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WHITE PAPER ON EU BROADBAND PLAN CHALLENGES AND OPPORTUNITIES

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1 Executive summary

The value of ubiquitous high-speed broadband connectivity has been demonstrated in numerous socio-economic studies.[1] Policy makers agree that there is a need for co-ordinated long-term investment to realise this potential. The Digital Agenda for Europe (DAE) is the organising structure for EU Member States. It includes ambitious targets for broadband coverage for 2020 and 2025 supported by various policy (e.g. Broadband EU Cost Reduction Directive) and regulatory (e.g. re-use of existing ducts and poles) measures.

Despite these efforts, many EU countries are far from achieving the 2020 target of universal 30Mbit/s coverage, and the 2025 targets will be even harder to meet. Failure to hit these targets is likely to mean that the socio-economic gains and digital inclusivity benefits that are associated with ubiquitous high-speed broadband coverage may not be fully realised. The emerging 'digital divide'[2] needs to be addressed, but the shortage of funds for major infrastructure projects is a significant problem.

Balancing the need for cost-efficient, widespread, high-speed connectivity in a context of limited public funds most likely requires a combination of technological solutions. Fibre networks offer very high-speed connectivity, but the high cost of deployment means that they are most cost-effective in dense areas. For wide-area coverage, the capabilities of wireless technologies mean that high-speed connectivity can be provided at a lower cost in certain circumstances, particularly where there are 'clusters' of demand in rural areas. Fixed wireless access (FWA) can play a role in complementing and extending the reach of fibre networks.

The current difficulties faced by the vast majority of the EU countries set to miss the DAE coverage targets for 2020 and 2025 have their origins in several contributory factors:

- **Funding:** Public funding for broadband roll-out has been variable from country to country. To date, most allocated public funds have already been consumed in supporting roll-out in the least challenging parts of rural areas. Remaining funds will struggle to extend coverage to less accessible and sparsely populated rural areas which are generally the most expensive. The importance of rural broadband coverage is recognised by stakeholders such as EC (DG AGRI[3]).
- **Policy priorities:** Many countries have national broadband plans (NBPs) that are not fully aligned with the DAE targets, partly as these targets are not legally binding on Member States. These NBPs vary according to local market conditions (including for example the extent and nature of competition) and national priorities, with differing coverage targets, broadband specifications (e.g. upload speed is sometimes specified), speeds of roll-out, distribution of eligible premises, and phasing approaches (e.g. targeting 100Mbit/s directly). Where the eligible premises are distributed in a highly-dispersed manner, demand-side intervention schemes (e.g. end-user subsidy) can be a complementary approach to supply-side intervention schemes to help achieve the DAE targets.

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1 An example of such a study is the European Commission (EC) report on the benefits of broadband (http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=1809).

2 This term refers to the split between those people who have high and those who have low broadband speed access.

3 The Directorate-General for Agriculture and Rural Development.

- **Legal compliance:** In order to ensure effective use of public funds, and to minimise risk associated with the digital divide, absolute clarity is needed on technology eligibility for next-generation access (NGA) broadband deployment in the EU broadband State-aid guidelines. The EC's current State-aid guidelines (in particular clauses 57 and 58) are ambiguous, meaning that FWA could potentially be dismissed as an NGA technology by authorities as it may not be considered as an eligible NGA technology. If the EC (DG COMP) were to clarify this ambiguity, and perhaps focus on service levels (e.g. minimum speed) and 'future-proofness', local governments would be in a better position to understand the technology trade-offs and be more effective in their engagements with suppliers during procurement.

  Similarly, BEREC[4] has been asked to develop guidelines for very-high-capacity networks (VHCNs), but it is unclear whether or how the VHCN guidelines might be linked to the broadband State-aid guidelines. It may be beneficial to have a single definition of future broadband networks to avoid any potential confusion amongst key stakeholders in Europe. BEREC should work closely with DG COMP while developing the VHCN guidelines to avoid such confusion. It may also be beneficial to adopt a technology-neutrality proposition similar to the principle used in the current State-aid guidelines.

Given limited public funding, each EU country should undertake an appraisal of delivery options to consider key factors such as 'future-proofness', broadband specification, implementation duration, geography and phasing approach (e.g. targeting 30Mbit/s first and then 100Mbit/s, and over what timeframe). Alternative NGA technologies need to be fully explored with the objective of delivering broadband in the most cost-efficient and rapid way to tackle and reduce the negative consequences of digital divide.

Previous mobile developments have involved competing broadband technologies for 3G through to 4G which to some extent limited the full potential of economies-of-scale benefits. 5G is different in that network operators have a very clear upgrade path to the future, with significant industry support towards 5G standards developed by the 3GPP body. One such benefit is lower cost for electronics devices (e.g. chipsets for user devices and network equipment) which could result in lower user-device and network-deployment cost. The future-proof 5G platform allows technology upgrades rather than technology 'overhaul', reducing long-term costs.

Wireless connectivity has a role to play as a complement to, rather than a substitute for, fibre to the premises (FTTP). Telefónica in Spain and Deutsche Telekom in Germany are examples of network operators with plans to deploy significant FTTP network infrastructure, but which have also indicated plans to deploy an FWA solution as a complement to their existing networks; other similar operators are likely to follow this lead over time. This suggests that FTTP and 5G networks can be used as effective complements to each other. Governments across Europe (e.g. France and the UK) have already devised and published 5G network strategies despite having invested heavily in FTTx[5] network infrastructure via their NBPs. A dense fibre network allows wireless masts to have fibre backhaul, resulting in synergy benefits (i.e. cost savings).

The economics of wireless infrastructure could be beneficial in certain circumstances to help achieve the DAE targets. A mix of fibre-based and FWA solutions could be used to address the rural broadband challenge in a timely manner; the nature of the technology mix being highly dependent on the total (private

4 The Body of European Regulators for Electronic Communications.

5 FTTx includes fibre to the cabinet (FTTC), fibre to the building (FTTB), fibre to the home (FTTH) and FTTP.

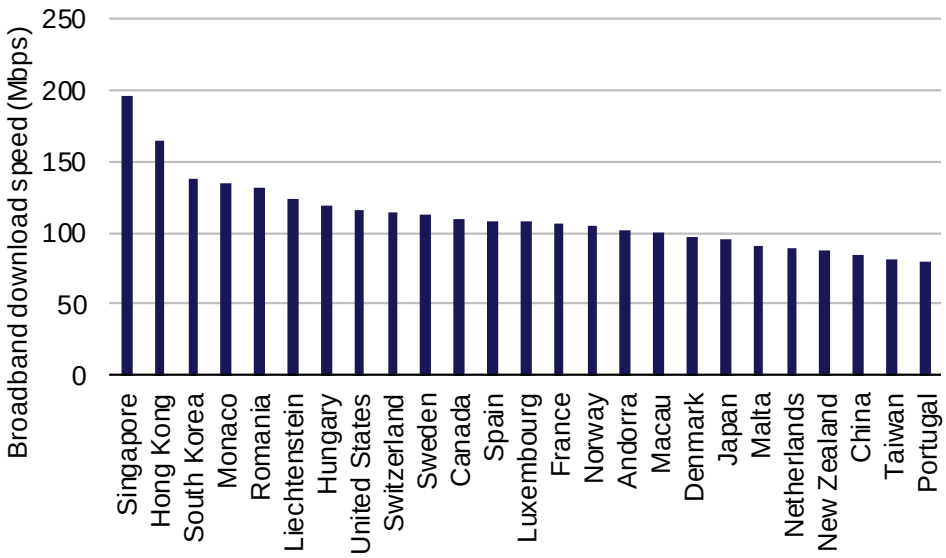
plus public) funding being available. There are already examples across Europe that demonstrate that FWA is an NGA technology that can satisfy the DAE 30Mbit/s coverage targets. Open Fiber in Italy and Relish in the UK are using FWA solutions based on a 3GPP solution as part of NBP delivery.

Given the future-proof nature of the 3GPP technology platform, FWA deployment (using both 3GPP 4G and 5G) can potentially play a role in helping meet NBP and DAE targets. The extent to which FWA plays a role will be critically dependent on local market conditions (e.g. the extent of population 'clustering' in rural and remote areas, suppliers' strategic choices, government budgets, the procurement process and State-aid policy implementation).

2 Introduction

The European Commission (EC) has placed significant emphasis on the economic and social value of high-speed broadband connectivity. Countries such as Singapore, Hong Kong and South Korea have higher broadband speeds than EU countries (see Figure 2.1) and have experienced socio-economic gains from these higher speeds. The EC has set out policy objectives, in the form of Digital Agenda for Europe (DAE) broadband targets, to expedite the deployment of high-speed broadband coverage and encourage take-up.

Figure 2.1: Leading countries based on download broadband speed [Source: Ookla,[6] Feb 2019]



In this paper, we examine the barriers and challenges faced by the EU countries in achieving their national broadband plan (NBP) targets and discuss how these barriers/challenges can be tackled or mitigated. The paper also explores how these targets could be achieved in a rapid and cost-efficient manner.

2.1 The importance of broadband connectivity

Evidence from numerous research studies supports the finding that broadband connectivity in a region brings a significant improvement in economic conditions and productivity.

A study, conducted on behalf of the EC,[7] found the benefit-to-cost ratio[8] (BCR) varying between 2.64 and 2.72 over a period of nine years for EU countries depending on the level of State-aid intervention

6 https://www.speedtest.net/global-index (February 2019).

7 http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=1809

8 In this context, the BCR is the ratio of benefits and costs associated with broadband investment. For example, a BCR of 2 means that every euro spent will result in EUR2 of socio-economic benefits.

policy. The study further specified that for every billion euro spent, c.19 000 jobs would be created over a period of nine years.

The European Court of Auditors (ECA) 2018 special report[9] states that a 10% increase in broadband connections could result in an increase of 1% in GDP per capita per annum, and a 10% increase in broadband connections could raise labour productivity by 1.5% over a period of five years.[10]

2.2 Broadband targets for DAE

The EC 'Europe 2020 Strategy'[11] has set objectives for the growth of the EU by 2020. The strategy consists of seven pillars, one of which is ICT-enabled benefits for EU society.[12] The EU's Digital Agenda proposes to tap the potential of ICT to ensure the economic and social growth of the EU countries. The EC has defined two sets of DAE targets that Member States should aim to achieve by 2020 and 2025. In the context of this paper, the focus is on 30Mbit/s and 100Mbit/s coverage:

- **DAE 30Mbit/s coverage target:** coverage of next-generation networks (NGNs) providing 30Mbit/s or more for all citizens by 2020
- **DAE 100Mbit/s coverage target:** all European households to have access to download speeds of at least 100Mbit/s by 2025.

The DAE targets are not legally binding in nature. This is one of the reasons why EU countries have developed their own NBP targets that are sometimes not fully aligned with the DAE targets.

2.3 Technology outcome of NBP projects

NBP projects aim to make broadband coverage available across a country/region by focusing on areas that are deemed to be uneconomic. These plans have to legally comply with EU broadband State-aid guidelines.[13] One of the key principles of State-aid guidelines is technology-neutrality,[14] which means the selection of technology is agnostic as long as the solution meets the specifications. There is no single, comprehensive solution – different technology solutions will be best in different contexts. The main criterion is that the solution meets the project specifications that are State-aid compliant.

Solutions proposed for NBP projects have predominantly focused on FTTx[15] technologies. This could be explained to some extent by the fact that fixed incumbent network operators won procurement competitions

9 *"Broadband in the EU Member States: despite progress, not all the Europe 2020 targets will be met"* (https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf)

10 Page 9 of *"Broadband in the EU Member States: despite progress, not all the Europe 2020 targets will be met"* (https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf)

11 https://ec.europa.eu/digital-single-market/en/europe-2020-strategy

12 The other six pillars are: enterprise environment, innovative Europe, education and training, labour market and employment, social inclusion, and environment sustainability.

13 https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF

14 Paragraph 78(e) of https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF

15 FTTx includes fibre to the cabinet (FTTC), fibre to the building (FTTB), fibre to the home (FTTH) and fibre to the premises (FTTP).

for a large share of the NBP projects in EU countries, and these operators have traditionally deployed fibre and copper cables. There are limited examples of instances where fixed wireless access (FWA) solutions have been granted subsidies in State-aid areas (one such example is Open Fiber in Italy).

However, we observe that national policies seem to show a general preference for FTTP deployments. Some EU countries explicitly mention fibre in their NBPs; others implicitly express a preference for FTTP. Some examples of NBPs that explicitly mention fibre are:

- **France:** The policy[16] states that, by 2022, 80% of the country's territory will be covered with fibre and the remaining 20% will be covered using alternative technologies[17]
- **Germany:** The policy's long-term aim is to develop a gigabit network using fibre and 5G[18]
- **Spain:** The policy (PEBA300×100[19]) aims to achieve 95%[20] fibre coverage by 2021
- **UK:** The policy aims to achieve 97% coverage with speeds of >24Mbit/s by 2020, using a mix of technologies. This is despite the fact that there is a preference for a fibre-based solution in the long term.[21] The UK Government has recently set out its ambition to achieve 100% FTTP coverage by 2033.[22]

2.4 Report roadmap

The remainder of this document is laid out as follows:

- Section 3 provides an assessment on the likelihood of EU countries meeting the DAE targets
- Section 4 assesses potential bottlenecks in the existing broadband State-aid guidelines and provides some early views on very-high-capacity network (VHCN) guidelines to be developed by BEREC[23]
- Section 5 describes the roadmap and capability of the 3GPP wireless ecosystem and discusses the role of FWA in EU countries.

16 Mission Très Haut Débit (THD); see http://www.francethd.fr/

17 https://www.connexionfrance.com/French-news/France-will-have-30MB-sec-internet-for-all-by-2022

18 https://ec.europa.eu/digital-single-market/en/country-information-germany

19 https://www.mincotur.gob.es/en-us/GabinetePrensa/NotasPrensa/2018/Paginas/ElGobiernopresentaelPlan300x100parallevarfibraa300Mbitsatodoslosn%C3%BAcleosdepoblaci%C3%B3ndeEspa%C3%B1a.aspx

20 https://opticalconnectionsnews.com/2018/03/spain-green-lights-e525-million-fibre-expansion/

21 Section 3 (page 4) of https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/379762/State_aid_-_Guidance_-_Technology_Guidelines.pdf

22 https://www.gov.uk/government/news/forging-a-full-fibre-broadband-and-5g-future-for-all

23 The Body of European Regulators for Electronic Communications.

3 Overview of NBPs across EU countries

This section analyses the current 30Mbit/s and 100Mbit/s coverage across EU countries and assesses the likelihood of the EU countries meeting these DAE coverage targets (see Section 2.2) on time.

3.1 The vast majority of EU countries (and potentially all EU countries) may not reach the DAE 30Mbit/s coverage targets

There are various factors contributing to relatively lower 30Mbit/s coverage in many EU countries

Figure 3.1 shows the progress made (by June 2017[24]) by EU countries towards achieving the DAE 30Mbit/s coverage targets.[25] The average 30Mbit/s coverage for EU28 was just below 80%. It is usually the case that the last 20% of coverage (in rural and remote geographical areas) is the most expensive part of network deployment. The European Investment Bank (EIB) estimates that deployment costs in rural areas make up c.50% of total deployment costs.[26]

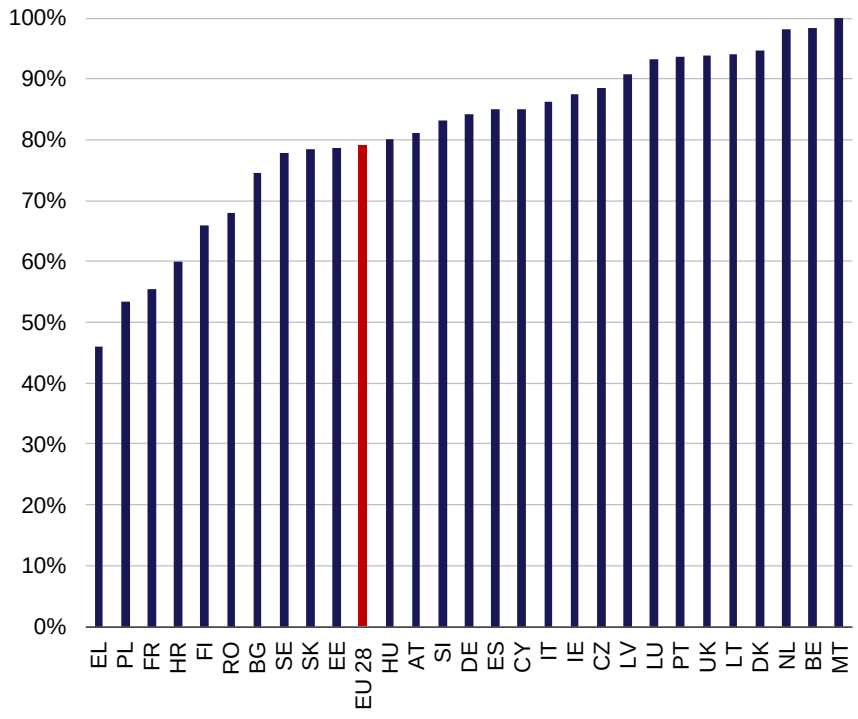


Figure 3.1: Household coverage of ≥30Mbit/s broadband across Europe [Source: EC, 2017]

24 The latest published data on the EC website is June 2017. It is acknowledged that some countries have probably progressed further in terms of 30Mbit/s coverage at the time of the publication of this paper.

25 https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017

26 Paragraph 51 of https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf

There are several factors (including funding and policy) that have contributed to the current state of 30Mbit/s coverage:

- funding availability
- coverage target
- broadband specification
- roll-out speed
- distribution of eligible premises (e.g. small contiguous region and population settlement patterns)
- geography/terrain
- phasing approach (targeting 100Mbit/s coverage instead of a phased approach of 30Mbit/s in the short term and 100Mbit/s in the medium term).

Regarding broadband specification, the EC has not technically defined the download speed goals for the DAE 2020 and 2025 targets. Broadband speed could be technically defined in different ways, including busy-hour, minimum, peak and average speed. Furthermore, the EC's definition does not define upload speed. This situation has led to inconsistent speed definitions set out in NBPs across Europe, leading to varied cost/funding challenges amongst EU countries. Figure 3.2 provides some examples illustrating how speed definitions vary across Europe.

Figure 3.2: Technical definition of 30Mbit/s speed in NBPs [Source: NBP of UK, Italy and Germany, 2019]

Country	Download speed	Upload speed	Comments
UK	Capable of 30Mbit/s with a minimum of 15Mbit/s for 90% of peak time	Unspecified	Download speed has specific conditions to meet but no specified upload speed
Italy	Minimum 30Mbit/s	Minimum 15Mbit/s	Download speed aligns with the EC but upload speed is specified
Germany	Minimum 50Mbit/s (proxy to the EC's 30Mbit/s)	At least doubling the existing upload speed in the region	Download speed exceeds EC definition and no upload speed definition from EC

It should also be noted that some EU countries (e.g. France and Poland) were late in finalising their NBPs. This resulted in a delayed start,[27] which has contributed to their coverage being below the EU28 average.

Many EU countries with ambitious NBPs are making good progress in terms of coverage, but are unlikely to meet the DAE 30Mbit/s coverage targets

The ECA 2018 special report[28] states that most EU countries are unlikely to meet the DAE 30Mbit/s coverage targets for various reasons. To further support this point, we have undertaken a forecast

27 The ECA 2018 special report acknowledges that this is one of the reasons why some countries are likely to miss the DAE 30Mbit/s coverage target.

28 Page 7 of https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf

analysis of three EU countries with ambitious NBPs[29] and well-advanced 30Mbit/s coverage, assessing whether they will meet the DAE 30Mbit/s coverage target (see Figure 3.3).

Figure 3.3: Forecast analysis of three EU countries and the DAE 30Mbit/s coverage target [Source: Analysys Mason, 2019]

Country (30Mbit/s coverage[30])	NBP target related to 30Mbit/s	30Mbit/s forecast analysis	Supporting reasons / factors for forecast analysis
Italy (c.86%)	• 100% 30Mbit/s coverage by 2020[31]	• c.95% by 2020	• No commercial DOCSIS cable deployment means relatively larger intervention area • Limited grant funding available to achieve 100% coverage by 2020 • High upload broadband specification • Challenging geography in remote areas
Spain (c.85%)	• 100% 30Mbit/s coverage by 2020[32]	• c.96% by 2021	• Deployment of FTTP in increasingly rural and remote areas is time consuming and costly • No announced plan to cover the remaining c.4% (this suggests a lack of grant funding)
UK (c.94%)	• 97% coverage with >24Mbit/s by 2020 • 100% 30Mbit/s coverage in Scotland by 2021[33]	• c.97–98% by 2021	• No announced plan to fully meet the DAE 30Mbit/s target (this suggests a lack of grant funding) • Universal Service Obligation (USO) set by Ofcom[34] to provide at least 10Mbit/s by 2020 (this can be interpreted as an implicit admission of not expecting to meet the DAE 30Mbit/s target) • Challenging geography in some remote areas • Focus of government has shifted to FTTP

The above sample analysis shows that even the EU countries with some of the most ambitious plans and advanced coverage are unlikely to meet the DAE 30Mbit/s coverage target. This suggests that EU countries with less ambitious NPBs and less advanced coverage will find it even more challenging to meet the DAE 30Mbit/s coverage target.

29 We have assumed that 'ambitious NBP' means NBP coverage targets that are virtually aligned with the DAE 30Mbit/s coverage target.

30 As of June 2017.

31 https://ec.europa.eu/digital-single-market/en/country-information-italy

32 https://ec.europa.eu/digital-single-market/en/country-information-spain

33 https://www.gov.scot/publications/digital-scotland-reaching-100-programme-public-consultation-report/

34 https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/ofcom-proposes-broadband-universal-service-providers

Insufficient funding support is one of the major reasons why the vast majority of EU countries are likely to miss the DAE 30Mbit/s coverage target

A 2013 EC report[35] estimates an overall deployment cost of up to EUR250 billion to achieve the DAE 2020 targets. Deployment costs vary due to factors including technology and level of broadband speed specification. In reality, since 2013 there has been a mix of next-generation access (NGA) technologies and speed specification, which means the overall deployment cost is lower than EUR250 billion. Various regulatory measures (e.g. duct and pole access) and policy measures (e.g. EU Broadband Cost Reduction Directive[36]) have likely reduced the deployment cost further. Nevertheless, the amount of funding required (i.e. for infrastructure deployment) to satisfy the DAE 30Mbit/s coverage target is still substantial (estimated >EUR100 billion depending on deployed technologies).

Various funding sources have been used to facilitate the NBPs' broadband deployment. The EC has allocated EUR15 billion of financing during the 2014–2020 programme period,[37] which represents less than c.10% of the required costs to achieve the DAE 30Mbit/s coverage target. However, most funding for a particular NBP comes from that country's central and regional government bodies. The French Government and the EC have, for example, contributed EUR3.3 billion and EUR670 million respectively to the French NBP.

Most unserved geographical regions are in rural areas. Fourteen EU countries have less than 50% NGA coverage in rural areas. Countries such as Finland and Greece have challenging rural coverage requirements, raising concerns about a 'digital divide'.[38] The reason why rural areas are unserved is that it is more costly to deploy technology and takes longer to deploy broadband in these areas, and the low number of consumers makes it difficult to recover costs. Rural area coverage often requires public intervention. This is done mainly by means of grant funding rather than loan funding, in order to make a viable investment case.

Many EU countries have already spent a large proportion of their allocated public funding on their NBP and additional funding would be required to cover the most challenging geographical areas. For example, by 2018 Italy had already spent EUR4 billion out of its allocated public funding of EUR5 billion by 2020. This means only EUR1 billion is available to provide NGA coverage to c.10% of Italian premises in the most expensive and challenging areas, and it is thus very likely that there will be a funding shortfall to achieve the NBP target. The ECA 2018 special report mentions that 1.3 million households in Poland could remain unconnected if no additional funding sources are found.[39] Overall, it is highly unlikely that the DAE 30Mbit/s coverage target will be met if no further grant funding is made available by the EC and/or government of each country.

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35 The deployment cost for various technologies are shown on page 207 of an EC report entitled "*The socio-economic impact of bandwidth*". The most expensive technology is FTTP, which is expected to cost EUR250 billion.

36 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32014L0061

37 This includes an EIB loan of EUR5.6 billion and a European Fund for Strategic Investments (EFSI) loan of EUR2 billion.

38 This term refers to the split between those people who have high and those who have low broadband speed access.

39 Paragraph 57 of https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf

There is a need to address the rural challenge in many EU countries to avoid the risk of digital divide and lagging behind leading economies on high-speed broadband

The importance of providing broadband coverage in rural areas is recognised by EC Directorate-Generals (DGs).[40] DGs that have not historically been directly involved in broadband-related matters are showing an interest. The DG for Agriculture and Rural Development (DG AGRI), for example, has indicated that it supports the rapid deployment of broadband in all rural areas.[41] Some rural projects have received awards for achieving excellence in innovative projects, which shows that such initiatives are recognised at the EC level.[42]

Some EU countries are taking additional initiatives to tackle the rural challenge. For example, the UK's Department for Environment, Food & Rural Affairs (DEFRA) has announced an additional GBP45 million of funding[43] (i.e. a total funding pot of GBP75 million from DEFRA for broadband) for rural broadband under the Rural Broadband Infrastructure Scheme.[44] The European Agricultural Fund for Rural Development (EAFRD) and the Rural Development Program (RDP) 2014–2020 has allocated a total of EUR35 million to the Greek ultrafast broadband programme.[45] While the amount of funding may not be sufficient to address the rural challenge, it is an important signal to acknowledge the importance of rural broadband coverage. We also note that there is a clear technology preference for full-fibre broadband where possible, which is understandable given the government policy. However, an appraisal of delivery options supported by cost modelling and consultation inputs from industry players could reveal alternative options to tackle the rural challenge in a timely and cost-efficient way.

The ECA 2018 special report puts forward recommendations to the EC to improve NGA broadband coverage in EU countries. One of the key recommendations is that each EU country should highlight areas where DAE targets may not be achieved and take remedial action. It is unclear whether this recommendation has been implemented by EU countries. We agree that this recommendation, if implemented, would be a positive step. However, given the importance of broadband coverage and the risk of a digital divide, more needs to be done to significantly and rapidly improve NGA broadband in EU countries.

In our view, each EU country should undertake an appraisal of delivery options to rapidly tackle the rural coverage challenge. This exercise should consider NGA technology, broadband specification, implementation duration and cost.

The EC and EU countries need to adopt a pragmatic approach to meeting the DAE 30Mbit/s coverage target

As mentioned in Section 2.3, NBP projects have predominantly focused on FTTx technologies. Broadband coverage in the most challenging parts of rural areas requires a pragmatic approach given

40 DG CONNECT and DG COMP are the two primary departments under the EC for broadband policy formulation.

41 http://ec.europa.eu/avservices/video/shotlist.cfm?ref=I112152

42 https://ec.europa.eu/digital-single-market/en/news/winners-european-broadband-awards-2018

43 GBP30 million had been allocated in 2017.

44 https://www.gov.uk/government/news/45-million-investment-in-rural-broadband?utm_source=d5378638-2657-4445-ba1a-eef08797d66c&utm_medium=email&utm_campaign=govuk-notifications&utm_content=immediate

45 http://www.nga.gov.gr/index.php/2019/02/27/ultrafast-broadband/?lang=en

the limited amount of public funding available and the pressure to rapidly deliver broadband coverage. This could mean that in certain circumstances FWA technologies may have a role to play. In line with the technology-neutrality principle, alternative future-proof technologies (e.g. FWA[46]) need to be given due consideration. FTTP is currently seen as the most future-proof technology that provides the best-in-class quality of service for many years, but such deployment comes at a high cost and can be time consuming to deploy. A few countries may be able to afford ubiquitous FTTP coverage deployed in a short period of time, but the vast majority of EU countries are unlikely to be able to support this. The appraisal of delivery options for the rural areas needs to consider the merits of the alternative future-proof technologies and explore how its NBP objectives can be met in a timely and cost-efficient manner. For example, in order to mitigate the risk of digital divide, ARCEP (the French regulator) has provisioned some spectrum in the 3.5GHz band that could be used for the French NBP in areas unlikely to receive FTTP broadband. In March 2019, InfraNum[47] (a group of various industry players) highlighted the risk of digital divide in some parts of France and proposed to extend the 3.5GHz spectrum licences to be used for NBP.

Demand-side intervention (i.e. end-user subsidy) can also be explored in more detail, especially where there is a highly dispersed distribution of intervention-eligible premises. Some countries such as the UK[48] and France[49] are using this additional mode of intervention to help achieve DAE targets. The 'Better Broadband Subsidy Scheme' in the UK offers grants of up to GBP350 per premises to rural homes and businesses that are unable to access a minimum 2Mbit/s download speed by December 2019. In France, a subsidy per premises of up to EUR150 will be provided to households that are unlikely to access 8Mbit/s download speeds by 2020 (a total EUR100 million has been allocated for this initiative). Other EU countries facing the dispersed distribution of eligible premises (e.g. Austria and Italy) may adopt such pragmatic initiatives to reduce the digital divide.

3.2 The DAE 2025 targets appear quite challenging for all EU countries due to lack of planning and funding constraints

Figure 3.4 overleaf shows the progress made (by June 2017) by EU countries towards achieving the DAE 100Mbit/s coverage target.[50] In 2017, the average 100Mbit/s coverage for EU28 was c.55%, which was mainly driven by existing FTTP and DOCSIS cable coverage. Countries like Malta and Spain have high FTTP coverage, which explains their relatively high 100Mbit/s coverage. Italy, on the other hand, has no cable coverage, which makes achieving the 100Mbit/s coverage target more financially challenging. Consequently, the country has just over 20% 100Mbit/s broadband coverage.

46 There are several examples of an FWA solution being awarded State-aid funding across EU countries. The UK, for instance, has awarded State-aid funding to a few local authority projects deploying 4G LTE and carrier-grade Wi-Fi.

47 http://infranum.fr/archives/3784

48 https://basicbroadbandchecker.culture.gov.uk/

49 https://ec.europa.eu/digital-single-market/en/country-information-france

50 https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017

EU countries are expected to face even more extensive challenges to meet the DAE 100Mbit/s coverage targets than they face meeting DAE 30Mbit/s targets. These challenges are discussed in more detail in the following sections.

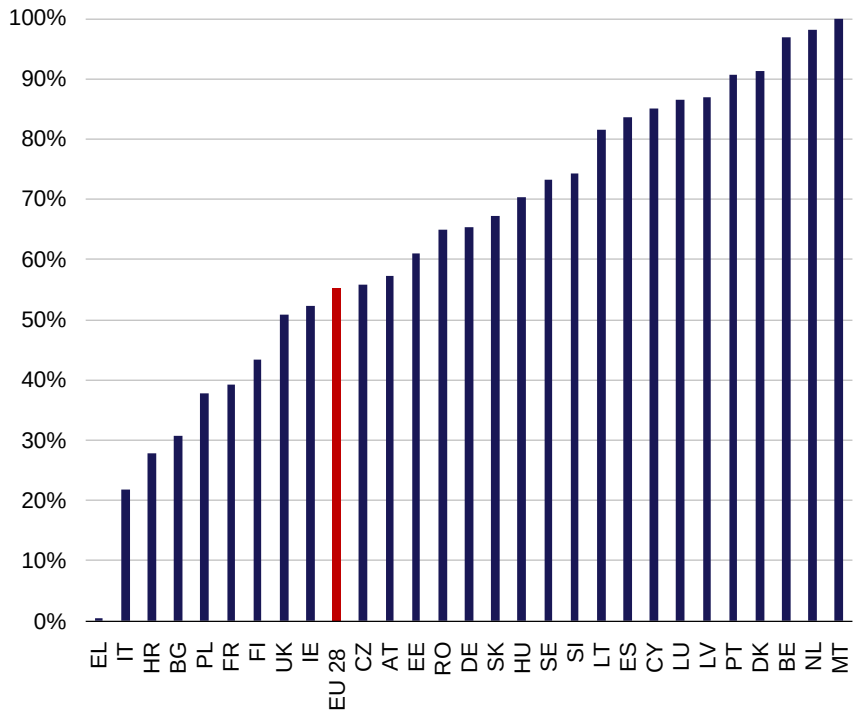


Figure 3.4: Household coverage of ≥100Mbit/s broadband across Europe [Source: EC, 2017]

The vast majority of EU countries have not yet developed an NBP to meet DAE 2025 targets

Most EU countries are still focussing on the DAE 30Mbit/s coverage target (the challenges related to this coverage target are discussed in Section 3.1). Germany is one of the few EU countries with an NBP that intends to build a gigabit (mix of technologies including fibre and 5G) network infrastructure (estimated by Germany's Federal Government to cost EUR100 billion) by 2025 that will satisfy the DAE 100Mbit/s coverage target.[51] Some existing NBPs have probably held a longer-term view that includes plans to reach the DAE 100Mbit/s coverage target. Spain and Portugal[52] have been focussing mainly on FTTP network deployment; such network infrastructure can satisfy both the DAE 30Mbit/s and 100Mbit/s targets.

France's NBP focuses on FTTP deployment across 80% of the country; the remaining areas are expected to be addressed by 2022 using alternative technologies. However, there is no specific plan beyond 2022, and without a proper plan and funding, France is unlikely to meet the DAE 100Mbit/s coverage target. The UK Government has not made any explicit public announcements regarding its intention to achieve the DAE 100Mbit/s coverage target but it has announced ambitions of 100% FTTP in the UK by 2033.[53]

51 https://www.dw.com/en/germany-to-invest-100-billion-into-national-gigabit-internet-network/a-37846238

52 It is acknowledged that Spain and Portugal have historically deployed extensive ducts and poles and that re-using these ducts and poles will significantly reduce the cost of network deployment.

53 https://www.gov.uk/government/news/200-million-to-kickstart-full-fibre-broadband-across-uk

One of the recommendations put forward by the ECA 2018 special report is that EU countries should develop new plans beyond 2020. Our reading of this recommendation is that the EU countries should plan to meet the DAE 2025 targets. While we welcome this recommendation, it is important to stress the need for a detailed plan including a funding plan informed by appropriate cost modelling and appraisal of delivery options. This is similar to our recommendation to meet the DAE 30Mbit/s target (Section 3.1).

Most EU countries are already facing funding challenges to meet the DAE 30Mbit/s target and the challenge to meet the DAE 100Mbit/s target will be greater

EU countries are already facing difficulties in meeting the DAE 30Mbit/s coverage target. A significant amount of funding will be required to reach the DAE 2025 targets: the EC[54] estimates that a total cost of EUR515 billion would be needed. It expects that EUR155 billion[55] would be provided by telecoms operators for commercially viable areas, which means a funding gap of EUR360 billion needs to be bridged (only EUR3 billion has been allocated for digital infrastructure for the 2021–2017 period).[56] [57] Analysis from the EC[58] shows that meeting the DAE 2025 targets could boost the GDP by EUR910 billion and create 2.3 million new jobs by 2025, which makes a clear case for public funding.

It is therefore important that the EC consults with EU countries to understand the funding challenges in detail and devises a funding strategy to meet the DAE 100Mbit/s coverage target. In our view, insufficient public funding appears to be the biggest hurdle to meeting the DAE 100Mbit/s coverage target. This should be considered a high-priority issue.

It is important that the EC and EU countries promote investment in cost-efficient, future-proof technologies that can guarantee the EC's Gigabit Society vision

Given the substantial funding requirement to meet the DAE 100Mbit/s coverage target and, ultimately, the EC's Gigabit Society vision,[59] the need for cost-efficient technologies has never been more critical. Another key consideration is the time taken to deploy broadband networks given the 2025 target and the need to avoid the risk of a significant digital divide in rural areas. It is vitally important for EU countries to explore alternative NGA technologies and undertake detailed cost modelling, including market consultation, to devise the most cost-efficient approach to meet the DAE 100Mbit/s coverage target and Gigabit Society vision.

In its "*Call for a Gigabit Society*" report,[60] Vodafone highlights the importance of investing in future-proof fixed and wireless technologies such as FTTP, cable and 5G networks. Investing in copper and satellite

54 https://www.eca.europa.eu/Lists/ECADocuments/AB_BROADBAND/AB_BROADBAND_EN.pdf

55 https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-587-EN-F1-1.PDF

56 http://europa.eu/rapid/press-release_IP-18-4029_en.htm

57 http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/628247/EPRS_BRI(2018)628247_EN.pdf

58 https://ec.europa.eu/digital-single-market/en/news/more-and-better-internet-connectivity-requires-investments-high-speed-and-quality-networks

59 https://ec.europa.eu/digital-single-market/en/broadband-europe

60 https://www.vodafone.com/content/dam/group/policy/downloads/Vodafone_Group_Call_for_the_Gigabit_SocietyFV-Dec15.pdf

technologies to meet short-term goals might not achieve the Gigabit Society vision, as these technologies are not expected to achieve 1Gbit/s broadband speeds in the foreseeable future. Copper and satellite technologies are not as future-proofed as FTTP and FWA. Investing in future-proof technologies thus becomes extremely important as a long-term aim.

4 Legal compliance requirements

Projects involving public funding in EU countries are subject to the most recent EU broadband State-aid guidelines.[61] Recently, following a recommendation from the European Electronic Communications Code (EECC),[62] BEREC has been tasked with developing guidelines on criteria to define VHCN networks. In this section, we analyse the NGA technology State-aid eligibility criteria and discuss potential alignment of future State-aid and VHCN guidelines.

4.1 Absolute clarity is needed on technology eligibility for NGA broadband deployment in the EU broadband State-aid guidelines

Section 3.1 of the EU broadband State-aid guidelines aims to distinguish between basic and NGA networks to help deliver NBP and DAE targets. The State-aid requirements have legal obligations and are reflected in tender requirement specifications. The State-aid guidelines play a critical role in selecting NGA technologies for State-aid intervention areas, which means absolute clarity is required to ensure common understanding across EU countries.

There are two main clauses (57 and 58) in the EU broadband State-aid guidelines related to eligibility of NGA technology. Clause 57 (as shown below, with our emphasis in bold) explicitly mentions NGA access networks "*rely wholly or partly on optical elements*", which might suggest wireless technologies are ineligible for NGA technology (despite the fact that the footnotes associated with Clause 57 might suggest otherwise).

Clause 57: *At the current stage of market and technological development, NGA networks* ***are access networks which rely wholly or partly on optical elements*** *and which are capable of delivering broadband access services with enhanced characteristics as compared to existing basic broadband networks.*

Clause 58 (as shown overleaf) provides more clarity on the eligibility of wireless technologies by stating that certain advanced wireless technologies could be eligible for NGA technology.

61 "*EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks* (2013/C 25/01)".

62 Article 82 of EECC (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972&from=EN).

Clause 58: *NGA networks are understood to have at least the following characteristics: (i) deliver services reliably at a very high speed per subscriber through optical (or equivalent technology) backhaul sufficiently close to user premises to guarantee the actual delivery of the very high speed; (ii) support a variety of advanced digital services including converged all-IP services; and (iii) have substantially higher upload speeds (compared to basic broadband networks). At the current stage of market and technological development, NGA networks are: (i) fibre-based access networks (FTTx); (ii) advanced upgraded cable networks; and (iii)* ***certain advanced wireless access networks*** *capable of delivering reliable high speeds per subscriber.*

Aspects of the above clauses and associated footnotes are ambiguous. This may result in stakeholders wrongly interpreting wireless technology as not being eligible for NGA technology. As discussed earlier, it is important that alternative technologies are fully explored to help achieve the DAE targets. Given the impact of State-aid guidelines on all EU countries, it is necessary to provide absolute clarity on NGA eligibility in the forthcoming revision of State-aid guidelines. Instead of focusing on specific technologies, DG COMP could provide State-aid guidelines based on service levels (e.g. minimum speed) and 'future-proofness' to make best use of public funds.

4.2 It is unclear whether or how VHCN guidelines (being developed by BEREC) will be linked to State-aid guidelines

In the context of future consumer and business demands (e.g. cloud computing, and virtual and augmented reality), the EC believes there is a need for VHCNs, which are currently defined at a high level only.

VHCN is defined as "*an electronic communications network which either consists* ***wholly of optical fibre elements at least up to the distribution point*** *at the serving location or which is capable of delivering under usual peak-time conditions similar network performance in terms of available down- and uplink bandwidth, resilience, error-related parameters, and latency and its variation. Network performance can be considered similar regardless of whether the end user experience varies due to the inherently different characteristics of the medium by which the network ultimately connects with the network termination point*".[63]

At this stage, it is understandable that the definition is not tightly defined and can be interpreted in different ways by key stakeholders. We would expect BEREC to develop guidelines that are sufficiently specific to allow key stakeholders to determine whether a network solution can be classified as VHCN. It may also be beneficial to adopt a technology-neutrality principle[64] for VHCNs to ensure networks are deployed in the most cost-efficient way, which is a critical input to BEREC's development of guidelines on VHCN criteria.

Moreover, it is unclear whether there will be any link between VHCN and broadband State-aid guidelines. It may be sensible to have a single unambiguous[65] definition of future broadband networks (e.g. VHCN

63 Footnote 11 in "*Connectivity for a Competitive Digital Single Market – Towards a European Gigabit Society"* (https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX%3A52016DC0587).

64 Similar to the principle used in the current State-aid guidelines.

65 This means avoiding potential confusion on technology eligibility in the current broadband State-aid guidelines.

could replace NGA in the forthcoming broadband State-aid guidelines) to avoid any potential confusion amongst key stakeholders in Europe. BEREC should work closely with DG COMP while developing the VHCN guidelines.

5 Role of 3GPP wireless technology

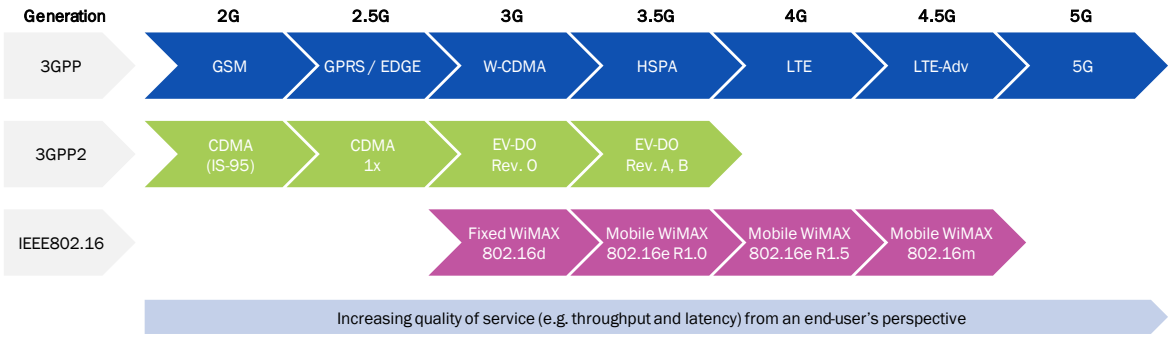
As discussed in Section 3, there is a need to explore all alternative NGA technologies to help achieve the DAE targets and minimise the digital divide in certain circumstances. It is well established that FTTP is a future-proofed technology capable of fulfilling the Gigabit Society vision. This section explores the potential role of wireless technologies in helping to meet the DAE targets. For the avoidance of doubt, this section is not intended to present a technical comparison of various broadband technologies.

5.1 The 3GPP wireless ecosystem is robust with a clear upgrade path

Network operators have a clearer upgrade path due to the massive industry support for 5G standards developed by the 3GPP body

Wireless technology has experienced fast-paced evolution ever since the substantial success of 2G. Customers have demanded ever-higher quality of service and higher connection speeds, and technological progress has led to increasingly sophisticated and bandwidth-hungry applications. Over the years, three main bodies – 3GPP, 3GPP2 and IEEE802.16 – have been developing standards for wireless networks. A summary of the technology roadmap for each of these three standardisation bodies is depicted in Figure 5.1.

Figure 5.1: Wireless technology roadmap from 2G to 5G [Source: Analysys Mason, 2019]



Historically, the 3GPP and 3GPP2 bodies competed on 2G and 3G wireless technologies, and all three bodies competed for 3G wireless technology. While industry support for 3GPP technologies has been greater, some countries and operators preferred to deploy the 3GPP2 technologies. Over time, the number of live networks supporting CDMA (3GPP2) technologies has constantly decreased, reaching 202 out of 3712 live networks.[66] The telecoms industry has shown much stronger support for the 3GPP technologies than 3GPP2 technologies, as demonstrated by existing CDMA network operators adopting LTE as their 4G technology. This resulted in no further standard development by 3GPP2 for 4G.

66 As of 1 March 2019, there are 3712 live wireless networks supported by 920 mobile network operators, according to GSMA Intelligence (GSMAi).

However, 3GPP LTE found a competitor in WiMAX technology developed by the IEEE802.16 standardisation body. The telecoms industry showed more support for 3GPP LTE (there are 1326 LTE networks currently[67]) even though WiMAX found some success in the FWA space and limited success on mobile networks in some developing countries (there are 16 WiMAX networks currently[68]). Most of the WiMAX networks have migrated or are migrating to 3GPP LTE Time Division Duplex (TDD) technology, which further indicates industry support for the 3GPP technology platform.

Regarding 5G wireless technology, the telecoms industry is strongly supportive of the 3GPP standard, making it an easier upgrade path from 4G to 5G. This significant development is expected to offer economies of scale, bringing down costs for electronics devices across the whole ecosystem such as chipsets (for user devices) and network equipment, which might lead to wider-scale deployment.

The 3GPP wireless ecosystem is highly future-proof in that it is the product of a successful history of technological improvements and extensive support of the telecoms industry for 4G, 5G and beyond. This means that stakeholders investing in 3GPP wireless ecosystems can confidently expect improved quality of service as and when new standards are available by upgrading the existing network infrastructure instead of replacing the existing network infrastructure.

5G technology promises to deliver a step change in quality of service over previous wireless generations

5G has the capability to deliver gigabit download speeds depending on the amount of available spectrum and low latency of ~1ms (suitable for real-time applications). As of February 2019, 21 network operators in 12 countries have launched 5G (3GPP-compliant) on their base stations within their live networks.[69] 5G trials have been announced in many EU countries and operators have started running pilot projects.[70] As of February 2019, 201 network operators in 83 countries have registered interest in 5G.[71] More than 20% of mobile network operators worldwide have thus started the process of 5G deployment in a short space of time (the first phase of 5G standards was only released in December 2018). This further demonstrates the strong industry support for 3GPP 5G technology.

The EC is co-financing research on and development of 5G through the 5G PPP initiative.[72] The 5G PPP initiative is one of the largest programmes in the world, and is driven by the EC in partnership with European ICT manufacturers, telecoms operators, small and medium-sized enterprises (SMEs) and research institutions. The EC has set aside funding of EUR700 million[73] for this initiative and private-sector contributions are expected to bring this to a total investment of EUR3.5 billion by 2025. This

67 As of 1 March 2019 (GSMAi).

68 As of 1 March 2019 (GSMAi).

69 Page 7 of "*5G Investments: Trials, Deployments, Launches – Feb 2019*" report ((https://gsacom.com/download.php?id=6620)) by Global Mobile Suppliers Association (GSA).

70 https://5g-ppp.eu/5g-trials-2/#1512735204240-3eb10a7b-5bdb

71 "*5G Investments: Trials, Deployments, Launches*" report by GSA.

72 https://5g-ppp.eu/

73 http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI%282017%29603979

demonstrates that, in addition to telecoms industry players, key policy makers also strongly support 5G technology.

5.2 Wireless technology can be used as a complement to FTTP

The EC as well as many governments across Europe have already devised and published their 5G network strategy despite having invested heavily in FTTx network infrastructure via their NBPs

The EC recognises that both fixed and 5G networks are required for its Europe Gigabit Society vision.[74] We have observed that various governments across Europe have proactively recognised the need for both future-proof FTTP and 5G wireless technologies, to satisfy future digital economy demand. Examples of these countries include:

- **Germany:** The country's digital infrastructure policy explicitly mentions fibre and 5G technologies.[75] In July 2017, the Federal Government published a paper entitled "*5G strategy for Germany*". The aim of the paper is to promote the development of Germany into a leader in 5G networks and applications.[76]

- **France:** In July 2018, the French Government and ARCEP published a 5G strategy paper entitled "*5G – An ambitious roadmap for France*".[77] In this paper, the French Government[78] states that "*by 2025, the main transport routes will be covered by 5G. We want France to be home to the world's first rollout plans, to innovation platforms that allow start-ups to test their projects, working in partnership with digital industry leaders based in France*".[79]

- **The UK:** In March 2017, the UK Government (led by the Department for Culture, Media and Sport) published its 5G strategy paper entitled "*Next Generation Mobile Technologies: A 5G Strategy for the UK*".[80] The paper sets out the government's ambition to be a global leader in 5G in order to take early advantage of 5G potential and help create a world-leading digital economy. In July 2018, the government published the Future Telecoms Infrastructure Review paper, which mentions its ambitious target for 15 million premises with full fibre (i.e. FTTP) by 2025, with nationwide

74 http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI%282017%29603979

75 https://ec.europa.eu/digital-single-market/en/country-information-germany

76 https://www.bmvi.de/SharedDocs/EN/publications/5g-strategy-for-germany.pdf?__blob=publicationFile

77 https://archives.arcep.fr/fileadmin/reprise/dossiers/programme-5G/Roadmap_5G_-_VA.pdf

78 Secretary of State to the Ministry of Economic Affairs and Finance (Delphine Gény-Stephann) and Secretary of State for Digital Affairs (Mounir Mahjoubi).

79 Page 4 of https://archives.arcep.fr/fileadmin/reprise/dossiers/programme-5G/Roadmap_5G_-_VA.pdf

80 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/597421/07.03.17_5G_strategy_-_for_publication.pdf

coverage by 2033, and reiterating its ambition to be a world leader in 5G, with deployment to the majority of the country by 2027.[81]

The above examples demonstrate the value that governments place on 5G network infrastructure despite already pursuing a policy of extensive FTTP coverage in order to support ever-increasing data consumption by end users. Government policy perspectives strengthen our view that 5G wireless network infrastructure is a complement to FTTP, rather than a substitute.

Some European network operators with extensive FTTx network infrastructure have started to explore 4G/5G FWA as part of their future strategy

Some operators across Europe are continuing to invest in both fixed networks (e.g. FTTP and DOCSIS cable) and wireless networks (e.g. 4G and 5G). Examples of network operators providing both FTTx and wireless network connectivity services include:

- **Deutsche Telekom (Germany):** As of April 2018, Deutsche Telekom[82] provided FTTx to more than 30 million households and mobile 4G coverage to 94% of the population.[83] It has confirmed its participation in the 5G spectrum auction in March/April 2019, and has also laid out its technology strategy on the complementarity of FTTH/B and 5G (mobile and FWA).[84]

- **Telefónica (Spain):** By May 2018, Telefónica provided FTTP coverage to 19.7 million premises and mobile 4G coverage to 96% of the population.[85] In July 2018, it paid EUR107 million for 50MHz of spectrum in the 3.6GHz band.[86] As part of its network and systems evolution presentation in June 2018,[87] it indicated that FWA will be part of its convergent ultrafast broadband access model, implying that FWA would be complementary to its existing networks.

The above examples show that network operators are exploring innovative cost-efficient ways of meeting the continuously increasing data demands from customers in the data-driven era. Due to funding constraints, we would expect more network operators to explore new technologies and adopt innovative deployment approaches such as hybrid fibre-wireless solutions (e.g. middle-mile with fibre and last-mile with wireless) and a mix of fibre and wireless solutions in some geographical areas to satisfy customer requirements in the most cost-efficient way possible.

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81 Page 1 of Future Telecoms Infrastructure Review (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf)

82 The fixed network part of Deutsche Telekom is branded as Telekom Deutschland.

83 Germany country report, TeleGeography.

84 https://www.telekom.com/resource/blob/518866/8997033006521ff675c8f4a2ec014787/dl-4-presentation-cn-data.pdf

85 Spain country report, TeleGeography.

86 Spectrum tracker, Analysys Mason Research (http://www.analysysmason.com/Research/Content/Data-set/RDTS0-spectrum-auction-tracker/)

87 Page 20 of https://www.telefonica.com/documents/162467/141939282/20180619-Network-Systems-Evolution.pdf/e61277f2-d64f-7186-0b40-d4da41c0d85d

In addition, a 5G radio access network would require fibre backhaul to achieve its full potential and a dense fibre network connecting mobile masts could provide significant synergy benefits (e.g. backhaul cost savings). Network operators recognise that a single infrastructure could be used to achieve such synergy benefits. For example, Verizon (in the USA) and SK Telecom (in South Korea) are planning to deploy 'one fibre' networks that have universal Next Generation – Passive Optical Network (NG-PON) aggregating connections from different technologies (FTTP, FWA and mobile).

5.3 The economics of wireless connectivity could be beneficial in certain circumstances to help achieve the DAE targets

There are already examples across Europe that prove that FWA is an NGA technology that can satisfy the DAE 30Mbit/s coverage target

As outlined in Section 2.3, the majority of State-aid projects have deployed FTTx technologies and there has been an increasing focus on FTTP deployment. FWA technologies have been deployed in some State-aid projects where circumstances have been suitable (e.g. a suitable distribution of premises or where budgets are more limited). In such cases, FWA has been deemed to comply with State-aid guidelines by some EU countries (and is therefore eligible to qualify as an NGA technology). Notable examples of FWA broadband deployment that have secured public funding are as follows:

- **Open Fiber[88] (Italy)** was awarded a combined grant funding of c.EUR2.3 billion[89] [90] [91] for the three public tenders to deploy NGA broadband (which is expected to predominantly consist of FTTP, and FWA[92] in remaining areas). An example of a declared mix of FTTP and FWA deployment by Open Fiber is on the island of Ischia.[93]

- **Relish[94] (UK)** was awarded a State-aid project (with a grant funding of GBP1.9 million) to provide superfast broadband coverage to 99.4% of households in the borough of Swindon.[95] [96] A 4G LTE FWA solution was deployed using licensed spectrum bands. It is likely to be upgraded to 5G since

88 Open Fiber was set up by the state-backed utility group Enel.

89 http://bandaultralarga.italia.it/en/open-fiber-won-the-first-infratel-tender/

90 https://uk.reuters.com/article/enel-broadband-tender-idUKI6N1J6006

91 https://www.telegeography.com/products/commsupdate/articles/2018/12/19/open-fiber-awarded-third-regional-broadband-tender/

92 Page 3 of https://innovation-regulation.telecom-paristech.fr/wp-content/uploads/2018/10/Nonno-5G-Seminar-Paris-Oct-5th-Open-Fiber-2.pdf?lang=en

93 https://www.telecompaper.com/news/open-fiber-launches-ischia-ftth-and-fwa-rollout--1260555

94 Relish was under the parent company UK Broadband and is now wholly owned by Hutchison 3G Limited, following UK Broadband acquisition.

95 https://www1.relish.net/swindon/home-broadband

96 http://superfastswindon.com/about-the-project.cfm

3GPP technology is future-proof and its parent company is aiming to commercially launch 5G FWA in the second half of 2019.[97]

FWA could be a cost-efficient NGA broadband solution in some geographical areas that could be delivered in a rapid way to help meet the DAE and NBP targets

For the selection of Relish, there was a competitive tender process (in line with the EU procurement rules[98]) and cost was an important evaluation criterion. Our reading of the tender outcome is that FWA could be more cost-efficient in some geographical areas (e.g. in rural and remote areas where there is a high degree of population 'clustering') given that there has been a general preference for FTTP across EU countries in general.

In light of the above, the EC and EU countries (in particular the BCOs[99] and local authorities) should consider an FWA solution when evaluating technology options that could help to meet DAE and respective NBP targets. It is noted that most FWA projects have been small in scale but the Open Fiber example suggests that FWA network infrastructure could be deployed at a large scale.

It should also be noted that these FWA deployments have been favoured in particular geographies (as mentioned in the above paragraph) where it can be time consuming and more costly[100] to deploy FTTx networks. This suggests that FWA networks could be deployed in a rapid manner, which is a key benefit given the number of EU countries that are likely to miss the DAE 30Mbit/s coverage target. This is another reason why FWA technology should be considered more seriously to help meet the DAE and NBP targets without compromising the path to the DAE 100Mbit/s coverage target.

FWA seems a suitable technology to help tackle the rural coverage challenge in most EU countries to mitigate the risk of digital divide

As highlighted in Section 3.1, there is a significant rural broadband coverage challenge and an urgency to address the challenge (e.g. policy support from DG AGRI). Typically, it is costly and time consuming to deploy broadband network infrastructure in rural areas. These points are supported by the French Court of Auditors who "*questioned the relevance of the use of fibre in certain areas, since the costs of fibre are high and the implementation timing too long*".[101] Moreover, the UK Government also recognises the alternative technologies for harder-to-reach areas and hybrid fibre-wireless solutions where it is cost ineffective to deploy FTTP.[102] Therefore, under certain circumstances (dependent on

97 http://www.threemediacentre.co.uk/news/2018/5g-wireless-home-broadband-predicted-to-double-internet-speeds-for-uk-households.aspx

98 https://ec.europa.eu/growth/single-market/public-procurement_en

99 BCOs are the Broadband Competence Offices that are typically responsible for delivering the strategic objectives of NBPs.

100 We acknowledge that there are certain geographical areas (e.g. highly rural, ribbon deployments) where FWA is not necessarily the cheapest solution to deploy.

101 Paragraph 22 of https://www.eca.europa.eu/Lists/ECADocuments/SR18_12/SR_BROADBAND_EN.pdf

102 Page of 8 of https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

local market conditions such as areas with a high degree of population 'clustering') FWA (both 4G and 5G) could be a suitable future-proofed solution addressing both the cost and deployment timeline issues that will help achieve the DAE (both 30Mbit/s and 100Mbit/s coverage) and NBP targets.

Currently, a digital divide[103] prevails in many parts of rural areas in various EU countries. It is characterised by marked differences in broadband coverage/speed between urban and rural areas. The lack of access to high-quality broadband services also prevents citizens and businesses from enjoying the socio-economic benefits that are highlighted in Section 2.1. Key policy stakeholders (including DG AGRI[104] and national ministries for rural development, such as DEFRA in the UK) have stated intentions to tackle this issue as quickly as possible. Therefore, it is imperative that DG AGRI (with the help of DG COMP and CONNECT) and their relevant counterpart(s) in EU countries reinforce the principle of technology-neutrality in selecting technology options in rural areas.

103 While all EU countries already have satellite broadband coverage levels that satisfy Target 1 of the DAE 2020 targets, it is not clear that every household can afford to buy a satellite broadband connection. There is also a significant difference in broadband quality in urban and rural areas.

104 DG AGRI provides access to European Agricultural Fund for Rural Development (EAFRD) funds for broadband network deployment in rural areas.