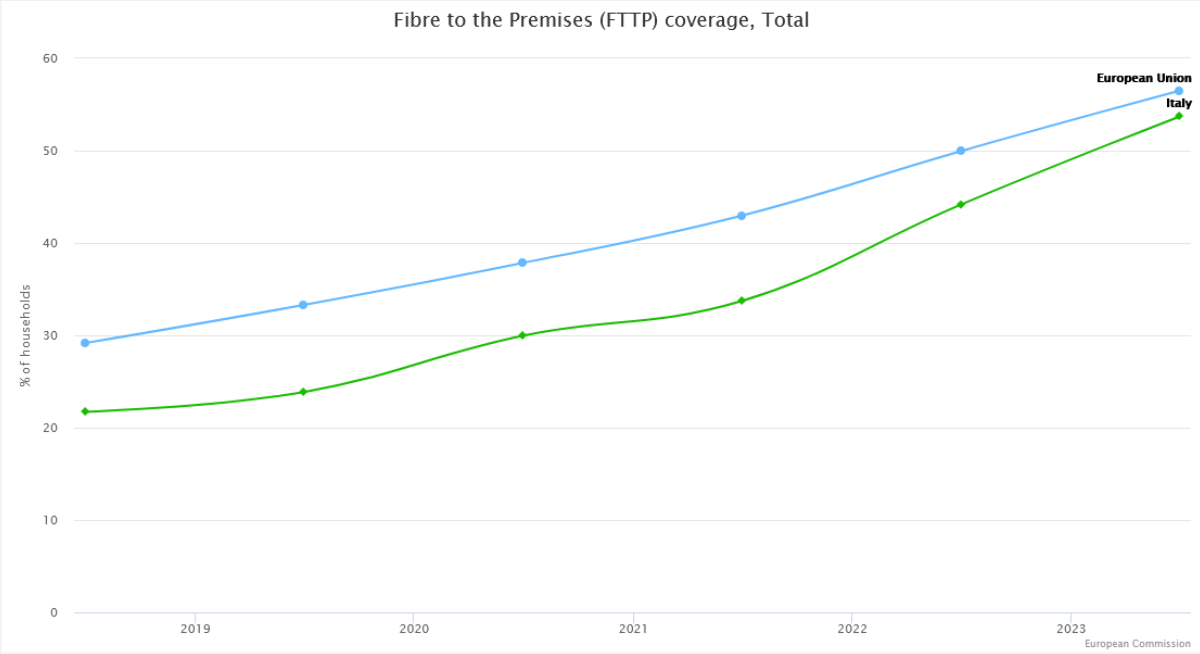


Figure 38 Percentage of households covered by FTTH and FTTB. Italy in comparison to EU. DESI 2023.

7.2.15.1 Key Features

National Broadband Plan

National Broadband Plan of Italy: key facts	
Main strategic document(s):	Strategy for Ultra Broadband Towards the Gigabit Society
Targets:	▪ gigabit connectivity across the entire territory by 2026

Table 47 NBP Italy key facts

The Italian Strategy for Ultra Broadband Towards the Gigabit Society, May 2021[87], defines the actions necessary to achieve the digital transformation Gigabit Society and Digital decade objectives. The strategy has seven intervention areas: a) Plan for white areas, b) Voucher plan, c) Plan Italy 1 Giga, d) Italy 5G Plan, e) Connected Schools Plan, g) Connected Health Plan, and h) Minor Islands Plan. First two, Plan for white areas and Voucher plan are continuation from the previous Strategy for next generation access network (Strategia Italiana per la Banda Ultra-Larga, SNBUL)[88]. The investments will be accompanied by a process of simplification of permit processes to speed up the rollout of infrastructures and by updates to the regulations.

Funding programmes and support measures

The Italian voucher scheme[89] of total EUR 610 million will provide aid in the form of vouchers to SMEs that will subscribe to broadband services capable of ensuring download speeds of at least 30 megabits per second (Mbps).

The Italian National Recovery and Resilience Plan allocates EUR 6.7 billion for the implementation of the five intervention areas of the Strategy for Ultra Broadband:

- Plan Italy 1 Giga[90], with planned allocation EUR 3.8 billion, aims to provide 1 Gbps in download and 200 Mbps upload speeds in grey and market failure areas, to be determined after the completion of a mapping exercise. In compliance of the principle of technological neutrality it is planned to cover a total of 8.5 million households by 2026.
- Italy 5G plan[91], with an allocation of EUR 2.02 billion aims to incentivise the deployment of 5G mobile networks in areas of market failure. The Plan is to encourage spread of 5G mobile networks capable of ensuring a significant leap in quality of mobile radio connectivity through fibre optic connections of radio base stations and the densification of network infrastructures, in order to guarantee speeds of at least 150 Mbps in downlink and 30 Mbps in uplink, in areas

[87] https://www.mimit.gov.it/it/notizie-stampa/la-strategia-italiana-per-la-banda-ultralarga
[88] https://bandaultralarga.italia.it/
[89] https://ec.europa.eu/commission/presscorner/detail/en/ip_21_6892
[90] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_441
[91] https://innovazione.gov.it/dipartimento/focus/piano-italia-5g/

where no network capable of providing 30 Mbps connectivity in typical operating conditions is present, nor will it be in the next five years. In 2022, the two tenders for the development of 5G networks in Italy were published. The two interventions, for a total of EUR 3.7 billion, are aimed at binding more than 10,000 existing mobile radio sites with optical fibre and creating new 5G mobile radio sites in more than 2000 areas of the country. The public funding provided for by the tenders will cover up to 90% of the overall cost of the works. Both tenders were awarded in June 2022[92][93].

- Connected schools plan, aiming to provide the state-of-the-art connectivity (at least 1 Gbps) to the approximately 9,000 schools.
- Connected health care facilities plan, which intends to cover approximately 12,000 hospitals and healthcare facilities (at least 1 Gbps and up to 10 Gbps connectivity).
- Connected minor islands plan, aiming to deliver adequate connectivity to 18 smaller islands through submarine fibre cables.

Main Challenges for gigabit connectivity in Italy:

- Fixed VHCN coverage 20 points below EU average,
- Complexity of the administrative and co-ordination processes in rolling out broadband infrastructure,
- Lower than EU average level of digital skills and internet use,
- Challenging topography.

Italy's national roadmap for the implementation of the connectivity toolbox includes several reforms, in particular on streamlining permit granting procedures for civil works, improving transparency and reinforcing the capabilities of the single information point, as well as expanding the right of access to existing physical infrastructure.

The 5G band auctions for 700 MHz, 3.5 GHz and 26 GHz spectrum took place in 2018, with licenses valid till end 2037. Vodafone and TIM launched 5G services in June 2019, Wind Tre in October 2020 and Iliad in December 2020.[94]

[92] https://www.infratelitalia.it/archivio-documenti/documenti/avviso-di-aggiudicazione-italia-5g-backhaul
[93] https://innovazione.gov.it/notizie/articoli/assegnate-tutte-le-gare-per-portare-internet-veloce-nel-paese/
[94] https://5gobservatory.eu/public-initiatives/national-5g-plans-and-strategies/#1533565840021-480921bd-2bd9

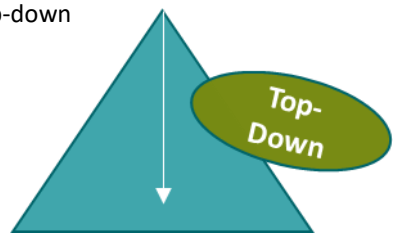
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of Enterprises and Made in Italy ▪ Department for Digital Transformation[95] ▪ Agency for Digital Italy (AgID) ▪ COBUL – Committee for the spread of high-speed broadband, a ministerial-level coordination committee acting as an interdisciplinary competence centre ▪ National regulatory authority AGCOM

Figure 39 Organizational Steering & Main Players Italy

7.2.15.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

The practical roll-out of the broadband plan is ongoing, but with delays. There are difficulties in accessing existing infrastructure and persisting difficulties in obtaining permits despite the implementation at national level of the Cost Reduction Directive.

The NGA coverage in 2022 was at solid 97 %. The fixed VHCN coverage is at 53,7% and increased by 20 points in the last two years. Yet it is still way below the EU average of 73,4%. The FTTP coverage increased by 20 points in the last two years towards 53,71%, very close to EU average. The at least 1 Gbps broadband take-up is with 13,45% also close to EU average, and increased by 9,2 points since DESI 2021.

The main private investment plans for the deployment of fibre-based networks in Italy are from TIM, Open Fiber and Fastweb. The investments mainly focus on the deployment of FTTH and FTTC networks.

The probability is assessed as **high** that the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is reached by 2025.

A considerable gap still exists between coverage in urban and rural areas. Only 26% of rural areas are covered by fixed VHCN. The administrative and co-ordination processes in rolling out broadband infrastructure are quite complex. Though the broadband prices are lower than the EU average, low level of

[95] https://innovazione.gov.it/dipartimento/en/structure/

basic digital skills of the population (46%) and slightly lower than EU average use of internet (83%) may have an impact on the demand. Also, partly due to difficult geography in many remote areas, the probability is **low** that Italy reaches the "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" target by 2025.

5G trials started already in 2017 as part of the programme launched by the Ministry of Economic Development '5 cities for 5G' and based on voluntary agreements between operators and municipalities. Vodafone and TIM launched 5G services in June 2019, Wind Tre in October 2020 and Iliad in December 2020. The 93,33% of 5G spectrum was made available to operators. The overall 5G coverage jumped by spectacular 91,6 points in the last two years towards 99,72%. Mobile broadband take-up is at 79,6%. The probability is **high** that the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is achieved by 2025.

Italy is progressing well in implementing measures under the Strategy for Ultra Broadband (some funded by RRP). This has resulted in Italian investments in connectivity increasing over the last two years. The Plan Italy 1 Giga is expected to be completed by 2026. Coupled with investment plans of private operators, it creates a positive outlook into the gigabit future in Italy. Yet the lower digital skills of the population and challenging topography will not make the rollout easy. Therefore, the probability is assessed as **medium-high** that Italy can provide Gigabit for everyone by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium-high

Table 48 Probability of achievement of connectivity targets in Italy

7.2.16 Latvia

Latvia facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	1,883,008 (0.4 % of EU-27)[I]
Population density:	29.8 per km^2 (EU average: 109 per km^2)[I]
Size:	64,573 km^2
Topography:	Largely undulating plains, uplands in the western (Kurzeme) and central part (Vidzeme)
Fixed Very High Capacity Network (VHCN) coverage	91,5% of households (EU average: 73,42 %)
FTTP coverage:	90,52 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 49 Latvia facts & figures

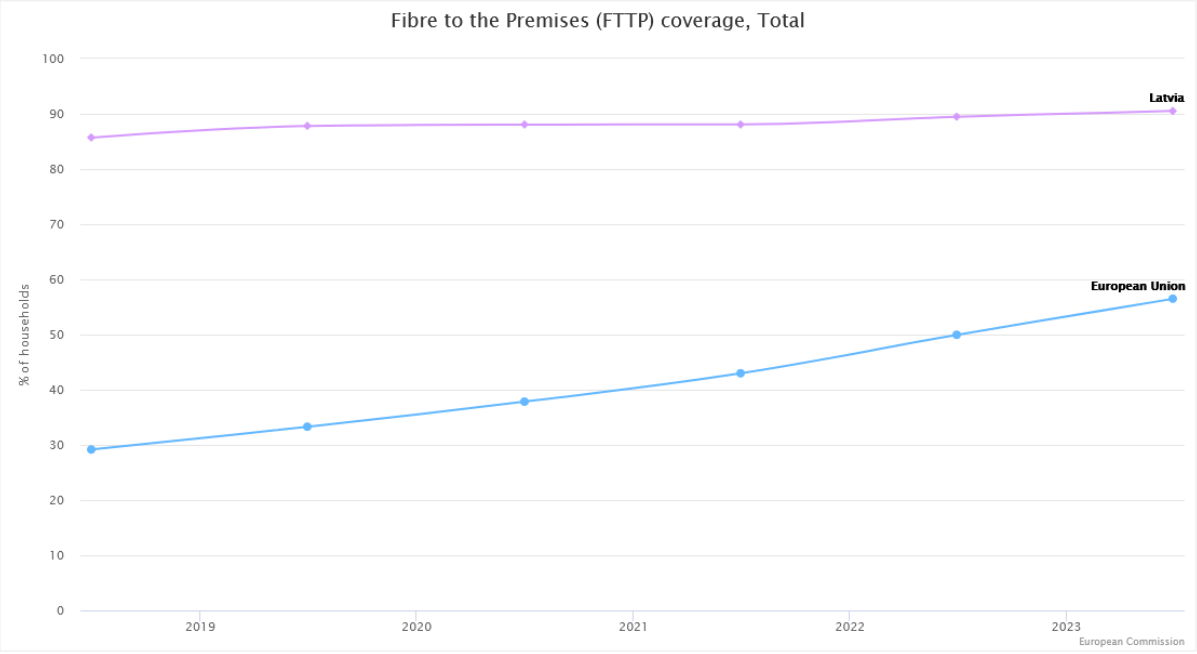


Figure 40 Percentage of households covered by FTTH and FTTB. Latvia in comparison to EU. DESI 2023.

7.2.16.1 *Key Features*

National Broadband Plan

The Electronic communications sector development plan for 2021-2027[96] regulates communications sector policy throughout Latvia. The target groups of the plan are electronic communications enterprises, planning regions, local governments and residents. The plan aims to facilitate the transition towards very high capacity communications networks capable of providing end-users with Internet access services with data transmission speeds of at least 100 Mbps in both urban and rural areas. The plan defines two courses of action:

National Broadband Plan of Latvia: key facts	
Main strategic document(s):	Electronic communications sector development plan for 2021-2027 Digital Transformation Guidelines for 2021-2027
Targets:	▪ 100 % coverage with at least 100 Mbps download speed that can be upgraded to gigabit speed ▪ 50% coverage with 5G in all large urban areas and all land transport arteries

Table 50 NBP Latvia key facts

a) development of broadband electronic communications infrastructure, and
b) security of electronic communication networks and services.

Given the limited amount of public funding available, the efforts will concentrate, without replacing private investment, in areas where, for economic reasons, electronic communications operators have no interest in deploying infrastructure or do so insufficiently.

The Digital Transformation Guidelines for 2021-2027[97] is an overarching strategy for the country's digital transformation, covering ICT education and skills, internet access, modern and efficient public administration, e-services and digital content for society. The guidelines set a vision of equal, fast and high-quality provision of electronic communications services throughout the territory of Latvia for all residents, state and local government institutions and companies to provide at least the minimum necessary for society and economic development availability of communication infrastructure. The guidelines set the following targets:

- All households have access to internet connection with at least 100 Mbps download speed that can be upgraded to gigabit speed, and

[96] https://www.sam.gov.lv/lv/elektronisko-sakaru-nozares-attistibas-plans-2021-2027gadam
[97] https://www.varam.gov.lv/lv/digitalas-transformacijas-pamatnostadnes-2021-2027gadam

- 50% 5G coverage in all large urban areas (in Latvia - Riga, Jelgava, Liepāja, Daugavpils) and all land transport arteries.

Main Challenges for gigabit connectivity in Latvia:

- Deploying the last mile
- Huge gap (90,5 points) between the FTTP coverage and at least 1 Gbps take-up
- Only 65.5 % of households have fixed broadband connection
- Relatively strong rural-urban digital divide
- Mainly GPON architecture

The national 5G roadmap was approved by the Cabinet of Ministers in February 2020[98]. The roadmap contains information related to the implementation of 5G mobile networks, including a timetable for ensuring the availability of radio frequency spectrum and aspects of infrastructure deployment related to the establishment of a 5G network in cities and along transport roads. It is necessary to identify the location of the existing fibre optic cable networks along the Latvian section of the international highway "Via Baltica" (E67), at the same time identifying the availability of electricity to get together with Lithuanian and Estonian experts.

Funding programmes and support measures

The implementation of the broadband project[99] helped increase coverage in Latvia. Supported by the European Regional Development Fund (ERDF), the project is deploying dark fibre and access points up to the centre of municipalities in rural areas currently not served by NGN and where there are no plans for NGN development ('white' areas defined according to EU broadband guidelines). Private providers have to deliver the last mile, for which no public support is foreseen.

In its roadmap to implement the Connectivity Toolbox, Latvia announced plans to simplify the permit-granting procedure for building electronic communications networks. The aim is to assess the possibility for tacit approval and a fast-track procedure for rights of way, further develop the single information point and simplify deployment of small cells. A working group has been established to evaluate the environmental footprint of electronic communications networks.

Latvia 's Recovery and Resilience Plan amounts to over EUR 1.8 billion in funding and allocates more than EUR 384 million, 21% of the total RRP allocation, to contribute to the Digital Decade targets. The RRP includes two measures on connectivity infrastructures, with a combined budget of EUR 16.5 million, accounting for 4% of the RRP digital budget. They will address last-mile connectivity in rural areas and passive infrastructure on the Via Baltica 5G corridor. The broadband or VHCN last-mile infrastructure development measure foresees to provide connectivity to 1,500 households, businesses, schools,

[98] https://www.mk.gov.lv/lv/aktualitates/satiksmes-ministrija-informe-valdibu-par-nacionalo-5g-ieviesanas-celvedi
[99] https://www.lvrtc.lv/projekti/platjosla/

hospitals and other public buildings in rural areas. It has a budget of EUR 4 million. An investment of EUR 12.5 million for the construction of passive infrastructure on the Via Baltica corridor for 5G coverage aims to ensure 100% fibre backhaul availability along the Latvian part of the Via Baltica.

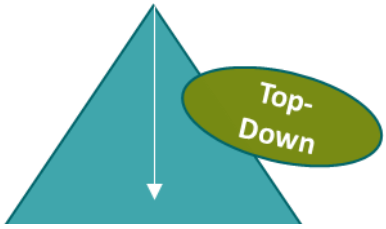
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of Transport ▪ Ministry of Environment Protection and Regional Development ▪ Public Utilities Commission ▪ Competition Council ▪ Latvia State Radio and Television Centre

Figure 41 Organizational Steering & Main Players Latvia

7.2.16.2 ***Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.***

The level of digital skills in Latvia is close to the EU average. 51% of population has at least basic digital skills and 90% of individuals use internet.

FTTP is widely available throughout Latvia, paving the way for the future-proof connectivity. One slightly negative aspect is the usual deployment of GPON architecture as the main technology, while p2p architectures are rare. The coverage with Fixed VHCN (91,5%) and FTTP (90,5%, one of the highest in EU) is excellent and well beyond EU average. Yet the increase in coverage was modest in the last two years: fixed VHCN increased by 3,4% and FTTP coverage increased by 2,44%. There is still a substantial gap between rural and urban. In rural areas, VHCN coverage has increased by 5 percentage points in the last year towards 80% in 2022, far above the EU average of 45%.

The demand side is lagging behind. The at least 1 Gbps broadband take-up is close to 0%. The Fixed VHCN take-up is with 62% above EU average of 55%, but not yet catching up with the coverage (91,5%). However, the increase in Fixed VHCN take-up was 23,8% in the last two years and provides an optimistic outlook.

Commercial 5G services are available since 2019. The mobile broadband take-up is with 86% close to the EU average and has further improved in the last few years. Latvian broadband prices are slightly

lower than the EU average. Even though the spectrum assignments and 5G coverage increased substantially in the last two years, the overall 5G coverage is with 42% very low compared to 81,2% in the EU, and only 62,5% of 5G spectrum was made available to operators. Latvia is working on reducing the administrative burden affecting the roll-out of 5G and on solving the spectrum issues.

Overall, Latvia has made strong progress in connectivity since 2015 and has established a remarkable broadband infrastructure. FTTP coverage is already very high, VHCN bandwidths are available for subscription and take-up grows steadily. The recent growth rates in coverage are low and rural-urban divide still persist. Being carefully optimistic, if Latvia manages to narrow the digital divide, even with the low FTTP growth rates of e.g. 1,5% per year the probability is **high** Latvia will reach the gigabit society targets by 2025 and provide gigabit for all by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	high
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 51 Probability of achievement of connectivity targets in Latvia

7.2.17 Lithuania

Lithuania facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	2,857,279 (0.6 % of EU-27)[I]
Population density:	44.7 per km^2 (EU average: 109 per km^2)[I]
Size:	65,286 km^2
Topography:	Lowlands along the coast and in the central part, south-eastern plain, highlands in the north (Žemaičia Highlands) and the east (Baltic Highlands)
Fixed Very High Capacity Network (VHCN) coverage	78 % of households (EU average: 73,42 %)
FTTP coverage:	78 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 52 Lithuania facts & figures

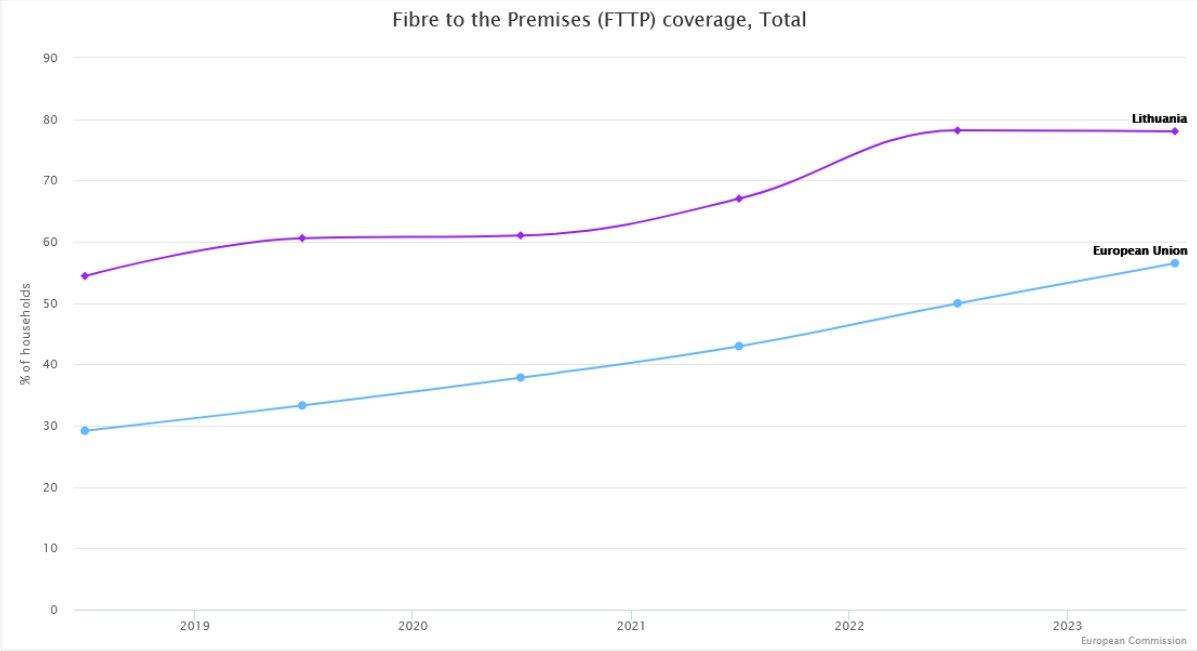


Figure 42 Percentage of households covered by FTTH and FTTB. Lithuania in comparison to EU. DESI 2023.

7.2.17.1 *Key Features*

National Broadband Plan

National Broadband Plan of Lithuania: key facts	
Main strategic document(s):	Plan for the ultra-fast broadband development 2021-2027
Targets:	▪ at least 100 Mbps availability for all by 2027

Table 53 NBP Lithuania key facts

The plan for ultra-fast broadband development[100] was launched by the Ministry of Transport and Communications in October 2021. It aims to speed up the implementation of electronic communications infrastructure so that in the period 2021-2027 internet speeds of at least 100 Mbps should reach households and public institutions not only in big cities, but also in rural areas. EUR 75 million was allocated for the development of ultra-fast Internet access. This funding will be used to build communication towers and lay fibre optic lines. When planning investments, the main public and economic activity spaces and public institutions will be considered and connected to the broadband network.

In October 2021, the Ministry of Transport and Communications, together with public sector institutions and telecommunications service operators, signed a memorandum by which all parties agreed to achieve 100 Mbps connection speed availability to at least 95% of Lithuanian households by 2025.

The Lithuanian Information Society Development Programme 2014-2020 "Digital Agenda of the Republic of Lithuania", was approved in March 2014 and updated in 2019[101], when references to the Gigabit society targets were made. The agenda focuses on 3 major areas:

- skills and motivation of the Lithuanian citizens to use ICT,
- development of electronic content and
- evolvement of ICT infrastructure, including NGA access.

The Programme assumes that only balanced development of all these areas can lead to sustainable and rapid development of the information society and result in implementation of the Gigabit society targets and objectives envisaged in the Digital Agenda for Europe. One of the Programme goals is to ensure the development of geographically uniform high-speed broadband infrastructure and encourage the use of Internet services (Goal 5). The following measures are foreseen to achieve this goal:

[100] https://sumin.lrv.lt/lt/naujienos/susisiekimo-ministerija-spartins-placiajuoscio-interneto-pletra-lietuvoje
[101] https://www.e-tar.lt/portal/lt/legalAct/fc43c4b0ac5811e9aa488968c21ecc58

- to ensure the development of the broadband electronic communication networks in the areas where the market did not ensure the infrastructure development and service provision,
- to encourage competition in the broadband communications market and the use of broadband services,
- to upgrade and develop the public internet access infrastructure in libraries.

Main Challenges for gigabit connectivity in Lithuania:

- Deploying the last mile
- Very low (1,7%) at least 1 Gbps broadband take-up
- Only 47% of 5G spectrum assigned

In the area of broadband development, Lithuania's Digital Agenda focuses on providing incentives for investments in broadband infrastructure and intervenes where market operators fail to satisfy the demand for broadband access due to a low degree of economic viability. It also gives a high priority to the stimulation of demand for fast internet access as well as the digital literacy of Lithuanians.

The Ministry of Transport and Communications set up a working group on 5G to discuss and develop together with stakeholders the "Guidelines for the development of next generation mobile networks (5G) in the Republic of Lithuania for 2020-2025", adopted in June 2020[102]. The guidelines[103] contain a set of measures to facilitate the deployment of 5G in Lithuania, e.g. measures on access to sites for radio-network building. The 5G rollout in Lithuania is planned in four stages:

- Beginning of implantation of 5G connection and its development in the domestic territories in 2021,
- 5G connection available in at least one of the largest Lithuanian cities by 2022,
- Uninterrupted 5G functioning in Vilnius, Kaunas, Klaipeda, Siauliai and Panevezys by 2023,
- 5G connection available in the territories of towns and villages, international transport corridors ("Via Baltica", "Rail Baltica"), on the roads of national importance, on the railways and in the ports by 2025.

[102] https://sumin.lrv.lt/en/news/lithuania-approved-the-5g-development-guidelines-for-2020-2025
[103] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/669a3b64aa5411ea8aadde924aa85003

A memorandum on 5G development in Lithuania[104], signed in October 2021, pledges that by 2025 international land transport corridors Via Baltica & Rail Baltica would offer uninterrupted 5G connection services. A 5G investment project[105] was setup and is being implemented by PE Plačiajuostis internetas.

Funding programmes and support measures

Government of Lithuania established a non-profit Public Enterprise "Plačiajuostis internetas" (EN: Broadband Internet) for rolling out state aid supported fibre and as the main wholesale provider for FTTP solutions. As there is no relevant cable network available, the publicly financed deployment of FTTP networks and competition on service level is rather efficient from a macroeconomic perspective, as this approach avoids overbuilding and duplication of infrastructures. Furthermore, Lithuania also made substantial progress concerning transparency of infrastructures and coordination of civil works.

In its roadmap to implement the Connectivity Toolbox, Lithuania plans to enhance transparency of existing infrastructure and civil works with a new national web-based geographic information system. It intends to develop guidelines to facilitate legal, technical and administrative conditions for mobile operators and apply a flexible authorisation regime, with a focus on local licensing, infrastructure sharing or other market needs for the 26 GHz band.

Lithuania's Recovery and Resilience Plan allocates EUR 701 million (31.5%) to measures supporting digital transition. Over EUR 660.5 million is estimated to contribute to the Digital Decade targets. Over half of the funds are assigned to investment in digital public services and infrastructure. The plan focuses on facilitating the rollout of 5G networks, the digitalisation of public services and creating innovative solutions for transport. The Lithuanian RRP commits EUR 49 million for Infrastructure investments, including the building of 50 new towers, rolling out 2,000 km of fibre and related active equipment with appropriate maintenance and administration. An investment project "High-speed communication infrastructure"[106] was prepared and is being implemented by PE Plačiajuostis internetas. These measures will provide gigabit speed to 5,000 digitally intensive enterprises and institutions in the areas where these services would not be provided on a commercial basis. In addition, internet service providers in white areas should be able to increase the speed of their last-mile services.

[104] https://sumin.lrv.lt/uploads/sumin/documents/files/Veikllos%20sritys/Memorandumas%20d%C4%97l%205G.pdf
[105] https://www.placiajuostis.lt/lt/5g-ip
[106] https://www.placiajuostis.lt/lt/naujienos/naujas-investicinis-projektas-259

Overall, Lithuania opts for a market-driven roll-out, mainly supporting infrastructure development in areas that suffer from market failure. Investments in broadband technologies by private operators are planned to be diverse, including mobile technologies.

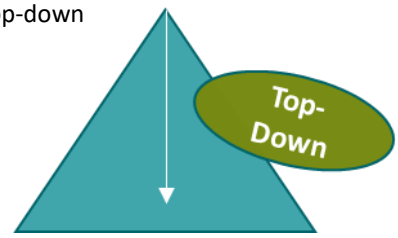
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of Transport and Communications of the Republic of Lithuania ▪ Information Society Development Committee ▪ Public Enterprise "Plačiajuostis internetas" ▪ Communications Regulatory Authority

Figure 43 Organizational Steering & Main Players Lithuania

7.2.17.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

Broadband infrastructure is well established in Lithuania. The NGA coverage in Lithuania was growing steadily, with the coverage of 84,81 % (DESI 2022). The Fixed VHCN and FTTP coverage has increased by 11 points in the last two years to the level of 78%. The fixed VHCN coverage is slightly above EU average, whereas FTTP availability is over 20 points higher than in the EU. The overall 5G coverage jumped to 90%.

The overall fixed broadband take-up was at 67% (DESI 2022). The at least 100 Mbps fixed broadband take-up increased by 20,5 points in the last two years and is at decent 51,54%. Yet at least 1 Gbps broadband take-up is very low with 1,7%. The coverage of fixed broadband is quite good, availability is therefore not an obstacle. Broadband prices in Lithuania are lower than in the EU.

The fixed and 5G investment projects[107] prepared by PE Plačiajuostis internetas on behalf of the Ministry of Transport and Communications are progressing well and show results.[108] With the created infrastructure, the public institution Platiajuostis internetas provides wholesale communication services to all communication operators at the same conditions and prices.

The probability is **high** that the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is met.

Yet, the lower rural coverage, quite low population density in rural areas coupled with low broadband prices may pose some challenges in reaching the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" by 2025 – the probability is therefore assessed as **medium**.

Though the roll-out of 5G has been delayed due to the postponed assignment of spectrum, there was substantial progress in the last years. The mobile broadband market is growing very fast, in terms of both value and subscribers. 5G coverage is at 90%. The 3.4-3.8 GHz and 700 MHz frequencies were assigned, and overall 47,2% of spectrum was made available to operators. Probability is **high** that Lithuania meets the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" target.

Considering the progress made in rollout of broadband infrastructure in the last years, the planned governmental support measures as well as plans by private operators, the probability is **high** that Lithuania can provide Gigabit for everyone by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

[107] https://www.placiajuostis.lt/lt/projektai

[108] https://www.placiajuostis.lt/lt/naujienos/igyvendintas-projektas-naujos-kartos-interneto-prieigos-infrastrukturos-pletra-525

Table 54 Probability of achievement of connectivity targets in Lithuania

7.2.18 Luxembourg

Luxembourg facts & figures	
Degree of self-governance:	Unitary state (constitutional monarchy)
Population:	660,809 (0.1 % of EU-27)[I]
Population density:	247.5 per km^2 (EU average: 109 per km^2)[I]
Size:	2,586 km^2
Topography:	Hill ranges in the northern part (Ardennes), Luxembourg Plateau in the South
Fixed Very High Capacity Network (VHCN) coverage	93,3 % of households (EU average: 73,42 %)
FTTP coverage:	76,2 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 55 Luxembourg facts & figures

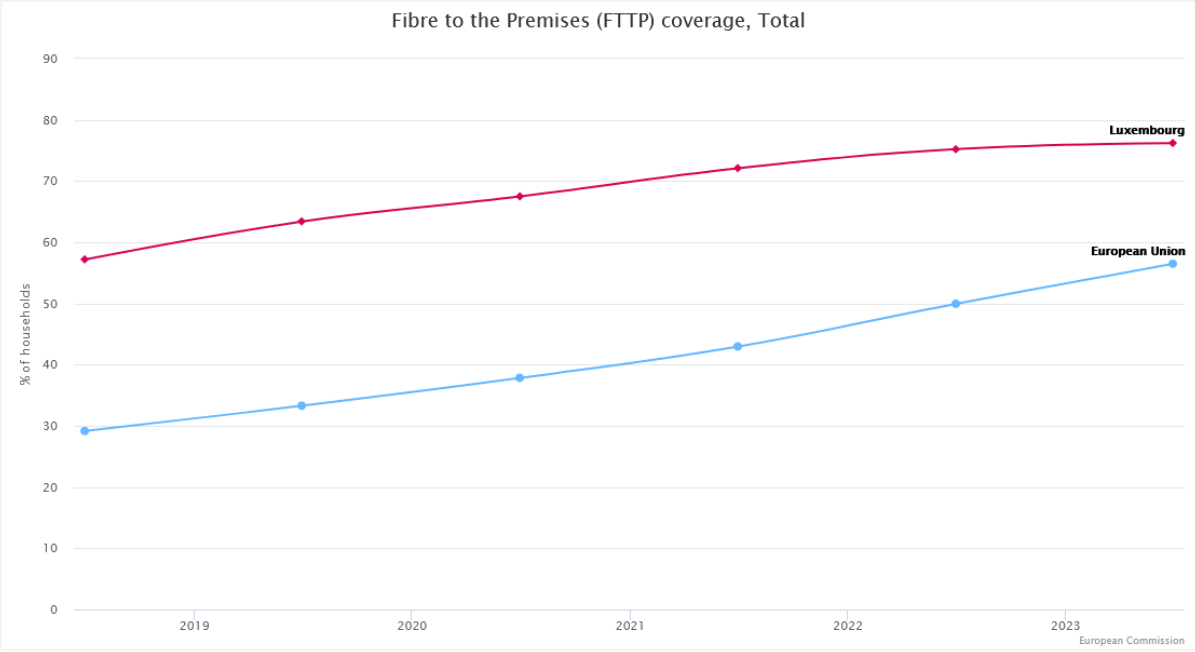


Figure 44 Percentage of households covered by FTTH and FTTB. Austria in comparison to EU. DESI 2023.

7.2.18.1 *Key Features*

National Broadband Plan

Luxembourg's ultra-high-speed broadband strategy 2021-2025[109] aims to achieve high performance connectivity for all, puts the digital divide and the competitive & dynamic telecoms ecosystem into focus. The Strategy sets following objectives for the 2021–25 period:

National Broadband Plan of Luxembourg: key facts	
Main strategic document(s):	Ultra-high-speed broadband strategy 2021-2025
Targets:	▪ access to 1 Gbps download and 200 Mbps upload in a fixed network for all by 2025

Table 56 NBP Luxembourg key facts

- Make connectivity accessible to all,
- Accelerate the transition of households & businesses to more efficient & sustainable technologies,
- Accelerate the deployment of future-proof infrastructure while respecting technological neutrality, to meet the current and future needs of all households, regardless of their geographical location. Eventually, the migration of all households to scalable futureproof technologies will optimise the energy efficiency of networks by progressively disconnecting the old fixed network,
- Improve transparency & strengthen consumer protection,
- Develop Luxembourg as the launchpad of choice for ICT service providers.

To prevent the digital divide, the strategy highlights the importance of an affordable basic high-speed internet connection for everyone, defined as a minimum 100 Mbps download internet connection and 20 Mbps upload service. In order to provide this service to the most disadvantaged households, targeted measures will be assessed and implemented.

The ambition of the strategy is to ensure that every housing unit has access to at least one VHCN (Very High Capacity Network) network, defined as 1 Gbps download and 200 Mbps upload in a fixed network. The strategy prioritises households in remote areas that are not connected by a VHCN network. Connecting remote & rural homes is costly and public support may be considered for cases where private operators have no plans to expand networks.

[109] https://innovative-initiatives.public.lu/initiatives/broadband-strategy-2021-25

A 5G taskforce was established to keep Luxembourg at the forefront of connectivity. 5G was launched by Post Luxembourg, Orange and Proximus in 2020. Luxembourg has established a 5G Strategy[110] aiming at establishing 5G in the first major cities, along major transport routes and in all strategic areas by 2025.

Main Challenges for gigabit connectivity in Luxembourg:

- Low at least 1 Gbps broadband take-up (6,7%),
- No public funding planned for broadband roll-out,
- permit granting procedures.

Funding programmes and support measures

The ultra-high-speed broadband strategy 2021-2025 foresees some measures:

- an awareness campaign that encourages consumers and businesses to subscribe to a scalable, fixed network service that meets their specific needs,
- facilitation of the deployment of vertical cabling within multihousehold buildings, considering the differing interests of the parties involved, e.g. tenants and owners,
- boost sustainable investment in the development of networks in remote areas.

Luxembourg's Recovery and Resilience Plan amounts to EUR 82.7 and has foreseen 30% of this (EUR 24.5 million) to digital transformation. Yet, the RRP does not include any investment in broadband networks, as the policy focus is on ensuring that private investment is sufficient to fulfil the objectives for 2025.

The government has developed a Broadband service mapping tool[111] that shows the level of broadband coverage for each municipality in Luxembourg. The map is based on fixed network operators' data (Docsis, VDSL and Fibre). Another important tool is the National Road Works Register[112] that contains all the applications for road and roadside permits, which have been submitted by businesses. It also contains information concerning public infrastructure works planned by communes and public administrators on telecommunications, gas, electricity and water networks, etc.

The Checkmynet.lu[113] tool measures the performance and quality of internet access services for end users and is free-of-charge. If a consumer finds the measured bandwidth to be lower than the one

[110] https://innovative-initiatives.public.lu/stories/luxembourgs-5g-strategy
[111] http://g-o.lu/izhky
[112] https://guichet.public.lu/en/entreprises/urbanisme-environnement/construction-amenagement-site/travaux-proximite-voirie/registre-travaux.html
[113] https://checkmynet.lu/home

contracted, they can contact their provider; if they do not receive a reply or the reply is unsatisfactory, the consumer can use ILR's[114] mediation service free-of-charge.

Luxembourg introduced the following obligations:

- Obligation to provide reception infrastructure for fibre optic. Municipalities have been asked to make reception infrastructure compulsory.
- Obligation to provide high speed broadband-ready in-house cabling in new dwellings. Appropriate in-house cabling is compulsory for all newly constructed buildings, and already existing multi-dwelling buildings in the event of major renovation works, for which applications for building permits have been submitted after 31 December 2016.
- Obligation of access of alternative operators to the network of the incumbent.

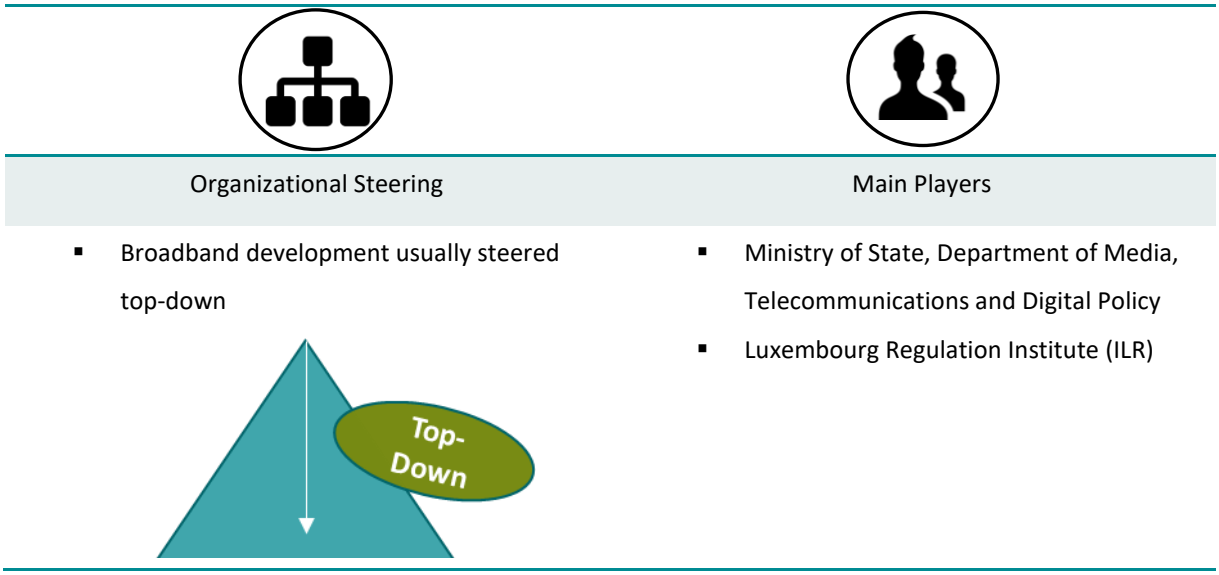


Figure 45 Organizational Steering & Main Players Luxembourg

7.2.18.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

Luxembourg is a small but economically prosperous country and it places a strong emphasis on technology and connectivity. Luxembourg has a well-developed and advanced telecommunications infrastructure.

The level of digital skills is in Luxembourg above EU average, e.g. the internet is used by 95% and the level of at least basic digital skills is at 64%.

[114] https://web.ilr.lu/FR/ILR

The broadband prices are slightly dropped and are a bit lower than in the EU. Overall fixed broadband take-up is at 90,77%. The NGA coverage is very high at 99.4 %.

The fixed VHCN coverage (93,3%) and FTTP coverage (76,2%) are both 20 points above EU average. Yet the expansion of coverage was very modest in recent years. Especially worrying is low progress in FTTP rollout (only 4,1% increase in the last two years).

The take-up of fixed VHCN or more is growing fast in the recent years. High demand for fast broadband reflects in 73,6% take-up of at least 100 Mbps fixed broadband (21 points increase in the last two years). Yet the at least 1 Gbps broadband take-up is below EU average at low 6,67%.

The state owned incumbent operator POST is the only significant contributor to fibre roll-out. POST is relying increasingly on opportunities for co-deployment with other infrastructure providers. This results in less predictability as to where new fibre lines will be available and by when. At the same time, POST is upgrading its GPON fibre infrastructure to point to point. The cable operators are investing in the upgrading of their networks to DOCSIS 3.1 technologies. The FTTP coverage (76,2%) was growing steadily during last decade. The probability is **high** that Luxembourg reaches the "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" and the "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" targets.

The upgrading of the radio network existing sites by mobile operators and the setting up of new sites is challenging as various authorities at municipality level have to be consulted, environmental and town planning requirements have become stricter. The various levels of permit granting are slowing down the roll-out of fibre and mobile networks. Prices for broadband access (both mobile and fixed) are slightly lower compared to the EU average. 5G services were commercially launched relatively late, but catched-up quickly with the rest of the EU. The overall 5G coverage is 93,21 %. The 60,8% of 5G spectrum was made available to operators. The probability is **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met.

Further roll-out of fibre will have a key role to play in meeting the Gigabit for everyone target. Luxembourg was strong in rolling out communication infrastructure in the last decade. Therefore, considering current FTTP coverage coupled ambitious plans of the broadband strategy (access to 1 Gbps download and 200 Mbps upload in a fixed network for all by 2025), the probability is **high** that Luxembourg will provide gigabit speeds for all by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	high
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 57 Probability of achievement of connectivity targets in Luxembourg

7.2.19 Malta

Malta facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	542,051 (0.1 % of EU-27)[I]
Population density:	1,656.7 per km^2 (EU average: 109 per km^2)[I]
Size:	315 km^2
Topography:	Three larger inhabited islands
Fixed Very High Capacity Network (VHCN) coverage	100 % of households (EU average: 73,42 %)
FTTP coverage:	56,24 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 58 Malta facts & figures

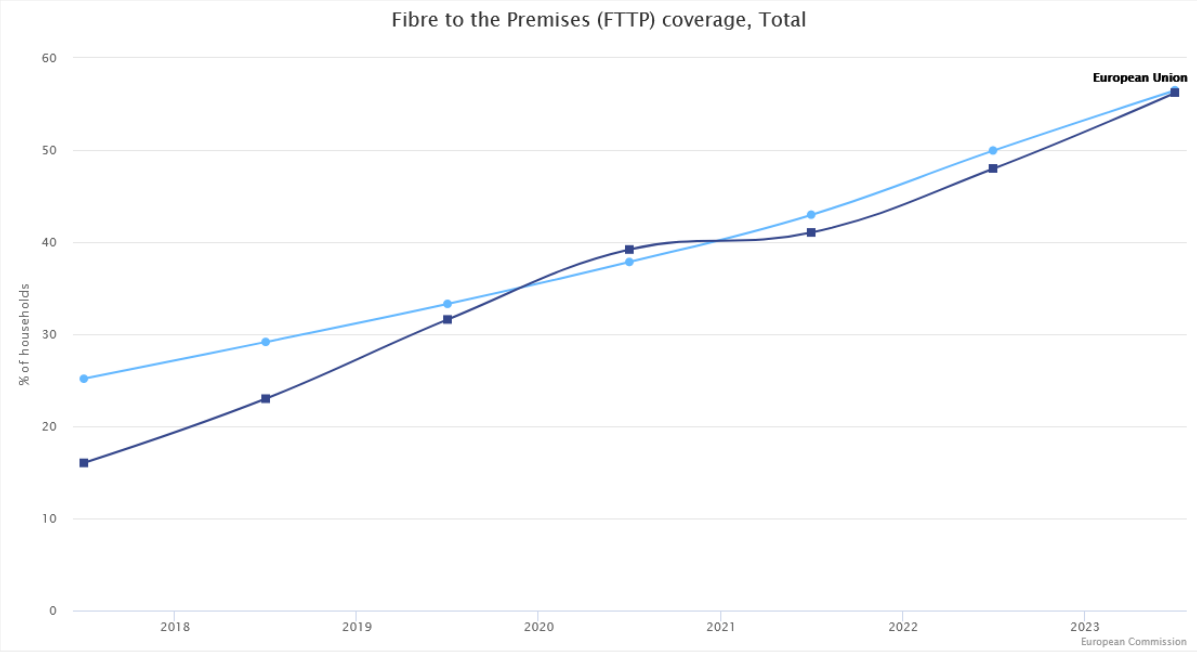


Figure 46 Percentage of households covered by FTTH and FTTB. Malta in comparison to EU. DESI 2023.

7.2.19.1 *Key Features*

National Broadband Plan

National Broadband Plan of Malta: key facts	
Main strategic document(s):	Malta Diġitali 2022-2027
Targets:	▪ align with the Digital Compass, no specific infrastructure targets set

Table 59 NBP Malta key facts

The Malta Diġitali 2022-2027[115] focuses on the transformation that is required through the digital aspect, aiming at a better society and a thriving economy. It builds on the progress in the realisation of Malta's preceding Digital Malta Strategy 2014-2020. Malta Diġitali's Vision is to establish digital as the key driving force for the transformation required to:

- Make the lives of Maltese citizens better, enable businesses to thrive, and make government services more accessible.
- Achieve economic growth through innovation and further strategic focus on specific societal and economic areas of importance.

Digital dimension is regarded as the driving force for transformation leading to a better society and a thriving economy. One of the Strategy's high-level goals is to prioritise investments in technical and infrastructural digital capabilities. The regulation and legislation, infrastructure and funding are considered as generic strategic enablers for the digital transformation. One of the planned actions is to support continued investment in local and international digital connectivity, provide broader access to the internet, and strengthen the resilience of Malta's national infrastructure.

Malta Diġitali is rather strategic than operational, mainly general statements and provisions are included. Concerning the supply side, Malta relies on a market driven approach which seems feasible considering the high population density.

The Malta Information Technology Agency (MITA) published its MITA Digital Strategy 2021-2023[116]. The strategy aims to, among others strengthen core services and connectivity in terms of resilience, security and redundancy.

[115] https://www.maltadigitali.mt/

[116] https://mita.gov.mt/2021/02/04/mita-strategy-2021-2023/

Malta issued a "National Roadmap for the UHF band between 470 –790 MHz"[117] in 2018 as well as a discussion paper and survey "5G Demand and Future Business Models. Towards a Feasible 5G Deployment"[118] in 2019, with references to Gigabit Society 5G targets.

Main Challenges for gigabit connectivity in Malta:

- Fibre to the Premises coverage 56,24 % of households
- High DOCSIS 3.1. market share may make fibre rollout more difficult

Funding programmes and support measures

Malta's Recovery and Resilience Plan foresees EUR 67.6 million (26%) to the digital transformation. A large part thereof is expected to contribute to the Digital Decade targets. Yet none of the RRP measures is dedicated to digital infrastructure targets.

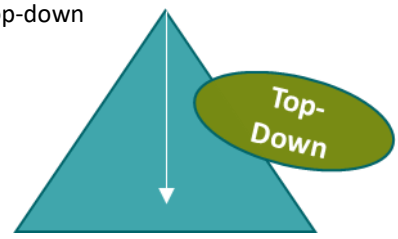
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Office of the Prime Minister ▪ Ministry for the Economy, European Funds and Lands ▪ Malta Information Technology Agency (MITA) ▪ Malta Communications Authority (MCA)

Figure 47 Organizational Steering & Main Players Malta

7.2.19.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

Malta is known for having a well-established telecommunications network, including fixed broadband and mobile services. The country has been investing in improving its digital infrastructure to keep pace with technological advancements. The government has also been active in promoting digitalisation of public services, digital transformation of businesses as well as digital literacy and skills to ensure that the country can benefit from the opportunities presented by the digital age. The level of internet use and digital skills slightly above the EU average is a positive indicator, suggesting that Malta's population is relatively well-prepared for the challenges and opportunities associated with digitalization.

[117] https://www.mca.org.mt/sites/default/files/700MHz%20Roadmap%20MCA_O_18_3256_0.pdf
[118] https://www.mca.org.mt/sites/default/files/5G%20discussion%20paper%20and%20survey.pdf

The main sources of connectivity within Malta are fibre, xDSL and cable networks. Malta's very high population density favours broadband infrastructure deployment. Densely populated areas often have cable networks available and distances to the next street cabinet are short enough so that VDSL and DOCSIS 3.1 became viable solutions for high speed connectivity. The fixed VHCN coverage is at 100% already since year 2019. The VHCNs are offering download speeds of up to 1Gbps provided by a hybrid fibre-coax network based on the DOCSIS 3.1 standard.

The FTTP coverage is with 56,24% close to the EU average, and increased by solid 15,3% in the last two years. The incumbent operator continues to invest in its fibre network with the aim of reaching full coverage over the coming years. Operator Epic received a EUR 20 million loan[119] from the EIB and plans investments in early deployment of 5G, roll-out of fixed very high capacity (VHCN) network as well as upgrades to the core network and the IT systems. The commitment is to cover 25% of Maltese households by 2024.

Overall fixed broadband take-up is with 88% above the EU level. The at least 100 Mbps fixed broadband take-up has increased by 18 points in the last two years towards solid 60,45%. However, the at least 1 Gbps broadband take-up is low with only 6,4%. This relatively low at least 1 Gbps broadband penetration rate might be a result of different developments. VDSL and cable currently deliver bandwidths that are sufficient for applications as of today and both technologies are able to deliver reliable VHCN connections. As demand for gigabit bandwidths is relatively low, there are few incentives to further invest in technologies that are capable of symmetric gigabit speeds. The demand side is lacking dynamism, among other reasons, due to relatively high prices. The higher bandwidths throughout Malta are a result of upgraded networks and not the demand for better connections. A large part of the connectivity networks in Malta is aerial and bringing it underground may require improved access to physical infrastructure and coordination of civil works.

The MCA subsequently established a 5G think tank and engaged with relevant stakeholders to highlight the potential benefits of 5G technologies. In September 2020 the operator Melita[120] was granted a trial license and started 5G trials. [121] Spectrum in all three 5G bands was made available in 2021. One mobile operator already operates a nationwide 5G network, and the other two operators plan to reach full coverage by the end of 2023[122]. Though only 25% of 5G spectrum was made available to operators,

[119] https://www.eib.org/en/projects/pipelines/all/20210442
[120] https://www.melita.com/mobile/5g-trial-results/
[121] https://5gobservatory.eu/public-initiatives/national-5g-plans-and-strategies/#1533566034425-f21fbb40-37e4
[122] https://www.mca.org.mt/sites/default/files/Assignment%20process%20for%20additional%20spectrum%20for%20wireless%20broadband%20electronic%20communications%20service.pdf

the overall 5G coverage skyrocketed towards 100% in the last two years. The mobile broadband take-up is at 86,8%.

Summing up, altogether Malta has a demographic and topographic structure which is supporting the roll-out of infrastructures with even higher capabilities than those of today. Therefore, there is no doubt that Malta is fit for its digital future. Malta already **reached** the Gigabit Society targets for 2025 and probability is **high** that symmetric gigabit speeds for everyone are provided by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	reached
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	reached
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	reached
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 60 Probability of achievement of connectivity targets in Malta

7.2.20 Netherlands

Netherlands facts & figures	
Degree of self-governance:	Unitary state (Constitutional monarchy)
Population:	17,811,291 (4 % of EU-27)[I]
Population density:	512.8 per km^2 (EU average: 109 per km^2)[I]
Size:	41,542 km^2
Topography:	Low coastal area (16 % below sea level protected by dikes, hill ranges in the south)
Fixed Very High Capacity Network (VHCN) coverage	97,8 % of households (EU average: 73,42 %)
FTTP coverage:	63,42 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 61 Netherlands facts & figures

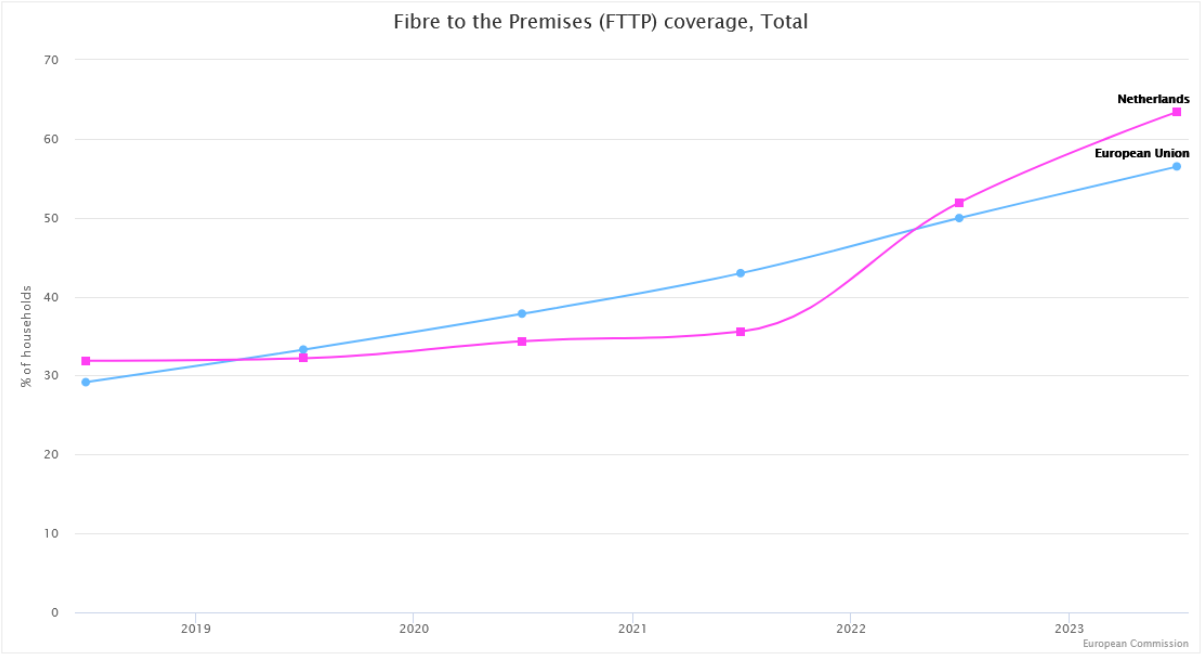


Figure 48 Percentage of households covered by FTTH and FTTB. Netherlands in comparison to EU. DESI 2023.

7.2.20.1 *Key Features*

National Broadband Plan

National Broadband Plan of Netherlands: key facts	
Main strategic document(s):	Dutch Digitalisation Strategy 2021 Connectivity Action Plan
Targets:	▪ access to least 100 Mbps for all by 2023 ▪ vast majority should be taking advantage of 1 Gbps by 2023 ▪ basic mobile services available anytime and anywhere

Table 62 NBP Netherlands key facts

The Netherlands is one of the top ranking member states in terms of VHCN coverage and aims to remain the European digital leader. The Dutch Digitalisation Strategy was updated in 2021[123] and states what is needed to get the Netherlands ready for the digital future. The challenge for the government is to speed up and support the digital transition in public sectors and to strengthen further privacy protection, cybersecurity, digital skills and fair competition. Connectivity based on the World-class fixed and mobile infrastructure is one of foundation pillars of the strategy.

The Connectivity Action Plan[124] refines the objectives of the Dutch Digitalisation Strategy and outlines the government's efforts of providing high-quality connectivity that can serve a wide range of demands and is available at competitive prices anytime and everywhere. In this plan, the Dutch government supports the EU Gigabit Society targets. One of the objectives is high-quality connectivity, which means more bandwidth, but above all meeting quality parameters, such as reliability of a network, low susceptibility to interference, good response speeds, low latency and high security. All households should have the opportunity to access broadband networks of at least 100 Mbps and a vast majority should be taking advantage of 1 Gbps by 2023.

The plan opts for a market-based infrastructure roll-out. It also puts key emphasis on the role of local and regional actors in coordinating and simplifying the process. Most of the broadband infrastructure roll-out is done by private operators autonomously.

Main Challenges for gigabit connectivity in the Netherlands:

- Low at least 1 Gbps broadband take-up (0%)
- Coordination between central and local governments
- No centralized comprehensive service mapping tool

[123] https://www.nederlanddigitaal.nl/documenten/publicaties/2021/06/22/the-dutch-digitalisation-strategy-2021-eng
[124] https://zoek.officielebekendmakingen.nl/blg-848095.pdf

Here, removing barriers and facilitating the exchange of information and best practices among stakeholders are the principal tasks of local governments to stimulate investment by operators.

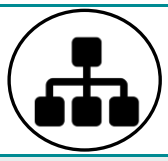
The Digital economy strategy (Nov 2022, Strategie Digitale Economie)[125] lists "Expanding reliable and strong digital infrastructure" as one of the main pillars and intends to close the digital divide with 19,000 addresses in the remote areas.

The Netherlands Authority for Consumers and Markets (ACM) released a paper on 5G in December 2018[126]. The paper covers regulation and the regulator's role with regard to 5G. The ACM explains where 5G overlaps with its duties (within the boundaries of its regulatory framework) to help the market participants to make choices with regard to the roll-out of the 5G-network.

Funding programmes and support measures

In the Roadmap for the implementation of the Connectivity Toolbox, various efforts have been made to coordinate between local and national governments regarding permit granting procedures. Next to information and knowledge sharing, the Ministry of Economic Affairs and Climate Policy created a taskforce of national and local authorities, to develop a uniform approach to permit-granting procedures for antennas and access to physical infrastructure for small cells. The government also introduced the possibility to establish broadband coordinators and develop guidelines on fees.

The Recovery and Resilience Plan by the Netherlands has the amount of EUR 4.7 billion plan. 25.6% of the total (EUR 834.4 million) will help achieve Digital Decade targets. The the digital transformation will be supported by investments to promote innovative technologies and digital skills, future-proofing the mobility sector, and future-proofing the government's IT infrastructure.

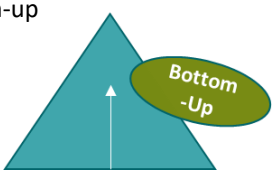


Organizational Steering

Main Players

[125] https://www.nederlanddigitaal.nl/documenten/publicaties/2022/11/16/strategie-digitale-economie
[126] https://www.acm.nl/en/publications/5g-and-netherlands-authority-consumers-and-markets

- Broadband development usually steered bottom-up



- Ministry of Economic Affairs and Climate Policy
- Authority for Consumers and Markets
- Dutch Authority for Digital Infrastructure
- Local & regional authorities

Figure 49 Organizational Steering & Main Players in the Netherlands

7.2.20.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

The population is well prepared for the digital transformation. The level of digital skills and internet use are way above EU average. The Netherlands also is a high performer in connectivity. The fixed broadband take-up is at 97%. NGA coverage is above the EU average (99.2 % of households in total). There is no significant digital divide. Due to the relatively high population density and small size of the Netherlands, xDSL and cable networks are feasible technologies to deliver high speed connections to the Dutch citizens. Yet, reaching the most remote households is challenging and costly.

VHCN coverage increased by 8,1% since DESI 2021 and is at 97,8 %, largely reflecting the upgrade of cable networks to DOCSIS 3.1 and fibre rollout. Covering the remaining households may prove to be more challenging, especially for the 20,000 most remote households.

Total FTTP coverage is 63,42 %. The operators invest in FTTP and there are also local initiatives (e.g. cooperatives) deploying future-proof technologies on their own.

The probability is **high** that the targets “Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises” is reached. Yet achieving the target “Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households” by 2025 may become more challenging in remote areas – the probability is **medium**.

Broadband prices in the Netherlands are generally slightly higher than the EU prices, except for mobile broadband prices which are slightly lower. The take -up 100 Mbps or more is at 52,65 %, with growth of 11,9% compared to two years before.

The overall 5G coverage is at impressive 99.9 %, though only 33,33% of 5G spectrum was assigned and stagnating since DESI 2021. Trial licences for 5G were granted already in 2017. Pilots have started in all major cities at local and regional level. The multi-band 700/1500/2100 MHz auction was completed in July 2020 raised 1.23 billion EUR. 5G was launched by VodafoneZiggo in April 2020, by T-Mobile and

KPN in July 2020.[127] There is some opposition to 5G developments, as a 5G protest movement filed a complaint in court against the Dutch government, claiming that the 5G technology poses potential health risks. The probability of reaching the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" target by 2025 is **high**.

Overall, the Netherlands are in a very good position in broadband development. There VHCN coverage is very high, FTTP coverage is above EU average and increasing substantially. Furthermore, demand for ultrafast bandwidths is strong and ICT services well accepted. VHCN take-up is increasing and a high population density favours the efficient upgrade and exchange of networks. The probability is **high** that Netherlands can provide gigabit connectivity for everyone by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 63 Probability of achievement of connectivity targets in the Netherlands

[127] https://5gobservatory.eu/public-initiatives/national-5g-plans-and-strategies/#1533566064328-14011b01-f20a

7.2.21 Poland

Poland facts & figures	
Degree of self-governance:	Unitary state (parliamentary republic)
Population:	36,753,736 (8,2 % of EU-27)[I]
Population density:	122.9 per km^2 (EU average: 109 per km^2)[I]
Size:	312,679 km^2
Topography:	Central lowlands (Polish Plain), Silesian lowlands in the west, mountain ranges in the south, Baltic coastal plains in the north
Fixed Very High Capacity Network (VHCN) coverage	70,7 % of households (EU average: 73,42 %)
FTTP coverage:	59,53 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 64 Poland facts & figures

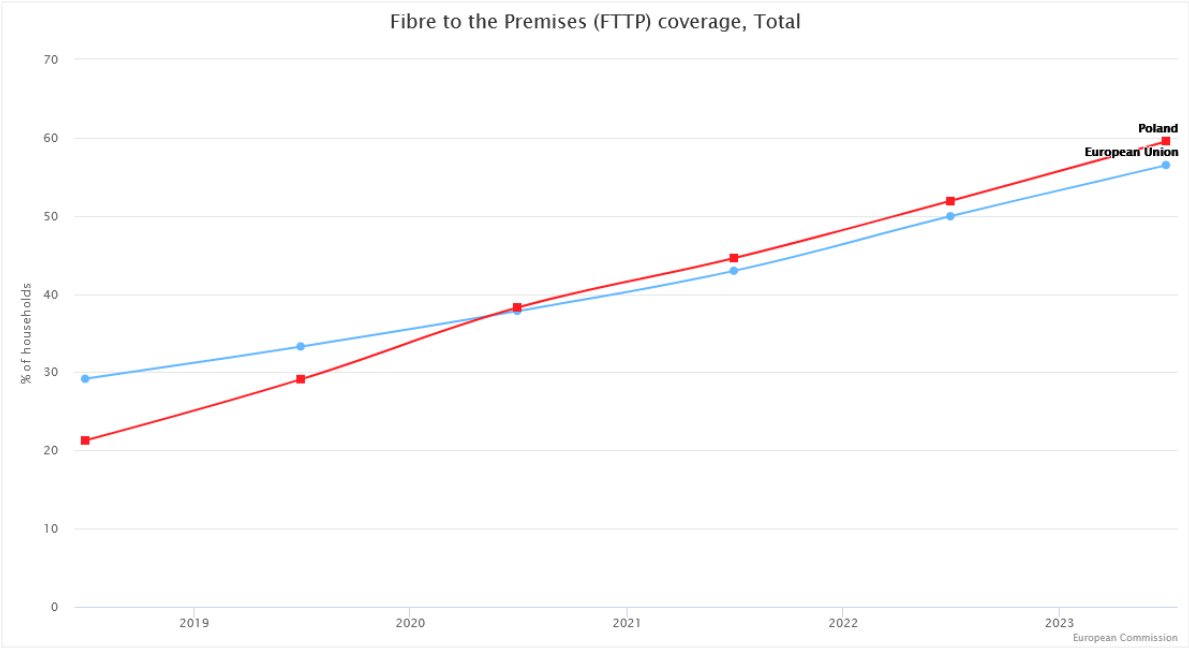


Figure 50 Percentage of households covered by FTTH and FTTB. Poland in comparison to EU. DESI 2023.

7.2.21.1 *Key Features*

National Broadband Plan

Poland's national broadband plan was updated in 2020[128]. The plan is closely connected with the strategic and implementing documents of the European policy in the area of the development of broadband networks. The objectives and its impact were set until 2025. Support from cohesion policy funds is planned for the years 2021–2027. The plan aims to achieve Gigabit Society objectives:

National Broadband Plan of Poland: key facts	
Main strategic document(s):	National Broadband Plan 2025
Targets for 2025:	▪ 100 % coverage with 100 Mbps upgradable to 1 Gbps ▪ 1 Gbps for all socio-economic drivers ▪ 5G connectivity on major routes and in major urban centres

Table 65 NBP Poland key facts

- universal access to 100 Mbps, with the possibility to upgrade to gigabit speed,
- at least 1 Gbps for all socio-economic drivers, e.g. schools, transport hubs, major public service locations and companies with intensive Internet activity, as well as
- 5G connectivity on all major communication routes and in major urban centres.

The national broadband plan mainly focuses on promoting broadband investments and expansion through initiating regulatory, legal and financial measures. Optical fibre is considered the medium on the basis of which networks are to be built. Achieving the objectives requires that fibre participates in transmission over longer and longer distances, getting closer and closer to households.

The plan foresees stimulation of the development of broadband infrastructure by elimination of investment barriers, use of cohesion policy and national funds. Government plans also activities stimulating demand for high-speed Internet access services.

A multi-stakeholder Agreement for the Strategy 5G for Poland[129] has been formed to respond to challenges, identify and implement measures aiming at coverage by 5G networks. The project "National research laboratory for 5G networks and services with its surroundings" (PL-5G)[130] aimed to build a research infrastructure on a national scale for conducting practical research on 5G technologies and services.

[128] https://mc.bip.gov.pl/articles/view/325195/narodowy-plan-szerokopasmowy.html
[129] https://www.gov.pl/web/cyfryzacja/strategia-5g-dla-polski
[130] https://www.gov.pl/web/instytut-lacznosci/pl-5g

The NBP estimates the investments necessary to reach the aims, as well as the gap between the forecast of private investments and the necessary total investments. The estimated financing gap in the implementation of the plan ranges from PLN 8.24 billion (EUR 1,84 billion) to PLN 21.6 billion (EUR 4.83 billion).

Main Challenges for gigabit connectivity in Poland:

- Insufficiently fast pace of broadband infrastructure development in rural and remote areas
- Legal, administrative, financial and technical barriers to investment process
- Demand for better quality services growing slower than infrastructure development
- Low use of infrastructure (water and sewage, road, electricity, etc.) and implementation of smart grid for synergistic development of telecommunications networks
- Low at least 1 Gbps broadband take-up (3,42%)

Funding programmes and support measures

State aid funding for broadband infrastructure thereby comes from both EU and national funds. Poland's broadband plan states that monetary resources from the EU are made available via the the Operational Programme Digital Poland 2014-2020[131]. The OP provides funding mainly for investments in digitally excluded areas. In the context of Digital Poland, telecommunications companies receive funds for the construction, extension or restructuring of broadband internet access and support for e-administration and e-services in collaboration with the local and central government administration. Local government units can use this programme to implement tasks aiming at e-integration and e-activation to increase intensity and quality of the use of internet. It is envisaged by Polish decision-makers to shift the responsibility for the distribution of EU funds in Poland to provinces ("województwa") and therewith increasing the importance of the regional operational programmes. The overall budget for the OP Digital Poland is EUR 2.57 billion, of which more than EUR 1 billion is dedicated to broadband.

The European Funds for Digital Development 2021-2027 programme[132] is a continuation of the Digital Poland Programme and is the next stage of the country's digital transformation. With a total budget of EUR 2 billion the scope of support under is complementary to the support of other programs implementing the objectives of cohesion policy for 2021-2027 and other national and EU instruments. Program objectives foresee i.a. building a gigabit society in Poland, increasing access to ultra-fast broadband Internet. The subsidies in these areas are addressed to telecommunications entrepreneurs and public administration.

[131] https://www.polskacyfrowa.gov.pl/
[132] https://www.rozwojcyfrowy.gov.pl

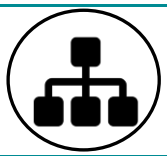
Poland has adopted a programme for the Nationwide Education Network[133] (Ogólnopolska Sieć Edukacyjna), which aims at providing all schools in Poland (circa 19,500 locations) with free of charge access of at least 100 Mbps, along with advanced cybersecurity measures and educational e-resources & e-tools. The programme is financed by state budget (approximately €310 million by 2027). The implementation phase (2018-2020) was also co-financed by the OP Digital Poland.

In its Roadmap implementing the Common Union Toolbox for Connectivity, Poland identifies as desirable a range of reforms concerning e.g. digitisation of permit-granting procedures, issuing guidelines on access to physical infrastructure, and further strengthening the Single Information Point.

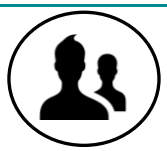
Measures contributing to the digital transition in the Recovery and Resilience Plan (RRP) account for 21.3% (over EUR 7.5 billion) of the plan's total allocation. EUR 6.8 billion is expected to contribute to achieving the Digital Decade targets. The planned measures are expected to boost Poland's digital transformation, by i.a. developing the broadband and 5G network, improving the delivery of public services to businesses and citizens, digitising public administration, and strengthening resilience and cybersecurity. They measures also help digitalising of the education system and the development of digital skills. The total amount allocated to investments in network infrastructure is EUR 1.4 billion for fixed broadband and EUR 1.2 billion for mobile broadband.

The Broadband Fund, which began its operation at the end of 2020, will also support investments in the deployment of NGA networks. The Fund is financed through charges borne by telecommunications firms for numbering resources, rights to use radio spectrum, etc. The annual allocation for 2022 was estimated at 130 MPLN (approx. EUR 29 million). A first pilot call for proposals[134], addressed to local municipalities, was launched in May 2022. The awarded projects started implementation at the beginning of 2023.

Atlas of broadband Internet access[135], setup by UKE, is an interactive map of high-speed broadband services indicating the services provided, as well as the telecommunications infrastructure and networks.



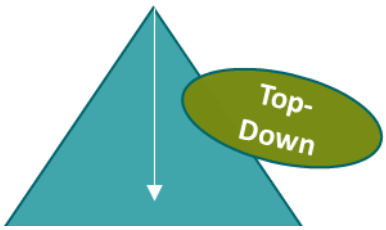
Organizational Steering



Main Players

[133] https://www.gov.pl/web/cppc/ogolnopolska-siec-edukacyjna-ose
[134] https://www.gov.pl/web/cyfryzacja/fundusz-szerokopasmowy--pierwszy-nabor-wnioskow
[135] https://mapbook.uke.gov.pl/

- Broadband development usually steered top-down



- Ministry of Digital Affairs
- Digital Poland Project Centre
- Ministry of Funds and Regional Policy
- Office of Electronic Communications (UKE)

Figure 51 Organizational Steering & Main Players Poland

7.2.21.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

The use of internet and digital skills in Poland are slightly below the EU level. The investments in the telecommunications market and take-up of broadband are increasing. According to UKE, revenues from telecommunications activities in 2022 decreased by 0.4% compared to 2021 and amounted to PLN 40.63 billion. Expenditures on telecommunications investments amounted to PLN 11.24 billion, which means an increase compared to 2021 by 26.3%. Revenues from mobile telephony services increased to PLN 14.40 billion (by 7.6%). The traditional landline telephony market continues to lose popularity. Penetration of the fixed-line broadband Internet services increased for another year in a row.[136]

The urban rural divide still persists, and the state aid measures are an important aspect to increase coverage in the near future as a significant part of the country still needs to be covered by fixed technologies. People living in rural areas account for nearly 40% of the country's population and that the average population density of rural areas in Poland is about 50 people per km2. The achievement of Gigabit Society 2025 targets will require large efforts. The NGA coverage rate is 78,16 %. The fixed VHCN coverage is at 70,7 %, with stable but slowing down growth since 2020. The FTTP coverage is at 59,53 % (slightly above EU) and the growth in the last years was substantial. Coupling this with the efforts of the programme for the Nationwide Education Network as well as the programmes Digital Poland & European Funds for Digital Development, and being optimistic about private investments in the telecom market, the probability is **high** that Poland reaches the target “Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises” by 2025.

[136] https://uke.gov.pl/akt/raport-o-stanie-rynku-telekomunikacyjnego-w-2022-roku,485.html

The broadband prices in Poland are lower than in the EU. The overall fixed broadband take-up is 68,81%, the at least 100 Mbps fixed broadband take-up is above EU level with impressive 65,2%, with increase by 28,5% in the last two years. The at least 1 Gbps broadband take-up is still very modest at 3,42%. The demand side some hurdles to overcome such as the level of digital skills, knowledge and acceptance of its advantages by some social groups, administration and businesses.

Considering the substantial urban rural divide and challenging territory with mountainous areas as well as vast rural areas with low population density, the probability is **low** that the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is met by 2025.

5G deployment is delayed, mainly due to postponed assignment of spectrum. Even if the overall 5G coverage increased steeply in the last years towards 63,43% (EU 81,2%), the current deployment is based on other frequencies thereby not allowing for advanced applications as Poland has not yet assigned radio spectrum for 5G deployment. The 5G services were launched by Polkomtel with 2.6 GHz spectrum in May 2020, by T-Mobile Poland early June 2020 in 2100 MHz spectrum, by Orange in July 2020 on 2100 MHz. Being a bit cautious, the probability is assessed as **medium** that Poland achieves the "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" target.

Overall, Poland has already made substantial progress and will continue to do so. For the future, an even stronger focus on the demand stimulation measures and the already growing number of FTTP investments, incentivising further intensive financing, both from the side of investors as well as financial institutions, would be desirable. Together with well-spent state aid funds, there is a good chance that Poland will significantly improve its infrastructure and prepare itself for its digital future. Yet, investments in vast rural areas may prove to be lengthy and costly. The probability is **medium** that Gigabit for everyone is provided by 2030 in Poland.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	medium
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium

Table 66 Probability of achievement of connectivity targets in Poland

7.2.22 Portugal

Portugal facts & figures	
Degree of self-governance:	Unitary state (semi-presidential representative democratic republic)
Population:	10,467,366 (2.3 % of EU-27)[I]
Population density:	113,9 per km^2 (EU average: 109 per km^2)[I]
Size:	92,226 km^2
Topography:	Low coastal area, lowlands in the north, uplands north of the Tejo river, hill ranges in the south and two archipelagos (Azores and Madeira)
Fixed Very High Capacity Network (VHCN) coverage	93 % of households (EU average: 73,42 %)
FTTP coverage:	90,8 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 67 Portugal facts & figures

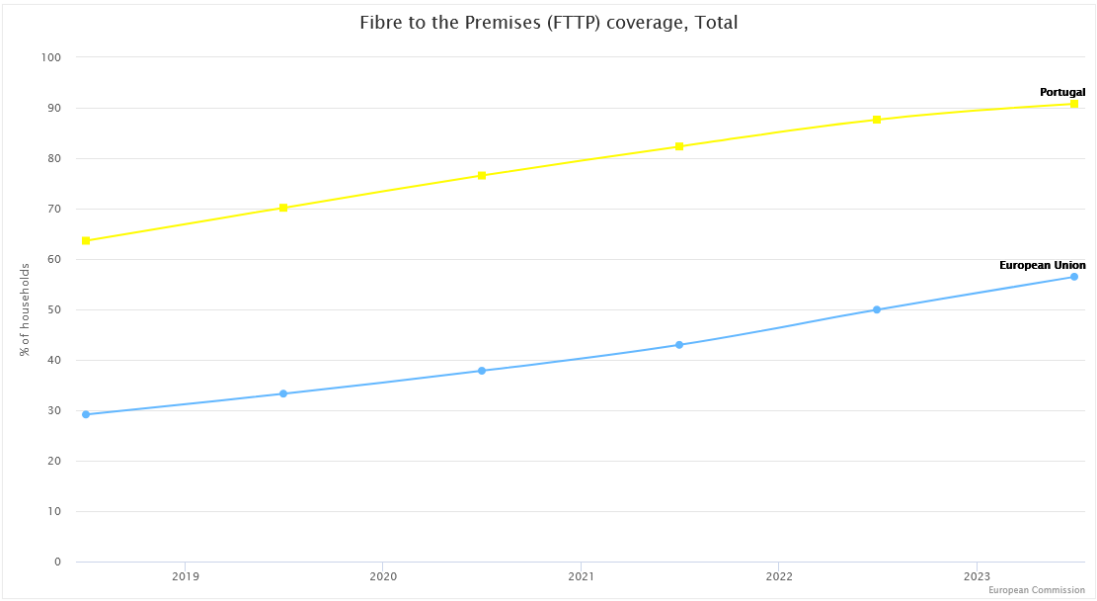


Figure 52 Percentage of households covered by FTTH and FTTB. Portugal in comparison to EU. DESI 2023.

7.2.22.1 *Key Features*

National Broadband Plan

The "Agenda Portugal Digital - Portugal's Action Plan for Digital Transition" [137] was updated in 2021[138]. It aims at development of a digital infrastructure that allows citizens to take advantage of the new opportunities offered by technologies, yet does not set any more concrete aims related to broadband infrastructure. The plan comprises three main pillars of action and a catalyst dimension:

- Pillar I – Capacity building and digital inclusion,
- Pillar II – Businesses' digital transformation,
- Pillar III – Public services' digitalisation.

Connectivity and infrastructure are mentioned as one of the catalysts.

National Broadband Plan of Portugal: key facts

Main strategic document(s):	Agenda Portugal Digital National Strategy for Connectivity in Very High Capacity Electronic Communication Networks for 2023-2030
Targets:	▪ digital infrastructure that allows citizens to take advantage of the new opportunities offered by technologies ▪ gigabit for all by 2030

Table 68 NBP Portugal key facts

The government approved the National Strategy for Connectivity in Very High Capacity Electronic Communication Networks for 2023-2030 in December 2022[139]. The aim of the Strategy is to ensure that all households are covered by a Gigabit network by 2030. The financing will be ensured by (i) private funding sources, where investments can be made under market conditions; and by (ii) public funds, where market failures may lead to the exclusion. In the "white areas", this public investment is complementary to private investment. The public intervention to support the installation of very high capacity networks in "white areas" is a proportional measure limited to the minimum necessary to achieve the objective of promoting equity and territorial cohesion in access to an infrastructure that is essential for citizens and for business needs. The strategy will make it possible to launch public tenders to install, manage and operate high capacity networks in 'white areas'. ANACOM will monitor broadband mapping and the installation of networks through Key Indicators.

[137] https://portugaldigital.gov.pt/

[138] https://www.anacom.pt/render.jsp?categoryId=347603

[139] https://diariodarepublica.pt/dr/detalhe/resolucao-conselho-ministros/139-2022-205378564

As a part of the Portugal 2030[140] there are plans of deploying VHCN to households as well as to industrial, commercial and agricultural premises by 2030. A call for tenders on deployment, operations and maintenance of fixed VHCN in "white areas" is to be launched in 2023.

The law on electronic communications (Law 16/2022)[141] that transposes Directive (EU) 2018/1972 of the European Electronic Communications Code (EECC) was adopted in August 2022. This law updates Portugal's regulatory framework in the field with the aim of facilitating investments into the country's very high capacity network.

Main Challenges for gigabit connectivity in Portugal:

- Low at least 1 Gbps broadband take-up (4,5%)
- Rural-urban divide in FTTP coverage (60% rural compared to 90,8% total)
- Relatively high broadband prices
- Relatively high (17%) number of individuals who do not the internet

Funding programmes and support measures

In its Recovery and Resilience Plan (RRP), Portugal has allocated 22% (EUR 3.6 billion) to digital skills, digital transformation in businesses and investments in public administration helping modernise public financial management. The Plan foresees EUR10 million to strengthen 5G coverage in commercial areas.

A new aid scheme with an allocation of total EUR 160.14 million is to support VCN role out and will be partially co-financed by EU funds. The white areas were identified and ANACOM has conducted two public consultations and published a report on the deployment and coverage of very high capacity fixed networks.[142]

Portugal's roadmap to implement the Connectivity Toolbox foresees revising the legislation to provide model regulations on electronic communications network deployment, launching a digital guide, and new cooperation between the government, the ANACOM and the municipalities to harmonise permit-granting procedures. Portugal also plans to set up a permanent group for improving transparency through the single information point and the right of access to existing physical infrastructures.

The public geo-referenced information portal[143], established by ANACOM, provides data on fixed broadband and mobile broadband coverage. The data is updated on a quarterly basis.

[140] https://portugal2030.pt/o-portugal-2030/o-que-e-o-portugal-2030/
[141] https://files.dre.pt/1s/2022/08/15700/0000200137.pdf
[142] https://www.anacom.pt/render.jsp?contentId=1746524
[143] https://geo.anacom.pt/publico/home

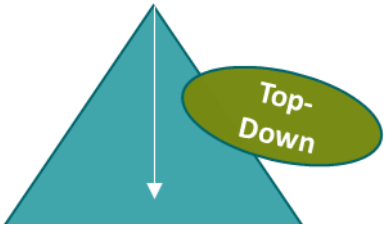
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Secretary of State for Digitalisation and Administrative Modernisation ▪ Ministry of Infrastructure and Housing ▪ National Communications Authority (ANACOM)

Figure 53 Organizational Steering & Main Players Portugal

7.2.22.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Portugal has made significant progress concerning its ICT infrastructure. Public investments and competition between private operators are driving the expansion of broadband in Portugal.

The VHCN coverage is 93%. The increase in the VHCN coverage is due to rollout of of optical fibre networks (FTTH) and the introduction of DOCSIS 3.x in cable TV networks. These two types of networks were accountable for 70% and 29% of coverage with at least 100 Mbps, respectively. The share of cable and xDSL in total broadband access continues to fall. There is a strong infrastructure-based competition between cable and FTTP networks. As usual, this kind of competition is considerably weaker in rural areas, where both cable and FTTP networks are less available, even though the rural coverage rate for both technologies is generally relatively high. FTTP is being deployed by both, the incumbent and AOs. Besides regulated access to ducts, some operators made agreements to reciprocally use their respective fibre infrastructures. Fibre (FTTH) is the main medium of fixed broadband Internet access, making up 65 % of total.[144] The FTTP coverage is at impressive 90,8 %. With 60 % FTTP coverage, the rural areas are lagging behind. The increase in FTTP coverage is was stable in the last years, even if slightly slowing down.

The VHCN take-up is at 77.8 % and growing, even if broadband prices are higher than the EU average. However, the at least 1 Gbps broadband take-up is very low at 4,5%.

[144] https://www.anacom.pt/render.jsp?contentId=1751514

Due to impressive progress in VHCN and FTTP rollout the probability is **high** that the targets "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" as well as "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" are met by 2025.

ANACOM works to create conditions for a consistent and competitive development of 5G[145]. Portugal assigned 700 MHz and 3.6 GHz bands as part of a multi-band auction that concluded in October 2021[146]. 61,11% of the 5G spectrum was made available to operators. The 0verall 5G coverage jumped towards 70,1%, but is still below the EU average. Mobile broadband take-up is at 82,6%, slightly below EU. The 5G Portal[147] provides information to the public. The probability is **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met by 2025.

Overall, Portugal is one of the countries with very good perspectives concerning broadband coverage and services. Market driven deployment and competition worked well to deploy significant amounts of fibre lines throughout the country. FTTP coverage is among the highest in Europe, illustrating Portugal's remarkable broadband infrastructure. Demand is overall good, but there is still a significant number of "non-liners". The challenge of incentivizing demand in rural areas and thus making them economically more attractive still persists. To tackle this issue without the use of substantial amounts of state aid, the regions of Portugal will be highly important. Hence, further demand aggregation, thereby convincing operators to take the risk of deploying high-end infrastructures within rural areas, should also be one of the key priorities in the future. The probability is high the Gigabit for everyone is available in Portugal by 2030.

[145] https://www.anacom.pt/render.jsp?categoryId=416723
[146] https://www.anacom.pt/render.jsp?categoryId=340980
[147] https://portal5g.pt/

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	high
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 69 Probability of achievement of connectivity targets in Portugal

7.2.23 Romania

Romania facts & figures	
Degree of self-governance:	Unitary state (semi-presidential, representative democratic republic)
Population:	19,051,562 (4.2 % of EU-27)[I]
Population density:	81.6 per km^2 (EU average: 109 per km^2)[I]
Size:	238,391 km^2
Topography:	Mountain ranges in the north & central part (Carpathians), Transylvanian Plateau, lowlands in the west, south & east
Fixed Very High Capacity Network (VHCN) coverage	95,6 % of households (EU average: 73,42 %)
FTTP coverage:	95,6 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 70 Romania facts & figures

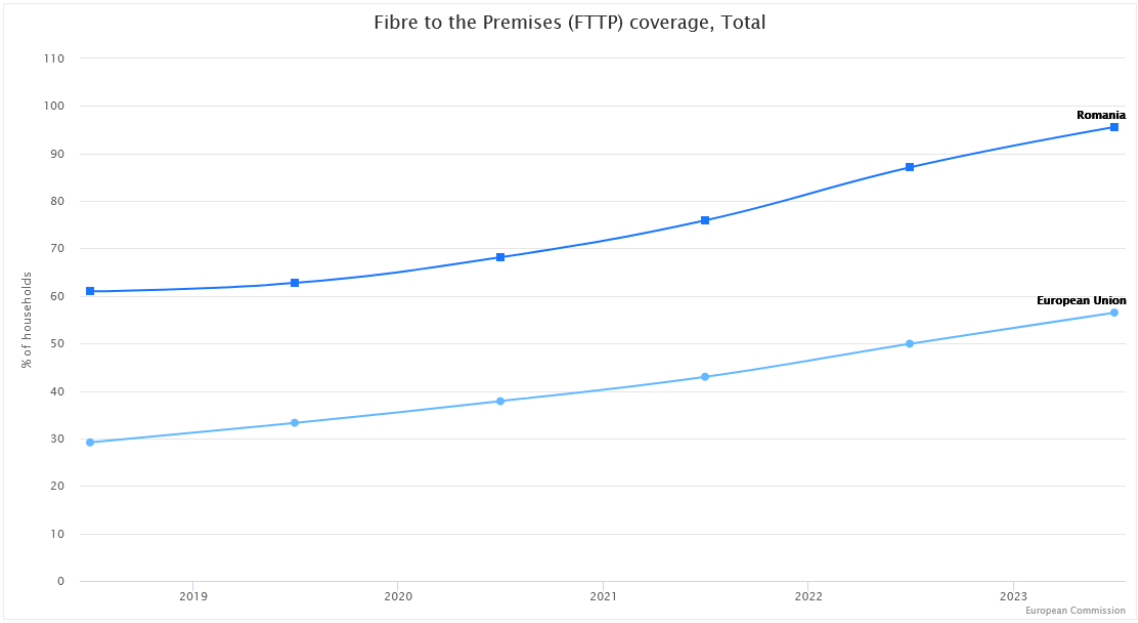


Figure 54 Percentage of households covered by FTTH and FTTB. Romania in comparison to EU. DESI 2023.

7.2.23.1 *Key Features*

National Broadband Plan

National Broadband Plan of Romania: key facts	
Main strategic document(s):	Reference framework in the field of broadband network development in Romania
Targets:	▪ Gigabit society targets for 2025 ▪ Digital Decade targets for 2030

Table 71 NBP Romania key facts

In July 2023, the Ministry of Research, Innovation and Digitalization (MCID) announced the reference framework in the field of broadband network development in Romania - a new policy in the field of broadband communications[148]. The policy is to ensure a general strategic approach for different intervention and financing tools for the development of networks and the identification of support measures encouraging the adoption of broadband ser-vices, an essential pre-condition for the e-government. The policy commits to the Gigabit Society 2025 and Digital Decade 2030 targets and lays out an analysis of public intervention options, measures increasing the demand and promotion of use of very high capacity networks. An action plan will support the implementation and sets the following four objectives:

- Objective 1 - Updating, simplifying and increasing the degree of application of the legal framework necessary to the development and operation of broadband infrastructures and services,
- Objective 2 - Accelerating and coordinating broadband infrastructure development projects,
- Objective 3 - Improving the competitive conditions on the broadband market,
- Objective 4 - Increasing the degree of digital literacy in rural areas.

A set of measures is formulated under each objective. The measures are to be implemented by 2026.

Objective 2 “Accelerating and coordinating broadband infrastructure development projects” will be tackled by establishment of regional bodies for approval of broadband projects, launch of regional consultative structures to support operators in public procurement, increasing the administrative capacity of institutions in managing broadband projects, a centralized system for monitoring in-vestment works. A construction of the electronic communications infrastructure for 945 localities in the white

[148] https://www.mcid.gov.ro/finalizarea-proiectului-stabilirea-cadrului-de-referinta-in-domeniul-dezvoltarii-retelei-de-banda-larga-in-romania-11840/

and grey areas is also to implemented under the objective 2. Approximately 945 localities will be covered by circa 4,000 km of optical fibre is planned to be rollout out with a total cost of EUR 94 million.

Romania's broadband development process is steered centrally. Romania commits to promoting the deployment of fibre-optic networks as a technology. The policy and the action plan are very operational. They include a variety of measures underpinned with responsibilities, funding sources and the implementation schedule.

Main Challenges for gigabit connectivity in Romania:

- Permit approval procedures, communication between public authorities and operators
- Strong urban-rural divide
- Low purchasing power of population
- Low level of digital skills
- Demanding topography

The National Strategy for the Implementation of 5G[149] has been adopted in 2019. It sets 4 strategic objectives: rapid launch of 5G services, frontloading 5G benefits by 5G services coverage, reducing barriers for deployment of 5G networks and promoting new uses and stimulating cooperation. The strategy envisaged the organisation of the spectrum multiband auction in the 700 MHz, 800 MHz, 1500 MHz, 2600 MHz and 3400-3600 MHz bands. By 2025, 5G coverage should be available: in all urban areas, on the main highways, express roads and railways, in international airports and ports, in 10 industrial parks.

Funding programmes and support measures

Romania's Recovery and Resilience Plan (RRP)contributes with EUR 5.97 billion (i.e. 20.5% of total) to the digital transformation. Of this, EUR 4.98 billion is estimated to contribute to the Digital Decade targets. Component 7, with commitment of EUR 1.81 billion, focuses on the digital transformation of the public sector, cybersecurity and connectivity. Reforms such as the 5G security law, the 5G auction and the adoption of the government cloud and interoperability laws are included.

The RoNET project[150], completed in 2022, used EU structural funds (approx. EUR 51,6 million, total costs circa EUR 75,6 million) to build up broadband infrastructure in uncovered areas (middle mile backhaul infrastructure). The RoNET project was and brought gigabit speeds of up to 10 Gbps to 695 localities. The project has built d about 5. 000 km of fibre and 6 radio towers in the Danube Delta area.

[149] https://www.ancom.ro/strategia-5g-pentru-romania-_6167

[150] https://www.comunicatii.gov.ro/proiecte-in-implementare/proiectul-ro-net/

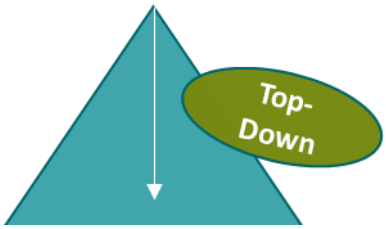
Organizational Steering	Main Players
▪ Broadband development usually steered top-down 	▪ Ministry of Research, Innovation and Digitization (MCID) ▪ The Authority for the Digitization of Romania (ADR) ▪ The National Authority for Management and Regulation in Communications (ANCOM)

Figure 55 Organizational Steering & Main Players Romania

7.2.23.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Romania is rolling out the broadband infrastructure at an impressive speed. The increase in FTTP coverage was almost 20 points in the last two years, promoting Romania to number one in FTTP coverage in the EU. However, the number of "non-liners" is still relatively high as 16 % of the population is not using internet. The level of internet use is with 84% slightly below the EU. The level of digital skills is much lower than in most of other EU countries, the at least basic digital skills are at 28%. The overall fixed broadband take-up is at 66%, compared to 78% in EU. The mobile broadband take-up is at 82,4%, somewhat below EU. Though broadband prices are lower than in the EU, the population has also much lower purchasing power. FTTP and cable networks are both well available in urban areas. Though the FTTP coverage is above EU average (95,59 %), in some rural areas connectivity is less available.

Concerning the fixed broadband take-up, the picture is also positive. Already 81,29 % of households subscribe to 100 Mbps or more, with increase of almost 30 points in the last two years. The take-up of at least 1 Gbps broadband is with 23,35% one of the highest in the EU.

Majority of the existing broadband connections are FTTP. It is being deployed by operators and is an overall very well accepted technology. Combined with a decent DOCSIS cable network, there is a great potential for high-speed connectivity. The FTTP coverage is at 95,59 % of households. Even if growth in the last year was substantial, the rural FTTP coverage in some regions is much below the average in Romania. However, being cautiously optimistic and considering investment measures planned by the government as well as investments by private operators, probability is **high** that the targets "Access to

1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" and "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households" are met by 2025.

Although three operators launched 5G services already in 2019, the 5G rollout stalled. 5G was launched by Digi (RCS & RDS) and Vodafone in June 2019, by Orange in November 2019.[151] Since March 2020, 5G services have been available in Bucharest, other nine big cities and four towns. In 2022 ANCOM awarded spectrum usage rights for 700 MHz, 1500 MHz, 2600 MHz and 3.4-3.8 GHz frequency bands. The overall 5G coverage is only 26,75%, and 38,33% of 5G spectrum as made available to operators. The excellent FTTP coverage may be one of reasons for lower demand and slower rollout of 5G. The probability is **medium** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met by 2025.

Fast pace of FTTP rollout coupled with ambitious and operational plans by the government, investment plans by operators create a positive outlook for connectivity in Romania. The rural connectivity gap is to be reduced in the next years. The probability is therefore **high** that Gigabit for everyone by 2030 may become a reality in Romania.

DAE/ Gigabit Society	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	high
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	medium
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 72 Probability of achievement of connectivity targets in Romania

[151] https://5gobservatory.eu/public-initiatives/national-5g-plans-and-strategies/#1533566139136-cb7ea001-0afc

7.2.24 Slovakia

Slovakia facts & figures	
Degree of self-governance:	Unitary state (parliamentary democratic republic)
Population:	5,428,792 (1.2 % of EU-27)[I]
Population density:	111.8 per km^2 (EU average: 109 per km^2)[I]
Size:	49,035 km^2
Topography:	Largely mountainous (Tatra Mountains in the north), flat terrain in the south
Fixed Very High Capacity Network (VHCN) coverage	71,3 % of households (EU average: 73,42 %)
FTTP coverage:	66,89 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 73 Slovakia facts & figures

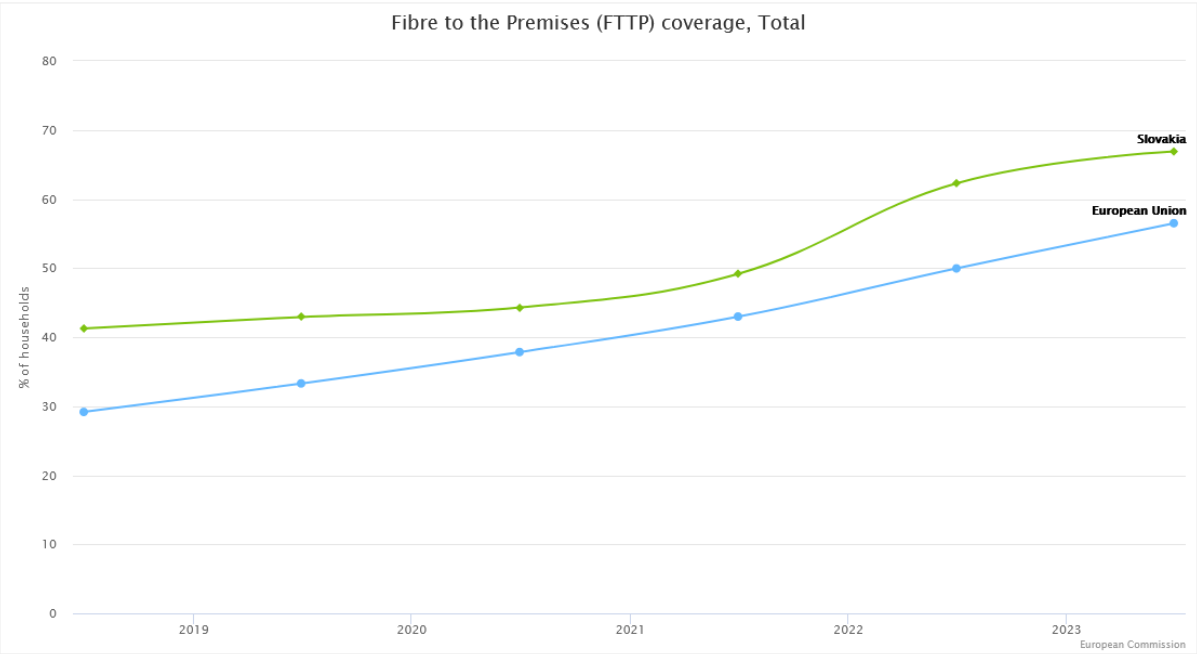


Figure 56 Percentage of households covered by FTTH and FTTB. Slovakia in comparison to EU. DESI 2023.

7.2.24.1 *Key Features*

National Broadband Plan

National Broadband Plan of Slovakia: key facts	
Main strategic document(s):	National Broadband Plan
Targets:	▪ 100% coverage by 100 Mbps upgradable to gigabit ▪ major socio-economic drivers have access to 1Gbps

Table 74 NBP Slovakia key facts

Slovak National Broadband Plan was approved in March 2021 It aims at ultra-fast broadband Internet by 2030 for all. Coverage of all households with speeds of at least 100 Mbps with the possibility of upgrade to 1 Gbps as well as coverage of socio-economic drivers (schools, institutions, offices, transport hubs) with speeds of at least 1 Gbps by 2030 are foreseen. According to the plan, the objectives are best met by support for the construction of passive fibre optic networks.

The role of the state is to ensure that all residents and businesses of Slovakia can benefit from the digitization and computerization of society. Therefore, everyone must have access to a fast and reliable Internet connection.

The drafting of the National Broadband Plan, was preceded by mapping and public consultation. According to the operators' plans, 59% of Slovak households would have access to an ultra-fast connection by 2022, 39% would have a lower connection and 2% no connection. That means that in 2022, 41% of households (circa 867,050 addresses) were without ultra-fast internet. These are mainly remote and geographically difficult locations, the coverage of which is economically not viable for operators.

Main Challenges for gigabit connectivity in Slovakia:

- Broad gap (38%) between the VHCN coverage and take-up
- Only 0,92 % of take-up of 1Gbps or more
- Strong urban-rural divide

The investment gap is estimated at EUR 960 million. The costs are to be covered mainly from private sources, where necessary also from public sources and the European Funds (RRF and ESIF). The plan envisages support to operators to build the infrastructure where it has not been economically attractive for them so far. This can also be combined with other incentives such as vouchers for households to purchase modern telecommunications services or calls for municipalities to build the necessary infrastructure with state support and then lease it to operators.

A public consultation[152] on the feasibility study for the implementation of the National Broadband Plan was finalised in April 2023.

The strategic document Support for the development of 5G networks in Slovakia for the years 2020 – 2025[153] sets a vision and goals for the 5G rollout. The plan foresees reorganisation and allocation of the 5G frequency spectrum, preparation of a new law on electronic communications as well as act on cyber security for 5G networks.

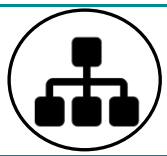
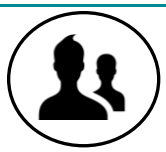
In 2019, the Strategy for the digital transformation of Slovakia 2030[154] was adopted. It lays down a long-term vision and aims to guide the economy, society and public administration through the technological change. It is also to stimulate smart regional development and help researchers and innovators to keep the pace with global trends. The strategy foresees Action plans. The first one for 2019-2022 lists four main objectives: digital transformation of schools, conditions for a data-based economy, innovating public administration as well as support for the development of Artificial Intelligence.

Overall, Slovakia emphasises that network deployment should be funded by private sources. Mobile technologies are viewed as an important element in providing nation-wide coverage. There are no regional broadband plans available in the Slovak Republic.

Funding programmes and support measures

The Slovak Recovery and Resilience Plan amounts to EUR 6.4 billion. The digital dimension is awarded EUR 1.3 billion (i.e. 21%). The Slovak RRP does not include investments in connectivity.

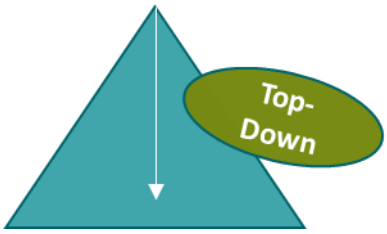
Slovakia has foreseen EUR 112,1 million, co-funded by the ERDF, for gigabit connectivity in 2021-2027 period.

	
Organizational Steering	Main Players
▪ Broadband development usually steered top-down	▪ Ministry of Investments, Regional Development and Informatization ▪ Ministry of Transport

[152] https://mirri.gov.sk/sekcie/investicie/broadband/

[153] https://www.mindop.sk/ministerstvo-1/elektronicke-komunikacie-8/strategicke-dokumenty/sirokopasmovy-pristup

[154] https://www.vicepremier.gov.sk/wp-content/uploads/2019/10/SDT-English-Version-FINAL.pdf



- Regulatory Authority for Electronic Communications and Postal Services
- National Agency for Networking and Electronic Services (NASES)
- Research Institute of Posts and Telecommunications (VUS)

Figure 57 Organizational Steering & Main Players Slovakia

7.2.24.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Slovakia has been making efforts to improve its broadband connectivity. The country has been investing in the development of high-speed internet infrastructure, both in urban and rural areas, as well as in digital skills of the population.

In Slovakia, 12% of individuals do not use Internet (11% in EU), and the level of digital skills is close to EU average. Overall fixed broadband take-up is with 81,35% slightly above the EU. The broadband prices are slightly below the EU level. Yet, the take-up of fixed VHCN networks is with 33,47% way below the EU average. The growth in the last two years was rather slow, only 8 points. Wide gap (38 points) between the fixed VHCN coverage and take-up may indicate that the demand will not be a driving force for further VHCN and FTTP rollout. The at least 1 Gbps broadband take-up is very low at 0,92%.

The NGA coverage rate is 84,27 %. The Fixed VHCN coverage increased by 21 points in the last two years towards is 71,3%. The rural coverage is significantly lower and the digital divide is severe. Within urban areas, there is an infrastructure-based competition between cable operators and the incumbent as well as AOs mainly deploying FTTH (usually P2P). The gigabit connectivity in Slovakia depends on fast FTTP rollout. The FTTP coverage is at 66,89 % with moderate but steady growth in the last two years (17,7 points). The probability is **high** that the target “Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises” is reached.

Yet, considering much lower rural FTTP coverage (21.6% in DESI 2022), relatively low demand for fast connectivity (compared to availability), digital skills at EU average, reaching the target “Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households” may need

substantial efforts. The Slovak authorities emphasised that full coverage with VHCN is a very challenging goal provided country's topography. Therefore, the probability is calculated as **medium** that the target is met by 2025.

The mobile broadband take-up is at 86%. 66,7% of the 5G spectrum is made available to operators. This number did not change for the last two years. 5G trials were started in Banská Bystrica in July 2019. 700/900/1800 MHz auction ended in November 2020, raising a total of EUR 100.2 million. As part of the 5G auction, Slovak national regulatory authority imposed obligations to ensure that at least 95% of the population of each regional capital of Slovakia is covered by a 5G network by the end of 2025 and that at least 90% of the population living outside regional cities is covered by 5G by the end of 2027. The overall 5G coverage increased from zero towards 55,34% in the last two years. Therefore, the probability is assessed as **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met.

The path towards gigabit connectivity in Slovakia may be challenging. The topography (mountains in the north of the country) and persistent urban -rural divide will make FTTP rollout in the so far uncovered areas resource-intensive. The steady increase in FTTP coverage since 2019, investment plans by private operators as well as public funds set aside to support gigabit connectivity in 2021-2027 provide an optimistic outlook. The probability is **medium-high** that Slovakia can provide Gigabit for everyone by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	medium-high

Table 75 Probability of achievement of connectivity targets in Slovakia

7.2.25 Slovenia

Slovenia facts & figures	
Degree of self-governance:	Unitary state (parliamentary representative democratic republic)
Population:	2,116,792 (0.5 % of EU-27)[I]
Population density:	104.6 per km^2 (EU average: 109 per km^2)[I]
Size:	20,273 km^2
Topography:	Largely mountain ranges (Alps), lowlands in the east (Pannonian Basin)
Fixed Very High Capacity Network (VHCN) coverage	75,5 % of households (EU average: 73,42 %)
FTTP coverage:	75,52 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 76 Slovenia facts & figures

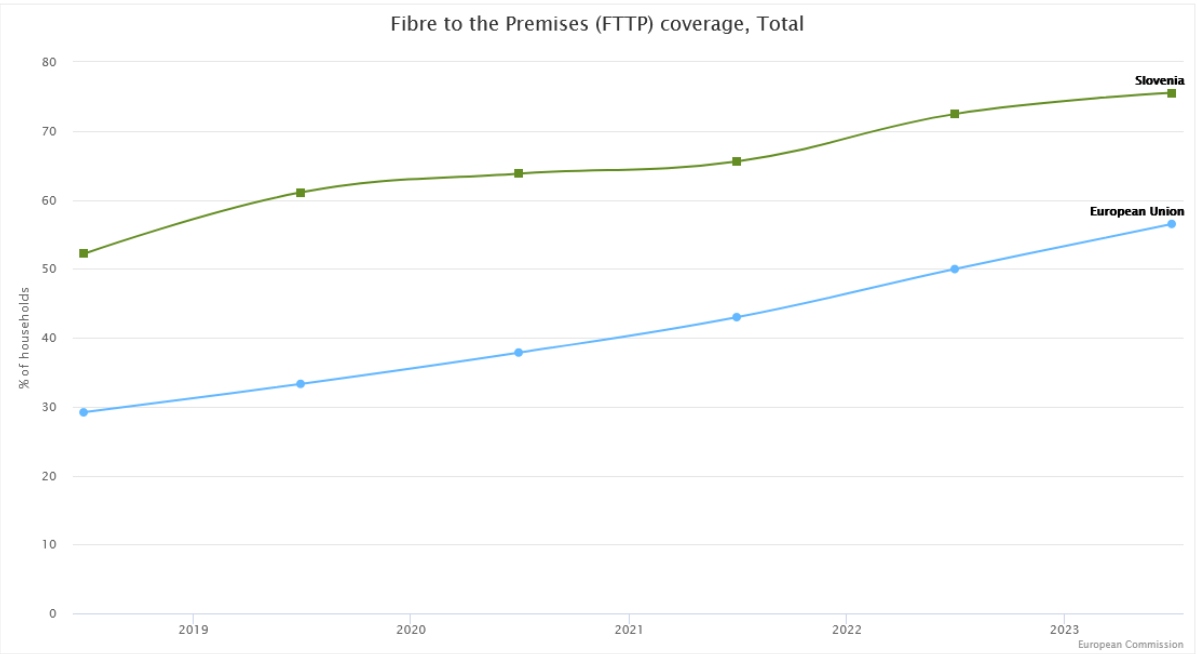


Figure 58 Percentage of households covered by FTTH and FTTB. Slovenia in comparison to EU. DESI 2023.

7.2.25.1 *Key Features*

National Broadband Plan

National Broadband Plan of Slovenia: key facts	
Main strategic document(s):	Gigabit infrastructure development plan until 2030
Targets:	▪ Gigabit Society 2025 and Digital Decade 2030 targets

Table 77 NBP Slovenia key facts

Accessible broadband infrastructure throughout Slovenia is to enable steady development, reduce the digital divide and increase everyone's involvement in modern social trends. In its strategic planning, Slovenia therefore follows the development of a ubiquitous high-performance broadband infrastructure, both fixed and mobile, which is open and accessible to all end users.

The development of electronic communications infrastructure and services depends to the greatest extent on the efficiency of the electronic communications market, so Slovenia will promote competitiveness, transparent regulation and a stable regulatory environment. By creating a stable and predictable business environment, it will encourage electronic communications operators to make private investments in the development of electronic communications infrastructure and services.

The strategic goals of the Gigabit infrastructure development plan until 2030[155] are in line with the gigabit society and digital decade targets of the EU:

- gigabit connectivity for all the main enablers of socio-economic development, such as schools, cultural institutions, transport hubs and main providers of public services and digitally intensive companies, by the end of 2025,
- continuous coverage with 5G networks for all urban areas and all major ground transport routes by the end of 2025,
- Internet access with a speed of at least 100 Mbps to the user, which can be upgraded to a gigabit speed, for all rural and urban households by the end of 2025,
- gigabit connectivity for all households, businesses and other promoters of socio-economic development in rural and urban areas by the end of 2030,
- coverage of all populated areas with the 5G network by the end of 2030.

[155] https://www.gov.si/teme/elektronske-komunikacije/

The plan foresees legislative, strategic (mapping, demand stimulation, cost reduction) and financial measures to support infrastructure rollout.

Overall, Slovenia opts for technological neutrality and market dynamics in developing broadband networks, in particular infrastructure- and service-based competition. Towards an increasing demand, the Slovenian NBP highlights the role of e-government, e-health, e-education and e-business services. Satellite technology is viewed as a viable approach towards increasing broadband coverage, especially in remote and less accessible areas. Mobile and wireless solutions are a complement for fixed broadband networks as well. Infrastructure deployment in white spots will be financed by EU funds and the state budget. Local and regional actors are encouraged to launch roll-out projects, assist in financing, establish public-private partnerships or contemplate other business models. The plan also invites local governments to adjust administrative procedures, for instance towards issuing permits, administrative processes and the provision of passive public utility infrastructure.

Main Challenges for gigabit connectivity in Slovenia:

- Gap (24 %) between the fixed VHCN coverage and take-up
- Low at least 1 Gbps broadband take-up (4,5%)
- Digital divide between urban and rural areas
- Dispersed settlement structures in rural areas increase the costs of construction of broadband infrastructure

The rollout of broadband infrastructure in rural areas in Slovenia is difficult due to sparse population and challenging topography (mountains). Therefore, Slovenia decided to use public funds to co-finance the construction of infrastructure in white spots.

Slovenian Development Strategy 2030[156] has five main pillars: (i) an inclusive, healthy, safe and responsible society, (ii) learning for and through life, (iii) a highly productive economy that creates added value for all, (iv) well-preserved natural environment, (v) high level of cooperation, competence and governance efficiency.

The Strategy for the Digital Transformation of the Economy (January 2022)[157] is part of the measures within the framework of the Recovery and Resilience Plan within the digital transformation of companies component. It addresses three main or priority areas: (i) advanced digital technologies that enable the digital transformation of the economy, (ii) an efficient ecosystem for a competitive economy, and (iii) an open and sustainable society as the basis for the growth of the digital economy.

[156] https://www.gov.si/assets/vladne-sluzbe/SVRK/Strategija-razvoja-Slovenije-2030/Slovenian-Development-Strategy-2030.pdf
[157] https://www.gov.si/novice/2022-01-06-vlada-republike-slovenije-je-sprejela-strategijo-digitalne-transformacije-gospodarstva/

Funding programmes and support measures

According to the Gigabit infrastructure development plan until 2030, public funds will be used to co-finance the construction of:

- open fixed broadband networks in white spots, in line with the principle of technology neutrality,
- 5G open passive mobile networks in areas where no construction is planned in the next few years,
- open networks to ensure connectivity for socio-economic drivers.

The Plan also foresees the use of public funds for a connectivity voucher scheme. The vouchers will be made available for new subscriptions or upgrade to a minimum download speed of 100 Mbps. The measure is intended to stimulate demand for broadband internet access service in areas where high-speed broadband coverage is already in place.

Two projects (i.e. GOŠO 4 and GOŠO 5) rolling out open broadband networks are financed from public funds and will provide access to high-speed broadband networks for 15,424 households by end 2023.

Based on mapping and an inquiry into market interest in building a broadband network, 107,932 households in Slovenia were identified as potential white spots in 2021. To provide coverage for 8,500 households for which there is no expressed market interest, the gigabit infrastructure will be deployed through the GOŠO 6 call for tenders. These households will be located in sparsely populated (less than 150 inhabitants per km2) or geographically challenging areas (not easily accessible) where adequate ICT infrastructure with suitable capacity is not yet available. The remaining 99,432 households in white areas, the gigabit infrastructure is to be deployed by GOŠO 7 with aim of covering them by 2030.

The Slovenian Recovery and Resilience Plan amounts to EUR 2.5 billion and EUR 0.5 billion (21%) is foreseen for the digital transformation. The RRP commits EUR 30 million to investments in connectivity to bridge the digital divide. The plan includes the development of the connectivity toolbox roadmap to foster 5G and broadband rollout with the introduction of best practices.

An infrastructure mapping tool PROSTOR[158] presents graphical form of the data on ducts, cables, nodes, base stations, etc. The system gathers data on electronic communication operators' facilities,

[158] https://eprostor.gov.si/javni/

mainly location and type of networks used. Citizens can check availability of broadband provided by operators.

An infrastructure investment portal[159] is designed to promote infrastructure sharing and joint deployment. Intentions to build and invitations to investors in electronic communications networks and associated infrastructure to express their interest in including electronic communications networks and associated infrastructure in the planning or joint construction are published on this portal.

Organizational Steering	Main Players
▪ Broadband development usually steered top-down	▪ Ministry of Digital Transformation ▪ Agency for Communication Networks and Services (AKOS)

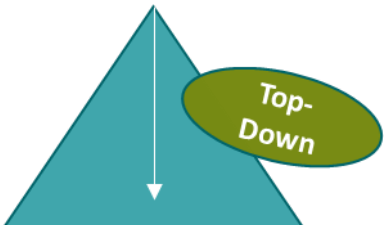


Figure 59 Organizational Steering & Main Players Slovenia

7.2.25.2 Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.

Slovenia generally had good connectivity infrastructure. The country has a well-developed telecommunications network, including a widespread broadband internet infrastructure. The capital city, Ljubljana, and other urban areas typically have excellent connectivity with access to high-speed internet. The level of internet use (88%) and digital skills are close to the EU average. The overall fixed broadband take-up is at 77%.

The NGA coverage in Slovenia is 89,5 %, which is by itself a very decent coverage rate equal to the EU average. The growth in the recent years was relatively slow, similar to the EU. The fixed VHCN coverage is with 75,5% slightly above the EU average, and the increase of 9,9 points in the last two years. There is a significant digital divide: in rural areas, the VHCN coverage rate is at 46,4 %. Again, in EU comparison, the rural coverage is at decent level. However, as roughly 50 % of Slovenia's population live in

[159] https://investicije.akos-rs.si/

rural areas, bridging this gap quickly will be cumbersome and costly. The gap between the VHCN coverage and take-up is not minor (24 %) and may indicate some deficits in demand. Currently 51,6% of Slovenian households subscribe to VHCN connections. The penetration had a growth rate of 22,3% in the last two years, slightly more than in the EU.

However, there are lots of positive signs concerning overall development of (fixed) digital infrastructures in Slovenia. Cable and other alternative providers were first movers within the NGA and VHCN market and offer high quality cable and FTTH connections, thus pressuring the incumbent to also invest in FTTH technology to keep up with the competition. By now, FTTP has a solid coverage of 75,52%. FTTP coverage had a decent growth of 10% in the recent two years. The probability is **high** that the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is met by 2025. There is however strong rural urban divide, the rural FTTP coverage is at 46,4%. Slovenia will most likely make a very good progress in the coming years in the rollout of broadband networks, yet probability is **medium** that the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is met by 2025.

The overall mobile broadband take-up is at 87,3%. The Government of the Republic of Slovenia adopted in March 2019 Plan for the use of the 470-790 MHz frequency band[160], and in April 2020 the Amendment to the Plan for the use of the 470-790 MHz frequency band[161]. In 2018 and 2019, the national regulatory agency AKOS awarded trial licences in 5G pioneer bands. By now, 98,33% of 5G spectrum is made available to operators and the overall 5G coverage increased towards 63,9%. The probability is **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met.

The overall development of digital infrastructures in Slovenia is very positive. There is a high market share of cable and FTTB/FTTH connections provided by several providers within a competitive environment. Future measures focus on publicly funded projects within white areas and further demand stimulation. Being optimistic about the effects of the planned rollout in white areas in the coming years, the probability is **high** that Gigabit for everyone is achieved by 2030.

[160] https://www.gov.si/assets/ministrstva/MJU/DID/Nacrt-700-MHz-sprejela-VRS-.pdf

[161] https://www.gov.si/assets/ministrstva/MJU/DID/Sprememba-Nacrta-uporabe-frekvencnega-pasu-470790-MHz.pdf

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 78 Probability of achievement of connectivity targets in Slovenia

7.2.26 Spain

Spain facts & figures	
Degree of self-governance:	Constitutional monarchy
Population:	48,059,777 (10.7 % of EU-27)[I]
Population density:	94.3 per km^2 (EU average: 109 per km^2)[I]
Size:	505,944 km^2
Topography:	Inner plateau, mountain ranges in the north (Pyrenees), lowlands in the southwest, north and coastal plains, Balearic and Canary Islands
Fixed Very High Capacity Network (VHCN) coverage	93,3 % of households (EU average: 73,42 %)
FTTP coverage:	91,02 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 79 Spain facts & figures

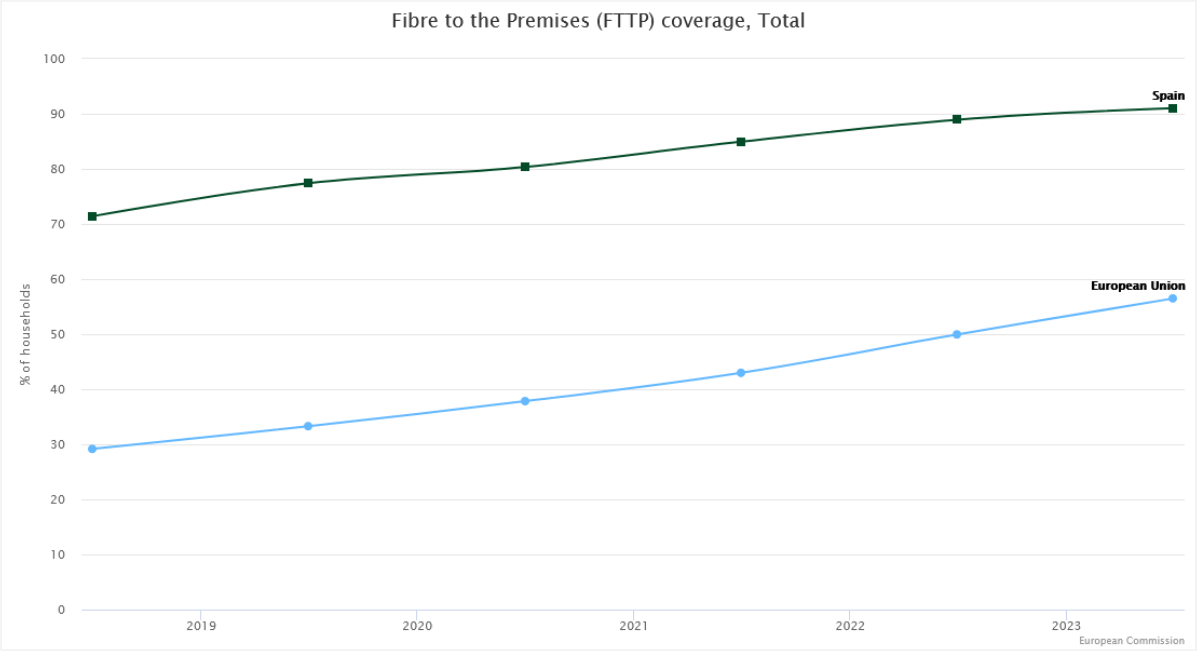


Figure 60 Percentage of households covered by FTTH and FTTB. Spain in comparison to EU. DESI 2023.

7.2.26.1 *Key Features*

National Broadband Plan

National Broadband Plan of Spain: key facts	
Main strategic document(s):	Digital Spain 2025 Agenda
Targets:	▪ 100 % coverage with 100 Mbps by 2025 ▪ 1 Gbps speeds for businesses ▪ entire radioelectric spectrum to be ready for 5G by 2025

Table 80 NBP Spain, key facts

The Digital Spain 2025 Agenda[162], announced in July 2020, is to mobilise public and private investment of 70 billion EUR. The objectives of Digital Spain 2025 focus on promoting the digital transformation of Spain as one of the essential levers for relaunching economic growth, reducing inequality, increasing productivity and harnessing all the opportunities offered by new technologies, while respecting constitutional and European values and protecting the rights of individuals and groups. The agenda consists of nearly 50 measures based on ten strategic priorities, two of which are including Digital connectivity and roll-out of 5G.

The strategic priority Digital connectivity seeks suitable digital connectivity for the entire population in order to foster the eradication of the digital gap between different rural and urban areas aimed at ensuring that the entire population has access to 100 Mbps coverage by 2025.

The strategic priority on 5G is to lead the roll-out of 5G technology and incentivise its contribution to an increase in economic productivity, social progress and regional structure. The goal is for the entire radioelectric spectrum to be ready for 5G by 2025.

The Plan for Connectivity and Digital Infrastructures and the Strategy to Promote 5G Technology[163] are part of the Digital Spain 2025 Agenda. The Plan for Connectivity will expand the high-speed broadband to reach 100% of the population by 2025. It will also strengthen connectivity in companies, industrial estates and promote the digitization of SMEs by

Main Challenges for gigabit connectivity in Spain:

- Gap between urban (91,02 %) and rural (68,9 %) FTTP coverage
- 76,5% gap between the FTTP coverage and at least 1 Gbps broadband take-up
- Three big operators (Telefonica, Orange and Vodafone) control majority of broadband lines

[162] https://avancedigital.mineco.gob.es/programas-avance-digital/Paginas/espana-digital-2025.aspx

[163] https://portal.mineco.gob.es/en-us/comunicacion/Pages/201201_np_conectividad.aspx

vouchers - aiming at 1 Gbps speeds for businesses. The Strategy to promote 5G technology will accelerate the deployment of this technology which is called to be an engine of transformation and economic and social development.

In addition, various regions (Comunidades Autónomas - CCAA) have developed their own projects, programmes and strategies for overall digital development and broadband roll-out, thereby, apart from their own financial resources and private sector investments, often also relying on European funds. Generally, the different regional strategies share many commonalities and also usually refer to the Spanish or European agenda as being a reference framework, but they also show some differences regarding their scope and emphasis.

Funding programmes and support measures

Implementation of the Spain Digital 2025 Agenda between 2020 and 2022 was financed with around EUR 20 billion in public funds, with approximately EUR 15 billion from the various EU programmes and new financing instruments under the Next Generation EU Recovery Plan. This was expected to be complemented by around EUR 50 billion from the private sector.

The Plan for Connectivity and Digital Infrastructures and the Strategy to Promote 5G Technology is expected to receive EUR 4.3 billion in public funding between 2020 and 2025. It is expected that private investment to the tune of an additional EUR 24 billion will be secured within this period.

Spain’s RRP has a total budget of up to EUR 69.5 billion and contains an ambitious set of reforms and investments in digital transformation. It assigns 28.2% of the allocation to digital measures (EUR 19.6 billion). The adoption of the Digital Spain 2025 strategy; the National Digital Competences Plan, the strategy for the promotion of 5G technology, the SME Digitalisation Plan 2021-2025, the national AI strategy and the Plan for the Digitalisation of Spain's Public Administration 2021-2025 were supported by RRP. Also, 5G spectrum and deployment (i.e. assignment of the 700 MHz band and the legal act on 5G spectrum reduction taxation) and measures targeted at digital skills and education were successfully rolled out.

Spain’s Recovery and Resilience Plan (RRP) includes significant investments to close the existing digital divide between urban and rural areas in fixed and mobile broadband networks as well as reforms to reduce costs and facilitate deployment. For example, the expansion of ultra-fast broadband connectivity (above 100 Mbps) mainly in rural areas and areas of historical value, which currently do not have such connectivity, will be supported via funding of EUR 812 million.

Among the RRP measures, the UNICO-Banda Ancha programme[164] has allocated EUR 250 million in the 2021 call to provide ultrafast fixed broadband networks in rural, remoted and less populated areas. This programme is an evolution of the previous national funding programme PEBA-NGA that supported the roll out of next-generation broadband networks in Spain from 2013 to 2020 and was co-financed by the European Regional Development Fund (ERDF).

The 5G strategy will incentivize roll out and several financial measures included in the RRP have been set. Among others, the extension of the duration of 700 MHz licences (minimum 20 years with potential 20 years of prorogue) and some taxation reforms, such as the temporary reduction of annual spectrum tax for 5G bands, and the review of the operators´ contributions to the annual tax to finance Spanish public television (TV tax) were introduced. On 15 December 2021, European Commission approved EUR 150 million Spanish scheme under Recovery and Resilience Facility to support deployment of passive infrastructure for mobile networks.

The roadmap to implement the Connectivity Toolbox includes several measures to reduce costs. The main measures include streamlining permit granting procedures, improving the single information point and increasing the transparency of physical infrastructure.

The National Telecommunications and Information Society Observatory (ONTSI)[165] provides public information on the digital transformation to support the assessment and, where necessary, adjustment of measures developed within the framework of the Spain Digital 2025 Agenda.

Organizational Steering	Main Players
▪ Broadband development usually steered top-down	▪ Ministry of Economic Affairs and Digital Transformation ▪ National Commission for Markets and Competition (CNMC) ▪ Regional actors (CCAA)

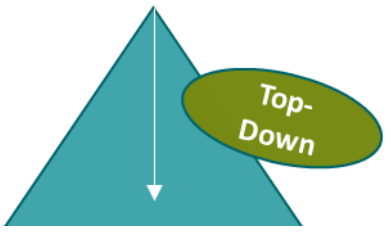


Figure 61 Organizational Steering & Main Players Spain

[164] https://portalayudas.mineco.gob.es/InfraestructurasDigitales/Paginas/Index.aspx
[165] https://www.ontsi.es/

7.2.26.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Spain has shown great efforts regarding the update of its telecommunications networks during the last years and thus has already an excellent NGA (94,39%), VHCN (93,3%) and FTTP (91,02%) infrastructure at its disposal. The level of Internet use (93%) and the digital skills is above the EU average. FTTP networks are currently strongly expanding, which will lead to a further increase of overall coverage in the coming years. FTTP coverage in Spain (total 91,02 %, rural 68,9.4 %) is significantly above European average, ranking Spain within the top group in Europe. The overall availability of networks is very good (especially in urban areas) and take-up of fixed VHCN (87,5%) is already at above-average level. Prices are lightly lower than the EU average, and seem to positively affect the take-up. The probability is **high** that the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is met.

The PEBA-NGA EUR 400 million scheme for 2020-2022 supported grey areas in rolling out infrastructure capable of providing speeds of 300 Mbps symmetrical, upgradeable to 1 Gbps symmetrical and had positive impact on availability of ultra-high speed broadband. UNICO-Banda Ancha programme will continue to support rollout in rural areas.[166] Yet reaching full VHCN coverage by 2025, may still remain a challenge. Considering the urban-rural divide, challenging topography in remote areas and the demographic developments, making rural areas economically even less interesting for internet service providers, reaching countrywide coverage may be costly and require substantial efforts and time. Even if the probability is assessed as **medium** that the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is met by 2025, Spain may get very close to the 100% mark.

A solid ground was in place for 5G deployment in Spain. The 5G strategy was in place since 2020[167]. The overall 5G coverage increased substantially in the last two years and is slightly above EU average with 82,30%. 98,33% of the 5G spectrum is made available to operators. The Mobile broadband take-up is at 94%. The probability is **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met.

Considering the steady growth of FTTP coverage since 2017, current impressive coverage and ambitious plans for supporting rollout in rural and remote areas, the outlook for the connectivity in Spain is very positive. The probability is high that Gigabit for everyone becomes reality by 2030.

[166] https://portalayudas.mineco.gob.es/banda-ancha/Paginas/Index.aspx

[167] https://portal.mineco.gob.es/en-us/comunicacion/Pages/201201_np_conectividad.aspx

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	medium
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 81 Probability of achievement of connectivity targets in Spain

7.2.27 Sweden

Sweden facts & figures	
Degree of self-governance:	Unitary state (Constitutional monarchy)
Population:	10,521,556 (2.3 % of EU)[I]
Population density:	25,6 per km^2 (EU average: 109 per km^2)[I]
Size:	438,574 km^2
Topography:	Coastal lowlands in the east and south, mountain ranges in the west
Fixed Very High Capacity Network (VHCN) coverage	84,6 % of households (EU average: 73,42 %)
FTTP coverage:	84,49 % of households (EU average: 56,5 %)

[I] 2023, Eurostat

Table 82 Sweden facts & figures

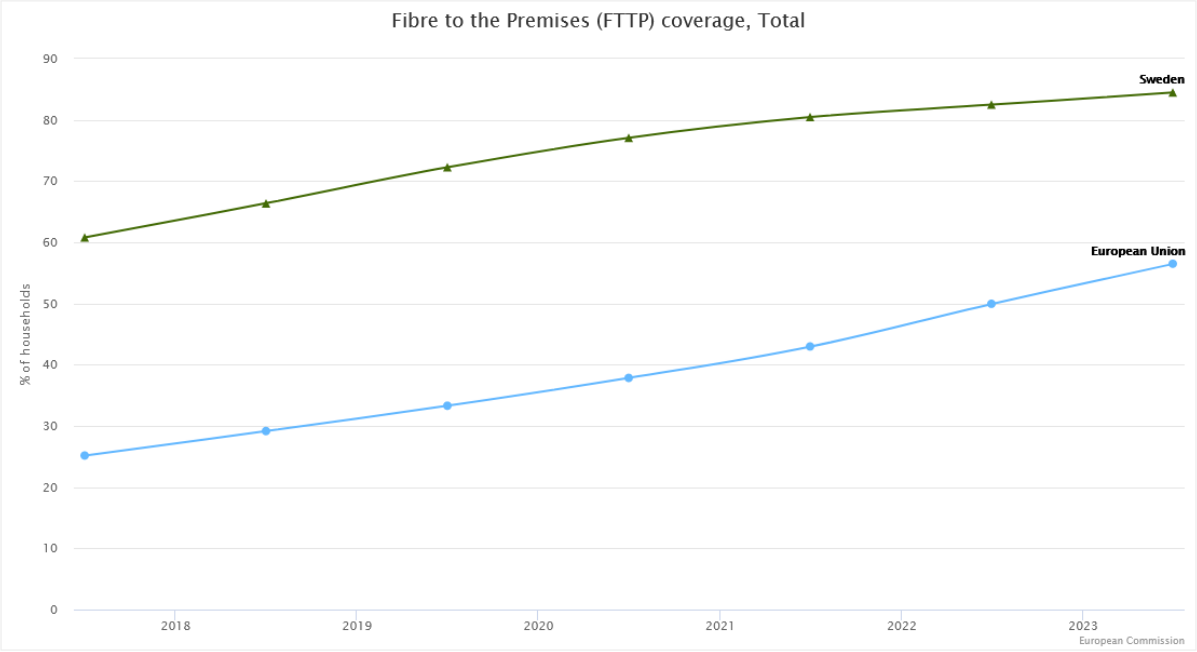


Figure 62 Percentage of households covered by FTTH and FTTB. Sweden in comparison to EU. DESI 2023.

7.2.27.1 *Key Features*

National Broadband Plan

National Broadband Plan of Sweden: key facts	
Main strategic document(s):	A Completely Connected Sweden by 2025 – a Broadband Strategy
Targets:	▪ all should have access to high-speed broadband by 2025

Table 83 NBP Sweden key facts

Sweden has had a broadband policy ever since the late 1990s. The country's overall objective is accordingly ambitious, namely to obtain "world-class broadband". The national strategy document is entitled "A Completely Connected Sweden by 2025 – a Broadband Strategy"[168] and was adopted in 2016.

In its broadband strategy, the Swedish government has identified three strategic areas in order to meet the goals set in the strategy: Roles and rules on the broadband market, cost-efficient expansion of the broadband infrastructure and services for everyone. According to the broadband strategy, the focal point has to be people's need for broadband access, whether they live in densely populated areas, scarcely populated areas and rural areas, or in areas situated in between.

The government's vision for a completely connected Sweden is that the broadband infrastructure should correspond to the user's need for connectivity. In the broadband strategy, the Swedish government identified the need for goals in two areas: access to high-speed broadband in all of Sweden and access to reliable and high quality mobile services. The objective of the strategy was that 95% of all households and businesses should have access to broadband at a minimum capacity of 100 Mbps by 2020 (not reached). The strategy goes beyond 2020 and states that by 2025 all of Sweden should have access to high-speed broadband. That implies that 98% of all households and businesses should have access to broadband at a minimum capacity of 1 Gbps. The remaining 1.9% should have access to connections at a minimum capacity of 100 Mbps and 0.1% at a minimum capacity of 30 Mbps. The strategy also has a goal for mobile coverage: all of Sweden should have access to reliable and high-quality mobile services no later than the year 2023.

Swedish broadband deployment is primarily market-driven, but in areas where there are no commercial incentives to invest, there is complementary public funding available. The government can actively take measures to put conditions in place that facilitate and supports deployment and usage of digital infrastructure. The government has allocated in its budget for 2020 SEK 150 million (EUR 14 million),

[168] https://bredbandsforum.se/sveriges-bredbandsstrategi/

SEK 200 million in 2021 and SEK 300 million in 2022 to a state aid scheme with financial aid to broadband deployment.

In Sweden municipalities play a crucial role in the operational implementation of network deployment by way of controlling access to municipal land and granting licenses to operators rolling out networks. Furthermore, it is also quite common for municipal city networks and housing companies to provide broadband services themselves (ranging from wholesale to consumer services). Many municipal city networks own and/or operate a fibre-based infrastructure.

Sweden is committed to be at the forefront of the development of 5G. One manifestation of this is the Nordic-Baltic cooperation on 5G, undertaken within the frame of the Nordic Council of Ministers. In May 2018, the Nordic prime ministers signed a declaration on 5G[169], with the common vision of being the first and foremost-integrated region in the world. In order to achieve this goal a common action plan for early adoption of 5G technology has been set up by the Nordic-Baltic ministers of digitalisation.

Main Challenges for gigabit connectivity Sweden:

- Urban (84,5 %) - rural (54,3 %) divide in FTTP coverage
- Rural and remote areas with challenging topography and low population density
- Lack of private investment in difficult & rural areas
- Low 5G coverage

Overall, the Swedish Post and Telecom Agency assumes the task of monitoring developments in the market with regards to the operational targets.

Funding programmes and support measures

During the program period 2014–2020, the rural development program allocated approximately SEK 4.45 billion in broadband support for expansion in areas where it is not commercially profitable to expand.

The Swedish Recovery and Resilience Plan (RRP) has a budget of EUR 3.3 billion, out of which EUR 650 million will support the Digital Decade targets. The RRP will promote broadband expansion by committing EUR 464 million to connect more households in 2023-2025. The RRP also allocates EUR 21 million to upgrade digital services in public administration, including a joint digital infrastructure.

[169] https://www.government.se/49b8be/globalassets/government/dokument/statsradsberedningen/letter-of-intent--development-of-5g-in-the-nordic-region-.pdf

A Broadband Support Fund was set-up in 2020. The Swedish Post and Telecom Agency (PTS) is the managing authority for this support scheme.[170] In 2020, SEK 136 million were distributed in 4 regions (Blekinge, Västra Götaland, Värmland and Västernorrland) to connect sparsely populated areas with broadband of up to 1 Gbps, resulting in 2.952 buildings that will be in absolute proximity to a network with capacity of at least 1 Gbps.[171] As from 2021, the Broadband Support Fund is co-financed by EU Funds (RRP). SEK 1.6 billion were committed in 2021, SEK 1.3 billion in 2022 and SEK 1.22 billion for broadband support in 2023.

A broadband mapping service Ledningskollen[172] has been developed and steered by the Swedish post and telecom authority (NRA) with the aim of sharing information on infrastructure owners (i.e. pipelines and other infrastructure). The platform has been developed and is publicly accessible on a voluntary basis in order to prevent damage during excavation and enhance coordination in civil work. In addition to the Ledningskollen, PTS has a national mapping tool called the Broadband Map (Bredbandskartan)[173], which shows the availability of broadband, network owners and ISPs near a specific location throughout Sweden.

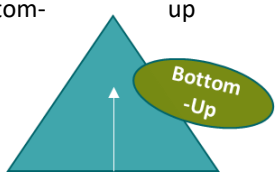
Organizational Steering	Main Players
▪ Broadband development usually steered bottom- up 	▪ Ministry of Climate and Enterprise ▪ Swedish Post and Telecom Authority (Post- och telestyrelsen (PTS) ▪ Swedish Broadband Forum (& regional/local broadband coordinators) ▪ Local and regional authorities

Figure 63 Organizational Steering & Main Players Sweden

[170] https://www.pts.se/sv/bransch/internet/bredbandsutbyggnad/bredbandsstod/
[171] https://www.pts.se/sv/bransch/internet/bredbandsutbyggnad/bredbandsstod/bredbandsstod-2020/
[172] https://www.ledningskollen.se/
[173] https://bredbandskartan.se/

7.2.27.2 *Feasibility Assessment. Reaching the EU Gigabit Society 2025 and Digital Decade 2030 aims.*

Sweden has a well-developed and advanced broadband infrastructure. The country has been actively investing in expanding its broadband network, particularly in rural and remote areas, to ensure widespread access to high-speed internet. The broadband market in Sweden is characterized by a mix of technologies, including fibre, cable, DSL, and mobile broadband. FTTP infrastructure has been expanding significantly, providing high-speed and reliable internet access to a large portion of the population.

The level of Internet use (96%) and level of digital skills in Sweden is way above EU average. The NGA coverage is 85.63 % (DESI 2022), fixed VHCN coverage at 84,55% and there is a strong digital divide: only 54,3 % of the rural Swedish population is covered by fixed VHCN networks. Due to the vast size of Sweden and its low population density, this result is not surprising. The take-up of VHCN is at 85,28 %, closely following the supply side.

Sweden has one of Europe's most advanced fibre infrastructure with high end access for the majority of its population. Within urban areas, FTTP is widely available. Furthermore, there are lots of regional initiatives to aggregate demand and deploy FTTP for previously underserved areas. Yet, there are still a substantial part of the rural population have no access to similar bandwidths. FTTP is the most dominant technology for new connections and upgrades across Sweden. There is a strong bottom-up movement in Sweden with roughly multiple local operators deploying FTTP, partly supported by state aid. The FTTP coverage is 84,49 %, rural only 54,3 %. Yet at least 1 Gbps broadband take-up is very low at 6%, way below EU average.

Due to well expanding FTTP infrastructure, the probability is **high** that the target "Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises" is met. Yet due to low population density and partly difficult geography, it is rather unlikely like the target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households" is fully met by 2025 – the probability is assessed as **low**. Even if with planned state aid measures combined with the strong bottom up FTTP rollout, it will be challenging to cover 100 % of the households. However, one has to add that Sweden will most probably get close to the 100% mark. The experience with the NGA coverage expansion (high, but still below 100 %) seems to confirm this assessment.

ICT services are well accepted in Sweden: rent mark ups for high-end inhouse wiring and FTTP connections are common and accepted, so are fees for initial connections. The overall perception is that there is a high willingness to pay, the costs for subscriptions are slightly below EU average.

Prices for mobile connectivity are lower than the EU average. The 4G coverage is 100 % and mobile broadband take-up is 95%. The affinity towards the use of mobile technologies is very high in Sweden. Though 84% of 5G spectrum is made available to operators, the overall 5G coverage remains very low at 20%. PTS released its spectrum plan for 5G test licences already in March 2017, and 60 licences for 5G test trials in 27 location have been issued. The 5G was launched by Tele2 and Telia in May 2020, by Tre in June 2020 and by Telenor in October 2020[174]. Considering strong affiliation towards mobile connectivity in Sweden and being optimistic about rollout of 5G in the next years, the probability is assessed as **high** that the target "Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways" is met by 2025.

Overall, Sweden is in a very good position. FTTP is expanding, local authorities and utility providers are active in rural areas and deploy high-end infrastructures to close the digital divide. Furthermore, affordability is not an issue which leads to a situation where no market saturation (in the ultrafast segment) is foreseeable. The bottom up initiatives, private and public investment and high demand for ultrafast connectivity make sure that Sweden is well on track to achieve gigabit connectivity targets. The probability is **high** that Gigabit for everyone is provided by 2030.

Gigabit Society 2025 & Digital Decade 2030 targets	Target	Probability of reaching the target
Gigabit Society	Access to 1 Gbps (download/upload) for all schools, transport hubs and main providers of public services and digitally intensive enterprises	high
Gigabit Society	Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all European households	low
Gigabit Society	Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways	high
Digital Decade	Secure and sustainable digital infrastructures: Gigabit for everyone	high

Table 84 Probability of achievement of connectivity targets in Sweden

[174] https://5gobservatory.eu/public-initiatives/national-5g-plans-and-strategies/#1533566316349-17451b2f-4c86

8 Main Trends

Within the analysis of the NBPs on European and on National Level, we found that there are several defining conditions that are in favourable for NGA roll-out in each given country, conditions that helped countries to achieve higher degrees of connectivity. However, one has to bear in mind that not all of these factors can be influenced by governmental strategies. Existing infrastructures, population density, degree of urbanization and several other aspects are difficult to change and often not within the sphere of influence of democratic governments. The conditions described within this section are therefore a mixture of influenceable and non-influenceable conditions that affect the current situation in the respective Member States. Often governments try within their NBPs to react to these conditions and define appropriate measures (e.g. low population density can be addressed by supply side intervention, such as funding schemes). This section shall thus describe these factors and possible measures that Member States could adopt.

8.1 Favourable conditions for broadband roll-out

8.1.1 Market pressure on the incumbent

It is evident that competition helps to expand the broadband-market. However, the technologies used seem to be rather irrelevant. In some cases, cable based operators pressure the incumbent to deploy FTTP, in other cases its WLAN technologies that challenge xDSL technologies and in even other cases there are FTTP providers competing with the VDSL Vectoring networks of the incumbent. In any case, alternative operators stimulate a general improvement of networks across Europe, triggering vast investments by incumbents that try to defend their market shares.

However, we found that the actual organizational structure of a competitor does not matter for determining its effect on the incumbent. The sole existence of a competitor that can offer a comparable or better quality of service at comparable prices forces the incumbent to upgrade its networks in order to compete with these new entrants.

There are several organizational models for Infrastructure Investors across Europe. The different models serve the different layers of the digital infrastructure value chain respectively (passive infrastructure, active infrastructure, services). Although vertically integrated corporations are still the major sources of connections and investments alike, there are also several other types emerging. For instance, Germany, Lithuania and Austria see several Public Special Purpose Associations which deploy passive infrastructure, while private companies operate active components and offer services (Model

3). Especially in Eastern European countries (e. g. Czech Republic), we see Public Private Partnerships (Model 4), while in England and Ireland vertically integrated private companies prevail (Model 6). An interesting aspect concerning these models is a rising number of cross-sector cooperations. In Sweden, Denmark and several other countries we see an increased activity of utility providers that invest into all layers of the value chain.

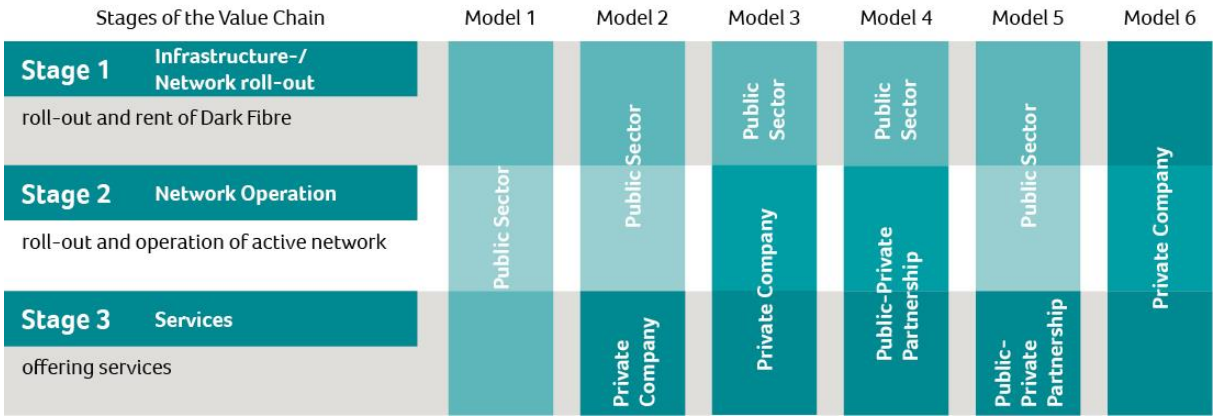


Figure 64 Organizational models for Infrastructure Investors across Europe

If we have a look at the correlation of incumbent market shares (fixed broadband) and the median fixed broadband prices for end-customers, we can observe another positive aspect of competition: a correlation coefficient of .38 indicates that there is a link between the position of the incumbent and the end customer prices. Generally speaking, the less dominant the incumbent, the lower the median end customer prices. This correlation in turn increases the probability of higher take-up rates. Therefore, we can conclude that increased competition positively affects coverage and take-up alike.

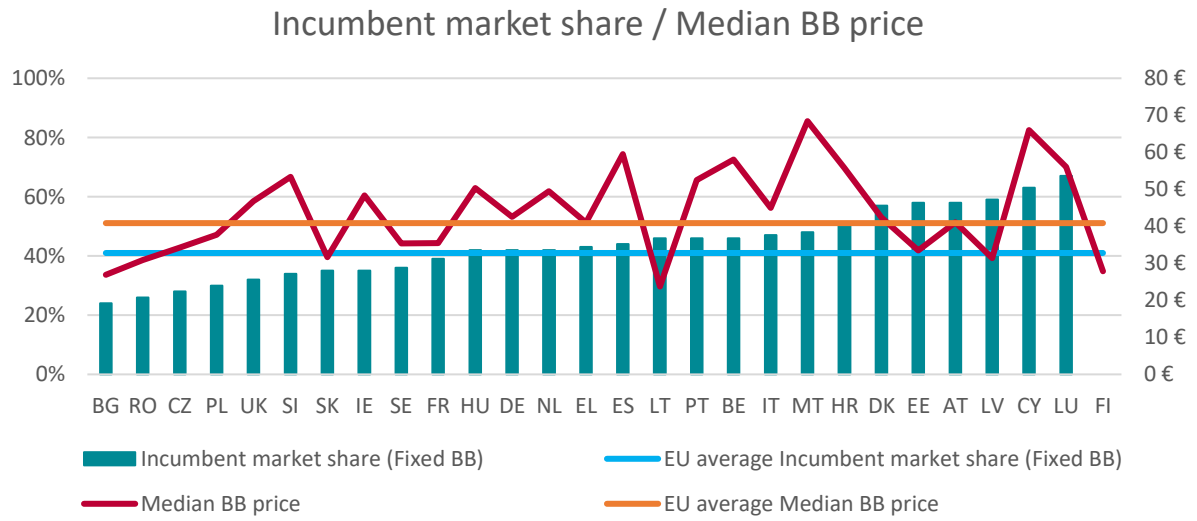


Figure 65 Correlation Incumbent market share and median BB price (own calculation & illustration based on DESI 2016)

➔ Possible NBP measures: infrastructure mapping tools, open access to state owned infrastructures, financial incentives for operators to enter the market, public investments (e.g. wholesale providers)

8.1.2 Demand side activities and digitisation of society as a whole

The acceptance of ICT-services within a given country is usually directly linked to take-up and therefore indirectly also linked to coverage. There are several indicators for the digitization of a country (e.g. digital skills of the population, availability and usage of eGovernment, usage of ICT technology in business, education, health care and other areas). However, they are often difficult to quantify. A very simple, yet meaningful indicator is the number of "non-liners", meaning the number of persons that have never used the internet in their life. This is an interesting figure to evaluate since a low share of non-liners indicates that a country has become truly "digitised", with digitization covering society as a whole, notwithstanding other socio-economic factors such as age, income, education or health. By contrast, a high number of non-liners means that a significant percentage of a country's population is completely excluded from digital life, not even being able to enjoy the most basic benefits of the digital world, which clearly indicates that a profound digitization of society has not taken place.

The number of "non-liners" is also linked to the quality of broadband infrastructure. The better the infrastructure and thus the better, faster and simpler the access to digital applications and services, the easier it is to illustrate the vast benefits of the digital world to non-liners and thereby turn them into "digital citizens". The percentage of non-liners correlates negatively with NGA coverage (correlation coefficient of -0,30), meaning the better the infrastructure, the lower the number of non-liners. Nevertheless, we can also observe that there are many countries which have a decent NGA coverage, but still a relatively high share of non-liners. The reasons for such a development are usually to be found in a lack of digital awareness and digital skills, but to some extent also in affordability. This underlines the importance of demand side activities, which are a powerful tool that is often neglected by the National Broadband Plans.

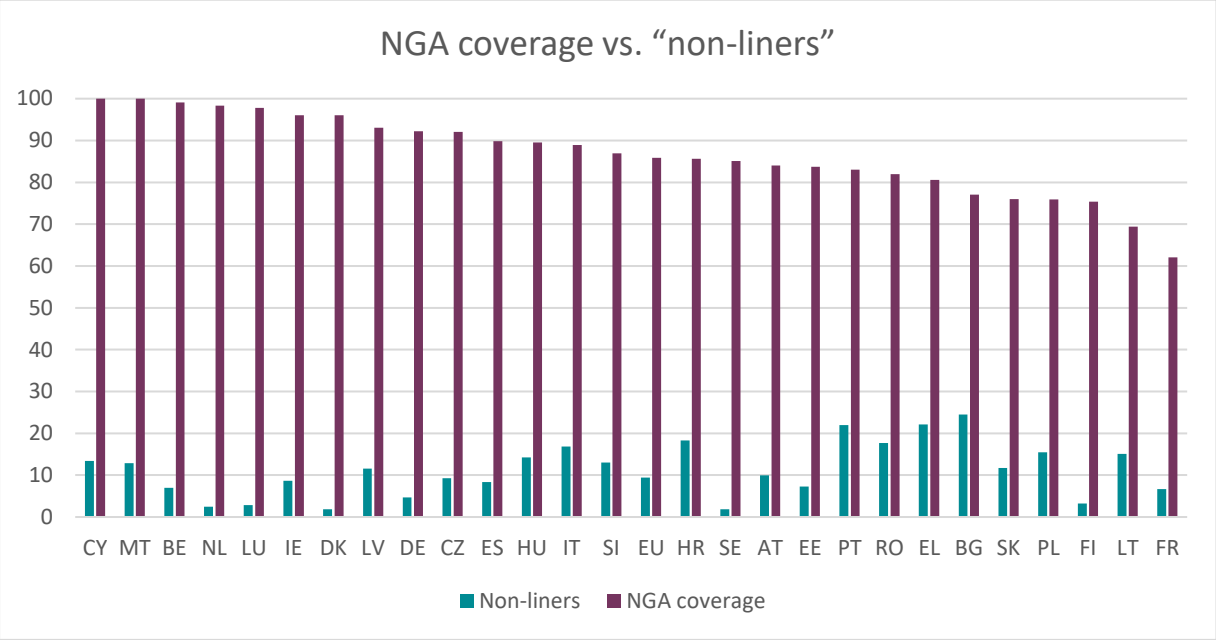


Figure 66 NGA coverage vs. “non-liners” (Individuals who have never used the internet). DESI 2020

➔ Possible NBP measures: awareness raising campaigns, public WLAN, use of digital media in education, tax deductions for end customers, vouchers, capacity building

8.1.3 State aid and financial instruments

Although there is still significant private investment across Europe and the number of white spots decreases on a daily basis, some areas will never be commercially viable. Public intervention is therefore sometimes inevitable to close the digital divide. To tackle this, in a number of cases Member States have decided to extensively use European Investment and Structural Funds (ESIF) – notably ERDF, EAFRD and RRF – for the extension of broadband networks.

The administrative capacity to maximise the leverage on public (national or regional) and private co-funding (notably through the use of financial instruments) will be crucial to support projects rolling out the broadband networks. These European funds are an important cornerstone of many National Broadband Plans and help to develop ICT-infrastructures, especially within rural areas with low commercial interest.

➔ Possible NBP measures: national funds and ESIF funds, dedicated financial instruments (e.g. loans), guarantees, PPP models

8.1.4 Regulation (AOs to access different infrastructures)

Regulation plays a major role in facilitating NGA roll-out. Most National Broadband Plans leave this topic to the mostly independent National Regulatory Authorities. However, although there are no measures described how the regulatory authorities should support NGA roll-out, they usually describe the ideal situation of a "level playing field". It is evident that national regulatory authorities can play a vital role in increasing competition. BEREC stresses the importance of network related factors such as "availability of high quality ducts in access networks". However, these capacities are only available in a small number of countries. Therefore, several other regulatory measures concerning access can increase broadband roll out, depending on the situation in each country (e. g. via LLU, SLU, VULA, duct access, access to civil works, fibre unbundling). The infrastructure based competition is a main driver of roll-out. Regulatory authorities can therefore play a vital role if they succeed in decreasing costs for late entrants that can subsequently put pressure on the incumbent and roll out their own networks. Furthermore, access regulations can avoid duplication of infrastructure and from a macro-economic perspective, avoid a waste of resources as capacity utilization increases. However, a regulatory approach that is too strict may backfire and discourage investments.

➔ Possible NBP measures: asymmetric and symmetric access regulation (to civil works, ducts), possibly also dark fiber, LLU and VULA

8.1.5 Population density and urbanization rate

One of the most defining characteristics for broadband roll out is the population density and urbanization rate. There is a correlation (correlation coefficient .425) between population density and NGA coverage. The explanation is simple: the more people are concentrated in one area, the cheaper the costs per connection. Malta is an outlier as it is extremely small with a comparably high population density. The case of France is interesting, as it shows a comparably low NGA coverage despite high population density. We hereby conclude that population density is not the single defining aspect, as there are also conditions inhibiting higher NGA coverage. We assume that factors such as topography, macro- und microeconomic hardships as well as few investments in network expansion and upgrades are leading to distorted results.

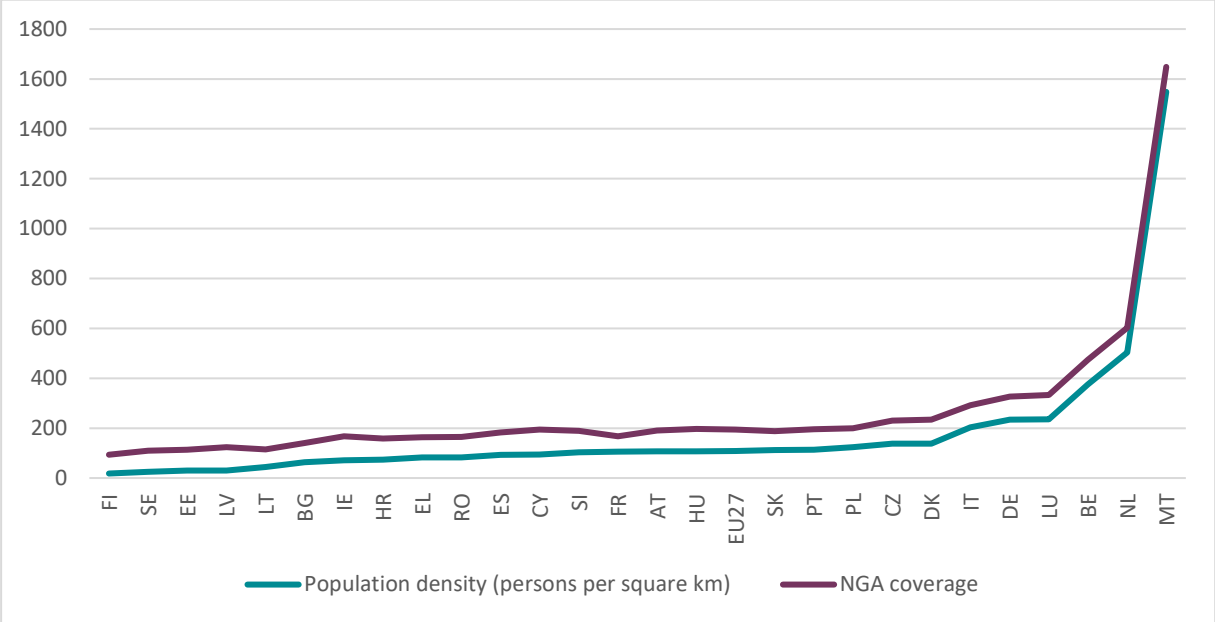


Figure 67 Population density (persons per square kilometre) and NGA coverage. Own calculation & illustration based on EUROSTAT and DESI 2020

Another important aspect besides the population density is the urbanization rate. Both a high degree of urbanization and a dense population indicate a potential business case that is in favour of private investments. Large urban areas are therefore an asset that supports swift roll-out.

Both population density and urbanization rate cannot be solved by a National Broadband Plan, therefore these two indicators are framework indicators that clearly foster deployment. National governments could in cases where low urbanization rate and low population density are given consider either the use of public funds, increased use of alternative methods of deployment (e.g. micro- and mini-trenching, aerial deployment etc.), aggregated demand via special purpose associations or financial incentives such as vouchers or tax deductions. There are a variety of instruments that might be used if national governments want to mitigate the negative impact of these conditions.

➔ Possible NBP measures: bottom-up approaches for demand aggregation, changes regarding USO, public investments, alternative methods of deployment

8.1.6 Availability of ducts and upgradable networks

While available ducts in access networks can increase the speed of roll-out, the inexistence of such ducts slows down the deployment of networks significantly. Directly buried cables are especially problematic as they cannot easily be upgraded or exchanged as the main cost driver – civil works - will apply for any party, either owner of these cables or alternative operators wishing to serve the same areas.

Although the influence of national governments and their respective National Broadband Plans on construction methods is limited, there are several examples where implementation processes solved these issues. For example, some countries use construction standards as a prerequisite for the receivers of funds (e.g. DE). In several countries there are also working groups for standardization, often led by the responsible ministry, a broadband competence centre or national regulators. Via these standardization approaches, the national governments can at least incentivize the use of common standards that provide for future-proof constructions.

➔ Possible NBP measures: development of construction standards, permit granting procedures can be altered to only allow for future proof methods of deployment

8.1.7 Willingness to pay and affordability

A very important aspect regarding take-up of broadband services is affordability and the willingness to pay respectively. This aspect is often an outcome of the economic situation (defined through e.g. rates of unemployment, median income, purchasing power).

When we analysed the situation in each Member State in 2016, we realized that the NGA retail prices (lowest offer) varied enormously. The absolute costs of an NGA subscription varied from 11,42 € in Lithuania to 69,37 € in Cyprus.

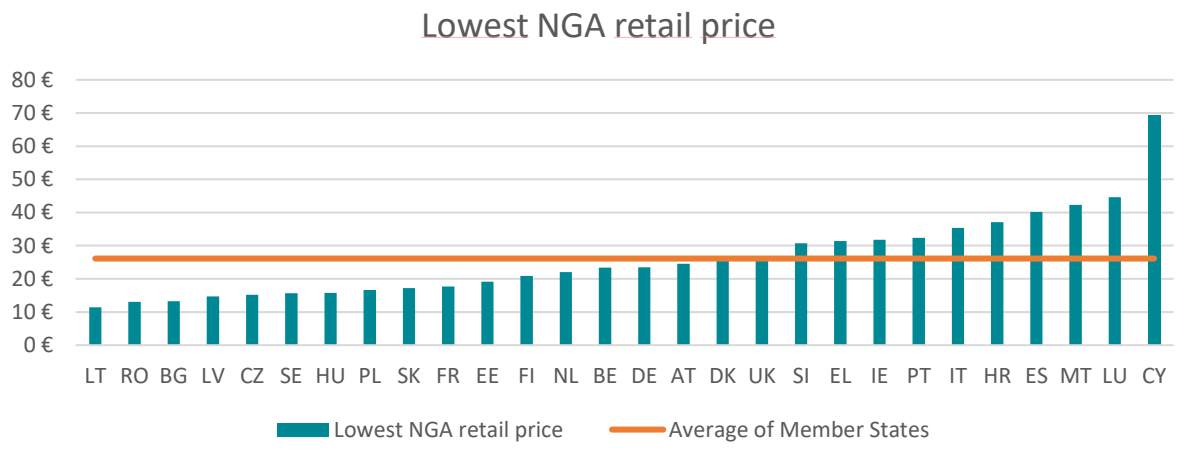


Figure 68 Lowest NGA retail price in MS (own illustration based on DESI 2016)

However, the nominal numbers cannot be compared as they do not reflect certain other aspects. For gaining more meaningful results, we put the Median monthly income of each Member State into relation to the lowest offer for an NGA subscription. This relation changed the picture substantially.

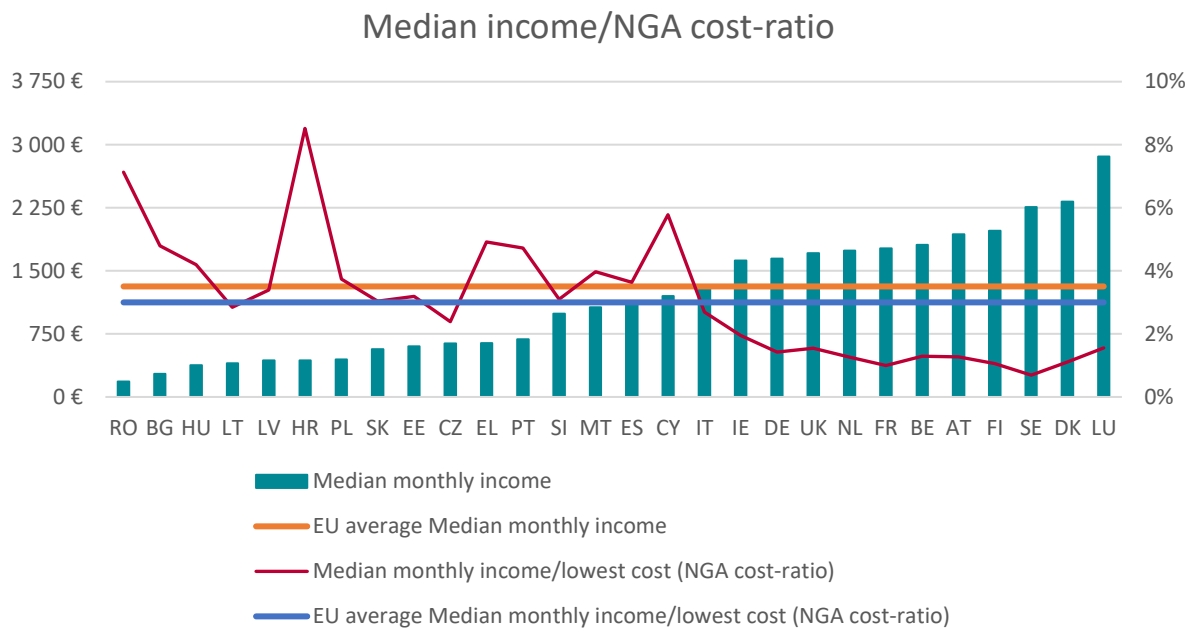


Figure 69 Correlation median income / NGA cost-ratio (own calculation & illustration based on EUROSTAT and DESI 2016)

By this comparison, we discovered some interesting developments in 2016. While the EU average median monthly income was 1314.58 €, the average lowest NGA offer was 26.12 € and the average ratio between median income and NGA subscription was roughly 3 %. Romanians payed an astonishing 7 % of the median monthly income on an NGA subscription, being the second highest value in the EU with only Croatians paying more while the Swedish population payed less than 1 %. This means that willingness to pay is an enormous asset. Sweden was often called as one of the countries with the highest willingness to pay, but in reality, the subscription prices were low in comparison to the median income. However, it is still true that in Sweden initial costs for getting connected or even rent mark-ups are well accepted, which in turn is again a true indicator that the Swedish population is willing to pay for high quality of services. In any case, lower prices incentivize take-up. However, a fierce price driven competition can slow down investments as return on investment takes place in longer periods of time.

➔ Possible NBP measures: tax deductions, free public WLAN, free internet access within centres of education (e.g. universities, libraries, schools)

9 Spheres of influence on NBP measures

The national governments of the EU-27 define different measures within their National Broadband Plans to stimulate NGA coverage and take-up in their respective countries. Overall, we defined four spheres of influence an NBP could have, namely Demand side measures, Supply side measures, Regulatory and Organizational measures as well as Transparency measures. Although one could argue that all of them could be subsumed under supply side and demand side, a more detailed analysis seems to be more appropriate. Demand and Supply are both enormous factors for broadband roll-out, however, transparency measures recently gained momentum. They are the striking feature of the cost reduction directive and often cover demand side (service mapping) and supply side (infrastructure mapping) alike. Regulatory and organizational measures are also in the middle of demand and supply as they often set the framework how supply and demand can interact. All measures described within the NBPs can be categorized within these four spheres of influence.

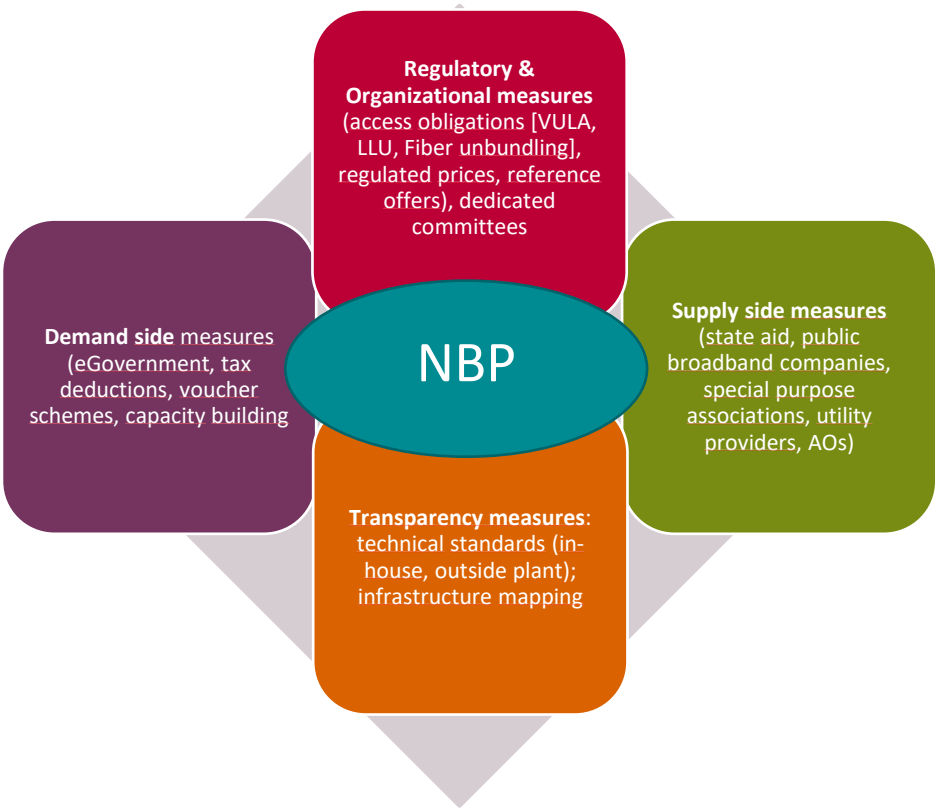


Figure 70 Spheres of influence of NBPs

Each NBP is especially detailed in one or more of these aspects. Nonetheless, a clear distinction is often not possible as a strong focus on regulations (e.g. access obligations) are often accompanied by strong

transparency measures. The NBPs in EU are relatively even distributed towards each of the four spheres.

10 Conclusion and outlook

This study was initially designed to give an overview on the National Broadband Plans of the European Union and to assess the probability of reaching the DEA 2020[175]. It has been adapted to the Gigabit Society 2025 and Digital Decade 2030 targets. For this purpose, we have first analysed the state of connectivity at European and on National Levels. We have seen that the outlook towards reaching the Gigabit Society 2025 and Digital Decade 2030 targets is overall quite positive. We then proceeded to analyse the National Broadband Plans individually. We have seen that many countries will struggle to meet the connectivity targets. However, we have identified several promising aspects that might positively impact rollout in the future: especially the strong demand for ultrafast bandwidths is a positive sign that will increase coverage and take-up alike. Furthermore, we have seen that in many countries there are strong efforts to bootstrap and incentivize VHCN and FTTx markets in rural areas. This is partly achieved through state aid, but sometimes also through cross-sector cooperation and demand aggregation.

We have seen that the involvement of local actors is gaining more and more importance with respect to deploying digital infrastructures in areas deemed economically not interesting for operators. These local actors act as catalysts, aggregate demand and build capacities whenever needed. Broadband competence centres already play a vital role within these activities. The established BCOs are further supporting these local activities.

After the country sections, we have shown some general trends that we have discovered during the study and illustrated the general possibilities countries have to influence them.

The EU is looking towards ambitious connectivity goals set by the Gigabit Society 2025 and Digital Decade 2030. As shown within the previous sections of this study, as of today many of the Member States are quite well positioned to achieve these goals.

Connecting the socio-economic drivers to gigabit networks by 2025 (Access to 1 Gbps for all schools, transport hubs & main providers of public services &digitally intensive enterprises) is a priority and, while robust backbone networks are expanding, yet there is still room for improvement for some of the Member States. Most Member States realized the importance of connecting centres of education,

[175] The original study published on 2017 and update from 2021.

business parks and public administrations. The demand by business and institutional consumers is of increasing importance. Often, these powerful drivers have socio-economic influence far beyond their actual scope as they act as multipliers for other entities, including the private sector. Whenever students, employees or customers have access to these facilities and experience the possibilities of modern digital infrastructures and corresponding web applications, they are more likely to demand better connections for their private life as well. This in turn reduces the take-up risk of operators which offer high-end solutions especially in areas where deployment of digital infrastructures is deemed to be economically not viable. Hence, for this objective to be attained, an even stronger focus on these socio-economic drivers is necessary.

Regarding the connectivity target "Access to download speeds of at least 100 Mbps that can be upgraded to 1 Gbps for all households by 2025", the situation is much more challenging. Currently, most Member States are struggling to meet this objective. They invest in future proof fibre networks that are able to deliver gigabit connectivity, however, there are some Member States that are still dependent on technologies where it is not guaranteed, whether the 100 Mbps connections can be upgraded to 1 Gbps and deliver reliably this performance for all users. Thus, in order to improve connectivity and achieve full coverage across Europe, future efforts need to provide appropriate incentives and means for increasing investment in broadband infrastructure roll-out. Local actors as well as the private sector investors have to be included and in turn have to make use of such measures. The existing urban rural divide and difficult topography in many MS will make covering 100 % of households very challenging.

Regarding the 5G target (Uninterrupted 5G wireless broadband coverage for all urban areas and major roads and railways), the perspectives are relatively good. Commercial roll-out of 5G is in full speed and there optimism about basic 5G connectivity. Yet, deployment and take up of standalone 5G systems is proceeding slower than expected and for some MS uninterrupted service along major roads and railways may be a challenge.

The fibre rollout is catching-up with expectations, and the planned public and private investments for the next years seem ambitious. The majority of the MS have high or medium probability of reaching the Digital Decade 2030 target of gigabit for all households, and the overall outlook for the EU is quite positive.

The future studies in this area might take an even closer look into the affordability of FTTH (e.g. price of FTTH, FTTC vice FTTH), focus further more on coverage and penetration by technologies that are capable of providing reliable symmetrical gigabit speeds (e.g. fibre or 5G FWA).

Current policies, investments and regulations in the EU will have an enormous impact on the rollout of the broadband technologies in the coming years.

In March 2021, the Commission presented a vision for Europe's digital transformation by 2030: the Digital Compass[176]. This vision for the EU's digital decade revolves around four main areas with specific targets for 2030: Secure and sustainable digital infrastructures, Skills, Digital transformation of businesses and Digitalisation of public services. The ambition for the Secure and sustainable digital infrastructures area is that by 2030 all European households are covered by a Gigabit network, and all populated areas are covered by 5G.

Here below the summary of the initiatives that help accelerating the achievements of the Gigabit Society 2025 and Digital Decade targets.

- The European Commission's Next Generation EU[177], an instrument designed to boost the recovery, is an important stimulus to gigabit-capable infrastructure's rollout financed through the EU budget. As part of the Next Generation EU, with a volume of EUR 672.5 billion in loans and grants, the Recovery and Resilience Facility (RRF) will offer financial support for investments and reforms in Member States. It provides a unique opportunity to accelerate 5G and gigabit infrastructure in Europe, as at least 20% of the RRF will be spent by the Member States on digital investments.
- The Connecting Europe Facility 2 (CEF-2) Digital strand[178] will stimulate the deployment and modernisation of broadband networks. The CEF-2, under the next 2021-2027 Multiannual Financial Framework, will finance digital connectivity infrastructure.
- The Connectivity Toolbox[179] provides best practices from Member States for cutting the cost of network rollout and for providing timely access to radio spectrum for 5G. The revised Guidelines on State aid for broadband networks[180] help public authorities to design support measures compatible with the Single Market that contribute to achieving the 2030 connectivity objectives of the European Digital Decade policy programme and ensure gigabit connectivity for everyone as well as 5G coverage for all populated areas.

[176] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en
[177] https://ec.europa.eu/info/strategy/eu-budget/long-term-eu-budget/2021-2027_en
[178] https://digital-strategy.ec.europa.eu/en/activities/cef-digital
[179] https://digital-strategy.ec.europa.eu/en/policies/connectivity-toolbox
[180] https://digital-strategy.ec.europa.eu/en/policies/broadband-state-aid

- The Gigabit Infrastructure Act (GIA), replacing the 2014 broadband cost-reducing directive (BCRD), will allow faster rollout of gigabit-capable connectivity. The Act will simplify, reduce the cost, and accelerate administrative procedures for granting permits, reduce hurdles for operators and national administrations, thereby making the deployment process smoother and faster.
- The work towards multi-orbital secure and resilient space connectivity for EU is launched[181]. The initiative will enhance and connect critical infrastructures, including terrestrial networks, and provide high-speed broadband and digital services throughout Europe, removing dead zones.
- The European BCO Network[182] brings together national and regional public authorities in charge of broadband deployment to exchange knowledge and good practices with peers, experts and European Commission representatives, building their capacity to bring reliable, high-speed broadband connectivity to all EU citizens.

Europe's digital future will heavily depend on scalable and future-proof technologies that are able to fulfil all future demands alike. If the Union and its Member States incentivise the deployment of these technologies, Europe's digital infrastructure can become a competitive advantage and support Europe's societal and economic progress alike.

[181] https://ec.europa.eu/defence-industry-space/major-space-breakthrough-secure-digital-connections-future-2021-01-12_en
[182] https://digital-strategy.ec.europa.eu/en/policies/bco-network

11 List of Abbreviations

2G ..... 2nd Generation Wireless Mobile Technology

3G ..... 3rd Generation Wireless Mobile Technology

4G ..... 4th Generation Wireless Mobile Technology

5G ..... 5th Generation Wireless Mobile Technology

ADB ..... Tender Database – Germany (Ausschreibungsdatenbank)

ADF ..... Association of French Counties (Assemblée des Départements de France)

ADSL(2)(+) ..... Asymmetric Digital Subscriber Line(2)(+)

Agcom ..... Authority for Communication Granting – Italy (L'Autorità per le garanzie nelle comunicazioni)

AgID ..... Digital Agency of Italy (Agenzia per l'Italia Digitale)

AKOS ..... Agency for Communication Networks and Services - Slovenia

ANACOM ..... National Communications Authority – Portugal (Autoridade Nacional de Comunicações)

ANCOM ..... Authority for Management and Regulation in Communications - Romania

AO(s) ..... Alternative Operator(s)

ARCEP ..... French Regulation Authority of Electronic Communication and Post (L'Autorité de régulation des communications électroniques et des postes)

ARF ..... Association of French Regions (Association des Régions de France)

AT ..... Austria

AVICCA ..... Association of local broadband connected communities – France (Association des Villes et Collectivités pour les Communications Electroniques et l'Audiovisuel)

BBB ..... Federal Broadband Bureau – Germany (Breitbandbüro des Bundes)

BDUK ..... Broadband Delivery UK

BE ..... Belgium

BEREC ..... Body of European Regulators for Electronic Communications

BG ..... Bulgaria

BGN ..... Bulgarian Lev (currency)

BIPT ..... Belgian Institute for Postal Services and Telecommunications – Belgium (Institut belge des services postaux et des télécommunications / Belgisch Instituut voor postdiensten en telecommunicatie)

BMVI ..... Federal Ministry of Transport and Digital Infrastructure – Germany (Bundesministerium für Verkehr und digitale Infrastruktur)

BMVIT ..... Ministry for Transport, Innovation and Technology – Austria (Bundesministerium für Verkehr, Innovation und Technologie)

BMWK..... Federal Ministry for Economic Affairs and Climate Action – Germany (Bundesministerium für Wirtschaft und Klimaschutz)

BNetzA..... Federal Agency for Electricity, Gas, Telecommunications, Post and Railway – Germany (Bundesnetzagentur)

BT..... British Telecom (private company)

CAPEX ..... Capital expenditures

CATV ..... Community Access Television (cable television)

CEF..... Connecting Europe Facility

CETIN ..... Czech Telecommunication Infrastructure - private company (Česká telekomunikační infrastruktura)

CIPE..... Interministerial Committee for Economic Programming - Italy (Comitato Interministeriale per la Programmazione Economica)

CIS..... Centralized Information System

CNMC..... National Commission for Markets and Competition on electronic and audiovisual communications - Spain

COBUL..... Committee for the dissemination of Ultrafast Broadband – Italy (Comitato per la diffusione della Banda Ultralarga)

ComReg ..... Commission for Communications Regulation - Ireland

CRC ..... Communications Regulatory Commission - Bulgaria

CTU ..... Czech Telecommunication Office

CY..... Cyprus

CYTA ..... Cyprus Telecommunications Authority (operator)

CZ..... Czech Republic

CZK..... Czech Koruna (currency)

DAE ..... Digital Agenda Europe

DBO..... Design Build and Operate

DCENR..... Department of Communications, Energy and Natural Resources - Ireland

DCLG ..... Department for Communities and Local Government - United Kingdom

DCMS..... Department for Culture, Media and Sport- United Kingdom

DE ..... Germany

DEC ..... Department of Electronic Communications - Cyprus

Defra..... Department for Environment, Food and Rural Affairs - United Kingdom

DK ..... Denmark

DKK ..... Danish Krone (currency)

DOCSIS..... Data Over Cable Service Interface Specification

(x)DSL..... Digital Subscriber Line

DSM ..... Digital Single Market

E.A. ECNIS ..... Electronic Communication Networks and Information Society - Bulgaria

EAFRD ..... European Agricultural Fund for Rural Development

EBRD ..... European Bank for Reconstruction and Development

EE ..... Estonia

EEK ..... Estonian Kroon (currency)

EETT ..... National Telecommunications and Posts Commission - Greece

EFSI ..... European Fund for Strategic Investment

EL ..... Greece

ELASA ..... Estonian Broadband Development Foundation

ELFA ..... European Local Fiber Alliance

ENGAGE ..... Enhancing Next Generation Access Growth in Europe (Project)

ERDF ..... European Regional Development Fund

ES ..... Spain

ESIF ..... European Structural Investment Funds

EU ..... European Union

EUR ..... Euro (currency)

FFTP ..... Fibre to the Premises

FI ..... Finland

FICORA ..... Finnish Regulatory Authority (Viestintävirasto)

FIRIP ..... Industrial Federation of Public Initiative Networks – France (Fédération des Industriels des Réseaux d'Initiative Publique)

FNCCR ..... National Federation of Public Service Providers – France (Fédération Nationale des Collectivités Concédantes et Régies)

FPS ..... Federal Public Service Economy, S.M.E.s, Self-employed and Energy - Belgium

FR ..... France

FSN ..... National Fund for the Digital Society – France (Fond National pour la Société Numérique)

FTTB ..... Fibre to the Building

FTTC ..... Fibre to the Curb

FTTH ..... Fibre to the Home

FTTx ..... Fibre to the x

FWA ..... Fixed Wireless Access

GAK ..... Joint Task on Agricultural Structures and Coastal Protection – Germany (Gemeinschaftsaufgabe Verbesserung der Agrarstruktur und des Küstenschutzes)

GBER ..... General Block Exemption Regulation

Gbps..... Gigabits per second

GHz ..... Gigahertz

GIA ..... Gigabit Infrastructure Act

GIS ..... Geographic Information System

GPON ..... Gigabit Passive Optical Networks

GSM ..... Global System for Mobile Communications

HAKOM ..... Croatian regulatory authority for network industries - Croatia

HFC ..... Hybrid Fibre-Coaxial

HH ..... Household

HR ..... Croatia

HRK ..... Croatian Kuna (currency)

HSDPA..... High Speed Downlink Packet Access

HSPA(+)/H(+) ..... (Evolved) High Speed Packet Access

HU ..... Hungary

HUF ..... Hungarian Forint (currency)

ICT ..... Information and communications technology

ICT UNIE ..... Information Technology and Telecommunication Association - Czech Republic

IE ..... Ireland

ILR ..... Luxembourgian Regulations Institute (Institut Luxembourgeois de Régulation)

IMT ..... International Mobile Telecommunications

IoT ..... Internet of Things

IS ..... Information System

ISO ..... International Organization for Standardization

ISP(s) ..... Internet Service Provider(s)

IST ..... Information Systems Technology

IT ..... Italy

ITL ..... Estonian Association of Information Technology and Telecommunications

IVPK ..... Information Society Development Committee - Lithuania

KLIC ..... Cable and Pipeline Information Centre - Netherlands

KLIM-CICC ..... Federal Duct and Cable Contact Point - Belgium, Wallonia and Brussels (Federaal Kabels en Leidingen Informatie Meldpunt / Contact federal Informations Câbles et Conduites

KLIP ..... Cable and Duct Information Portal - Belgium, Flanders (Kabel- en Leidingin-formatieportaal)

LAG ..... Local Action Group

LDR ..... Less Developed Region

LEC ..... Law for Electronic Communication - Bulgaria

LIA ..... Latvian Internet Association

LIKTA ..... Latvian Information and Communications Technology Association

LLU ..... Local Loop Unbundling

LSA ..... Learning Support Assistant

LSP ..... Law on Spatial Planning - Bulgaria

LT ..... Lithuania

LTE ..... Long-Term Evolution

LU ..... Luxembourg

LV ..... Latvia

LVL ..... Latvian Lats (currency)

LVRTC ..... Latvia State Radio and Television Centre (Latvijas valsts radio un televīzijas centrs)

M2M ..... Machine to Machine

MAN ..... Metropolitan Area Network

Mbps ..... Megabits per second

MCA ..... Malta Communications Authority

MCSI ..... Ministry of Communications and Information Society - Romania

MDA ..... Ministry of Digital Affairs - Poland

MDR ..... More Developed Region

MDU ..... Multi-Dwelling Unit

MDVRR ..... Ministry of Transport, Construction and Regional Development of the Slovak Republic

MHz ..... Megahertz

MISE ..... Ministry of Economic Development – Italy (Ministero dello Sviluppo Economico)

MITA ..... Malta Information Technology Agency

MND ..... Ministry of National Development of the Republic of Hungary

MNO ..... Mobile Network Operator

MS ..... Member State

MT ..... Malta

MTITC ..... Ministry of Transport and Communications - Bulgaria

MVNO ..... Mobile Virtual Network Operator

NASES ..... National Agency for Networking and Electronic Services - Slovakia

NBP ..... National Broadband Plan

NGA ..... Next Generation Access

NGN ..... Next Generation Network

NGO ..... Non-governmental organization

NL..... Netherlands

NMHH..... National Media and Infocommunications Authority - Hungary

NP-BBI..... National Programme for Broadband Backhaul Infrastructure - Croatia

NPRSNG ..... National NGN Development Plan - Czech Republic (Národní plan rozvoje sítí nové generace)

NRA..... National Regulatory Authority

Ofcom ..... Office of Communications - United Kingdom

OP ..... Operational Programme

OPRD ..... Operational Programme Regional Development - Bulgaria

PL..... Poland

PNBL ..... National Broadband Plan – Italy (Piano Nazionale Banda Larga)

PNBUL..... National ultrafast-Broadband Plan – Italy (Piano Nazionale Banda Ultra Larga)

PON..... Passive Optical Network

(M)POP ..... (Minimum) Point of Presence

PPDR ..... Public Protection and Disaster Relief

PPP..... Public–private partnership

PSTN ..... Public Switched Telephone Network

PT..... Portugal

PTS..... Swedish Post and Telecom Agency (Post- och telestyrelsen)

PUC..... Public Utility Commission - Latvia

R&D ..... Research and Development

RCA ..... The Radio Communication Agency - Netherlands

RCBF ..... Rural Community Broadband Fund - United Kingdom

RO..... Romania

RRT..... Communications Regulatory Authority of the Republic of Lithuania

RSPP..... Radio Spectrum Policy Programme

SE..... Sweden

SEK..... Swedish Krona (currency)

SETSI ..... Secretary of State for Telecommunications and Information Society - Spain

SI..... Slovenia

SIM..... Subscriber Identity Module

SJSC..... State Joint-Stock Company

SK..... Slovakia

SLU ..... Sub Loop Unbundling

SMC ..... Communications and Media Service - Luxembourg

SME(s)..... Small and medium-sized enterprise(s)

SMP ..... Significant Market Power

SOP-IEC..... Sectoral Operational Programme-Increase of Economic Competitiveness - Romania

SSSI(s) ..... Site(s) of Special Scientific Interest - United Kingdom

SUMIN ..... Ministry of Transport and Communications of the Republic of Lithuania

TDD ..... Time-division duplexing

TEN-T ..... Trans-European Transport Networks

TIFF ..... Tagged Image File Format

TKG ..... Telecommunications Act - Austria/Germany (Telekommunikationsgesetz)

TLC ..... Telecommunication(s)

TSM..... Telecoms Single Market

UHF ..... Ultra High Frequency

UK ..... United Kingdom

UKE ..... Office of Electronic Communications - Poland

UMTS ..... Universal Mobile Telecommunications System

USO..... Universal Service Obligation

VAT ..... Value Added Tax

VDSL..... Very-high-bit-rate Digital Subscriber Line

VHCN ..... Very High Capacity Networks

VULA ..... Virtual Unbundled. Local Access

WCDMA..... Wideband Code Division Multiple Access

WiMAX..... Worldwide Interoperability for Microwave Access

WLAN..... Wireless Local Area Network

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