



BRIEFING PAPER

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Full-fibre broadband in the UK

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Summary

Superfast broadband in the UK

Over 95% of UK premises have access to superfast broadband, which the Government defines as download speeds of at least 24 megabits per second (Mbps). Superfast broadband has been mainly delivered by Fibre-to-the-Cabinet technology, which is a part-fibre, part-copper technology. While superfast broadband is fast enough for most household uses today, growing data demands are pushing the limits of the copper-based superfast broadband infrastructure.

Policy focus has now shifted to rolling out gigabit-capable full-fibre broadband. As of September 2019, [10% of UK properties](#) had access to full-fibre connections.

What is gigabit broadband?

Gigabit-capable broadband means any technology that can deliver 1 gigabit per second (1 Gbps is equal to 1000 Mbps). 1 Gbps allows a high definition film to be downloaded in under one minute. Gigabit broadband usually means full-fibre technology but could also include cable broadband and future [5G networks](#).

What is full-fibre?

Full-fibre broadband uses fibre optic cables to connect the exchange directly to each premises. Full-fibre connections are capable of download and upload speeds over 1 Gbps. It is currently the fastest and most reliable broadband technology.

Government targets

Theresa May's Government had a target to build a UK-wide full-fibre network by 2033. Her Government's strategy for achieving this was set out in its [Future Telecoms Infrastructure Review](#) (FTIR) published in July 2018.

Boris Johnson's Government has adopted a target to deliver "gigabit-capable broadband" nationwide by 2025. Some commentators have noted that the shift from "full-fibre" to technology-neutral "gigabit broadband" is a [watering down of the target](#) although it does make the 2025 timescale more realistic.

Industry stakeholders have welcomed the Government's ambition but warned that the 2025 target can only be achieved with [urgent policy reform](#) to address barriers that are delaying roll-out. Barriers cited include access to properties to install infrastructure, new homes being built without full-fibre and skilled labour shortages.

Government infrastructure policy

The Government's policy is that full-fibre or gigabit-broadband infrastructure will be mostly built by private investment. The Government has committed to provide funding for areas that are not viable for commercial investment (see below).

The Johnson Government has said that a new National Infrastructure Strategy would be announced alongside the first budget (11 March 2020) and would set out the Government's ambition on broadband.

Two areas of policy reform were highlighted in the [December 2019 Queens Speech](#):

- Legislation to reform access for telecoms providers to tenanted properties – the [Telecommunications Infrastructure \(Leasehold Property\) Bill 2019-20](#) was introduced to Parliament on 8 January 2020 (see Section 3.1 of this paper);
- Legislation on gigabit-broadband infrastructure for new build properties.

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Government funding

The Johnson Government has allocated £5 billion to tackle the “hardest to reach” 20% of UK premises, there are no details yet of how that funding will be used.

There are several existing funding programmes for full-fibre launched under the May Government, including [two voucher schemes](#) to subsidise full-fibre connections to rural premises and small and medium sized business.

Is telecommunications a reserved power?

The UK Government has primary responsibility for broadband policy and coverage targets because telecommunications is a reserved power. However, the delivery of broadband infrastructure projects often involves local authorities or devolved responsibilities, for example, engagement with planning and highways authorities regarding street works.

Constituency broadband statistics

Constituency broadband statistics are available on the Library data dashboard: [broadband coverage and speeds](#).

1. Full-fibre networks: what and why?

1.1 Superfast broadband

From 2010, Government policy has focused on the roll-out of superfast broadband, which it defines as download speeds of at least 24 megabits per second (Mbps).¹ Superfast broadband availability reached 95% of UK premises as of February 2018 based on this definition, according to Ofcom (the UK telecoms regulator).²

The Government's superfast broadband programme supported the delivery of superfast broadband to areas not reached by the private sector. More information about the programme is provided in the Library briefing paper: [Superfast broadband in the UK](#).

Superfast broadband in the UK has been mostly delivered by Fibre-to-the-Cabinet (FTTC) technology. FTTC is a part-fibre technology: fibre optic cables run to a street cabinet, and then existing copper telephone wires are used to connect the cabinet to individual premises. The speed of connection decreases the further away from the cabinet the premises is based, because the signal loses strength as it travels along the copper wire.

FTTC relies on using the copper telephone network which (other than in Hull) is owned and operated by Openreach, the infrastructure division of the BT Group.³ Broadband retail providers, for example BT retail, Sky and TalkTalk, deliver broadband services to consumers using Openreach's network.

Other technologies are also capable of supporting superfast broadband, including cable broadband (delivered by Virgin Media) and fixed wireless connections (usually delivered by smaller regional providers). See Section 5 (Glossary) for more information about broadband speeds and technologies.

1.2 Do we need a digital infrastructure upgrade?

While superfast broadband is fast enough for most current individual/household needs, the availability of and demand for data-intensive services such as online video streaming and video calls is increasing. High data demands by many users at one time can push the limits of a superfast broadband connection. To support this growing dependence on and demand for digital services, high capacity internet connections that can support fast download speeds, large amounts of

The UK has high availability of superfast broadband (95%) provided mostly by part-fibre, part-copper networks.

¹ There is no single definition of superfast broadband. Ofcom and the European Commission define superfast broadband as download speeds of 30 Mbps.

² Ofcom, [Connected Nations: Spring Update 2018](#), published 30 April 2018. Data was collected in January 2018.

³ See the Library briefing paper on [BT and Openreach](#) (CBP 7888, 11 January 2019) for more information.

data and many users at one time will be required. In the 2019 General Election all main political parties pledged major digital infrastructure upgrades in their manifestos.⁴

In July 2018 the National Infrastructure Commission concluded it was uncertain if and when the demand for data would outstrip existing networks, but described that a decision to invest in full-fibre networks, compared to upgrading the existing copper network, was a “risk worth taking” to avoid the potential consequences of not having digital infrastructure to support future needs.⁵

Research commissioned by Ofcom in 2018 showed that broadband investment has contributed significantly to the UK economy over the last 15 years.⁶ Most commentators agree that continuing investment in new networks such as full-fibre and 5G will continue to bring economic and societal benefits, however the extent and scale of benefits is difficult to predict.⁷ Commonly cited benefits include enhanced productivity from home working, enhanced labour force participation, new business opportunities, and efficiency benefits for public services through online access.

1.3 Full-fibre broadband

Full-fibre technology, also called fibre-to-the-premises (FTTP) or fibre-to-the-home (FTTH), can deliver over 1 gigabit per second (Gbps) download and upload speeds (Box 1). Full-fibre consists of fibre optic cables running from the local exchange directly to each premises. Fibre optic cables transmit data using light and can carry more data with much faster speeds and significantly less signal loss with distance compared to copper cables.

Box 1: What is gigabit broadband?

Gigabit-capable broadband means any technology that can deliver download speeds of at least 1 gigabit per second (Gbps). 1 Gbps is equal to 1000 Mbps. A 1 Gbps download speed would allow a high-definition film to be downloaded in under 1 minute.

Gigabit broadband usually means full-fibre broadband but can also include other technology that can support gigabit speeds, for example, the most advanced cable broadband and potentially future [5G networks](#).

⁴ See for example: [Conservative and Unionist Party Manifesto](#) 2019; [Labour Party Manifesto](#) 2019; [Liberal Democrats Manifesto](#), 2019; [Scottish National Party Manifesto](#) 2019; [Plaid Cymru Manifesto](#), 2019; [Green Party Manifesto](#) 2019.

⁵ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21-22.

⁶ Ofcom, [The economic impact of broadband](#), 27 April 2018; research carried out Dr Pantelis Koutroumpis, Oxford University.

⁷ See for example: Broadband Stakeholder Group, [Local Benefits for Full Fibre and 5G](#), report by economic consultancy Oxera, 13 September 2019; Openreach, [Full-fibre broadband: a platform for growth](#), report from the Centre for Economics and Business Research for Openreach, October 2019; City Fibre, [The Economic Impact of Full Fibre Infrastructure in 100 UK Towns and Cities](#), report by economic consultancy Regeneris for City Fibre, March 2018;

Full-fibre is also the most reliable broadband technology currently available. Full-fibre connections experience fewer operating faults than copper-based networks and are cheaper to maintain and operate. Full-fibre connections are also less likely to slow down when many people use the network. Full-fibre networks are often expensive to deploy however, because they require new infrastructure to be built.

Fibre infrastructure is also important for supporting high capacity mobile broadband networks, particularly 5G networks (see Box 2).

Box 2: 5G and full-fibre

5G is the next generation of wireless communications technology, after 4G mobile broadband. 5G is expected to support very fast download speeds and near instant response times, with the capacity to support many devices accessing large amounts of data at the same time. 5G is expected to deliver applications beyond mobile phone services, for example in health care, automated manufacturing, transport and traffic management.

Fibre infrastructure is important for mobile networks because the masts that transmit mobile signals must be connected to a core internet network. The connection between a mobile mast and the core network is called backhaul. Backhaul is usually provided by fibre cables due to the need to support large volumes of data traffic. This is particularly the case for 5G due to the large volumes of data that 5G networks will support.

5G networks will likely see base stations being deployed close together. This is because some applications of 5G will use higher frequency spectrum that cannot travel long distances. These base stations will require a dense fibre infrastructure to support them or new solutions to provide backhaul.

The [Library briefing paper on 5G](#) provides more information about 5G technology and roll-out.

1.4 Current full-fibre availability

According to Ofcom, [10% of UK premises](#) (around 3 million premises) had access to full-fibre as of September 2019.⁸

For comparison to other European countries, full-fibre was available to 38% of households in France and 8.5% of households in Germany in July 2018. European countries with the highest levels of full-fibre coverage to households were Latvia (88%), Spain (77%), Sweden (72%) and Portugal (70%).⁹

Many factors can affect how easy or difficult it is to build full-fibre infrastructure so it is not always fair to make direct comparisons between countries. Factors include: different geographies, population distributions, existing infrastructure and the history of telecoms regulation. For example, South Korea and Japan, which have 99% full-fibre coverage, have high population densities and large proportions of people living in urban areas, which reduces the cost-per-premises to deploy full-fibre.¹⁰ Some countries also prioritised full-fibre

10% of UK premises had access to full-fibre broadband as of September 2019.

⁸ Ofcom, [Connected Nations 2019](#), 20 December 2019, data collected in September 2019.

⁹ European Commission, [Broadband Coverage in Europe 2018](#), 31 October 2019. Note that the data for this study was collected in mid-2018. The UK had 4% full-fibre coverage to households at that time. Note that Ofcom reports data.

¹⁰ Ofcom, [International Communications Market Report 2017](#), 18 December 2018, page 52.

infrastructure from an early stage, rather than prioritising fibre-to-the-cabinet (FTTC) in the first instance like in the UK.

1.5 How much will a nationwide full-fibre network cost to build?

The May Government's [Future Telecoms Infrastructure Review](#) (FTIR, July 2018), estimated that the national roll-out of full-fibre broadband would require a total investment "in the region of £30 billion".¹¹ Both the May and Johnson Governments' approach is that most of this investment will come from the private sector.¹²

The National Infrastructure Commission came to a similar figure, estimating that the cost of building and maintaining a nationwide full-fibre network would be £33.4 billion (over a 30-year period). This was estimated to be £11.5 billion more than the cost of incrementally upgrading existing copper infrastructure, but would save £5.1 billion in operating and running costs (between 2020 and 2050).¹³ The Commission acknowledged that while the cost of a building a full-fibre network was higher than upgrading copper, it was nonetheless worth doing to avoid the risk of not having the infrastructure to support future demands for data.

Section 4 of this paper provides information about Government funding programmes for full-fibre networks.

1.6 Is telecommunications a reserved power?

The power to legislate with respect to telecommunications is reserved to the UK Parliament.¹⁴ The UK Government has primary responsibility for setting broadband policy and coverage targets. However, the delivery of broadband infrastructure projects often involves local authorities or devolved responsibilities – for example, engagement with planning and highways authorities regarding street works (see Section 3).

Under the superfast broadband programme, the UK Government has been providing funding to local authorities in England and the devolved Administrations to deliver infrastructure projects in their regions. For example, the Welsh and Scottish Governments have their own separate broadband infrastructure build programmes using a combination of UK Government funding and funding from their own budgets and other sources. These programmes are also delivering full-fibre in some areas. More information is provided in the Library briefing paper: [Superfast broadband in the UK](#) (CBP06643, 13 November 2018).

¹¹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

¹² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

¹³ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21-22.

¹⁴ [Section C10 of Schedule 5 of the Scotland Act 1998](#); [Section C9 of Schedule 7A of the Wales Act 2017](#); Northern Ireland Department for the Economy, [Broadband policy context in Northern Ireland](#) and Cabinet Office, [Devolution settlement: Northern Ireland](#), 20 February 2013 [accessed 5 June 2018].

2. Government targets and strategy

2.1 Targets

May Government

The May Government had a target to deliver a nationwide full-fibre network by 2033, with 15 million premises connected to full-fibre by 2025.¹⁵ This target upgraded the Government's previous target set in 2017 to connect 10 million premises to full-fibre "over the next decade".¹⁶

The May Government's strategy for meeting the 2033 target was set out in its [Future Telecoms Infrastructure Review](#) (FTIR), published on 23 July 2018. The FTIR acknowledged that gigabit-capable technologies other than full-fibre (such as hybrid fibre-wireless solutions) may be necessary for some of the hardest to reach premises.¹⁷

Johnson Government

The Johnson Government has adopted a new timescale to deliver "nationwide gigabit broadband" by 2025.

Telcoms news site *ISPReview* in September 2019 highlighted the Government's change in terminology, from originally promising nationwide "full-fibre" broadband by 2025, when Boris Johnson first became Prime Minister,¹⁸ to the now technology-neutral commitment to "gigabit broadband". Gigabit broadband could also include cable broadband or 5G wireless networks in addition to full-fibre. When questioned by the House of Commons Digital Culture Media and Sport Committee in October 2019, then Secretary of State for DCMS Nicky Morgan clarified that the Government's target was to deliver nationwide gigabit broadband by 2025.¹⁹ This target was reiterated in the Conservative Party's December 2019 [General Election Manifesto](#), but did not feature explicitly in the December 2019 Queens' Speech.²⁰

The Johnson Government has a target to deliver nationwide gigabit capable broadband by 2025.

Is the 2025 target achievable?

ISPReview described the change in terminology as a "watering down" of the target but that the change makes the 2025 timescale more

¹⁵ This target was first announced in a speech by the Chancellor in May 2018: HM Treasury, [Chancellor speech: CBI Annual Dinner 2018](#), 22 May 2018, accessed 31 August 2018.

¹⁶ [Conservative and Unionist Party Manifesto](#), 2017. HM Government, [Industrial Strategy](#), November 2017, page 154.

¹⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 137, page 45-46.

¹⁸ During Boris Johnson's campaign to become Prime Minister in July 2019: [Let's reboot 'left-behind' Britain with a turbo-charged broadband revolution](#), Boris Johnson, *The Telegraph*, 16 June 2019 and [HC Deb 663, 25 July 2019 c12486](#).

¹⁹ [Oral evidence: The work of the Department for Digital, Culture, Media and Sport, HC 71](#), 16 October 2019, Q579-587.

²⁰ [Conservative and Unionist Party Manifesto](#) 2019, December 2019; PM's Office, [Queens' Speech](#) and [background briefing notes](#), 19 December 2019.

realistic.²¹ In an article in the *Telegraph* in January 2020, Matthew Hare, (founder of Gigaclear, a rural full-fibre broadband provider) argued that a commitment to nationwide full-fibre would be the most future-proof technology choice.²²

Industry stakeholders have welcomed the 2025 target but have questioned its feasibility, stating that [urgent policy reform](#) is required to tackle issues causing delays to the roll-out.²³ Four key issues highlighted by industry requiring policy reform include:²⁴

- 1 Access to tenanted properties to allow properties to be connected if the landlord cannot be contacted (see Section 3.1 below)
- 2 Requirements for new-builds to have fibre-broadband (see Section 3.3 below).
- 3 Tax relief for fibre infrastructure providers (see Section 4.5 below).
- 4 Access to skilled labour.

The House of Commons Environment Food and Rural Affairs (EFRA) Committee, in its September 2019 report on rural broadband, welcomed the new Government's 2025 target, but was "sceptical that this target will be achieved without substantial new, long-term, public investment and potentially controversial regulatory reform".²⁵

2.2 Government policy approach

Both the May and Johnson Government's approach to full-fibre networks is to promote private investment by encouraging a competitive market to deploy fibre infrastructure (see Section 2.3). Government funding will be provided to support areas not reached by commercial investment, following an "outside in" approach, which means targeting the hardest to reach areas first (see Section 4).

This policy approach was adopted by the May Government after a formal consideration of policy approaches through the [Future Telecoms Infrastructure Review](#) (FTIR) in July 2018. The Johnson Government has not signalled a major departure from the overarching approach outlined in the FTIR, but a new National Infrastructure Strategy is expected to be published alongside the first budget (set for 11 March 2020) to outline the new Government's approach.²⁶

²¹ [Government to Water Down 2025 Full Fibre for All UK Target – Become Gigabit](#), Mark Jackson, *ISPReview*, 14 September 2019; [Government dodges 'full fibre for all by 2025' pledge](#), *BBC News*, Leo Kelion, 14 October 2019. [accessed 2 January 2020]

²² [Boris must not water down pledges on UK full-fibre broadband](#), Matthew Hare, *The Telegraph*, 3 January 2020, accessed 3 January 2020.

²³ techUK, [Connected Britain – Can reality meet the rhetoric on Fibre roll out?](#) Matthew Evans, 9 August 2019; Openreach, [The blueprint for a full fibre future](#), October 2019 [accessed 10 January 2020].

²⁴ [Broadband chiefs fire back at PM's full-fibre internet pledge](#), Leo Kelion, *BBC News*, 3 August 2019).

²⁵ EFRA Committee, [An Update on Rural Connectivity](#) 17th Report of Session, HC 2223, 18 September 2019, para 67.

²⁶ PM's Office, Queens' speech: [background briefing notes](#), 19 December 2019, page 90. The Strategy was originally expected in Autumn 2019 but was not published

The May Government committed to monitor progress under the FTIR on an annual basis and undertake a “full review” of the strategy’s impact after three years.²⁷ There has not yet been a review of the FTIR published.

The Labour Party’s manifesto for the 2019 General Election adopted a different approach, proposing a nationwide [publicly funded full-fibre network](#), stating:

Labour will deliver free full-fibre broadband to all individuals and businesses by 2030. We will integrate the broadband-relevant parts of BT into a new public entity, British Broadband, with a mission to connect the country. Labour will aim to deliver free full-fibre broadband to at least 15-18 million premises within five years. [...]

Public ownership of the broadband network will help tackle the regional inequality in coverage caused by competition that has led to under-build in rural and remote communities, and over-build in profitable areas.²⁸

Stakeholder comment

The May Government’s FTIR was broadly welcomed as a statement of Government policy and direction.²⁹ The National Infrastructure Commission welcomed the review, saying it mirrored many of recommendations it made in its National Infrastructure Assessment.³⁰

Both the National Infrastructure Commission and Ofcom – the communications regulator – also consider that market competition is the most appropriate way to encourage and deliver full-fibre deployment.³¹ International comparisons, such as with Spain, France and Portugal, have shown coverage of full-fibre networks to be correlated with competitive market conditions. The Government published a report containing international comparisons alongside the FTIR.³²

before the December 2019 General Election. HM Treasury, [Chancellor launches Budget process to usher in ‘decade of renewal’](#), 7 January 2020.

²⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

²⁸ [Labour Party Manifesto 2019](#); Labour Party, [British Broadband: Labour sets out mission to connect communities across Britain by delivering free full-fibre broadband for all](#), 14 November 2019.

²⁹ See, for example, techUK, [initial response to Future Telecoms Infrastructure Review](#), 23 July 2018; Independent Networks Cooperative Association (INCA), [INCA welcomes Government’s Future Telecoms Infrastructure Review](#), [accessed 17 August 2018]; Broadband Stakeholder Group, [A long read – Forging our Full-Fibre and 5G Future](#), 23 July 2018, accessed 24 July 2018.

³⁰ National Infrastructure Commission, Chairman Sir John Armitt, [New Telecoms Review will help deliver full fibre to all communities](#), 23 July 2018, accessed 17 August 2018.

³¹ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018. See also the House of Commons Scottish Affairs Committee, Digital Connectivity in Scotland, 18 July 2018, [HC 654](#), para 75.

³² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018.

Industry operators particularly supported the Government's commitment on measures to reduce barriers to deployment (see Section 3).³³

Consumer group Which? welcomed the FTIR alongside a warning that any changes "must not result in significantly higher bills for customers".³⁴ Some stakeholders expressed concern that the May Government's 2033 target was not ambitious enough.³⁵ Mobile UK, a trade body for mobile operators, argued that the FTIR lacked urgency and clear deadlines for action:

The problem is the language here. Ensure, consider, explore, encourage – these are all words with no definite timeline. [...] The report talks of using the full range of available levers yet deadlines do not appear to be one of those levers. Urgency is the watchword here, as if the aim is to lead the world we need to be ahead of our nearest competitors. Without clear actions and deadlines, we will simply be watching as others surge ahead...³⁶

2.3 Promoting a competitive market

Promoting a competitive market for full-fibre infrastructure build means encouraging other companies to build infrastructure in competition to Openreach. This is quite different from the roll-out of superfast broadband by Fibre-to-the-Cabinet, where Openreach had dominance due to its ownership of the copper network, which covers almost all of the UK (outside the Hull area).³⁷ Virgin Media is the only major infrastructure competitor to Openreach for superfast broadband.

In contrast, there is a growing competitive market for the delivery of full-fibre infrastructure, with several smaller providers building in competition to Openreach and Virgin Media (see Box 3). Ofcom estimated in August 2018 that investments announced by industry at that stage could bring full-fibre coverage to 20% of the UK by 2020.³⁸

³³ *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATE5](#), Mark Jackson, 23 July 2018, accessed 24 July 2018. Internet Service Providers' Association (ISPA), [ISPA supports government ambition for world class connectivity – addressing barriers to rollout should be the no 1 priority](#) 23 July 2018, accessed 24 July 2018.

³⁴ Which?, [Which? response to the DCMS Future Telecoms Infrastructure Review](#), 23 July 2018, accessed 14 July 2018.

³⁵ *ISP Review*, [Gov Detail BIG Changes to Boost UK Full Fibre Broadband and 5G UPDATE5](#), Mark Jackson, 23 July 2018, accessed 17 August 2018; *The Times*, [Every home to get fast broadband \(but it will take 15 years\)](#), 24 July 2018. Institute of Directors, [Government's telecoms review 'doesn't go far enough'](#), Dan Lewis, Senior Advisor on Infrastructure, 23 July 2018, accessed 17 August 2018.

³⁶ Mobile UK, [Future Telecoms Infrastructure Review is a positive step but it is deadlines that will achieve its goals](#), Gareth Elliot, Head of Policy and Communications, July 2018, accessed 31 August 2018.

³⁷ See the Library briefing paper on [BT and Openreach](#), CBP 7888, 11 January 2019.

³⁸ Ofcom, [Wholesale Local Access Market Review Statement – Volume 1](#), 28 March 2018, paragraph 5.31; Ofcom, [New Ofcom rules to boost full-fibre broadband](#), 23 February 2018, accessed 17 August 2018.

Government plans to promote a competitive market

The Government has committed to deliver a regulatory and policy framework that promotes infrastructure competition and gives providers confidence to invest, including:

- Removing ‘barriers’ that are delaying infrastructure build (see Section 3).
- Creating a stable regulatory environment that promotes investment. This is largely done by Ofcom through its approach to regulating Openreach (see Section 2.4)
- Encouraging customers to switch to full-fibre and supporting Openreach to ultimately retire the copper network (see Section 3.5). Customers switching to, and paying for, full-fibre services underpins the return on investment for private operators.

Box 3: Industry investments in full-fibre

The following are some examples of investments in full-fibre networks announced by industry:

- **Openreach** has committed to deliver 4 million premises with full-fibre by March 2021 through its [Fibre First](#) programme. Openreach has stated an ambition to deliver 15 million by around 2025 but they say this would require favourable regulatory conditions for investment.³⁹
- **Virgin Media** plans to reach four million premises by the end of 2019/20, as part of its [Project Lightning](#) network expansion (which includes a mix of full-fibre and cable broadband).
- **Hyperoptic** plans to expand its network to cover two million homes by 2021 and five million by 2024.⁴⁰
- **CityFibre**, in partnership with **Vodafone** as a retail provider have plans to roll out full-fibre to one million UK homes and businesses by 2021 and is targeting five million by 2025.⁴¹

Telecoms news site *ISPReview* collates industry announcements on full-fibre investment and plans in their article: [Who is Building – UK Summary of Full Fibre Broadband Plans and Investment](#).⁴²

2.4 Ofcom’s work in promoting full-fibre

Ofcom has an ongoing programme of work to promote investment in full-fibre by encouraging a competitive market for infrastructure, in line with the FTIR⁴³ and the Government’s [Statement of Strategic Priorities to Ofcom](#).⁴⁴

Ofcom has used two main approaches in the last few years to promote investment in full-fibre:⁴⁵

³⁹ Openreach, [Blueprint for a full-fibre future](#), October 2019 [accessed 10 January 2020].

⁴⁰ Hyperoptic, [Hyperoptic raises record £250m to accelerate the growth of its 1Gbps full fibre broadband across the UK](#), 3 August 2018

⁴¹ CityFibre, [About Us](#), accessed 16 December 2019.

⁴² ISPReview, [Who is Building – UK Summary of Full Fibre Broadband Plans and Investment](#), Mark Jackson [accessed 16 December 2019].

⁴³ Ofcom, [Regulatory certainty to support investment in full-fibre broadband](#): Ofcom’s approach to future regulation, 24 July 2018.

⁴⁴ DCMS, [Statement of Strategic Priorities](#) (for telecommunications, the management of radio spectrum, and postal services), 29 October 2019. The *Digital Economy Act 2017* introduced powers for the Government to make a “statement of strategic priorities” to which Ofcom must have regard when carrying out its functions.

⁴⁵ Ofcom, [New Ofcom rules to boost full-fibre broadband](#), 23 February 2018; For full details see Ofcom’s webpage [Wholesale local access market review](#), 28 March 2018.

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- Duct and pole access: opening up access to Openreach's network of poles and underground tunnels (called ducts) to allow competitors to install fibre optic cables to homes and businesses at a lower up-front cost (see Section 3.4 below for more information).
- Regulating the cost of some, but not all, of Openreach's wholesale services. Ofcom's approach aims to promote investment in building full-fibre networks by encouraging providers to build their own networks (rather than relying on wholesale access from Openreach), while also protecting consumers that rely on Openreach's copper network.

Ofcom published a consultation in January 2020 on its regulatory proposals for 2021–2025 which aim to boost investment in full-fibre.⁴⁶ Changes include:

- Moving to different regulatory approaches in different parts of the country depending on levels of competition for full-fibre build in the area. This would mean reducing regulation on some of Openreach's wholesale prices in areas where there is competition from other fibre providers while supporting Openreach to recover the costs of building in areas where it is the only provider of a large-scale network.
- Moving from 3 to 5-year regulatory cycles to give investors certainty over a longer period.
- Supporting Openreach to retire the copper network in areas where full-fibre has been built (see section 3.5).

Ofcom's announcement has been welcomed by industry stakeholders.⁴⁷ Some stakeholders cautioned however that Ofcom must be careful not to reduce regulation on Openreach too early and should ensure that smaller networks in rural area are also supported.⁴⁸

⁴⁶ Ofcom, [Supercharging investment in fibre broadband](#), 8 January 2020.

⁴⁷ [Ofcom puts pressure on BT over fibre network](#), Alex Ralph, *The Times*, 9 January 2020; [Ofcom sets out plan for rapid investment in UK rural broadband](#), Nic Fields, *Financial Times*, 8 January 2020.

⁴⁸ See for example TalkTalk and Truespeed's comments quoted in *ISPreview: Ofcom Start Major Review to Boost UK Full Fibre Broadband Market*, Mark Jackson, 8 January 2020; and techUK, [Supercharging investment in fibre broadband](#), 8 January 2020, accessed 10 January 2020.

3. Building fibre infrastructure

Building nationwide full-fibre broadband is a major national infrastructure project. It requires new fibre optic cables to be built to every premises.

Industry operators argue that the willingness to invest in fibre networks exists but that there are barriers to infrastructure deployment which are holding the market back.⁴⁹ Commonly cited barriers include:

- negotiating wayleaves for access to land (particularly in the case of absentee landlords);
- negotiating with local authorities regarding street works; and
- accessing existing infrastructure to reduce building costs.⁵⁰

In 2018 DCMS established a “Barrier Busting Task Force”, which is a cross-Government group working to address barriers to digital infrastructure deployment.⁵¹ The Task Force has developed a [Digital Connectivity Portal](#) that provides resources and practical advice for local authorities and commercial providers that is intended to facilitate deployment of digital infrastructure (full-fibre and mobile networks). The following sections provide some information about building infrastructure and proposals for reform.

DCMS's [Digital Connectivity Portal](#) provides practical guidance and resources about building digital infrastructure.

3.1 Installing infrastructure on land

This section outlines how telecoms companies can obtain rights to install infrastructure on public and private land. A separate framework exists for installing infrastructure on public roads (commonly referred to as street works) which is set out in section 3.2 below.

Wayleaves

A wayleave is a form of access agreement whereby a landowner grants a communications provider a licence to install, access and maintain equipment on their land. This is generally in return for a rental payment which is agreed by negotiation between the parties. Wayleaves are private legal agreements and the specific terms may differ in each case. A wayleave may also bind any subsequent owners or occupiers.⁵²

These agreements are usually entered into consensually between the parties. If such an agreement cannot be reached however, the telecoms company may apply to the courts to impose a wayleave agreement through powers contained in the Electronic Communications Code (see below).

Further information on wayleaves is provided on the Government's Digital Connectivity Portal page: [guidance on access agreements](#).

⁴⁹ Openreach, [The blueprint for a full-fibre future](#), October 2019 [accessed 10 January 2020].

⁵⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, page 5-6.

⁵¹ There is no webpage dedicated to the Barrier Busting Task Force. The [FTIR](#) (July 2018) provided a summary of the work of the Task Force at pages 5-6.

⁵² [Electronic Communications Code](#), Part 2, paragraphs 10.

Several broadband providers also provide information about wayleaves on their website, for example, [Openreach](#) and [Virgin Media](#).⁵³

The Electronic Communications Code

The [Electronic Communications Code](#) (ECC) provides telecoms companies (called network operators) with rights, called “code rights”, to install, operate, maintain and upgrade electronic communications infrastructure (such fibre broadband cables) on private and public land. It is contained in Schedule 3A to the [Communications Act 2003](#) (as amended). For more information about reforms to the ECC in 2017, see the Library briefing paper on: [Mobile Coverage in the UK](#).

Code rights in respect of land may only be conferred on an operator by a written agreement between the occupier of the land and the operator⁵⁴ – e.g. by a wayleave, as described above. If such an agreement cannot be agreed consensually, the operator (or landlord) can apply to the court to impose an agreement to confer the Code Rights. The relevant court currently the Upper Tribunal (Lands Chamber) in England and Wales, the Lands Tribunal for Scotland or the county court in Northern Ireland.⁵⁵

The powers of the court to impose an agreement are set out in Part 4 of the ECC. Part 4 also includes provisions for calculating the rent to be paid to landowners for hosting equipment under an imposed agreement.⁵⁶

The Code only applies to operators that have been granted Code Powers by Ofcom, following a public consultation.⁵⁷ Ofcom publishes a [Register of operators with powers under the ECC](#)

Ofcom has also published a [Code of Practice](#) to accompany the ECC that provides a framework for what landowners and network operators should expect from each other when negotiating wayleave agreements.⁵⁸

Wayleave reform: tenanted properties

Even with ECC rights, operators have said that there are still administrative barriers that delay getting access to land, particularly for tenanted properties with unknown or unresponsive landlords. Operators have said this often occurs for multi-dwelling units, office blocks and business parks.⁵⁹ While Part 4 of the ECC allows operators to apply to the Court to impose Code Rights if a consensual agreement cannot be reached with the landlord, operators argue that this process is lengthy

⁵³ Openreach, [Obtaining Wayleaves](#), accessed 3 September 2018; Virgin Media, [What's an access agreement?](#) accessed 3 September 2018.

⁵⁴ [Electronic Communications Code](#), Part 2, paragraphs 9 and 11.

⁵⁵ [Electronic Communications Code](#) Part 16, paragraphs 94 and 95 and [Electronic Communications Code \(Jurisdiction\) Regulations 2017](#).

⁵⁶ [Electronic Communications Code](#), Part 4, paragraph 24.

⁵⁷ Ofcom, [Register of persons with powers under the Electronic Communications Code](#), 11 May 2018, accessed 31 August 2018.

⁵⁸ Ofcom, [Electronic Communications Code: Code of Practice](#), 15 December 2017.

⁵⁹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 52-53; Openreach, [The blueprint for a full-fibre future](#), October 2019 [accessed 10 January 2020].

and costly, leading to some tenanted properties facing lengthy delays to get connected, or being left out of build plans altogether.⁶⁰

The National Infrastructure Commission recommended that the Government should simplify and standardise the processes for obtaining wayleaves by implementing a notification scheme similar to that used by other utilities by 2019.⁶¹ The FTIR (July 2018) included a commitment to bring forward primary legislation to bring telecoms companies in line with other utilities by creating a “right to entry” for tenanted properties.⁶² In October 2018 the Government launched a [consultation on ensuring tenants’ access to gigabit-capable connections](#), which ran until 21 December 2018.

On 10 October 2019 the Government announced it would [bring forward primary legislation](#) to amend the Electronic Communications Code to introduce a “cheaper and faster” process for telecoms operators access and connect tenanted properties in residential blocks of flats. The [Telecommunications Infrastructure \(Leasehold Property\) Bill 2019-20](#) was included in the December 2019 Queens’ Speech and was introduced to Parliament on 8 January 2020.⁶³ A version of the Bill had previously been introduced into Parliament in October 2019, but did not have a second reading before the 2019 General Election.⁶⁴

The Bill would introduce a new process for telecoms providers to access to multiple dwelling buildings (blocks of residential flats and apartments) through the Lands Tribunals. The new process would only apply where a tenant has requested a connection from a telecoms operator, but the landlord has repeatedly failed to respond to formal requests from the operator to negotiate access. The rights would be for an interim period of no more than 18 months.⁶⁵

A Library briefing on the Bill will be published ahead of second reading.

3.2 Street works: installing infrastructure on public roads

Part 8 of Electronic Communications Code (ECC) provides designated telecoms companies with rights to install telecommunications infrastructure on or under public roads and to carry out the necessary associated street works to do so. This provides the legal basis for those telecoms companies to be considered statutory undertakers (along with other utility companies) under Parts III and IV of the [New Roads and Street Works Act 1991](#) in England, Wales and Scotland (the 1991 Act),

⁶⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 52. Some industry responses to the FTIR consultation specifically raise this, such as [Virgin Media](#), [TalkTalk](#), and [BT](#).

⁶¹ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 21-22.

⁶² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 54.

⁶³ DCMS, [Millions set to benefit from faster broadband with new plans to tackle rogue landlords](#), 10 October 2019; [Ensuring tenants’ access to gigabit-capable connections](#): consultation response, 10 October 2019.

⁶⁴ [Telecommunications Infrastructure \(Leasehold Property\) Bill 2019](#), Bill 005 2019-20.

⁶⁵ The [Telecommunications Infrastructure \(Leasehold Property\) Bill 2019-20](#) clause 27G.

and under the *Street Works (Northern Ireland) Order 1995* ([SI 1995/3210](#)) in Northern Ireland.^{66 67} The 1991 Act and associated regulations allows statutory undertakers to carry out street works on public roads without the prior consent of the local highway authority. This means that telecoms companies do not need to agree a wayleave to install infrastructure on/under a public road; a wayleave would however be required for a private road (see section 3.1 above).

The 1991 Act provides some powers to local highway authorities to manage *how* companies conduct works and requires utility companies to provide advance notice of the works to the authority. Some areas have introduced permit or lane rental schemes, which give the highway authority more control over works. More information on street works generally is provided in the Library briefing paper: [Street works in England](#) (CBP 8500).

In addition, telecoms companies must comply with the [Electronic Communications Code \(Conditions and Restrictions\) Regulations 2003](#) (SI 2003/2553, as amended),⁶⁸ which apply UK-wide. These regulations require operators to consult with or give notice to local highways and planning authorities in certain circumstances. For example, operators are required to give notice to planning authorities in areas where they have not previously installed infrastructure (with some exceptions), and planning authorities can set reasonable requirements that it wishes the operator to comply with. The Regulations also include specific conditions relating to the installation of infrastructure in proximity to listed buildings and in relation to conservation and protected areas.⁶⁹

Calls for reform

Telecoms companies have raised concerns about inconsistent approaches between local authorities to the management of street works and interpretation of street works legislation, arguing that this inconsistency has created uncertainties and inefficiencies when seeking to build infrastructure.^{70 71} The Government has stated that road and street works account for 70% of the cost of fibre deployment.⁷²

⁶⁶ In England and Wales the 1991 Act was heavily amended by Parts 3 and 4 of the [Traffic Management Act 2004](#); in Scotland by Part 2 of the [Transport \(Scotland\) Act 2005](#).

⁶⁷ A comparison of street works and planning legislation relevant to building telecoms infrastructure in each nation is provided in a report by Analyst Masons, commissioned by the Broadband Infrastructure Group, [Lowering barriers to telecoms infrastructure deployment](#), Dr Matt Yardley, Ian Adkins, Dr Robert Woolfson, May 2017.

⁶⁸ Amending legislation includes: [SI 2013/1403](#), [SI 2016/1049](#) and [SI 2017/753](#).

⁶⁹ Regulations 6-8, *Electronic Communications Code (Conditions and Restrictions) Regulations 2003* (as amended); see amending legislation: [SI 2016/1049](#), [SI 2013/1403](#) and [SI 2009/584](#).

⁷⁰ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 60.

⁷¹ See also for example, a report by Analyst Masons, commissioned by the Broadband Infrastructure Group, [Lowering barriers to telecoms infrastructure deployment](#), Dr Matt Yardley, Ian Adkins, Dr Robert Woolfson, May 2017.

⁷² DCMS, DfT, [Street Works Toolkit](#), 23 May 2019.

The National Infrastructure Commission recommended that local authorities appoint a 'digital champion' with responsibility for engaging with telecoms providers. It recommended:

The digital champion in each local planning authority should be responsible for coordinating and facilitating digital infrastructure deployment in their area, acting as the single point of contact for all telecoms providers, and assisting them in delivering better connectivity for the local area. Digital champions should prioritise:

- reforming and streamlining the process around permissions for street works, reducing the variability across the country and removing inefficient delays
- improving the accessibility of their publicly owned assets, making it easier and cheaper for operators to deploy digital infrastructure in the local area.⁷³

Similar calls have been made by the Broadband Stakeholder Group and the thinktank Centre for Cities.⁷⁴

On the other hand, local highway authorities have argued that telecoms companies take an inconsistent approach to sharing information about their deployment plans, which makes it difficult for them to coordinate works (across multiple utilities – not just telecoms companies) effectively.⁷⁵ Local authorities also complain about poor quality work carried out by undertakers. While local authorities currently have powers to demand reinstatement of the road to an acceptable standard, this takes extra time if the work is not completed properly in the first place, with the additional consequences of traffic disruption and, depending on the location, loss of local business and trade.

In the FTIR, the Government noted that there was a "culture of mistrust" between local authorities and operators.⁷⁶ The FTIR stated that the Government's aim is to "ensure a uniform approach" to street works across the country with both local authorities and undertakers "promoting a collaborative and flexible approach".

The Government has published a [Street Works Toolkit](#) (for England and Wales) that provides practical guidance for managing street and road works for the deployment of broadband infrastructure. The Toolkit was agreed between the Government and Street Works UK (on behalf of operators), the Joint Authorities Group (on behalf of local authorities) and the Highway Authorities and Utilities Committee. In the FTIR the Government also refers to wider work undertaken by the Department for Transport regarding street works.⁷⁷

⁷³ National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 30.

⁷⁴ Analyst Masons, commissioned by the Broadband Infrastructure Group, [Lowering barriers to 5G deployment](#), Dr Matt Yardley, Janette Stewart, Ian Adkins, Dr Robert Woolfson, July 2018; [Delivering change: How cities can make the most of digital connections](#), Simon Jeffrey and Lahari Ramuni, Centre for Cities, July 2018.

⁷⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 61.

⁷⁶ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 61.

⁷⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 64.

3.3 New builds

There is currently no obligation on developers to connect new build properties with broadband infrastructure, and historically, most new build properties have been connected to either only copper-based connections, or more recently, part-fibre, part-copper connections.⁷⁸

There have been two reforms since 2016 that aimed to improve digital connectivity in new builds:

- 1 [A voluntary agreement between BT Openreach and the Home Builders Federation \(HBF\)](#) was brokered by the Government in February 2016.⁷⁹ It does not place any legal requirement on developers but the aim of the agreement is that “fibre-based” broadband is installed in new housing developments either at no cost to the developer or co-funded by the developer and Openreach. Virgin Media and GTC (another infrastructure provider) have since signed similar agreements with the HBF.⁸⁰ According to the HBF, its members deliver about 80% of the new homes built in England and Wales each year.⁸¹
- 2 Amendments were made in 2016 to building regulations in each UK nation to implement the EU *Broadband Cost Reduction Directive* 2014/61/EU.⁸² The amended regulations require that all new buildings have the infrastructure required to support a superfast broadband connection (such as cable ducts) but do not go as far as to require provision of the connection itself. The amended regulations apply to any new building applications submitted after 31 December 2016. Local authorities have a duty to ensure that building regulations are complied with in their area.

Further reform

In the FTIR the Government accepted that connectivity in new build developments is “not as good as it should be” and that new builds “must be connected to fibre networks”.⁸³

In October 2018 the Government [launched a consultation](#) on the following main proposals to “ensure delivery of gigabit-capable connections to all new build homes”:

- Developers and network operators share the cost of connecting new build sites to gigabit-capable networks.
- Introducing a 'duty to connect' provision upon network operators.
- Amending Building Regulations Approved Document Part R: (Physical infrastructure for high-speed electronic communications networks). This will mean all new build

⁷⁸ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 56.

⁷⁹ DCMS, [Superfast connectivity in new homes](#), 5 February 2016.

⁸⁰ [PO HL6920, 30 April 2018 \[Housing: Broadband\]](#).

⁸¹ Home Builders Federation, [About the HBF](#), accessed 23 August 2018.

⁸² For England, see: [Approved Document R \(England\)](#); for Wales, see: [Approved Document R \(Wales\)](#); for Scotland, see: [Building Standards Technical Handbook \(Domestic\)](#), part 4.14; for Northern Ireland, see: [Technical Booklet M](#).

⁸³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 56-58.

sites will be built with the necessary infrastructure in place to support gigabit-capable networks.⁸⁴

The consultation closed on 21 December 2018. The Government has not yet published a response to the consultation.

The [December 2019 Queens' Speech](#) stated that the Government would bring forward legislation on new builds and full-fibre connectivity that would include:

- Amending legislation so that all new build homes are required to have the infrastructure to support gigabit-capable connections.
- Requiring developers to work with broadband companies to install gigabit capable connections in virtually all new build homes, up to a cost cap.⁸⁵

3.4 Access to existing infrastructure: ducts and poles

The biggest cost for fibre deployment is the civil engineering works required – physically digging trenches and laying cables. Accessing existing infrastructure to host telecoms cables can help reduce this cost. The main policy measure in place to facilitate access to existing infrastructure is to open access to Openreach's network of ducts (underground tunnels) and poles for use by competitors.

The Government and the National Infrastructure Commission have both strongly supported opening access to Openreach's ducts and poles, framing it as one of the most important reforms that could quickly enhance infrastructure build. Both stressed the importance of monitoring the success of this approach, and to consider further intervention if take up is low.^{86 87}

Background information is provided in the POST briefing paper: [Telecommunications Infrastructure: Cables, Ducts and Poles](#) (March 2017).

Duct and pole access reforms

Openreach has been required to allow competitors (telecoms companies other than BT) to rent access to its ducts and poles since 2010 for the purpose of laying fibre cables for high-speed broadband services but not, for example, fibre for the purposes of supporting mobile networks (see Box 2 on 5G).

In 2016, the *Communications (Access to Infrastructure) Regulations 2016* (ATI regulations) were introduced, which included the requirement for operators of utilities to share physical infrastructure with competing

⁸⁴ DCMS, [New Build Developments: Delivering gigabit-capable connections](#), 29 October 2018.

⁸⁵ PM's Office, [Queens' Speech: Background briefing notes](#), 19 December 2019, page 92: the *Telecommunications (Connectivity) Bill*.

⁸⁶ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 68.

⁸⁷ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 28.

network operators (including other utilities such as gas, electricity and water). In the FTIR the Government noted that the ATI regulations have had limited success.⁸⁸

Ofcom introduced reforms to duct and pole access in March 2018, having found the above two measures had not had high take up by operators.⁸⁹ The reforms included introducing a non-discrimination requirement, meaning that Openreach must provide access nationally to other providers as easily as to BT, including the same service levels and digital data maps. Ofcom stated that the reforms could cut the cost of laying fibre cables by 50% and reduce the time taken from days to hours.⁹⁰ In May 2019 Ofcom announced further reforms to allow Openreach's ducts and poles to be used for all telecoms services, by extending duct and pole access to lines serving large businesses and high-speed lines used to support mobile broadband networks.⁹¹

In January 2020 Ofcom reported uptake of duct and pole access had increased since May, with over 80 companies taking advantage of Openreach's infrastructure with plans to use over 40,000 poles and 5,000km of duct, up from around 12,000 and 2,500km respectively in May.⁹²

3.5 Retiring the copper network

The UK's copper telephone and broadband network is owned by Openreach. Openreach's copper network supports the analogue telephone network, copper-based broadband connections (including FTTC) as well as other devices such as house alarms.

Switching off the copper network would require all premises and devices to have a non-copper based telephone and broadband connection. This could include a full-fibre connection, a cable connection (such as provided by Virgin Media) or a wireless connection.

In the FTIR the Government carefully distinguishes between copper "switch-off" (retiring the copper network) and "switchover" (moving customers over to new non-copper based networks). The Government only expressed clear support for an industry-led copper "switch over".⁹³

What are the advantages and disadvantages of retiring the copper network?

The FTIR sets out the benefits of switching to a full-fibre network, including:

- benefits to network providers on their investment case by providing certainty as to future customers;

⁸⁸ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 69.

⁸⁹ Ofcom, [Wholesale Local Access Review, Volume 3](#), 28 March 2018, para 2.11-2.19.

⁹⁰ Ofcom, [Opening up BT's infrastructure for new fibre broadband](#), 20 April 2017, accessed 17 August 2018.

⁹¹ Ofcom, [Further Ofcom rules to support fibre investment](#), 24 May 2019.

⁹² Ofcom, [Supercharging investment in fibre broadband](#), 8 January 2020, accessed 9 January 2020.

⁹³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 138.

- benefits to consumers through the improved connectivity and reliability that comes with fibre networks;
- benefits to retail service providers through lower operating costs and improved customer satisfaction (because fibre provides a higher quality service); and

Running a fibre network and copper network in parallel has high costs, which is an incentive for Openreach to retire the copper network.⁹⁴

Will there be an impact on consumers?

Concerns have been raised however about the impact that switching to full-fibre services would have on consumers, particularly vulnerable consumers.⁹⁵ Clive Selley, CEO of Openreach, estimated in July 2018 that switching off the copper network could result in broadband wholesale charges increasing by £5 per month more (which would likely result in retail price increases for consumers).⁹⁶

The National Infrastructure Commission recommended that any switch off plan should contain protection for vulnerable consumers:

The transition plan will need to include protection for potentially vulnerable consumers. Some consumers will not want fibre but will receive it anyway. Openreach should not be able to charge customers extra that had no need for the upgrade.⁹⁷

Concerns have also been raised about consumers who do not have a broadband connection and rely on the copper network for telephone calls. A switch to fibre would require a phone adapter to transmit phone calls via the internet (called “Voice over Internet Protocol” or VoIP). Openreach is already working on plans to move towards VoIP services, stating an intention to withdraw the Public Switched Telephone Network (PSTN) by 2025.⁹⁸

There are other devices, too, such as security alarms that use the copper network that will need to be considered in any switch-off plan.^{99 100}

[Ofcom set out expectations](#) for industry regarding protections for consumers during the transition to VoIP services in February 2019.¹⁰¹ Ofcom’s expectations for industry include having strategies in place to identify and support migrating customers and engaging with relevant service providers.

⁹⁴ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 140-142.

⁹⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 142; National Infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 27-28.

⁹⁶ [BBC Radio 4 Today Programme, 17 July 2018](#), at 1:16:55.

⁹⁷ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, page 28.

⁹⁸ [Openreach Consult UK ISPs on WLR Telephone Network Closure, ISP Review](#), Mark Jackson, 19 April 2018; Openreach, [Openreach to consult Communication Provider customers on switch to digital phone services by 2025](#), 15 May 2018, accessed 17 August 2018.

⁹⁹ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 148

¹⁰⁰ Internet Telephony Services Providers’ Association (ITSPA), [ITSPA welcomes Government drive for full fibre rollout but adds caution to current plans for PSTN switch off](#), 23 July 2018, accessed 24 July 2018.

¹⁰¹ Ofcom, [The future of fixed telephone services](#), 22 February 2019 [accessed 15 March 2019].

How and when will it happen?

In its National Infrastructure Assessment, the National Infrastructure Commission recommended that the Government develop a plan to allow for copper “switch-off” by 2025. The NIC noted however that the decision to “switch off” the copper network is ultimately a commercial decision for Openreach.¹⁰²

While not specifying a firm date, in the FTIR the Government expected that “switchover” will be underway in a “majority of the country by 2030” but that timing depends on the pace of the full-fibre roll-out. The Government expects switchover to start when a significant proportion of the population has taken-up new fibre services.¹⁰³

Openreach has announced plans for a trial in Salisbury where it would aim to move customers to full-fibre services and then withdraw copper services at the end of 2022. Ofcom has published consultations regarding proposed changes to regulation in the area to facilitate the early stages of this trial.¹⁰⁴

Ofcom has also announced that where Openreach has built a full-fibre and copper-based network, it intends to help Openreach switch customers to full-fibre, by removing regulation on the copper network and transferring it to the fibre network. This means that Openreach could increase charges on the copper network, which would incentivise retail service providers to move customers to full-fibre networks instead. The proposals are open to consultation; changes would come into place from 1 April 2021.¹⁰⁵

¹⁰² National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 27.

¹⁰³ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 144.

¹⁰⁴ Ofcom, [Consultation: Promoting competition and investment in fibre networks – Measures to support Openreach's trial in Salisbury – migrating customers to full fibre and withdrawing copper services](#), 24 July 2019; [Consultation: Measures to support Openreach's trials in Salisbury and Mildenhall](#), 27 November 2019.

¹⁰⁵ Ofcom, [Supercharging investment in fibre broadband](#), 8 January 2020.

4. Government funding for full-fibre networks

Summary: Government funding for full fibre networks

The Government has committed to provide additional public funding to support gigabit broadband infrastructure in areas that will not be reached by commercial investment. The May Government stated that it would pursue an “outside in” approach to funding, which means targeting hardest to reach premises first.

In September 2019 the Chancellor announced that the Government would allocate [£5 billion to support the rollout of gigabit-capable broadband](#) in the “hardest to reach 20 per cent of the country”. No announcements made about how this funding would be used were made before the December 2019 general election.

There are currently two main UK-wide Government funded programmes delivering full-fibre networks, launched under the May Government. The programmes are delivered by [Building Digital UK \(BDUK\)](#), part of DCMS:

- 1 The [Local Full Fibre Networks Programme \(LFFN\)](#) (£287 million) supports a [voucher scheme](#) focused on small and medium sized businesses (see Box 4) and provides grants to local public sector bodies on a competitive basis. The programme aims to stimulate customer demand for full-fibre networks across the UK.
- 2 The [Rural Gigabit Connectivity Programme \(RGCP\)](#) (£200 million) includes a [voucher scheme for rural premises](#) (see Box 4) as well as a trial scheme to connect public sector buildings such as schools and hospitals in rural areas.

Other funding initiatives to support investment in full-fibre include tax breaks for building full-fibre infrastructure (Section 4.5) and the Digital Infrastructure Investment Fund (Section 4.6).

4.1 Public funding for rural areas

Challenging geographies in many rural areas increase the cost of installing fibre, while low population densities reduce the returns that operators receive from customers buying services. As such, commercial operators are unlikely to service these areas without public funding support. Some full-fibre providers, however, do target rural areas, for example [Gigaclear](#), [TrueSpeed](#) and [B4RN](#).

In July 2018, the National Infrastructure Commission highlighted that more public funding will be required to deliver a nationwide full-fibre network.¹⁰⁶ The Commission recommended that a taxpayer-subsidised infrastructure programme to deliver full-fibre to areas that cannot support commercial investment, largely rural areas, should start by 2020. It said that such a programme should be along the lines of the Government’s “successful” superfast broadband programme, but should focus on delivering the hardest to reach premises first.¹⁰⁷ More

¹⁰⁶ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018.

¹⁰⁷ National infrastructure Commission, [National Infrastructure Assessment](#), 10 July 2018, page 25-26.

information about the superfast broadband programme is available in the Library briefing paper: [Superfast broadband in the UK](#).

Outside-in approach

The May Government committed to pursue an “outside-in” strategy to support full-fibre roll-out in the Future Telecoms Infrastructure Review. This means targeting the hardest to reach premises first. The FTIR stated that investment would start with areas that do not yet have superfast broadband.¹⁰⁸

The “outside-in approach” has been [largely welcomed by rural stakeholders](#).¹⁰⁹ The House of Lords Committee on the Rural Economy, in their [April 2019 report](#), expressed optimism about the approach to rural areas but stressed the need for effective implementation:

The Government appears to have identified the challenges and we are optimistic about the overall direction of travel outlined in the FTIR which is giving greater focus to rural areas. [...]

We welcome the Government’s ambition to achieve nationwide full fibre connectivity by 2033 as set out in the Future Telecoms Infrastructure Review (FTIR) but stress the need for effective coordination, monitoring and accountability in its implementation.¹¹⁰

The House of Commons Environment Food and Rural Affairs Committee in its September 2019 report on Rural Connectivity welcomed the outside in approach but stated it remained cautious about how the approach would be delivered in practice.¹¹¹

How many premises and how much funding?

The May Government estimated that £3–5 billion funding could be required to deliver full-fibre to the 10% of premises it estimated were not likely to attract commercial investment.¹¹²

The Johnson Government has since increased the scope of the Government’s funding plans to cover the “hardest to reach 20 per cent of the country”.¹¹³ The Chancellor Sajid Javid announced in September 2019 that the Government would allocate [£5 billion to support the rollout of gigabit-capable broadband](#) in the hardest to reach 20% of the country.¹¹⁴ There were no announcements made about how this funding would be used before the December 2019 general election was

The Johnson Government has promised £5 billion funding to support roll-out of gigabit capable broadband to the hardest to reach 20% of UK premises.

¹⁰⁸ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 130.

¹⁰⁹ For example: Rural Services Network, [Rural welcome for Government’s digital connectivity plan](#), 25 July 2018; Country Land and Business Association, [CLA responds to DCMS announcement of £200 million for rural broadband](#), 21 May 2019; INCA, [INCA welcomes Government’s Future Telecoms Infrastructure Review](#), 23 July 2018.

¹¹⁰ House of Lords Committee on the Rural Economy, [Time for a strategy for the rural economy](#), Report of Session 2017–19, HL 330, 27 April 2019, para 252-254.

¹¹¹ House of Commons Environment Food and Rural Affairs Committee, [An Update on Rural Connectivity](#), Seventeenth Report of Session 2017–19, HC 2223, 18 September 2019, para 58.

¹¹² DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 135.

¹¹³ DCMS, [Building Digital UK](#), updated 17 October 2019 [accessed 17 December 2019].

¹¹⁴ HM Treasury, [Chancellor announces support for post-Brexit future](#), 29 September 2019.

called. The December 2019 Queens' Speech briefing notes stated that a National Infrastructure Strategy, would be published alongside the next budget (expected 11 March 2020).¹¹⁵

The following sections outline existing funding programmes for full-fibre networks that have been announced to date (under the May Government).

Box 4: Gigabit broadband voucher schemes

1. **Gigabit voucher scheme (UK wide):** eligible small and medium sized businesses (SMEs) can claim up to £2500 against the cost of installing a gigabit capable connection, either individually or as a group. Residents can claim up to £500 as part of a group project that includes businesses. This scheme is part of the Local Full Fibre Networks programme.
2. **Welsh top-up voucher:** the [Welsh Government has provided separate funding](#) to top-up vouchers issued through the above gigabit voucher scheme in Wales, providing an additional £3000 per business and up to £300 per residential premises.¹¹⁶ This means that as of March 2019 in Wales, eligible SMEs can claim up to a total of £5500 per businesses and £800 per residential premises (as part of a group project).
3. **Rural gigabit voucher scheme (UK-wide):** residents and SMEs in rural areas that cannot access superfast broadband speeds (30 Mbps) can claim vouchers towards the cost of a gigabit capable connection. SME's can claim up to £3,500 and residents up to £1,500 (per premises). This is part of the Rural Gigabit Connectivity Programme. The vouchers can only be used to support group schemes (where two or more SMEs and/or residents combine their vouchers). Rural areas are defined based on standard classifications used in each nation – see the [rural voucher scheme webpage](#) for more information.

The vouchers support the cost of a gigabit capable connections – this means a full-fibre connection or any other technology capable of supporting 1 Gbps upload or download speeds.

The schemes are supplier-led which means suppliers request the vouchers on behalf of their customers. To access funding, customers should contact a [registered supplier](#) operating in their area.

More information about all three voucher schemes, including eligibility requirements, is available on the [Gigabit Broadband Voucher Scheme website](#).

4.2 Local Full Fibre Networks (LFFN) Programme

The Local Full Fibre Networks (LFFN) programme is directed towards stimulating demand for full-fibre networks. It is set to run until 2021 and comprises £287 million investment.¹¹⁷

The programme includes:

- 1 The [LFFN Challenge Fund](#) (£190 million), which awards grants to local public sector bodies on a competitive basis. It aims to

¹¹⁵ PM's Office, [Queens' Speech: background briefing notes](#), 19 December 2019; HM Treasury, [Chancellor launches Budget process to usher in 'decade of renewal'](#), 7 January 2020.

¹¹⁶ DCMS, Welsh Government, [Gigabit broadband voucher scheme boost for Wales](#), 22 March 2019.

¹¹⁷ House of Commons Library correspondence with DCMS, 3 June 2019. The £287 million comprises: £200 million from the NPIF (£190 LFFN Challenge Fund and £10 million trial project); £67 million gigabit broadband voucher scheme; and £11.1 million for the Trans-Pennine Initiative.

support full-fibre infrastructure projects that have the potential to leverage further commercial investment in the area.¹¹⁸

- 2 The [Gigabit Broadband Voucher Scheme](#) (£67 million; see Box 4), provides vouchers to small and medium sized businesses (SMEs) to support the cost of installing a gigabit capable connection. Residents can also apply as part of a group project that includes businesses.¹¹⁹
- 3 The [Trans-Pennine Initiative](#), which is a joint project between the LFFN and 5G Testbeds and Trials Programme “to investigate the potential of using the rail network to enhance connectivity for rail passengers and the population more generally”.¹²⁰ It is supported by £11.1 million funding.¹²¹

LFFN Challenge Fund

Funding under the LFFN Challenge Fund has been awarded in 3 Waves:

- 1 Wave 1 funded trial projects, for example [six trial projects](#) in different areas announced in September 2017.¹²² In February 2019 DCMS [published a list of rural schools](#) to be connected under a pilot project that aimed to inform the development of the Rural Gigabit Connectivity Programme.¹²³
- 2 Wave 2 was the first round of local projects to be funded by the LFFN Challenge Fund; 13 projects were announced in the [2018 Spring Statement](#) in the following areas, with a total of £95 million funding:
 - Armagh City, Banbridge & Craigavon; Highlands; Cardiff; Manchester; North Yorkshire (Nynet); Coventry, Solihull & Warwickshire (CSW); Wolverhampton; London; Mid Sussex; Portsmouth; Cambridgeshire; Belfast and Blackpool.¹²⁴
- 3 Wave 3 projects, funded by the remaining £95 million in the Challenge Fund, are being announced individually and include projects in the following areas:¹²⁵

¹¹⁸ DCMS, [Revised Guidance for the Local Full Fibre Networks Challenge Fund](#), August 2018.

¹¹⁹ DCMS, [£67 million boost for a Full Fibre future](#), 15 March 2018, [accessed 31 May 2019].

¹²⁰ DCMS, [Trans Pennine Initiative Trial: Call for Information](#), updated 30 January 2019 [accessed 3 June 2019].

¹²¹ House of Commons Library correspondence with DCMS, 3 June 2019. Originally the Trans-Pennine project included the construction of physical masts to support 5G and was funded by approximately £22 million; this has now been reduced to £11 million as parts of the project were dropped. For information about changes to the TPI project, see DCMS, [Trans Pennine Initiative Trial: Call for Information](#), updated 30 January 2019 [accessed 3 June 2019].

¹²² DCMS, [Local Full Fibre Networks Challenge Fund Guidance](#), 22 November 2017 [accessed 1 June 2019]; DCMS and HM Treasury, [Six areas to pilot UK's fastest broadband as part of £200 million project](#), 3 September 2017.

¹²³ DCMS, [More than 100 rural schools to get gigabit speed broadband](#), 26 February 2019 [accessed 15 March 2019]. House of Commons Library correspondence with DCMS (3 June 2019) confirmed this was part of Wave 1 of the LFFN programme.

¹²⁴ DCMS, Guidance: [Local Full Fibre Networks Programme](#), 13 March 2018.

¹²⁵ House of Commons Library Correspondence with DCMS, 3 June 2019.

Suffolk Council (£5.9m);¹²⁶ Plymouth (£3.0m);¹²⁷ Herts and Essex (£2.1m); Colchester (£3.5m); Rutland (£2.0m); Isle of Wight (£0.8m); Shetland Islands (£2.0m); Norfolk (£8.0m); South Essex (£4.5m); North Wales (£8.0m); Stoke-on-Trent (£9.2m); Northern Ireland (£15.0m).¹²⁸

4.3 Rural Gigabit Connectivity (RGC) Programme

The Government describes the Rural Gigabit Connectivity (RGC) Programme as the “first step” in the process of providing funding for full-fibre for rural areas via the outside-in approach described in the FTIR.

The two-year programme [commenced in May 2019](#) and will run until the end of March 2021.¹²⁹ The Government has committed £200 million to the programme, first announced in the 2018 Autumn Budget and drawn from the National Productivity Investment Fund (Box 5).¹³⁰

The RGC Programme has two parts:

- 1 A [voucher scheme](#) for rural residents and small and medium sized businesses to help support the cost of installing a gigabit capable connection (see Box 4); and
- 2 A trial programme to connect rural public sector buildings such as schools and hospitals (‘Hubs’) to a gigabit capable connection.

The Hub approach is a trial that the Government states has been designed to “validate a potential approach and forecast costs”. The Government described the benefits of the “Hub” approach as being two-fold: first to provide an improved public service and secondly, the surrounding area may then become increasingly viable for commercial investment.¹³¹ The voucher scheme is also intended to help stimulate commercial investment.

The Programme team are working with the Department for Education and the Department of Health and Social Care as strategic partner organisations.¹³² The Government [announced the first 31 primary schools](#) to be connected under the programme in May 2019, and provided details about which areas had been first prioritised:

RGC is a two year, £200 million UK-wide programme focused on rural areas. Government has initially prioritised sites in Cornwall, Cumbria, Northumberland and Pembrokeshire. Additional sites in Scotland, Northern Ireland, Wales and the rest of England will be announced in the coming months.

¹²⁶ HM Treasury, [Autumn Budget 2018](#), 29 October 2018, para 4.13.

¹²⁷ Plymouth County Council Newsroom, [Ultra-fast broadband coming to Plymouth](#), 26 March 2019 [accessed 3 June 2019].

¹²⁸ HM Treasury, [Spring Statement 2019: Written Ministerial Statement](#), 13 March 2019, page 2 includes a list of 9 projects funded under Wave 3 of the LFFN.

¹²⁹ DCMS, [£200 million rollout of full fibre broadband begins](#), 19 May 2019 [accessed 30 May 2019].

¹³⁰ HM Treasury, [Budget 2018](#), 29 October 2018, para 4.13.

¹³¹ DCMS, [RGC Programme Key Information](#), 29 May 2019, [accessed 30 May 2019].

¹³² DCMS, [RGC Programme Key Information](#), 29 May 2019, [accessed 30 May 2019].

The RGC Programme will trial a model connecting local hubs* in rural areas, starting with primary schools. Working with the Department for Education, DCMS has identified the first 31 schools eligible for a connection under the scheme. These new speeds will enable whole classes to simultaneously surf the internet on tablets as part of structured lessons, and gives schools easier access to online training and educational learning.

Further information is provided in the [RCG Programme guide](#) including how local authorities can express an interest in becoming a strategic partner under the programme.

Box 5: National Productivity Investment Fund

The Government has allocated £740 million to telecoms investment up to 2023 through the [National Productivity Investment Fund](#) (NPIF), in particular to support the roll out of full fibre networks and future 5G communications.¹³³

The National Productivity Investment Fund also covers other areas, including transport, housing, and research and development. It was first announced in the [Autumn Budget 2016](#) as a £23 million fund to 2020–2021. The [Autumn Budget 2017](#) extended the overall NPIF to £31 billion, which corresponds to an extra £7 billion for 2022–2023. The [Autumn Budget 2018](#) extended the NPIF to 2023–24, and expanded it to £37 billion overall.

Telecoms programmes supported by NPIF funding have included:

- £200 million for the Local Full Fibre Networks Programme (LFFN);
- £200 million for the Rural Gigabit Connectivity Programme (RGCP);
- £160 million to support for 5G development;
- £35 million to improve connectivity on trains (combination of mobile and fibre broadband).¹³⁴

4.4 Superfast broadband programme

The superfast broadband programme has been providing funding to local bodies in England and the devolved Administrations to fund superfast broadband infrastructure build in regions not reached by commercial networks. The programme has largely funded Fibre-to-the-Cabinet connections. More information about the programme is available in the Library briefing paper: [Superfast broadband in the UK](#).

In the FTIR the Government stated that the final stages of superfast programme (Phase 3) would prioritise delivery of full-fibre networks and that £200 million existing funding in that programme had been identified for this purpose.¹³⁵ Regarding full-fibre delivery under the superfast broadband programme, the Broadband Stakeholder Group commented that “in practice this is accelerating what is already underway”.¹³⁶

Delivery of superfast broadband under the programme is led by local bodies in England and the devolved Administrations. See Box 1 of the Library paper on [superfast broadband](#) for how to find information about local projects.

¹³³ HM Treasury, [Autumn Budget 2016](#), 23 November 2017.

¹³⁴ HM Treasury, [Autumn Budget 2017](#), 22 November 2017.

¹³⁵ DCMS, [Future Telecoms Infrastructure Review](#), 23 July 2018, para 135.

¹³⁶ Broadband Stakeholder Group, [A long read – Forging our Full-Fibre and 5G Future](#), 23 July 2019.

4.5 Business rates relief

The [*Telecommunications Infrastructure \(Relief from Non-Domestic Rates\) Act 2018*](#) was granted Royal Assent on 8 February 2018 and applies to England and Wales. The Act provides the powers necessary to implement the Government's commitment to 100% business rates relief for full, new fibre infrastructure until April 2022 (5 years from 1 April 2017). This is to support and incentivise the roll-out of broadband and 5G services. Relief is only granted in respect of 'new fibre' that has not yet been laid. Secondary legislation implementing the relief is now in force in England: [*The Non-Domestic Rating \(Telecommunications Infrastructure Relief\) \(England\) Regulations 2018*](#). The [Library briefing paper on the *Telecommunications Infrastructure \(Relief from Non-Domestic Rates\) Bill*](#) (17 January 2018) provides further information.

The Scottish Government has introduced non-domestic rates relief for new fibre broadband infrastructure in Scotland for 10-years from 1 April 2019.¹³⁷

Fibre infrastructure providers are calling for longer-term tax relief. Openreach argues that return on investment in digital infrastructure "takes decades" and that investors need a "clearer long-term commitment" from Government.¹³⁸ The Confederation of British Industry (CBI) has called for the Government to review the business rates system, stating it is currently limiting UK investment in deploying and adopting digital infrastructure improvements.¹³⁹ techUK (trade body for tech industry) have called for business rates relief for full fibre for "at least the next 15 years".¹⁴⁰

4.6 Digital Infrastructure Investment Fund

The Government announced the Digital Infrastructure Investment Fund (the DIIF)¹⁴¹ in the [March 2016 Budget](#) to support the roll out of ultrafast broadband by increasing the amount of capital available for investment:

Supporting the market to deliver ultrafast broadband (roughly defined as providing speeds greater than 100 mbps) to as many premises as possible is a government manifesto commitment and the Fund is a key element in delivering this. The main policy objective, therefore, is to increase the amount of capital invested in the sector, particularly (but not exclusively) more "debt-like"

¹³⁷ Scottish Government, [Rates relief puts Scotland in fibre fast lane](#), 24 March 2019 [accessed 9 January 2020].

¹³⁸ Openreach, [The blueprint for a full-fibre future](#), October 2019 [accessed 10 January 2020].

¹³⁹ CBI, [Ready. Steady. Connect](#), December 2018.

¹⁴⁰ techUK, [Connected Britain – Can reality meet the rhetoric on Fibre roll out?](#), Matthew Evans, 9 August 2019.

¹⁴¹ Referred to in the Budget as a Broadband Investment Fund but has since been renamed as the Digital Infrastructure Investment Fund – this has been confirmed in House of Commons Library correspondence with DCMS as the same fund.

capital that would enable faster expansion of ultrafast broadband networks.¹⁴²

The [Autumn Statement 2016](#) confirmed £400 million of Government investment in the Fund to invest in new fibre networks over the next four years, which the Government expects to be matched by private finance.¹⁴³

The Government announced the [launch of the fund in July 2017](#). The fund is expected to release “over £1 billion” funding available for industry:

The fund, which is expected to more than double the government’s £400 million investment, and unlock over £1 billion of capital in the sector, will be managed and invested on a commercial basis by private sector partners, generating a commercial return for the government. It will ignite interest from private finance to invest in the sector, resulting in more alternative providers entering and expanding in the market.¹⁴⁴

Investments from the fund have included a £35 million [investment in Wightfibre](#) (towards building a full-fibre broadband network across the Isle of Wight)¹⁴⁵ and an £18 million [investment in Community Fibre](#) (a business aiming to provide full-fibre broadband to social and private housing estates in London).¹⁴⁶

¹⁴² HM Treasury, [Broadband Investment Fund: request for proposals](#), 16 June 2016 [accessed on 17 June 2016].

¹⁴³ HM Treasury, [Autumn Statement 2016](#), 23 November 2017, paragraph 4.7 *Digital communications*. The £400 million is not listed as a new policy cost in the HM Government, [Autumn Statement 2016 policy decisions](#), Table B.2 (Treasury scorecard of policy decisions). The press release launching the fund in July 2017, stated that the £400 million investment was “in addition to” the National Productivity Investment Fund (HM Treasury, [Billion pound connectivity boost to make buffering a thing of the past](#), 3 July 2017).

¹⁴⁴ HM Treasury, [Billion pound connectivity boost to make buffering a thing of the past](#), 3 July 2017, accessed 31 August 2018.

¹⁴⁵ Wightfibre, [Major Investment And New Jobs As Wightfibre Announces “Gigabit Island”](#), Zoe Heyett, 8 November 2019.

¹⁴⁶ Amber Infrastructure Group, [Community Fibre receives backing from NDIE](#), 23 April 2018, accessed 31 August 2018; [London FTTH Broadband ISP Community Fibre Raises Extra £25m](#), Mark Jackson, *ISP Review*, 23 April 2018; [Community Fibre raises cash to connect social housing](#), Nic Fildes, *Financial Times*, 23 April 2018 (subscription only).

5. Glossary

Broadband speeds

Megabits and megabytes

Megabits (Mb) and megabytes (MB) are both units for expressing a quantity or amount of data. 8 megabits (Mb) is equal to 1 megabyte (MB); 8 gigabits is equal to 1 gigabyte (GB). Bits tend to be used as the unit for broadband speeds, bytes tend to be used as the units for data storage capacity.

Upload and download speeds

Broadband speeds are expressed as the amount of data downloaded or uploaded per second, usually in megabits per second (Mbps). Upload and download speeds are also called the bandwidth.

Download speeds refer to how long it takes to download data to your computer or device. Upload speeds refer to how long it takes for a file to transfer from your device to the internet.

Most typical internet activities, such as browsing websites and checking emails require higher download speeds than upload speeds. Therefore, most internet connections have higher download speeds than upload speeds. Reasonable upload speeds are necessary for applications such as video calling and uploading large files to social media. A “symmetric” connection is one that delivers the same upload and download speed.

More information about typical broadband speeds and what you can do with them is provided in the Library briefing paper: [Superfast broadband coverage in the UK](#) (SN06643).

Decent broadband

Ofcom and the UK Government define a “decent” broadband as a connection capable of delivering a download speed of at least 10 Mbps and an upload speed of at least 1 Mbps.¹⁴⁷ This is the specification for the Governments Universal Service Obligation (USO). For more information, see the Library briefing paper on the [Universal Service Obligation \(USO\) for Broadband](#) (CBP8146, 8 June 2018).

Superfast broadband

Superfast broadband does not have a single definition. The UK Government defines it as download speeds greater than 24Mbps, whereas Ofcom and the European Commission define it as download speeds greater than 30Mbps.

For more information about superfast broadband in the UK, see the Library briefing paper: [Superfast broadband coverage in the UK](#) (SN06643).

Ultrafast broadband

Ultrafast broadband does not have a single definition. The UK Government defines it as download speeds of 100 Mbps and higher, whereas Ofcom defines it as download speeds greater than 300 Mbps.

¹⁴⁷ Ofcom, [Connected Nations 2017](#), December 2017.

It can be delivered by technologies such as cable broadband, G-fast and full-fibre. Ofcom reported that ultrafast broadband (300 Mbps) was available to 57% of UK premises as of September 2019.¹⁴⁸

Gigabit-capable connection

The UK Government defines a gigabit capable connection as one that can support 1 gigabit per second (Gbps) download or upload speeds. 1 Gbps is equal to 1000 Mbps.

Broadband technologies

ADSL

ADSL (asymmetric digital subscriber line) technology delivers broadband using copper telephone lines—the connection speed will depend on which type of ADSL is being used; and the quality and length of the line from the telephone exchange to the premises. The further away from the telephone exchange, the slower the connection.

Fibre optic cable

Fibre optic cables are made of glass or plastic. They transmit data using light. Fibre optic cables can transmit more data with faster speeds and significantly less signal loss with distance compared to copper wires.

Fibre to the Cabinet (FTTC)

Fibre to the Cabinet (FTTC) is the main technology used for superfast broadband roll-out in the UK. FTTC connections use fibre optic cables to carry the signal from the exchange to street cabinets and then existing copper telephone lines are used from the cabinet to premises.

FTTC technology can provide download speeds of up to around 80 Mbps. However, the maximum speed that a premises can receive reduces the further away it is from a cabinet, with superfast speeds (above 24 Mbps) available up to approximately 1000 metres from the cabinet.

For more information, see the POST briefing on [Telecommunications Infrastructure](#) (24 March 2017).

G-fast

[G-fast](#) is a broadband technology being deployed by Openreach.¹⁴⁹ G-fast is a variant of FTTC technology that allows ultrafast download speeds (up to 300 Mbps) to be delivered using the same copper telephone lines that are used in FTTC technology.¹⁵⁰ It works by expanding the frequency range over which signals are transmitted, allowing for higher speeds.¹⁵¹ Higher frequencies slow sharply with distance however so only premises within 350 meters of the cabinet are expected to benefit. G-fast is installed by fitting an 'extension pod' onto existing cabinets, and therefore can be installed quickly at low cost.

¹⁴⁸ Ofcom, [Connected Nations 2019](#), 20 December 2019.

¹⁴⁹ Openreach, [Ultrafast fibre – G-fast](#), accessed 7 September 2017.

¹⁵⁰ Openreach, [Ultrafast fibre – G-fast](#), accessed 7 September 2017.

¹⁵¹ [Is G.fast the answer to the UK's fibre vs copper debate?](#), *Computer Weekly*, 22 October 2015; [Openreach Extend 330Mbps G.fast Broadband Pilot to 1 Million UK Premises](#), *ISP Review*, 17 August 2017.

Cable Broadband (Hybrid Fibre Coaxial (HFC))

Most cable broadband in the UK is provided by Virgin Media. Cable networks use a combination of fibre optic cables to street cabinets and high-grade co-axial cables (which are also used for cable TV) from the cabinets to premises. Co-axial cables experience less signal loss over distance compared to copper wires. The latest standard DOCSIS3.1 is capable of speeds of around 1 Gbps (1000 Mbps).

Full-fibre (Fibre to the Premises/Home, FTTP/FTTH)

In a full-fibre connection, a fibre optic cable runs from the exchange directly to the premises or home. Full-fibre connections can provide download and upload speeds in excess of 1 Gbps (1000 Mbps). Full-fibre is also called Fibre-to-the-Premises (FTTP) or Fibre-to-the-Home (FTTH).

5G

5G is the next generation of wireless networks. 5G is expected to support fast download speeds and near instant response times, with the capacity to support many devices operating at the same time. 5G is expected to offer advantages beyond mobile broadband, supporting a wide array of internet connected devices and services, for example, from healthcare to manufacturing.

For more information, see the Library briefing paper on [5G](#) (CBP7883).

Fixed Wireless

Fixed Wireless uses specific frequencies of the radio spectrum to transmit signals through the air in a similar way to mobile phone networks, doing away with wires. Depending on the number of users served by the wireless connection, wireless networks may be capable of delivering superfast speeds. Most wireless ISPs only offer limited coverage in specific areas, for example rural villages.

Satellite broadband

Satellite broadband is an option for those who live in rural areas where traditional fixed-line based broadband services aren't available. It uses a satellite dish to provide access to broadband services. The main advantage of satellite broadband is that it can be provided virtually anywhere in the world, as long as there is a clear line of sight to the satellite (south for the UK). Limitations of satellites include lower latency and lower bandwidth (data capacity), although technologies are improving.

Next-Generation Access (NGA) Broadband

The EU uses the terminology "next-generation access" (NGA) broadband. The EU defines NGA broadband to be networks that consist wholly or in part of optical fibre cables that are capable of delivering broadband with enhanced characteristics compared to already existing copper networks.

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