**Before the**
**NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION**
**U.S. DEPARTMENT OF COMMERCE**
**Washington, DC**

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| In the Matter of | ) | |
| | ) | |
| The National Strategy to Secure 5G | ) | Docket No. 200521–0144 |
| Implementation Plan | ) | |

# COMMENTS OF THE FIBER BROADBAND ASSOCIATION

Lisa R. Youngers
President and CEO
Fiber Broadband Association
Suite 800
2025 M Street NW
Washington, DC 20036
Telephone: (202) 367-1236

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## COMMENTS OF THE FIBER BROADBAND ASSOCIATION

The Fiber Broadband Association ("FBA")[1] hereby submits these comments in response to the Notice[2] issued by the National Telecommunications and Information Administration ("NTIA") seeking comment to inform the development of the Implementation Plan for the National Strategy to Secure 5G,[3] as required by the Secure 5G and Beyond Act of 2020.[4] In particular, NTIA is requesting information regarding "how the U.S. Government can best facilitate the accelerated development and rollout of 5G infrastructure in the United States and with our international partners, and lay the groundwork for innovation beyond 5G."[5] One response is certain: we cannot accelerate 5G network deployment without in tandem

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1 FBA is a not for profit trade association with more than 250 members, including telecommunications, computing, networking, system integration, engineering, and content-provider companies, as well as traditional service providers, utilities, and municipalities. Its mission is to accelerate deployment of all-fiber access networks by demonstrating how fiber-enabled applications and solutions create value for service providers and their customers, promote economic development, and enhance quality of life. A complete list of FBA members can be found on the organization's website: https://www.fiberbroadband.org/.

2 *The National Strategy to Secure 5G Implementation Plan*, Notice, Docket No. 200521–0144, 82 Fed. Reg. 32016 (May 28, 2020) ("Notice").

3 "The National Strategy to Secure 5G of the United States of America" (March 2020), available at https://www.whitehouse.gov/wp-content/uploads/2020/03/National-Strategy-5G-Final.pdf.

4 Secure 5G and Beyond Act of 2020, Public Law No. 116–129, 134 Stat. 223–227 (2020).

5 Notice at 32017.

accelerating the ubiquitous deployment of all-fiber infrastructure. Put simply, all-fiber and 5G infrastructure are the two fundamental communications technologies for the 21st century, and while all-fiber networks provide direct connectivity on their own, there are no 5G networks without fiber providing connectivity between and among cell sites and to the network core. As such, any plan to accelerate the deployment of 5G infrastructure must also include a strategy and measures to ensure the rapid deployment of all-fiber networks throughout the country. In these comments, FBA sets forth the following as essential elements of an all-fiber infrastructure plan to support 5G and other communications technologies:

1. Establish Symmetrical Gigabit Broadband Service as the National Fixed Broadband Benchmark for the Entire United States;
2. Remove Barriers to Entry by Any Service Provider;
3. Further Facilitate Access to Poles, Rights-of-Way and Other Critical Infrastructure;
4. Extend Federal Support Programs to Bring All-Fiber Networks to Unserved Areas to Ensure 90% of Households Have Access by 2029; and
5. Enhance Workforce Training and Education.

## I. 5G RELIES ON UBIQUITOUS ALL-FIBER DEPLOYMENT

For the past decade, mobile wireless data traffic has exploded, growing from 0.4 TB in 2010 to more than 15 TB in 2017.[6] To keep up with this demand, mobile wireless service providers, have invested hundreds of billions of dollars to build robust, higher-performance broadband networks.[7] More recently, to further improve network capabilities, mobile providers have been steadily densifying their 4G LTE networks with small cell deployments – and they have been deploying large amounts of fiber to connecting their macro and small cell sites to the

6 "The Wireless Industry Data," CTIA, available at https://www.ctia.org/the-wireless-industry/infographics-library/.

7 *See id.* ("$315B invested since 2005").

network core, because, as discussed below, fiber is the only transmission medium that can carry multi-gigabit traffic today and evolve over time to meet the exponential growth in mobile data traffic.[8]

The deployment of 5G networks will further accelerate these "densification"[9] and "fiber" trends for several key reasons.[10] First, 5G networks, especially in more urban areas, will often use millimeter wave spectrum, which can provide higher throughput but over shorter distances.[11] That means, a great many more small cells will need to be deployed to provide 5G coverage, and much more fiber will be deployed to connect and transport traffic to and from small cell sites. Second, unlike traditional wireless networks where computing and processing power is co-located at the cell sites, 5G networks place more of the processing power in the network core, meaning networks will need even more fiber connectivity to support data rates that are many

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8 *See e.g.*, "What are Radio Access Networks and 5G RAN?," Verizon (Feb. 2, 2020) ("Most base stations (aka transceivers) are primarily connected via fiber backhaul to the mobile core network."), available at https://www.verizon.com/about/our-company/5g/5g-radio-access-networks. Technologies such as Integrated Access Backhaul can be a useful augmentation in locations where fiber is difficult to deploy, but fiber densification throughout the network is essential.

9 *See id.* ("There are 154,000 cell towers today. To meet growing mobile data demands and win the Race to 5G Accenture projects we will need to install hundreds of thousands of small cells in the next few years. S&P Global Market Intelligence projects more than 800,000 small cells deployed by 2026.").

10 For a more elaborate discussion of these factors, *see* "The Road to 5G is Paved with Fiber," A White Paper by the Fiber Broadband Association (Dec. 2017), available at https://www.fiberconnect.org/page/paving-the-road-to-5g-with-fiber.

11 *See e.g.*, "What's the technology behind 5G?," Verizon ("Thanks to these improvements, as well as efforts to secure valuable millimeter wave spectrum and deploy a massive fiber network, we've been able to introduce Verizon 5G Ultra Wideband—a technology that we expect will revolutionize industries and provide immediate impact for customers—faster and more efficiently."), available at https://www.verizon.com/about/our-company/5g/what-5g. FBA notes that fiber will be used to provide connectivity to and among cell sites regardless of the spectrum band used for 5G.

times greater than in 4G networks.[12] Third, 5G networks are designed to tie together small cells with fiber to increase performance and reliability. As a result of these factors, FBA has estimated that for each square mile of small cells, providers will need to deploy approximately eight miles of fiber.[13] That means that in the top 25 urban areas in the United States alone, we will need to deploy over 250,000 miles of fiber. To provide some perspective of how much more "5G fiber" will be needed, in 2018, less than 50,000 miles of fiber were deployed to small cells.[14]

And there are additional factors driving "5G fiber." Mobile service providers are increasingly opting to deploy a greater number of fiber strands in each cable to account for future needs and because it is much more cost efficient to deploy additional strands at the outset than go back years later and install new cable. Further, mobile service providers are finding they can construct additional viable business cases for fiber deployments by coordinating their "5G fiber" and fiber-to-the-premises builds. Moreover, as 5G deployments go indoors, so will fiber to provide connectivity to micro-cell sites.[15]

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12 FBA notes that the O-RAN Alliance has a working group dedicated to transport requirements ("WG9: Open X-haul Transport Work Group. This workgroup focuses on the transport domain, consisting of transport equipment, physical media and control/management protocols associated with the transport network"), available at https://www.o-ran.org/. *See e.g.*, "ORAN Use Cases and Deployment Scenarios WhitePaper," O-RAN Alliance, Fig. 2 (Feb. 2020) (showing the connectivity, the vast majority of which will be fiber, required among cell sites, edge clouds, and regional clouds), available at https://static1.squarespace.com/static/5ad774cce74940d7115044b0/t/5e95a0a306c6ab2d1cbca4d3/1586864301196/O-RAN+Use+Cases+and+Deployment+Scenarios+Whitepaper+February+2020.pdf.

13 This estimate assumes 60 small cells are spaced at 750 feet in each square mile.

14 *See* "North America, 2019 Advanced Broadband Report," RVA, LLC for the Fiber Broadband Association, at 19 (Dec. 19, 2019) ("RVA 2019 Report").

15 *See* "5G networks impacts on fiber-optic cabling requirements," Corning, available at https://www.corning.com/in-building-networks/worldwide/en/home/knowledge-

In essence, the aim of mobile wireless providers in a 5G world will be to get the transmission "out of the air" and "into the ground" as quickly as possible.[16] That means, a vast amount of fiber will need to be deployed, and any plan meant to "facilitate the domestic rollout of 5G technologies and the development of a robust domestic 5G commercial ecosystem"[17] must address how to accelerate robust domestic deployment of fiber. In the next section, we discuss why service providers are compelled to deploy fiber.

## II. THE COMPELLING REASONS FOR DEPLOYING ALL-FIBER INFRASTRUCTURE FOR FIXED AND WIRELESS, INCLUDING 5G, NETWORKS

Fiber and 5G are the two network technologies that will drive the 21st century communications infrastructure, but in many respects, fiber is the more fundamental because it is the essential underlying infrastructure for 5G and all other mobile and fixed communications services and applications. Fiber's leading role in the communications ecosystem stems from its superior performance. Fiber enables the fastest symmetrical data transmission, currently achieving 1000 Mbps and even 10,000 Mbps.[18] These speeds support the enormous data flows engendered by video transmissions and other innovative applications that consumers rely on today. Fiber is also future-proof, meaning it is readily scalable to higher speeds simply by

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center/5g-networks-impact-on-fiber-optic-cabling-requirements.html (last visited June 25, 2020).

16 The Federal Communications Commission ("FCC") has noted that 80 percent of "wireless" use is Wi-Fi offload, and developments in wireless networks will depend on the availability of fiber backhaul. *See Lifeline and Link Up Reform and Modernization, Telecommunications Carriers Eligible for Universal Service Support, Connect America Fund*, WC Docket Nos. 11-42, 09-197, 10-90, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, Second Report and Order, Memorandum Opinion and Order, FCC 15-71, ¶ 45 & n.134 (rel. June 22, 2015).

17 *Id.*

18 *See e.g.*, "10 Gig PON," Adtran, available at https://portal.adtran.com/web/page/portal/Adtran/group/4531; and n. 40, *infra*.

upgrading modulating electronics. As a result, fiber not only provides the performance that consumers demand today and that is necessary for 5G transport,[19] but it will meet these needs for decades to come.

Fiber's superior performance also derives from its position as the most secure, reliable, and durable, of the network technologies. Fiber technology offers greater network security because it is less vulnerable to cable tapping and hacking,[20] and new innovations are making it even more impenetrable.[21] Fiber reliability exceeds that of other network infrastructure because it is less susceptible to inclement weather, electromagnetic interference, and other issues that degrade or destabilize service.[22] In particular, buried fiber networks have proven to be the most robust transmission media, especially in areas prone to natural disasters, because fiber cables and associated materials are specifically designed to withstand water penetration and corrosion and because active electronics in fiber networks tend to be housed in well-constructed buildings and not in outdoor cabinets in the field. Thus, fiber allows data to flow over great distances without degrading so consumers can enjoy steady and stable internet connections.

Because of fiber's superior performance characteristics, communications providers, both fixed and mobile, have been evolving to deploy high-performance fiber as close to consumers as

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19 FBA uses the term "transport" as a generic term indicating fiber connectivity throughout a 5G network, including backhaul (the connection to the internet or the network core), midhaul (the link between the controller or the radio head that feeds the next link), and fronthaul (generally the link between the controller and the radio head or small cell). For a diagram of this infrastructure, *see Cell Backhaul and Midhaul and Fronthaul*, Wade4Wireless.com (April 1, 2018), available at https://wade4wireless.com/2018/04/01/cell-backhaul-and-midhaul-and-fronthaul/.

20 *The Benefits of Fiber*, USTelecom (June 2, 2017), available at https://www.ustelecom.org/the-benefits-of-fiber/.

21 As the foundational transmission medium, optical fiber and cable are essential to supply chain security and consequently must rely on trusted suppliers to minimize vulnerability.

22 *Id.*

possible. This is reflective of an industry-wide consensus that fiber is the only network technology that can support the ever-increasing demand by consumers for a superior experience from traditional broadband service.[23] Today, all-fiber networks pass approximately 50 million homes in the United States, and millions more will be passed in 2020.[24] These networks also connect over 1 million commercial buildings and anchor institutions.[25] It is the fastest growing fixed communications network technology in our history.[26] Further, fiber provides the needed underlying infrastructure for fixed and mobile wireless networks, smart communities, and smart grids, as well as Internet of Things ("IoT") sensors, applications, and devices.[27] Additionally, fiber does and increasingly will facilitate consumers' growing reliance on Wi-Fi and 5G to engage with mobile applications and services, such as real-time video.

The characteristics of fiber support technologies and applications that are increasingly part of our digital world. The low-latency characteristics of fiber are ideally suited for gaming, telehealth, and remote surgery. The reliability, high through-put, and rapid speeds make fiber the

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23 In its June 2018 Mobility Report, Ericsson forecasts that by 2023, there will be a total of 31.4 billion connected devices (including IoT devices and mobile phones). *See* "Ericsson Mobility Report" (June 2018), available at https://www.ericsson.com/assets/local/mobility-report/documents/2018/ericssonmobility-report-june-2018.pdf.

24 *See* RVA 2019 Report at 10.

25 *See e.g.*, "2019 U.S. Fiber Lit Buildings LEADERBOARD," Vertical Systems Group (Apr. 2, 2020) ("The number of on-net fiber lit commercial buildings exceeded one million in 2019 as network providers concentrated on U.S. footprint expansion."), available at https://www.verticalsystems.com/2020/04/01/2019-us-fiber-leaderboard/.

26 *See* RVA 2019 Report at 18.

27 *See e.g.*, *Why Fixed 5G Will Never Completely Replace Wired Internet*, gvec.net (June 10, 2019), available at https://www.gvec.net/fixed-5g-will-never-completely-replace-wired-internet/; *The Case for Fiber to the Home, Today: Why Fiber is a Superior Medium for 21st Century Broadband*, EFF (Oct. 16, 2019), available at https://www.eff.org/wp/case-fiber-home-today-why-fiber-superior-medium-21st-century-broadband.

needed infrastructure for precision agriculture, autonomous vehicle, and virtual reality applications. The future-proof and ubiquitous characteristics of fiber allow for improved functionality, monitoring, and efficiencies across the energy sector, while the sensing capabilities that can ride on fiber optic cable allow for real-time automatic monitoring in the areas of building/structural integrity, oil/gas pipeline safety, border patrol, and seismic activity.

Deploying fiber not just in urban and suburban areas but ubiquitously across the country is achievable. A study completed for FBA by consulting firm Cartesian shows that between innovative deployment models by fiber providers, government efforts to lower access to essential infrastructure, and efficiently provided government support, future-proof, all-fiber networks can be deployed to 90% of households in the next decade.[28] The fiber industry is actively playing its part. A study by FBA member Corning shows the costs to deploy fiber have already been driven down by industry-led investments in technology and deployment efficiencies.[29]

Once built, fiber infrastructure will support U.S. global competitiveness. Virtually all developed countries are charging ahead to deploy this critical infrastructure, and foreign competitors are treating fiber as a strategic asset by upgrading technology and flooding the market – China is leading the charge. A report from the Center for a New American Security highlighted that "China has invested more heavily [than the U.S.] in the fiber and physical infrastructure for standalone 5G," and that "the Chinese government has undertaken significant investments in building up a more robust digital infrastructure of fiber optic networks that are

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28 *See* "All-Fiber Deployment Cost Study 2019," Cartesian for the Fiber Broadband Association, at 2 (Sept. 10, 2019).

29 *See* "Getting More Gigabit Service from the Rural Digital Opportunity Fund," Corning, at 2 (Dec. 19, 2019).

important to facilitate the large-scale deployment of 5G."[30] From 2013 to 2019, because of a government-supported strategy, fiber connections in China have increased from 17 to 86 percent.[31] In the United Kingdom, Ofcom has launched a review to bring "full fibre" across the country. The interim CEO of Ofcom stated that it seeks to adopt a plan that:

> will help fuel a full-fibre future for the whole country. We're removing the remaining roadblocks to investment and supporting competition, so companies can build the networks that will drive the UK into the digital fast lane. Full-fibre broadband is much faster and more reliable. It's vital that people and businesses everywhere – whether in rural areas, smaller towns or cities – can enjoy these benefits. So we're making sure companies have the right incentives to accelerate full fibre to every part of the UK.[32]

The U.S. is making great strides in deploying fiber, even though we have a greater number of sparsely populated areas than other countries, but there is much more that industry can accomplish and the government can facilitate to speed deployments.

Because fiber offers superior performance, provides needed security and reliability, and is so critical to the deployment of 5G, NTIA should ensure that the Implementation Plan for the National Strategy to Secure 5G incorporates strategies to ensure fiber is deployed to all parts of the country. In the next section, we describe actions the government should take to accelerate all-fiber deployment for 5G and other services.

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30 *See* "Securing Our 5G Future: The Competitive Challenge and Considerations for U.S. Policy," Elsa B. Kania, Center for New American Security, at 6-7 (Nov. 2019), available at https://www.cnas.org/publications/reports/securing-our-5g-future.

31 *See e.g.*, "China's Fiber Broadband Internet Approaches Nationwide Coverage; United States Lags Severely Behind," Broadband Now (Dec. 3, 2019), available at https://broadbandnow.com/report/chinas-fiber-broadband-approaches-nationwide-coverage.

32 *Ofcom Start Major Review to Boost UK Full Fibre Broadband Market*, ISPreview (Jan. 8, 2020), available at https://www.ispreview.co.uk/index.php/2020/01/ofcom-start-major-review-to-boost-uk-full-fibre-broadband-market.html.

## III. GOVERNMENT ACTIONS TO ACCELERATE ALL-FIBER DEPLOYMENTS

Over the past decade, federal, state, and local governments have taken many actions that have helped accelerate all-fiber deployments, including by facilitating access to utility poles and government rights-of-way and by subsidizing builds in rural areas. But, we need to do more, especially to drive 5G deployments. FBA, therefore, proposes the following actions:

### 1. Establish Symmetrical Gigabit Broadband Service as the National Fixed Broadband Benchmark for the Entire United States

FBA submits that, as a first step to accelerate deployment of all-fiber infrastructure for 5G transport and many other uses, the United States establish a national goal that would drive the deployment of all-fiber networks ubiquitously to all areas of the country. FBA asserts that establishing "symmetrical gigabit" fixed broadband service as the national benchmark today will achieve that aim. (In effect, providing "symmetrical gigabit" service will require all-fiber builds in virtually all instances.) Moreover, as explained below, that aim is supportable and, while a reach, it is well within our grasp.

Over the past decade, mobile and fixed communications networks have evolved from providing narrowband voice to broadband data and video. And, we have seen the demand for increasingly higher broadband network performance skyrocket as consumers and businesses seek to use more bandwidth hungry applications over an increasing number of devices. These trends – and consumers' and businesses' reliance on high performance broadband capabilities – have become even more apparent during the past months with Americans staying and working at home during the COVID-19 emergency,[33] and they are certain to continue. As a result,

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[33] *See e.g.*, "Home Internet data usage surges amid COVID-19 crisis," LightReading (Mar. 18, 2020) ("OpenVault, a company that specializes in the collection and analysis of household-level broadband usage data, found that average downstream usage per customer in urban areas rose 98.3% while upstream usage per customer climbed 68.6%

according to the FCC's just issued "Broadband Deployment Report," "the vast majority of Americans—more than 85%—now have access to fixed terrestrial broadband service at 250/25 Mbps, a 47% increase since 2017, with the number of rural Americans having access to 250/25 Mbps fixed terrestrial broadband service more than tripling between 2016 and 2018."[34] In addition, as a precursor to symmetrical gigabit service, other sources report that downstream gigabit broadband service is available to at least 80 percent of the households in the United States.[35] And, as discussed above, all-fiber networks, which support symmetrical gigabit broadband service, now pass approximately 50 million households (a number growing by over 10% annually)[36] and connect over 1 million commercial buildings.[37] The fact that two-way gigabit broadband is swiftly becoming the benchmark for broadband service in the country was just acknowledged by two leading Members of the U.S. House of Representatives, Congressmen Clyburn and Upton, who introduced legislation prioritizing "symmetrical gigabit" broadband service for awarding support to deploy networks in unserved areas.[38]

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on Monday, March 16 compared to a week earlier. Additionally, average upstream usage per subscriber on March 16 in these areas was 22.1% higher than the peak over the past three weeks."), available at https://www.lightreading.com/services/home-internet-data-usage-surges-amid-covid-19-crisis/d/d-id/758298. A stay-at-home individual's broadband needs, during the emergency, often exceeds 50-100 Mbps both upstream and downstream, and this amount quickly rises when multiple people in a household seek access at once. *Id.*

34 "New FCC Report Shows Digital Divide Continuing to Close," FCC News Release (Apr. 24, 2020), available at https://docs.fcc.gov/public/attachments/DOC-363985A1.pdf. Unfortunately, this report does not track higher speed broadband offerings.

35 *See e.g.*, "American is Now a Gigabit Nation," NCTA (Jan. 18, 2019), available at https://www.ncta.com/whats-new/america-is-now-a-gigabit-nation.

36 *See* n. 24, *supra*.

37 *See* n. 25, *supra*.

38 *See* "Rural Broadband Acceleration Act," H.R. 7022, 116th Congress (2020).

A decade ago, FCC Chairman Genachowski announced his "100 Squared" objective – 100 Mbps to 100 million homes by 2020[39] – substantially underestimating both the public's needs and providers' capabilities. As discussed above, Americans wanted much more. Today, we have an opportunity to establish a goal that will meet our needs, including for 5G networks, and is within our reach – Symmetrical Gigabit to 100 million households by 2025 and to 90 percent of households by 2029.[40] By expanding fiber "capillaries" throughout the country, we will build the infrastructure required for 5G small cells, for smart cities, for IOT, and for many more applications that are still on the drawing board.

**2. Remove Barriers to Entry by Any Service Provider**

To achieve our Symmetrical Gigabit objective, we need to unleash "supply" by removing barriers to entry. While all-fiber deployments have been driven in large measure by Verizon and AT&T, today we are finding the smaller providers, including rural telephone providers, rural electric cooperatives, municipalities, and new entrants, are rapidly increasing deployments.[41] In 2019 alone, smaller providers deployed all-fiber networks passing over 2 million new homes and

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39 *See e.g.*, "100 Questions about 100 Squared," Fierce Telecom (Feb. 18, 2010), available at https://www.fiercetelecom.com/telecom/100-questions-about-100-squared.

40 FBA recognizes that even its "Symmetrical Gigabit" goal may underestimate American broadband needs. Already, all-fiber providers are providing symmetrical 10 gigabit service. *See e.g.*, Cedar Falls Utilities' recent announcement it was providing symmetrical 10 gigabit service ("We know customer demand for bandwidth and connection speed will continue to grow. . . . We view it as our job to offer a world-class communications network and get out of the way to see what our customers can do with no limitations. Most importantly, the business-ready infrastructure helps local companies succeed and positions Cedar Falls to compete nationally for new jobs and economic growth. The 10 Gig network is a platform built for innovation.") available at https://www.cfu.net/tv-internet/internet-service-info/10-gig-internet. The fact that Cedar Falls Utilities can readily upgrade its all-fiber network to provide this performance is further evidence of the value of all-fiber infrastructure and further reason for the federal government to make it a priority to deploy it ubiquitously.

41 *See* RVA 2019 Report at 15.

accounted for 41% of capital expenditures.[42] Yet, barriers to entry remain. For instance, over 20 states limit or prohibit entry by municipalities, often even where private providers offer substandard service.[43] At a time when we are seeking to have ubiquitous all-fiber deployment, which will be a challenge in many areas, these barriers are simply counterproductive. Rather, we should tear down entry barriers and permit any entity willing to build all-fiber infrastructure to have the opportunity.

**3. Further Facilitate Access to Poles, Rights-of-Way and Other Critical Infrastructure**

All-fiber deployments are substantial construction projects that require reasonable and timely access to poles, ducts, and conduit, as well as rights-of-way and easements, owned or controlled by another public or private entity. Most recently, the FCC revised its pole attachment rules to facilitate access, including by using a One-Touch Make-Ready approach.[44] The FCC also clarified rules for accessing state and local government rights-of-way, particularly to ensure providers are charged cost-based rates.[45] Federal executive agencies also have been working to facilitate access to public lands and facilities.[46] FBA commends these efforts.

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42 *See id.* at 14.

43 *See e.g.*, "Muni Broadband is Roadblocked or Outlawed in 22 States," BroadbandNow (May 13, 2020), available at https://broadbandnow.com/report/municipal-broadband-roadblocks/.

44 *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Inv., et al.*, WC Docket No. 17-84, et al., Third Report and Order and Declaratory Ruling, 33 FCC Rcd 7705 (2018).

45 *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment et al.*, WT Docket No. 17-79, FCC 18-133, 33 FCC Rcd 9088 (2018).

46 *See e.g.*, "Federal Permitting: Overview," BroadbandUSA, National Telecommunications and Information Administration (March 11, 2020) ("In February 2020, GSA and USDA's Forest Service finalized the process to make the existing SF-299 a Common Application Form suitable for telecommunications purposes. All the major federal property-managing agencies will use the SF-299 as the common application form

But, even with these positive developments, FBA service providers and construction contractors continue to find that, at times, it takes too long to obtain access to critical infrastructure and it costs too much. That said, FBA recognizes that entities that own or control critical infrastructure have legitimate and important objectives, particularly when it comes to protecting public safety and welfare, and these should be considered in weighing the timeliness and cost of access by all-fiber providers. To address continuing concerns, FBA urges government agencies to be vigilant, continuously monitoring whether laws and regulations are working as intended and updating and refining them where necessary. In addition, federal agencies need to enforce laws and regulations in a commercially reasonable timeframe. To facilitate expedited enforcement, FBA urges the federal government, as part of its 5G strategy, to propose that Congress adopt alternative dispute resolution processes that enable prompt resolution of disputes.

**4. Extend Federal Support Programs to Bring All-Fiber Networks to Unserved Areas to Ensure 90% of Households Have Access by 2029**

While existing all-fiber providers and new entrants will continue to expand deployments, there will be areas that are less economically viable that will still be unserved. Over the past decade, federal and state governments have stepped up and implemented numerous programs to provide support to bridge this gap and close the digital divide. Many of these programs, especially more recently established programs, focus on providing support to build future-proof, all-fiber networks. For instance, the Rural Utility Service's ReConnect program has made it a

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to authorize permits for wireline or wireless communications uses or facilities."), available at https://broadbandusa.ntia.doc.gov/ntia-resources/federal-permitting-overview.

priority to target its support to build all-fiber networks,[47] and the FCC's Rural Digital Opportunity Fund program favors the deployment of gigabit broadband networks.[48] As FCC Chairman Pai has stated, "the Universal Service Fund must be forward-looking and support the networks of tomorrow."[49]

Late last year, U.S. Senators John Thune (R-S.D.), Amy Klobuchar (D-Minn.), and almost four dozen other Senators wrote FCC Chairman Pai emphasizing that "If our rural communities are to survive and flourish, our rural constituents need access to services that are on par with those in urban areas. By contrast, it would be an inefficient use of resources to promote services that cannot keep pace with consumer demand and the evolution of broadband in urban areas."[50] As discussed above, an FBA study found that it would cost $70B to reach 90% of households in the United States by the end of the decade. All of this investment does not need to come from the government, but a significant amount of government support will be required. Any strategy to accelerate the deployment of all-fiber networks, including to support 5G, thus needs to include provision of government support, in addition to that currently provided, so that 90% of households in the country can access all-fiber networks by 2029.

**5. Enhance Workforce Training and Education**

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47 *See* "ReConnect Loan and Grant Program," U.S. Department of Agriculture, available at https://www.usda.gov/reconnect.

48 *See Rural Digital Opportunity Fund, Connect Am. Fund*, WC Docket Nos. 19-126, 10-90, Report and Order, FCC 20-5 (Feb 7, 2020).

49 *See*, "Chairman Pai Announces Plan to Launch $9 Billion 5G Fund for Rural America," FCC News (Dec. 4, 2019), available at https://docs.fcc.gov/public/attachments/DOC-361168A1.pdf.

50 Letter to Chairman Ajit Pai, Federal Communications Commission, from Sen. John Thune (R-S.D.), Sen. Amy Klobuchar (D-Minn.), United States Congress (Dec. 9, 2019), available at https://www.klobuchar.senate.gov/public/index.cfm/2019/12/klobuchar-thune-46-colleagues-urge-federal-communications-commission-fcc-to-promote-the-deployment-of-sustainable-broadband-networks-in-rural-america.

Any all-fiber acceleration plan also needs to include policies to enhance workforce training and education. Because of the many all-fiber networks currently being deployed across the country, FBA members are finding that getting and retaining skilled personnel is among the biggest chokepoints in deployments, even though these are good jobs with a good career path. The personnel shortfall has become so bad that one FBA construction member has started to turn away work. Another member reports that it is short 100 crews needed to support the amount of work they could bring in, and an equipment provider member reports that after two years of record sales, contractors have stopped buying new equipment because they do not have enough people to run the machines.

FBA members have already taken action on their own to increase the workforce for the fiber industry. Because existing educational programs do not provide the skills they need, members are partnering with community colleges and trade schools to develop programs and curricula that will give students training on deploying broadband networks: from creating network architecture and reading blueprints, to fusing, splicing and closing fiber connections, and from operating heavy machinery to climbing poles and towers to install fiber and other equipment, as well as training on how to conduct "locates" – the ability to locate and mark other facilities that are already in the ground.[51] These efforts are significant, but they will not alone meet increasing workforce demands.

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[51] One example of such a program is the Utility System Technician associates degree at the State Technical College of Missouri. This degree offers students a hands-on education, learning how to install and maintain utility systems, including fiber, and even offers a "Fiber Optic Technician" certification. The program is up and running thanks to $2 million in state funding, donations from private companies in the form of heavy operating equipment, and industry support in creating the curriculum. Another example is Wilson Community College in North Carolina, which partnered with a local fiber broadband provider to bring a 10-week course and a 5-day boot camp on fiber deployment training to the school in 2019. There are already efforts to expand these courses into a degree or

Federally-supported workforce development programs further provide productive opportunities to support and expand educational opportunities. The Department of Labor ("DOL") Employment and Training Administration overseas two grant programs that can make a difference. The Workforce Opportunities for Rural Communities ("WORC") and the Apprenticeship Readiness grant programs are each geared toward supporting educational institutions and other programs that will provide skills training that help put people to work. In 2019, these DOL grant programs offered $130 million combined in grants, any portion of which could make a significant impact in developing the broadband deployment workforce. FBA has called on DOL to prioritize granting funds for broadband deployment, fiber deployment, and 5G training – calling out those areas in their grant programs and announcements specifically.[52]

---

certificate program. Each of these programs and their curricula can be models for other institutions across the country.

In addition to these developments, other members are working to drive interest in broadband deployment careers among high school students. One FBA member has created a scholarship for high school students planning to enroll in community colleges or trade schools and who have an interest in apprenticeship or pre-apprenticeship in construction trades. Another member has been working with a local high school, talking to students interested in engineering and other careers in the broadband construction industry and providing them with internship opportunities. FBA members have also been ramping up their on-the-job training, which they feel is needed to support employees new to the industry and as an addition to tech school or community college training.

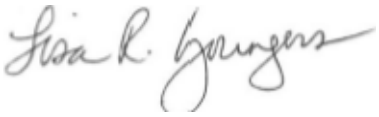
[52] Congress is exploring opportunities to address these workforce issues. For instance, Senator Thune has introduced legislation (S. 3355, the Telecommunications Skilled Workforce Act) that establishes an Interagency Working Group ("IWG"); directs the Secretary of Labor to "establish and issue guidance on how States can address workforce needs;" and requires the Comptroller General to draft a report estimating the workforce needs to build and maintain rural broadband and 5G wireless infrastructure. In addition, Senators Garner and Sinema have introduced the TOWER Infrastructure Deployment Act, which would create the Telecom Workforce Development Advisory Council to advise the Federal Communications Commission on workforce needs in the communications industry, ways to encourage participation in industry-led workforce development programs, and ways to improve workforce development in the industry.

In sum, FBA commends its members, education and training institutions, and DOL on the actions taken to date, but more is required to prevent delays in all-fiber deployments. Accordingly, FBA submits that any all-fiber acceleration plan needs to address these workforce concerns and propose concrete and immediate actions to address them.

## IV. CONCLUSION

For the foregoing reasons, to facilitate the deployment of 5G, NTIA must ensure that the Implementation Plan for the National Strategy to Secure 5G includes a strategy and the specific proposals set forth herein to ensure all-fiber networks are deployed expeditiously throughout the country.

Respectfully Submitted,



Lisa R. Youngers
President and CEO
Fiber Broadband Association
Suite 800
2025 M Street NW
Washington, DC 20036
Telephone: (202) 367-1236

June 25, 2020

**Before the**
**NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION**
**U.S. DEPARTMENT OF COMMERCE**
**Washington, DC**

| | | |
|---|---|---|
| In the Matter of | ) | |
| | ) | |
| The National Strategy to Secure 5G | ) | Docket No. 200521–0144 |
| Implementation Plan | ) | |

# COMMENTS OF THE FIBER BROADBAND ASSOCIATION

Lisa R. Youngers
President and CEO
Fiber Broadband Association
Suite 800
2025 M Street NW
Washington, DC 20036
Telephone: (202) 367-1236

June 25, 2020

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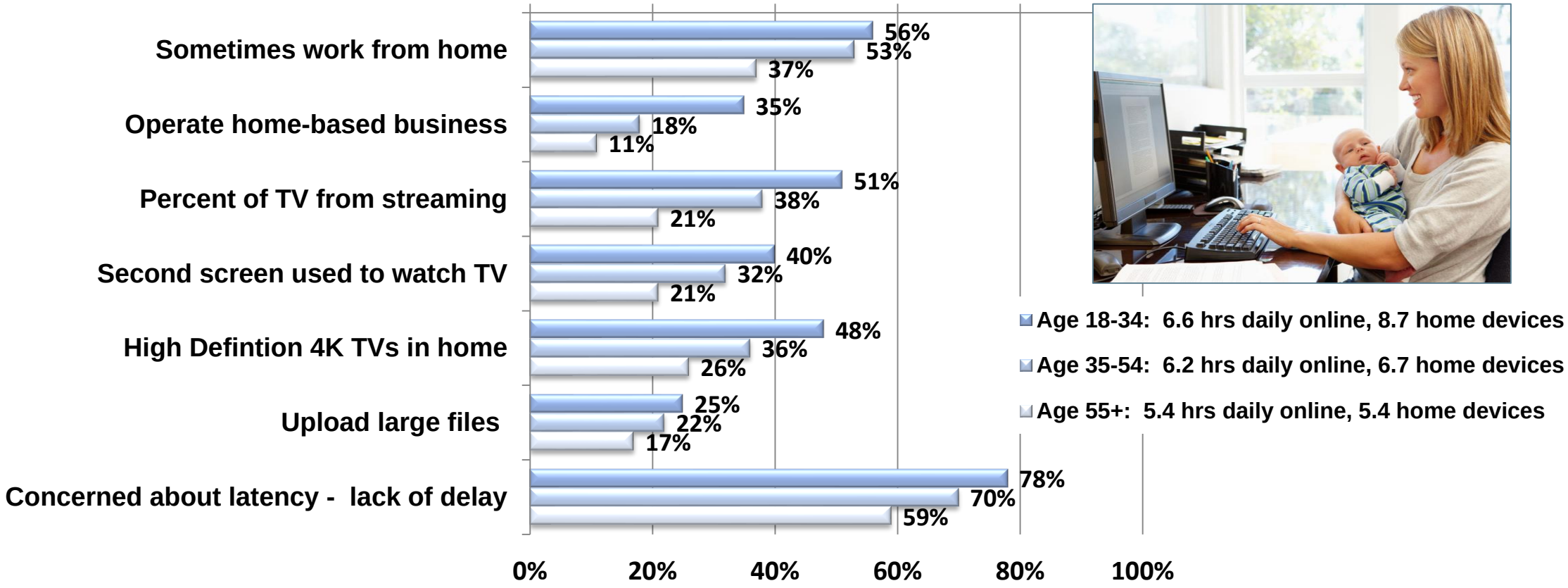
# Why Fiber Broadband Is Desirable and Growing?

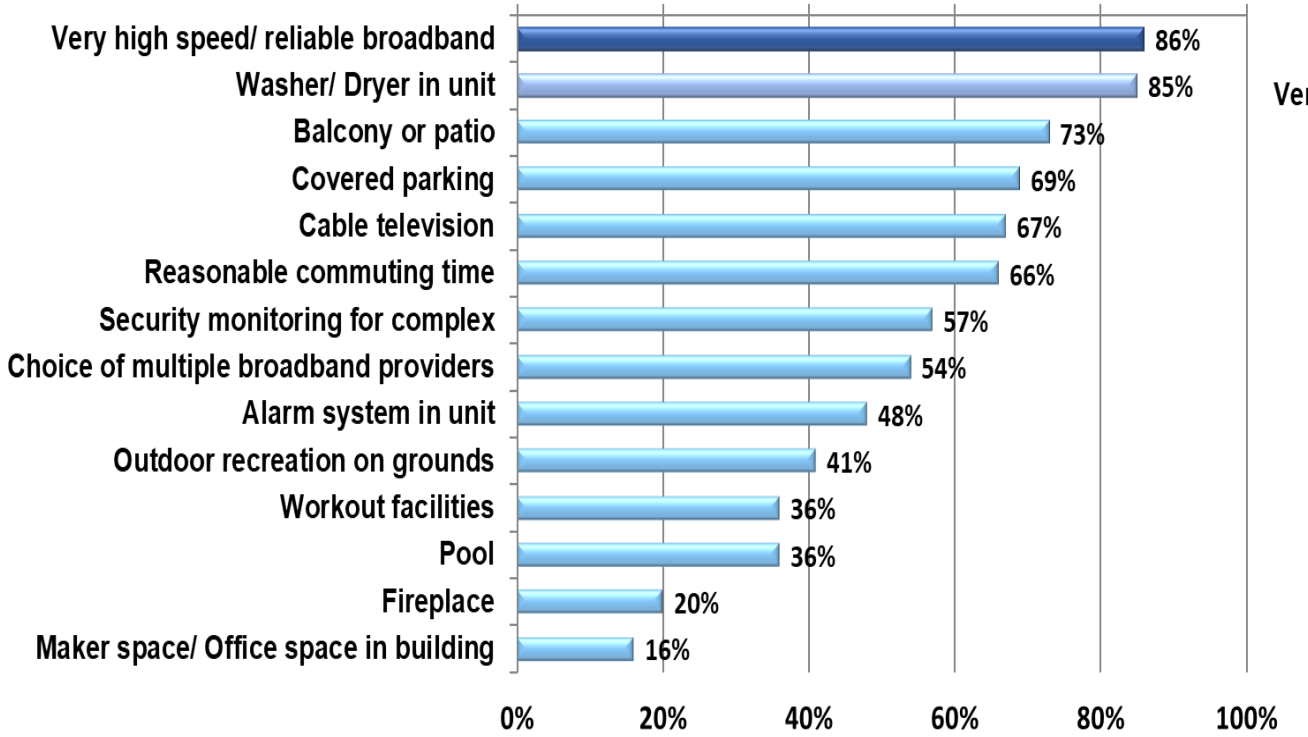
# Broadband Is Very Important To Consumers

## RVA Consumer Study 2019

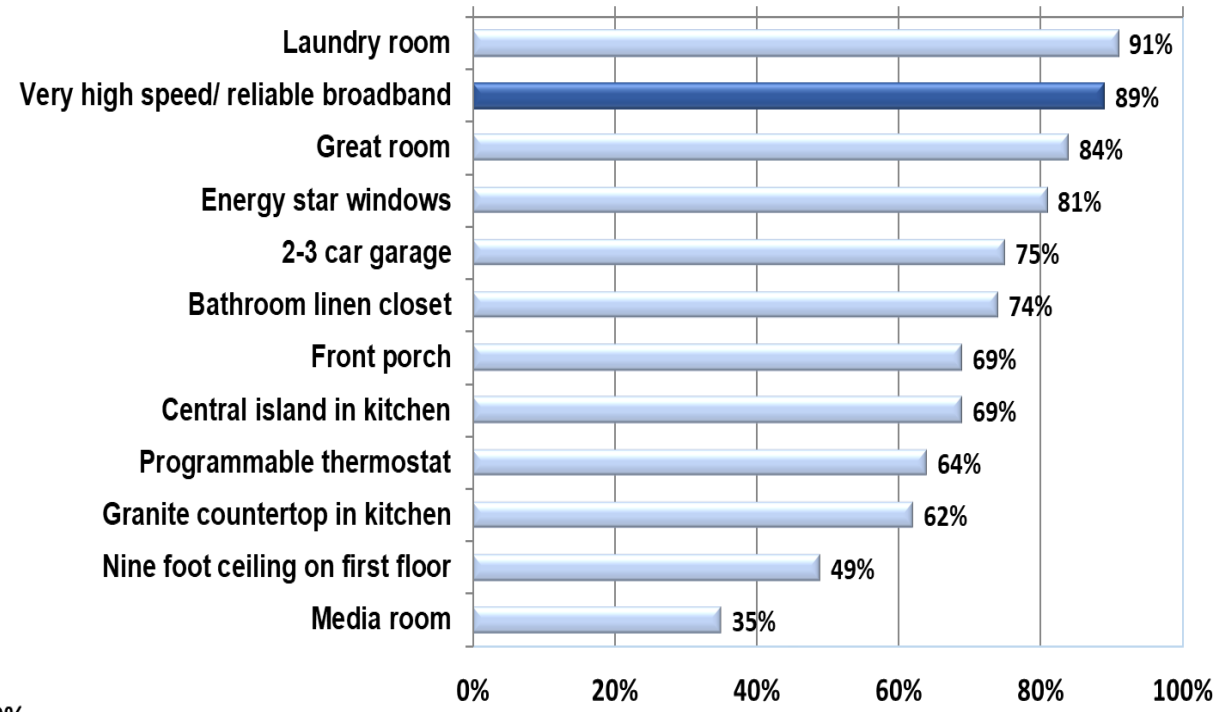


# Superior Broadband Drives Relocation Decisions
## Percent Stating Attribute Very Important "5"
## RVA Consumer Study May 2018

### MDU/Condo Purchase




### Single Family Home Purchase



# Fiber Provides A Superior Experience To Other Types Of Broadband

## Broadband Experience Index 2019

| | FTTH | Cable | Wireless | DSL/FTTN | Satellite |
|---|---|---|---|---|---|
| 2019 BEI | 98% | 65% | 38% | 38% | 1% |
| 2019 ALTERNATIVE BEI | 99% | 69% | 47% | 45% | 14% |

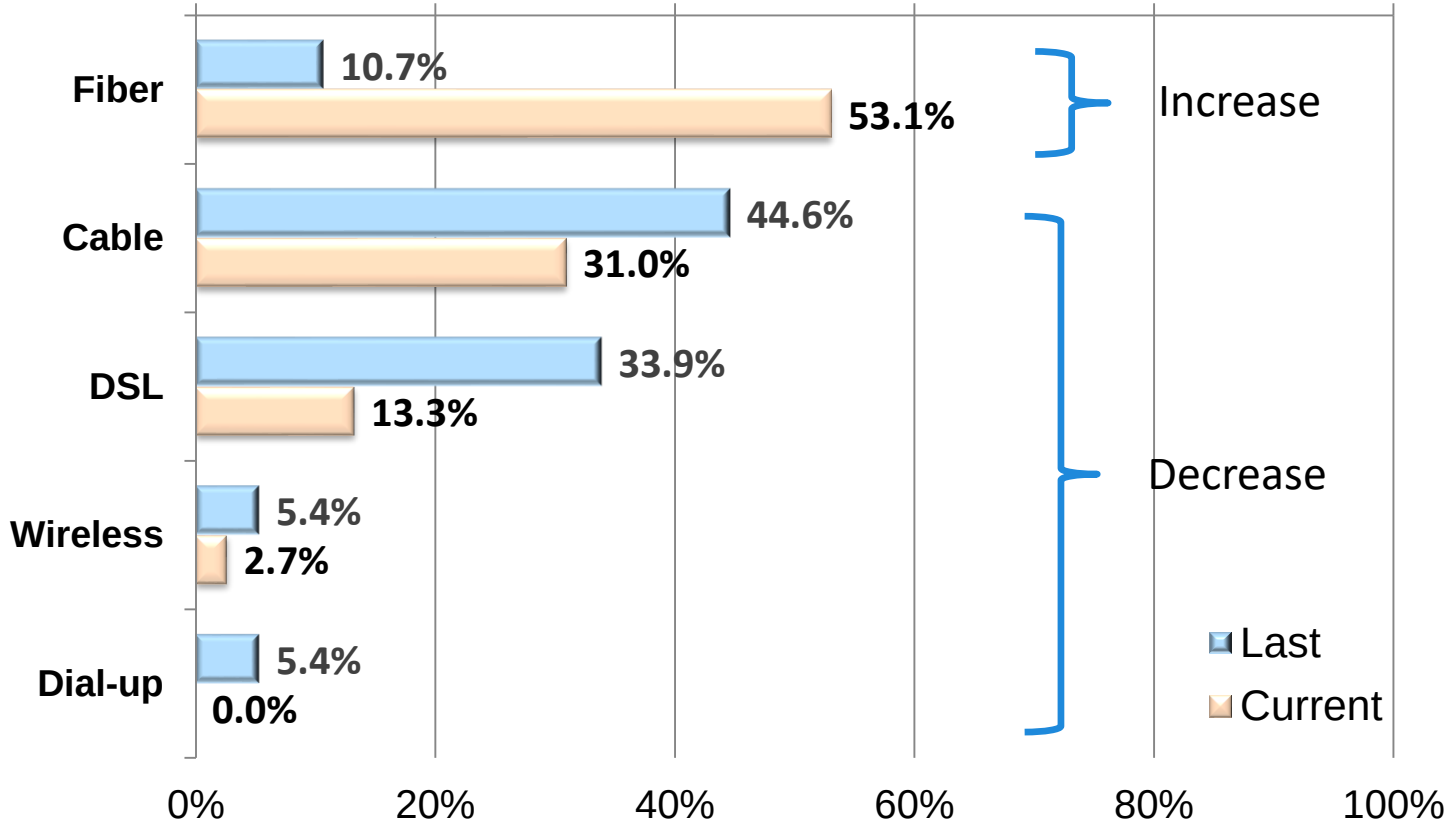

**Index based on 2019 RVA consumer survey measurements (and 2017 FCC Data)**

- **Net Promoter Score**
- **Reliability**
- **Upload Speed**
- **Download Speed**
- **Latency**

# Fiber Wins During Churn

## Within Same Residence In Past Three Years (Where Fiber Available)

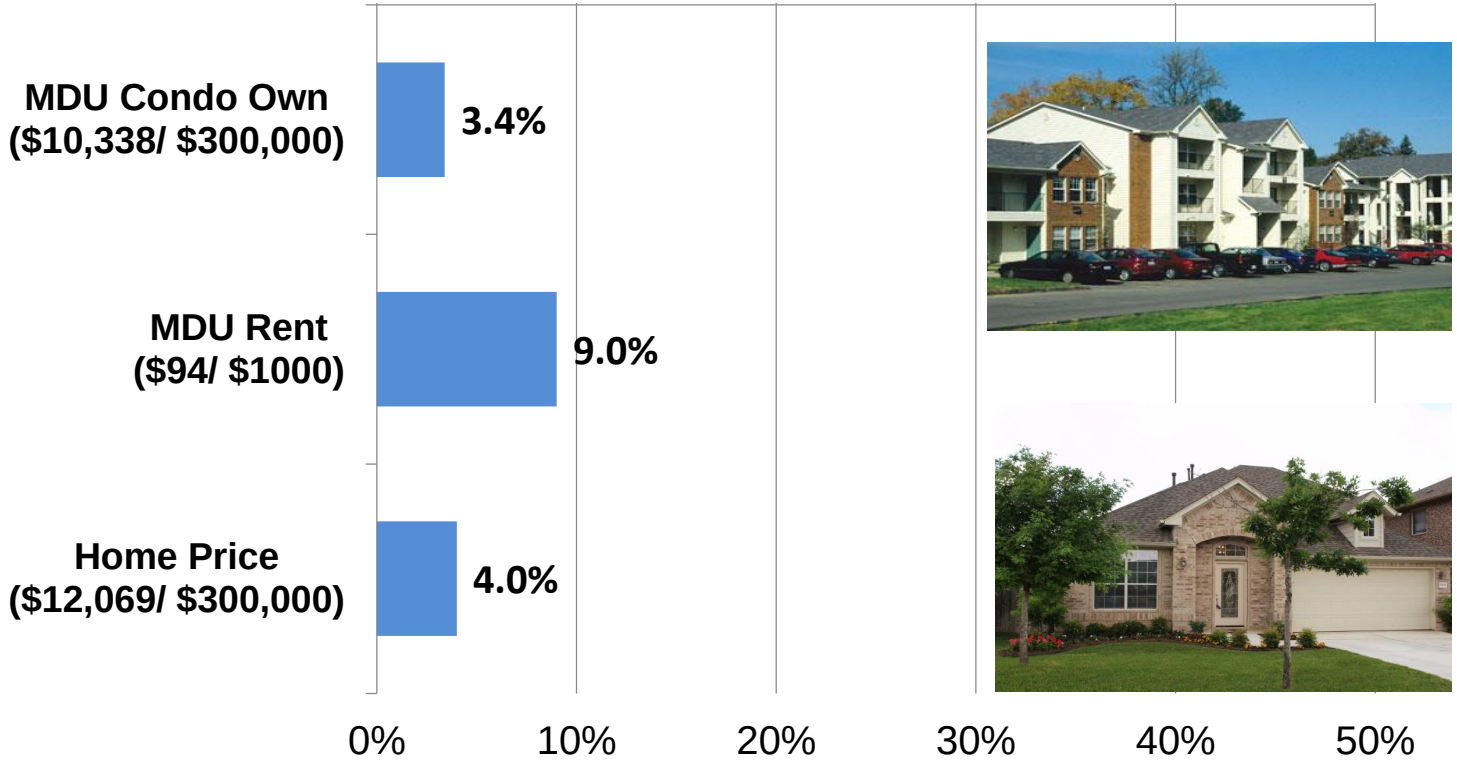
### RVA Consumer Study 2019



# Fiber Adds To Home Value

## Discount Needed To Consider Similar Non-Fiber Broadband Home

### RVA Consumer Study May 2018

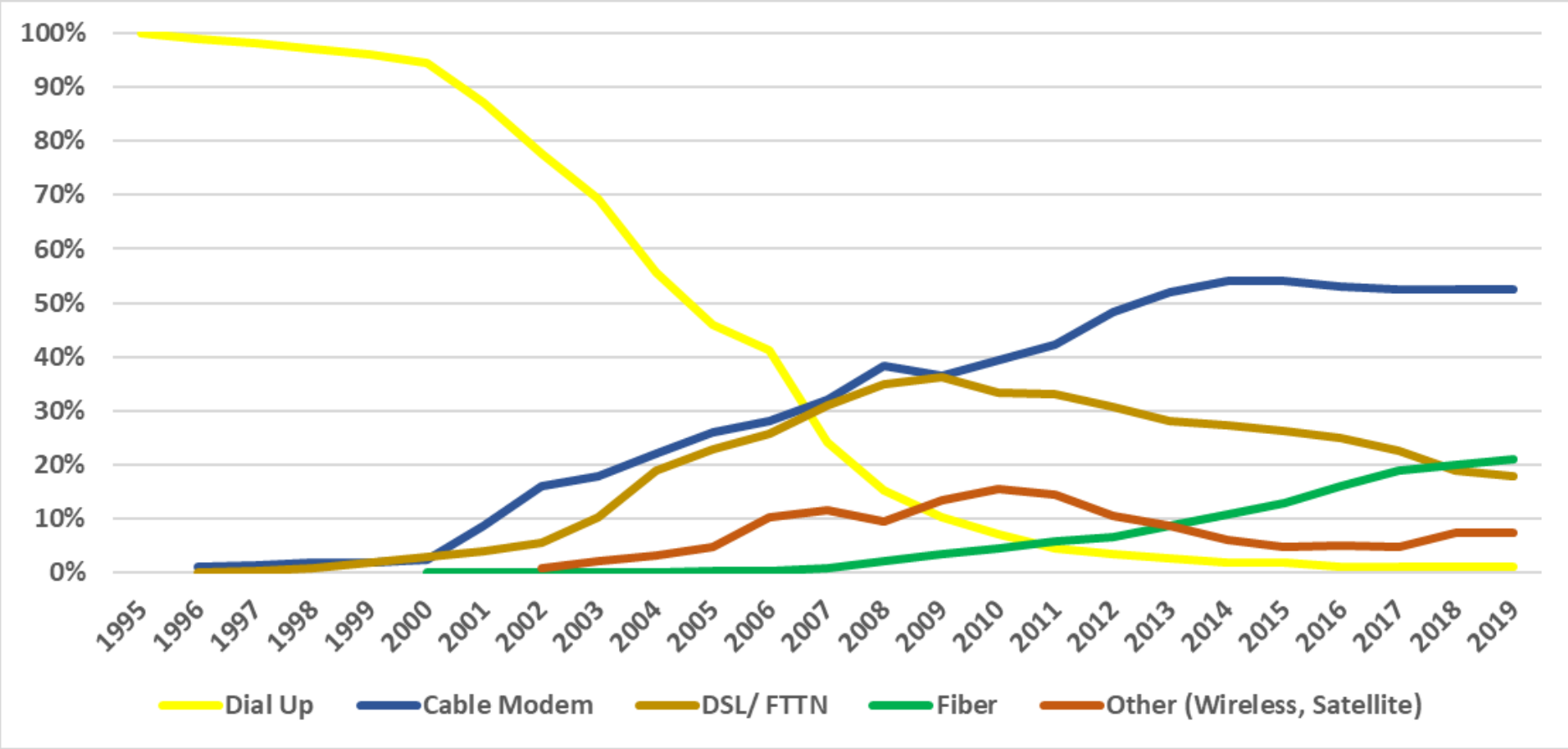


# How Fast Is U.S. FTTH Growing?

# Fiber Broadband Has Moved Into Second Place For Home Internet

## Broadband Type Market Share Based On RVA Consumer Research 2006-2019

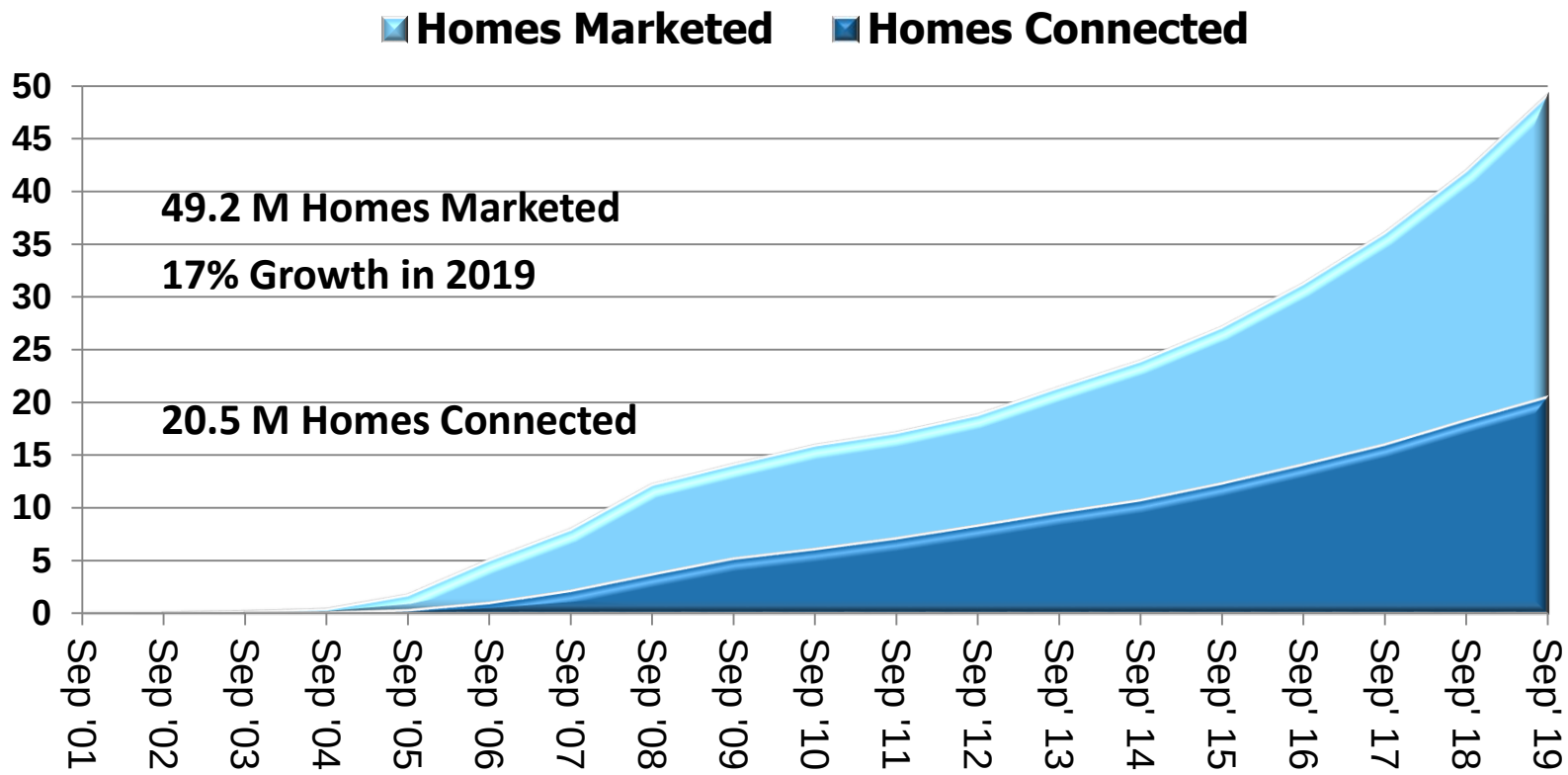
## 1995-2005 Based On Other Published Studies (with estimates between points)




Note: Other comparisons based only major carrier subscribers. This RVA research is based on consumers (includes small providers).

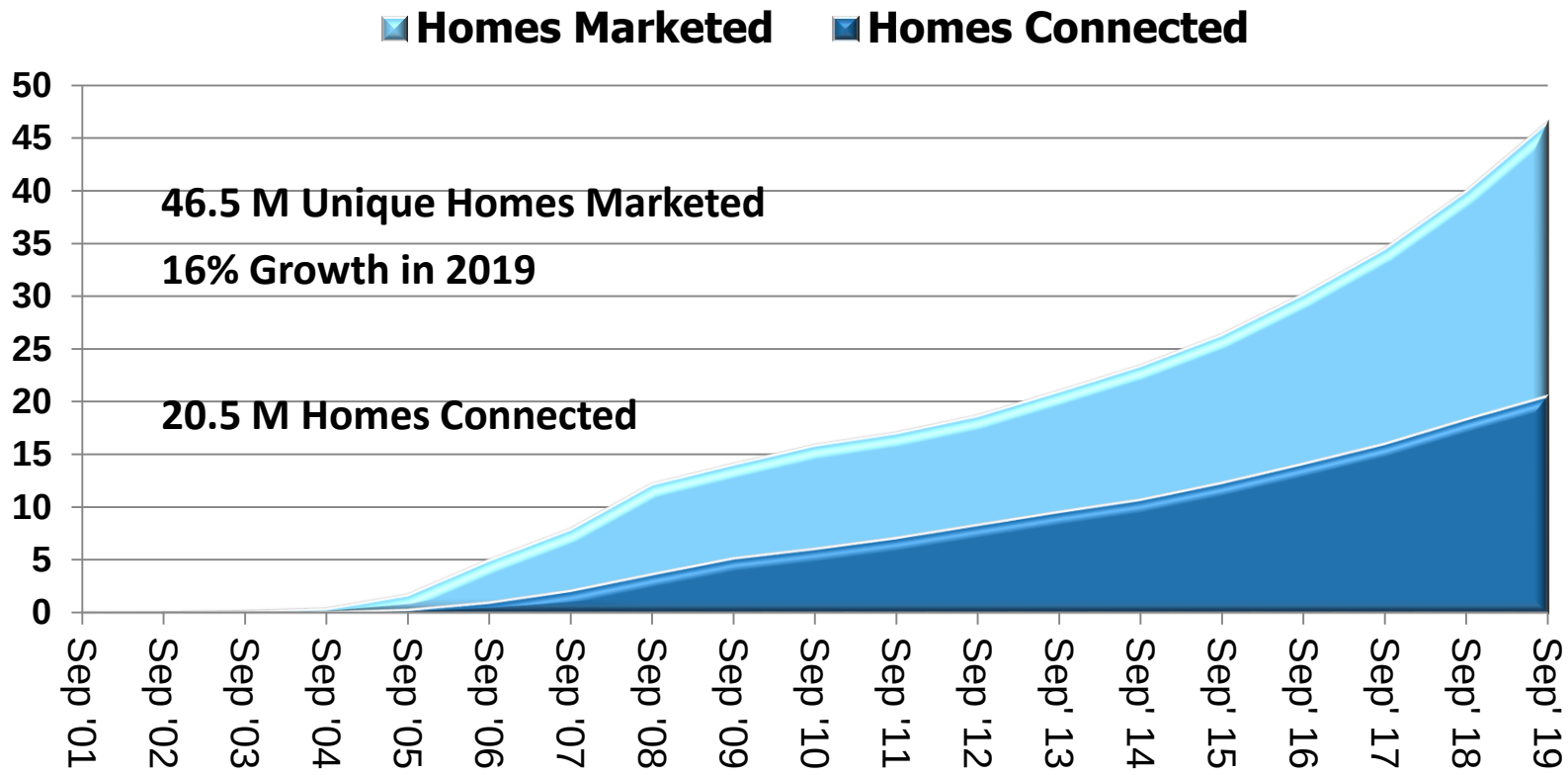
# Fiber Broadband Providers Have Nearly 50 Million Homes Passed In The U.S.

## RVA Provider Study 2019



# Fiber Broadband Now Passes 46.5 Million Unique Homes* In The U.S.

## RVA Provider Study 2019

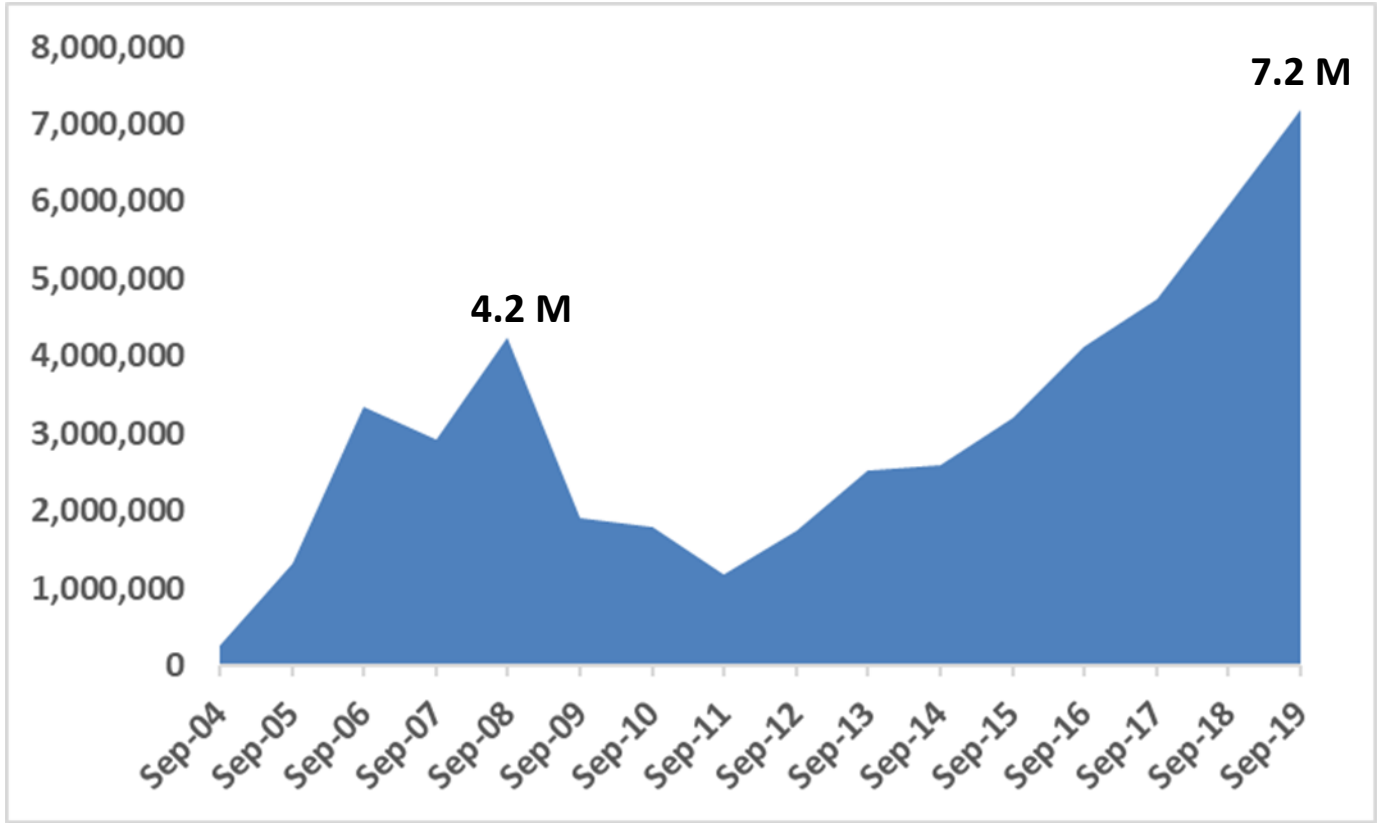



* Number of homes with at least one fiber service marketed (excludes estimate of redundant services available to the same home)

# 2019 Annual U.S. Fiber Broadband Deployment Far Surpasses Past Records

## Annual Homes Marketed (All Years Ending Q3)

## RVA Provider Study 2019



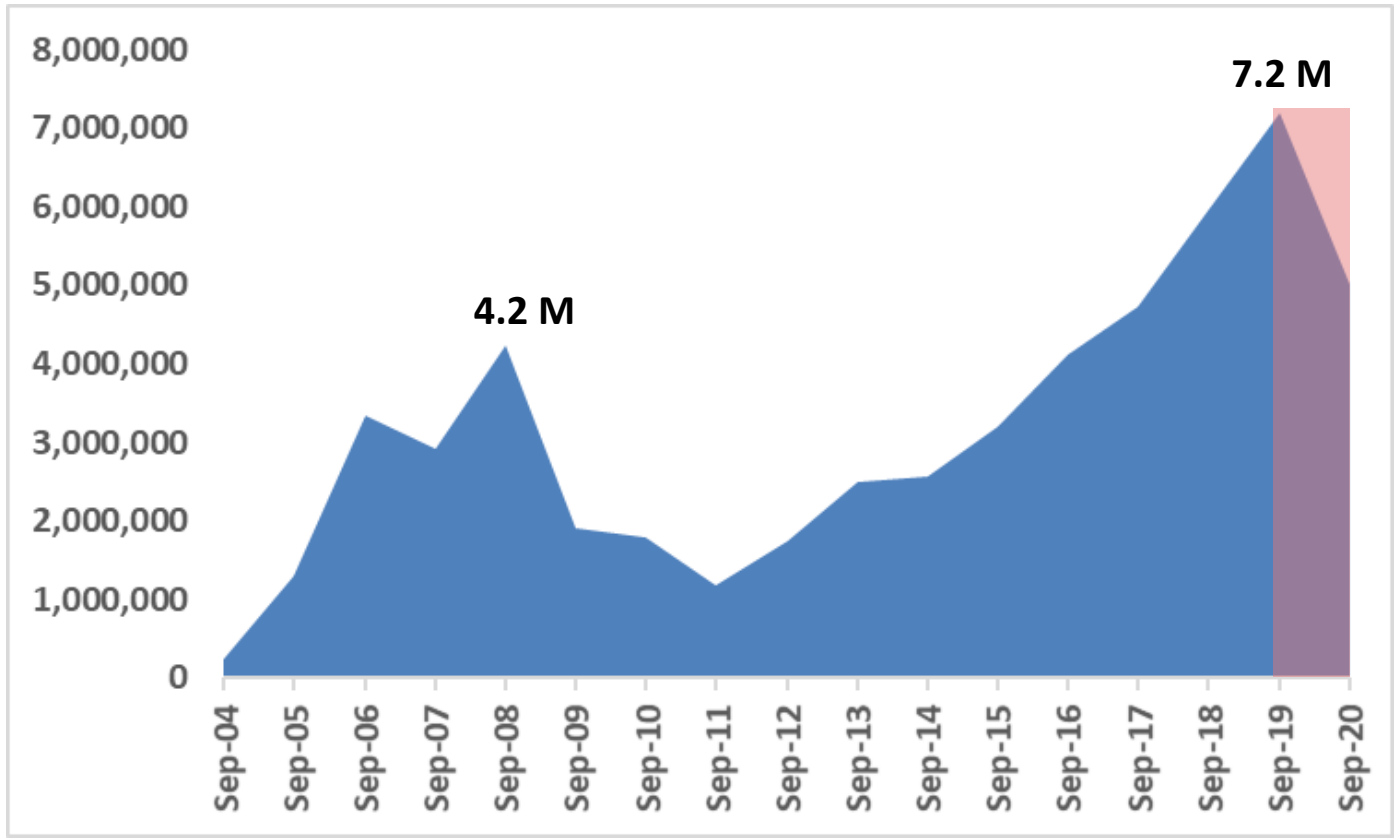

Over 7 Million homes passed by network operators in 2019.

(6.5 Million unique homes.)

# 2020 Annual U.S. Fiber Broadband Deployment Will Decline Somewhat

## Annual Homes Marketed (All Years Ending Q3)

## RVA Provider Study 2019

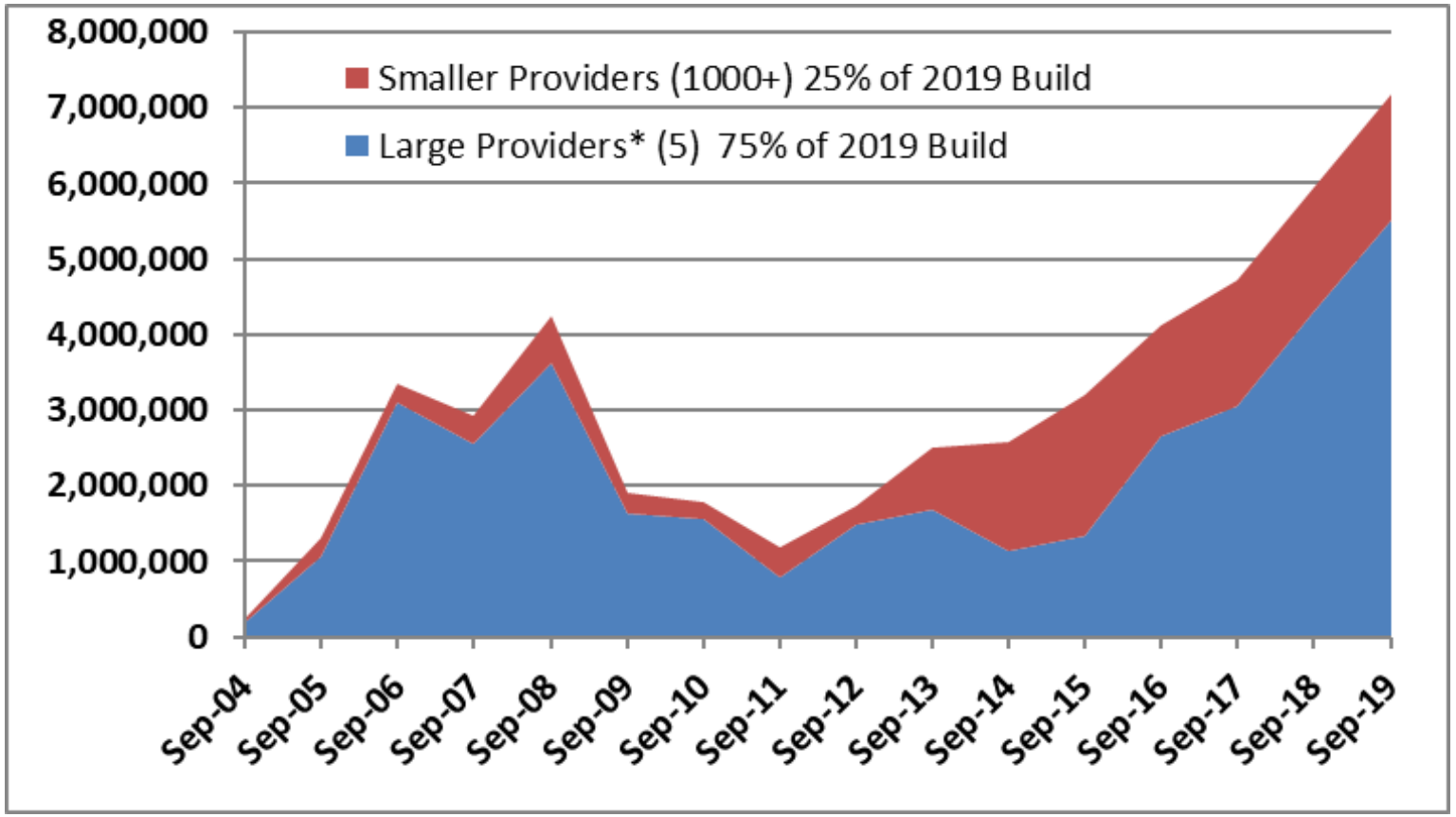



**Due to a dramatic cutback in AT&T fiber deployment, 2020 deployment will almost certainly be down – but still good by historic standards.**

# Smaller Fiber Players Are Making A Difference

## Annual Homes Marketed By Type Of Provider

## RVA Provider Study 2019




**In 2019, smaller providers represented 25% of new homes marketed and 41% of FTTH capital expenditures.**

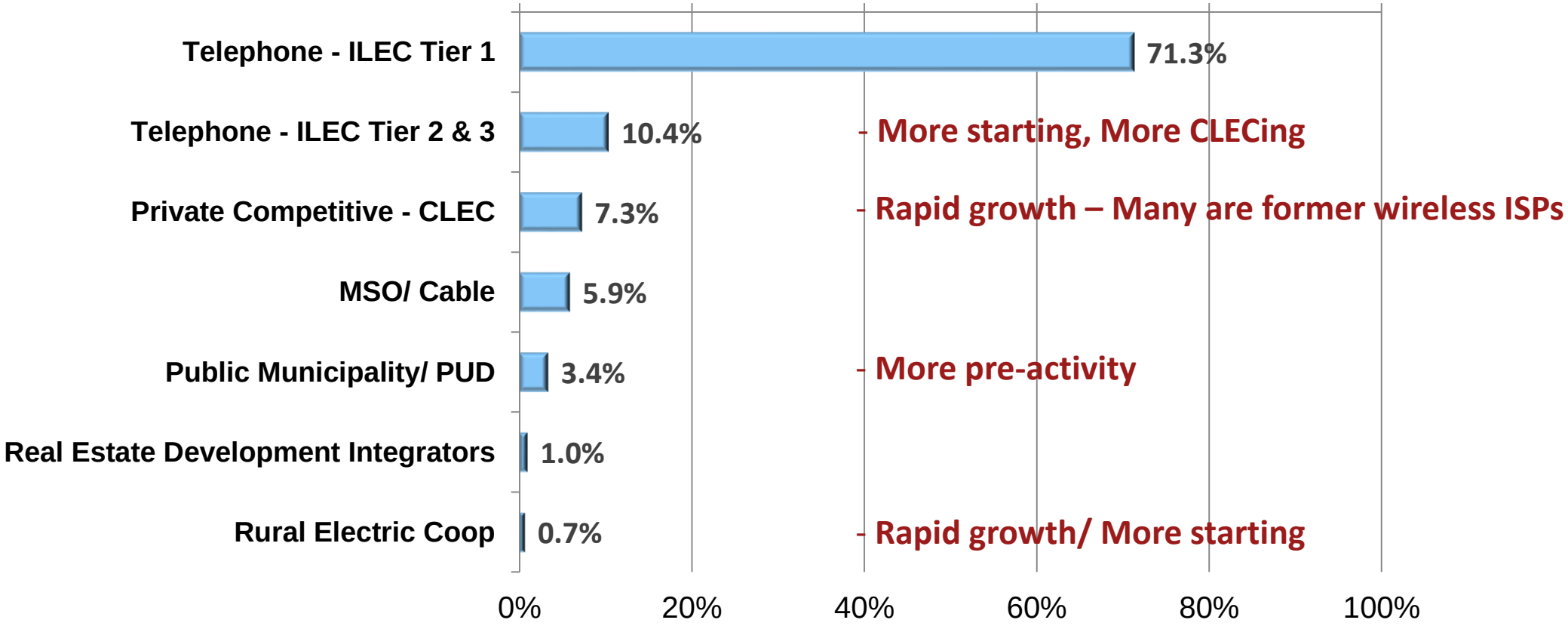
**Smaller providers also have higher take-rates – a higher percent with connections completed.**

**Note: Over 1,000 fiber providers in the U.S.**

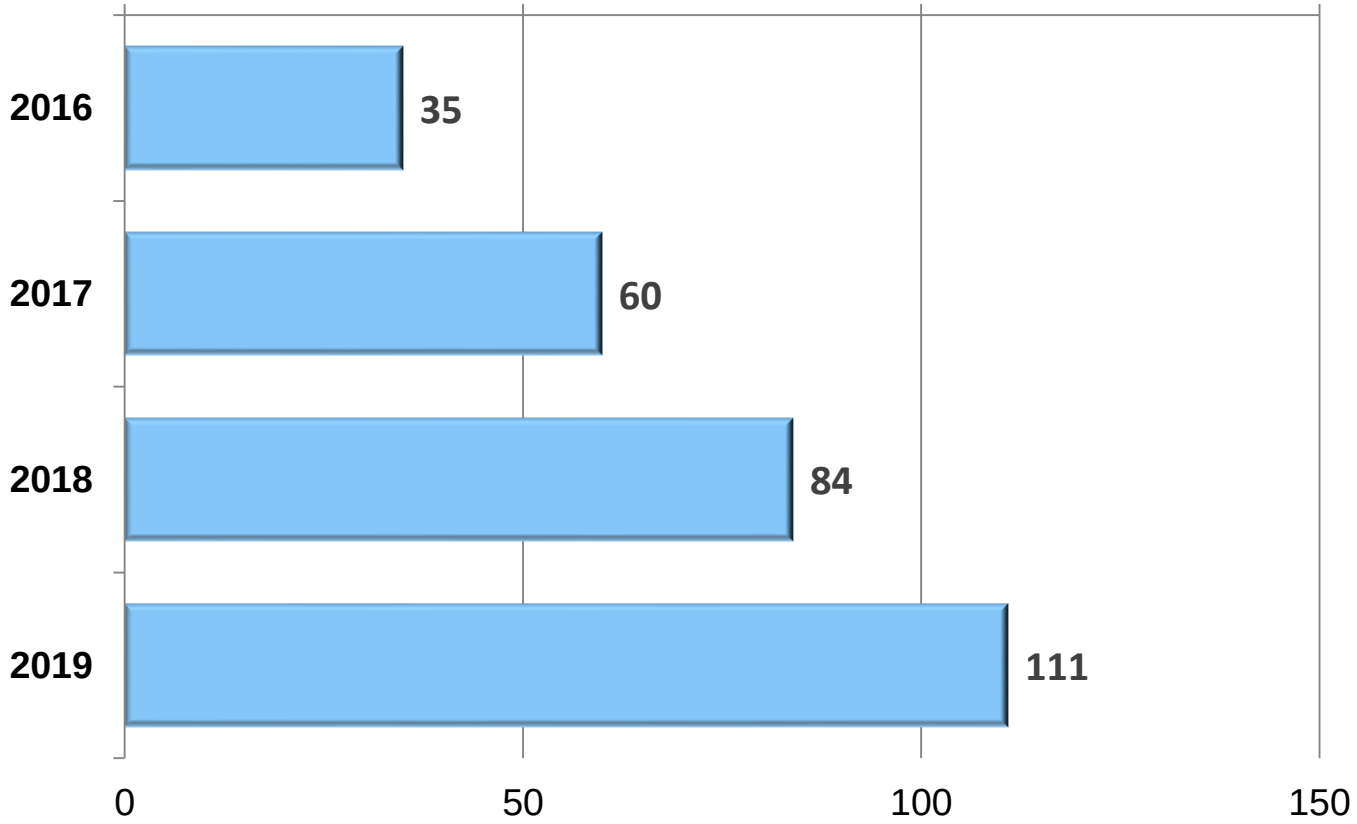
# Diverse Fiber Providers Are Adding To The Total

## US Cumulative Home Marketed By Provider Types

### RVA Provider Study 2019



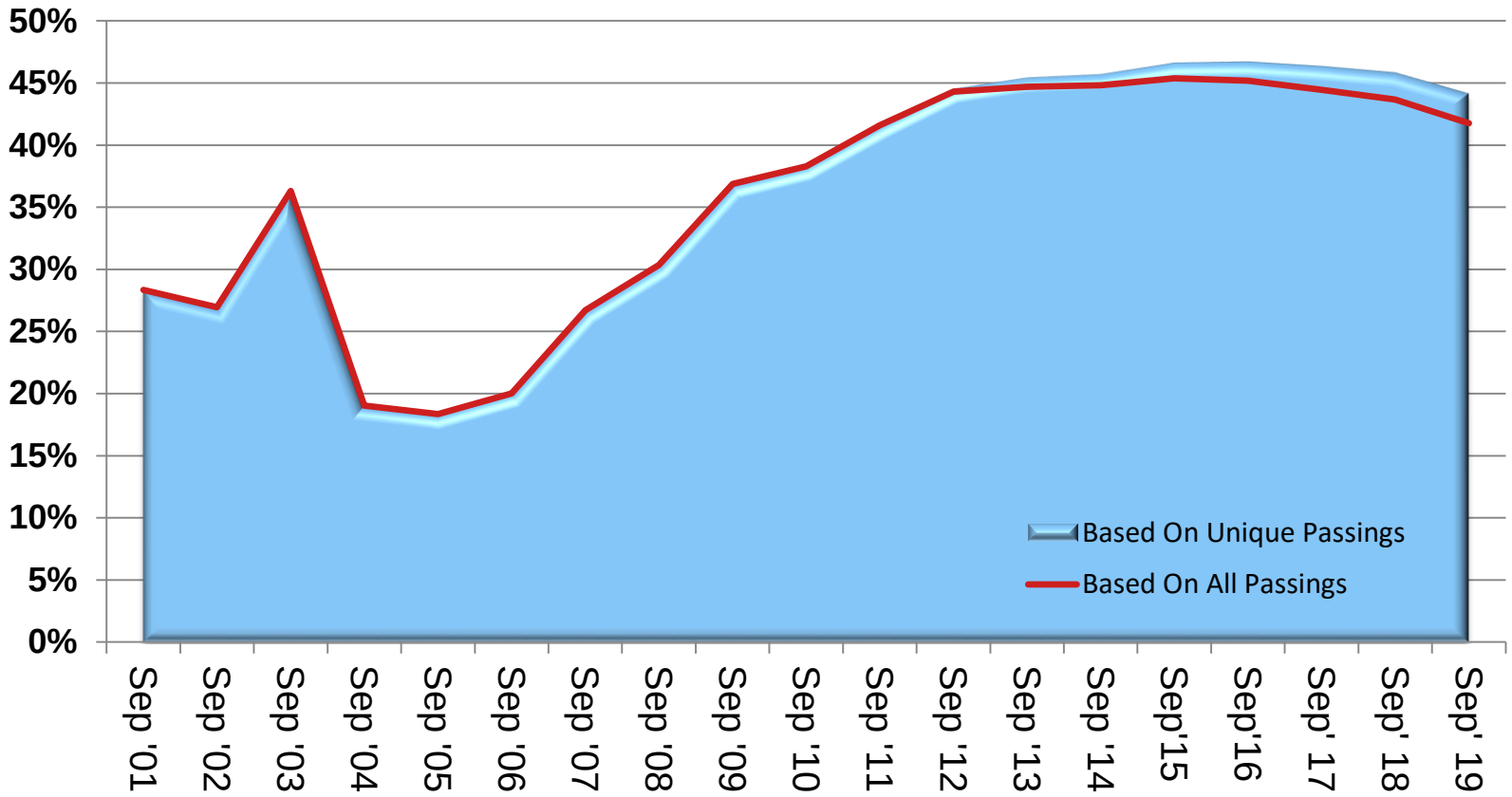
# Number Of Rural Electric Coops Building Fiber
## RVA Study May 2019




**To date, about 12% of U.S. rural electric coops have announced fiber builds.**

# U.S. Fiber Take-Rates Are Temporarily Slightly Declining

## RVA Provider Study 2019




**44% average take based on unique passings.**

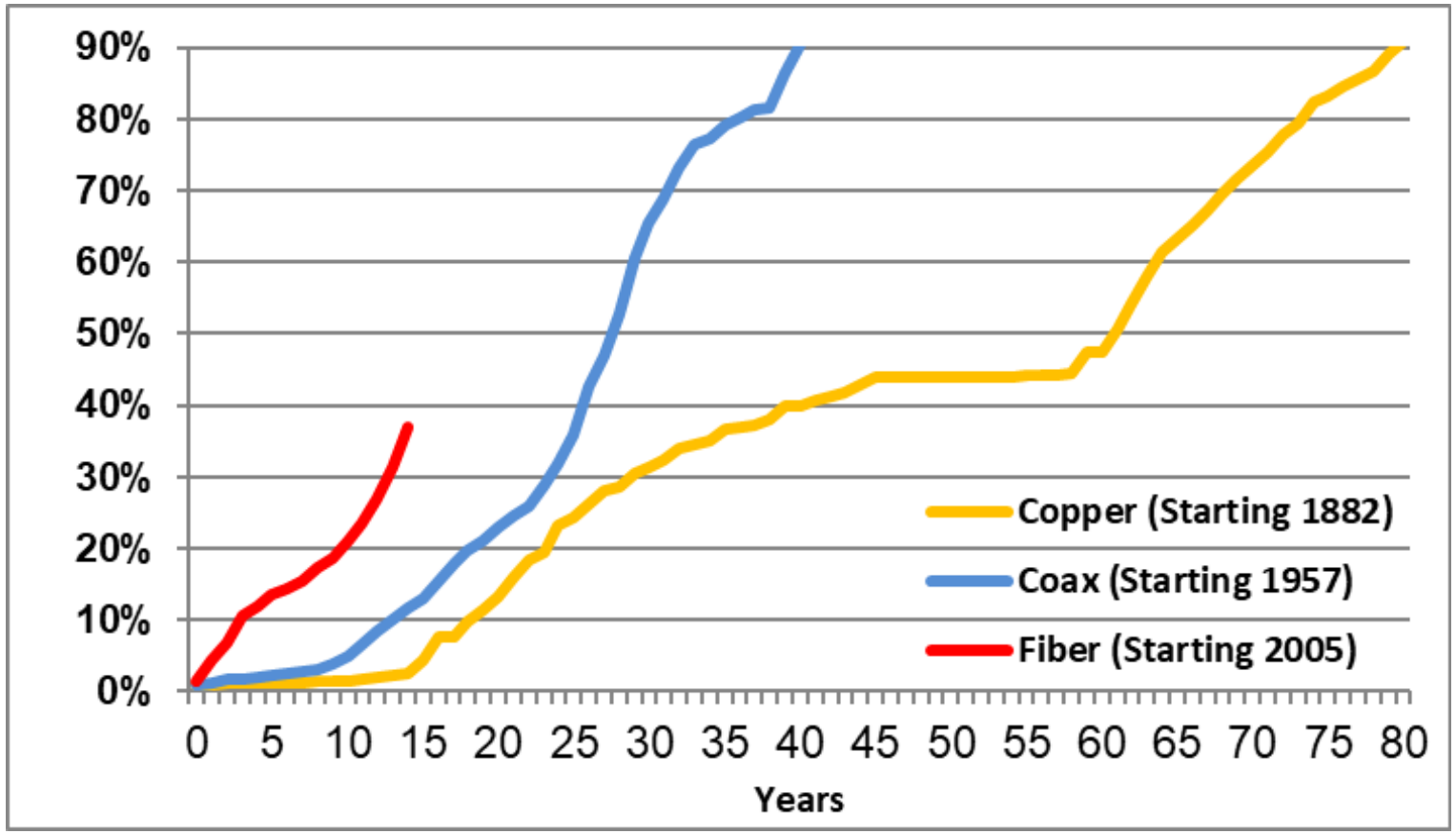
**66% average market share (excluding homes with no home Internet).**

**Take-rates declining in short term because of large new build, especially from larger players.**

# Fiber Availability Is Approaching 40% Of U.S. Households

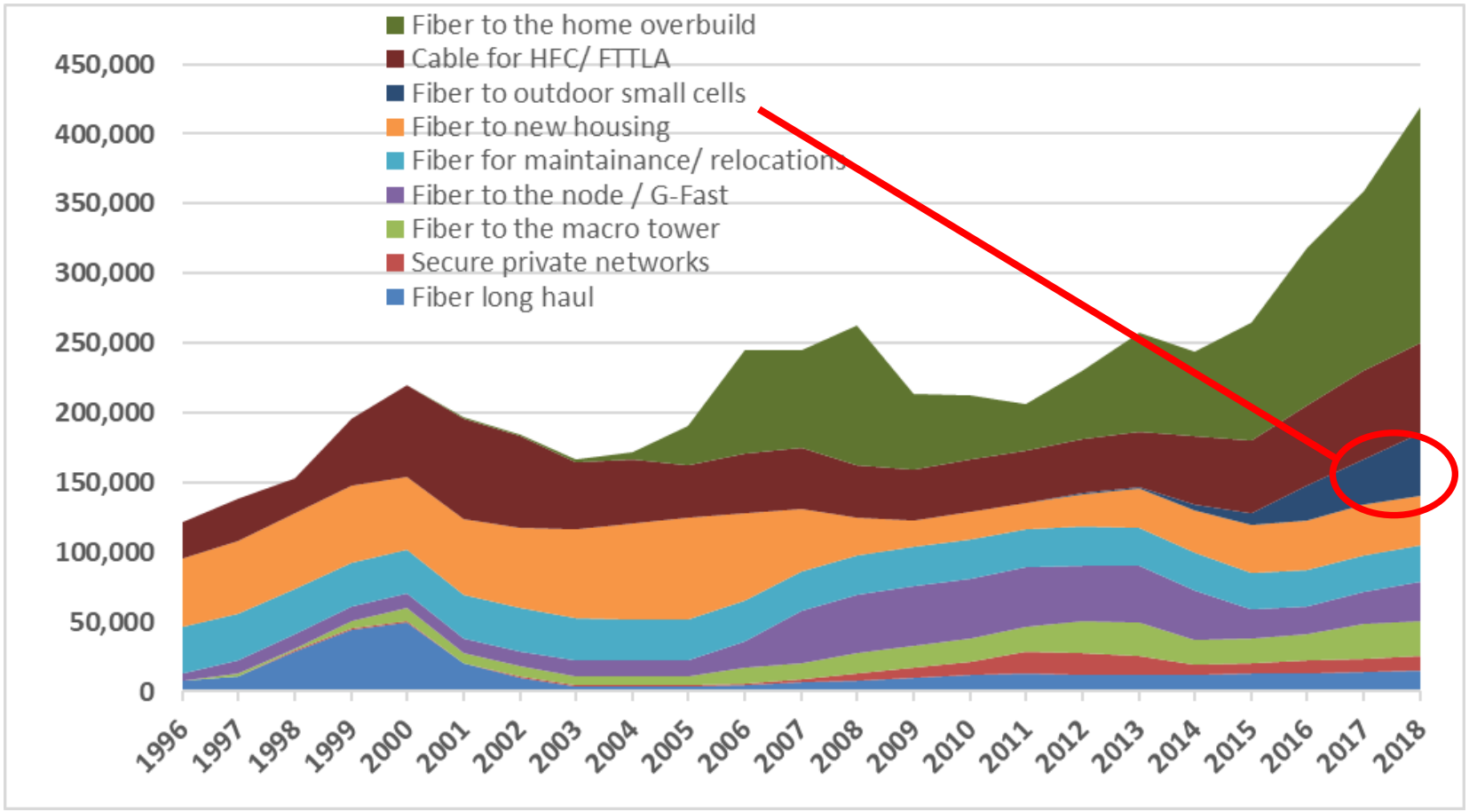
## U.S. Homes Passed Versus Households (tracking since technology hit 1%)

## RVA Provider Study 2019



# Total Fiber Deployment Is At Record Levels – And Small Cell Is Just Starting

## RVA Ongoing Analysis (2018 Data)

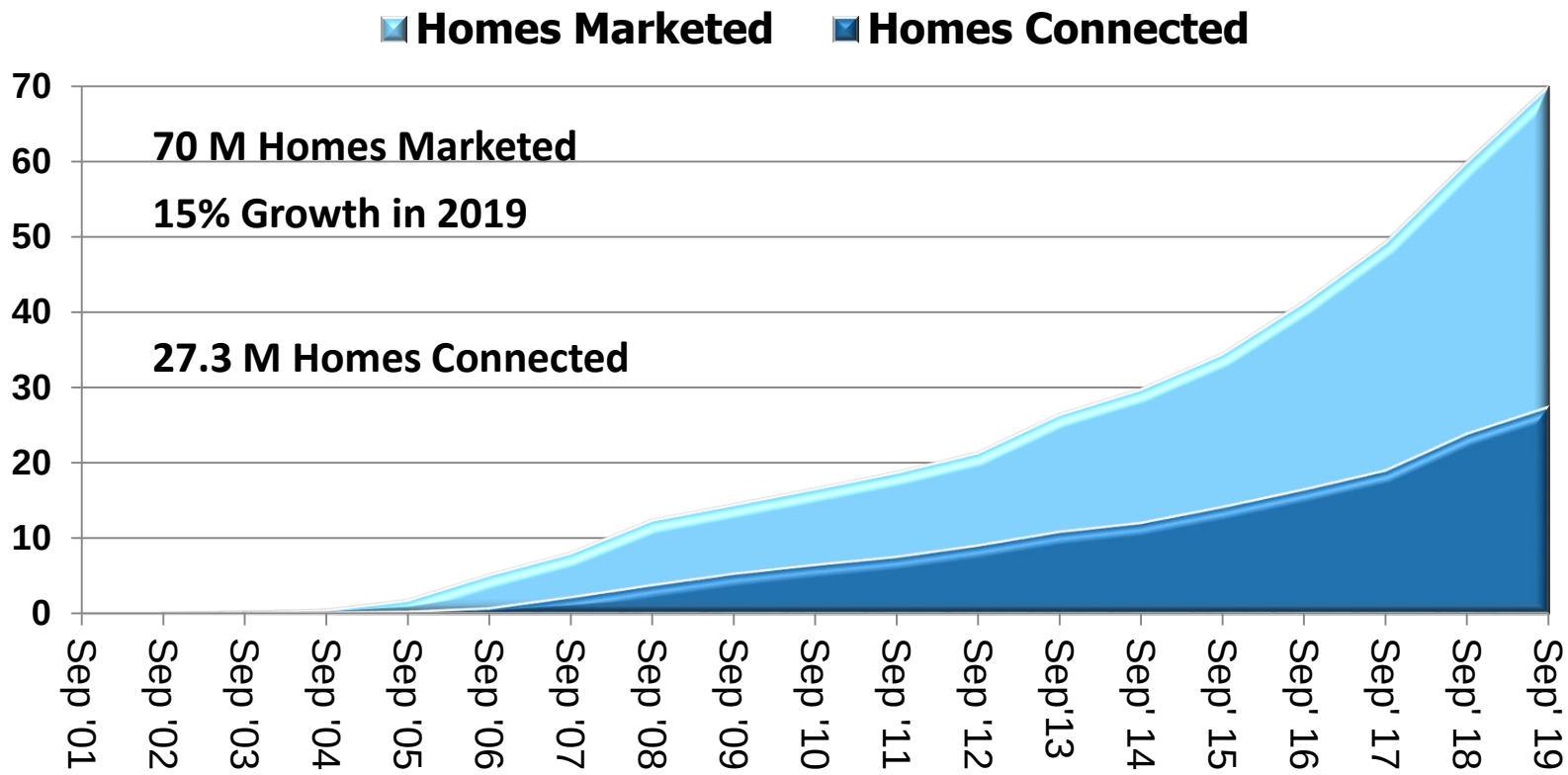



**This is reviewing fiber route miles, i.e. the number of linear miles fiber is deployed overhead or underground – whether single or multiple fiber strands/ lines.**

# How Fast Is North American FTTH Growing?

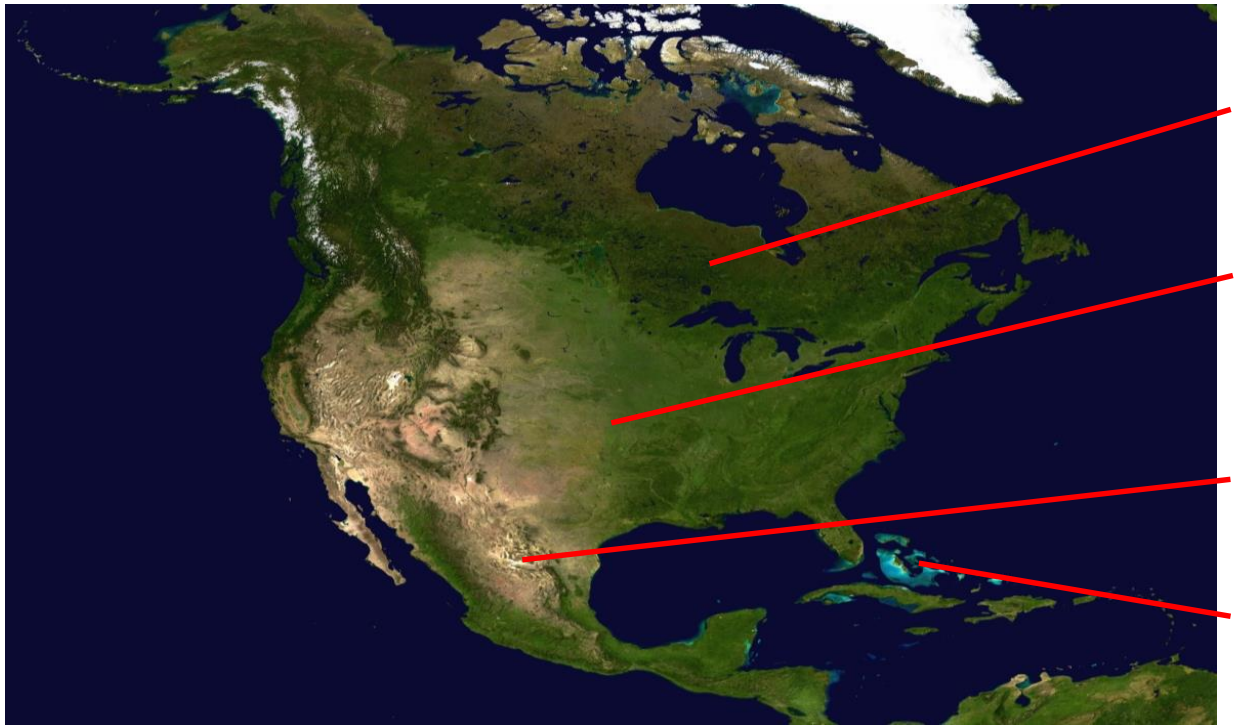
# Fiber Broadband Now Passes 70 Million Homes In North America

## RVA Provider Study 2019



# In Terms Of Raw Numbers Marketed, The U.S. Leads, Followed By Mexico

## RVA Provider Study 2019



**Canada:** 7.6 M Marketed
2.5 M Connected

**U.S.:** 49.2 M Marketed
20.5 M Connected

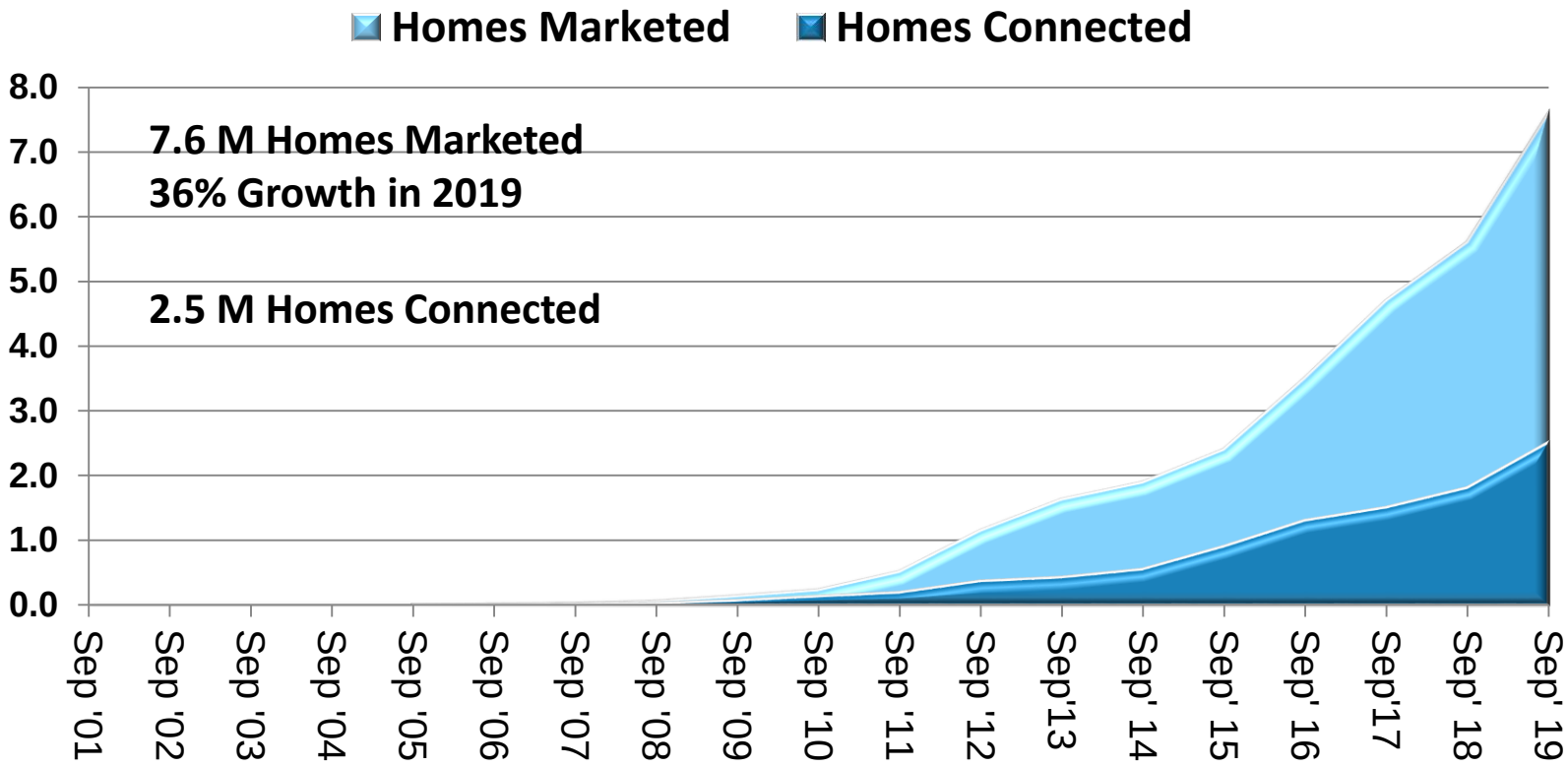
**Mexico*:** 12.5 M Marketed
4 M Connected

**Caribbean:** 0.65 M Marketed
0.27 M Connected

*According To IDATE

# Canada Is Experiencing Extraordinary Fiber Broadband Growth

## RVA Provider Study 2019

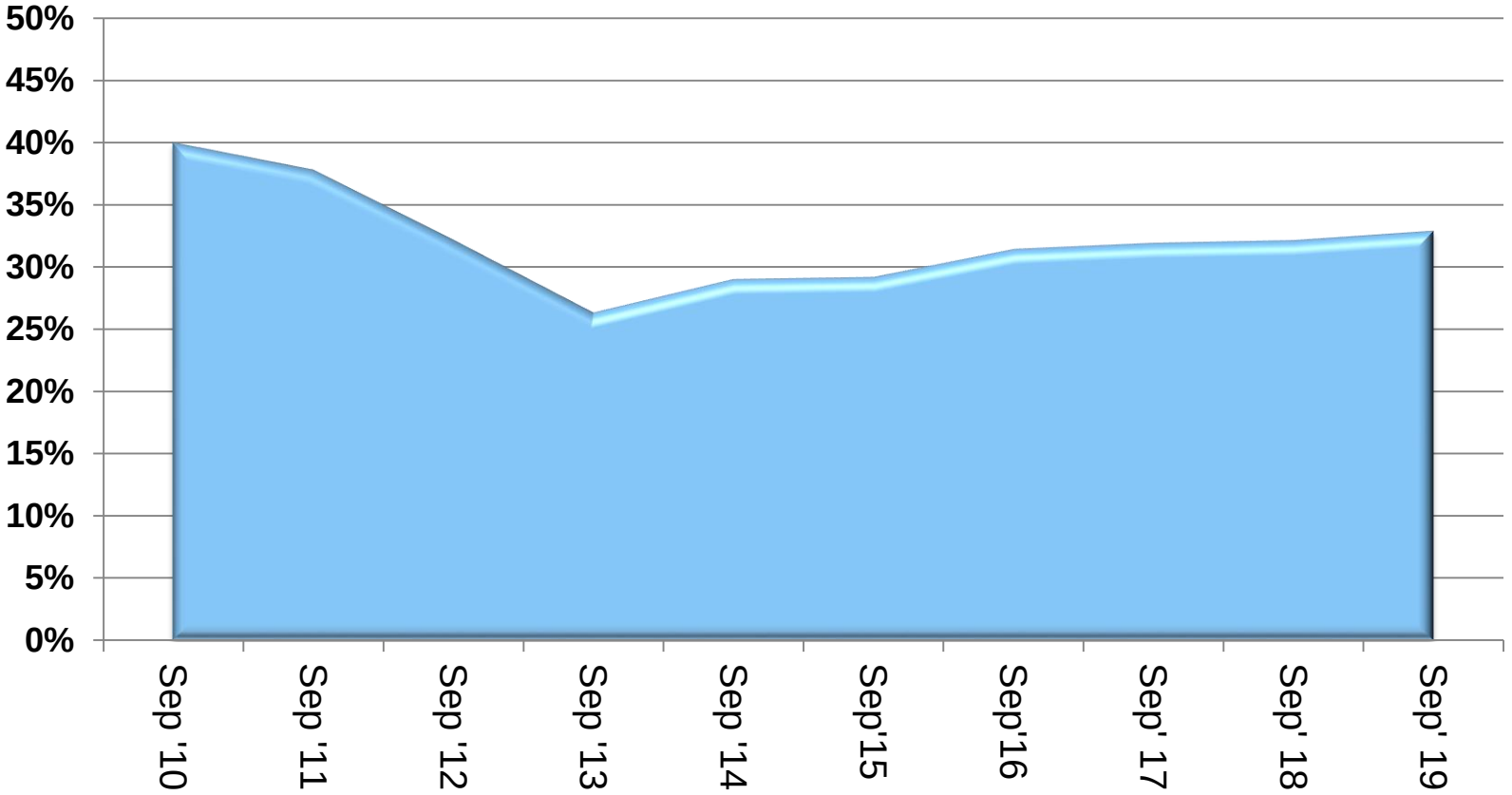



Canada has now passed half its households.

The remaining will become more difficult given more rural locations.

# Canada's Take-Rates Have Been Restrained By High Growth

## RVA Provider Study 2019

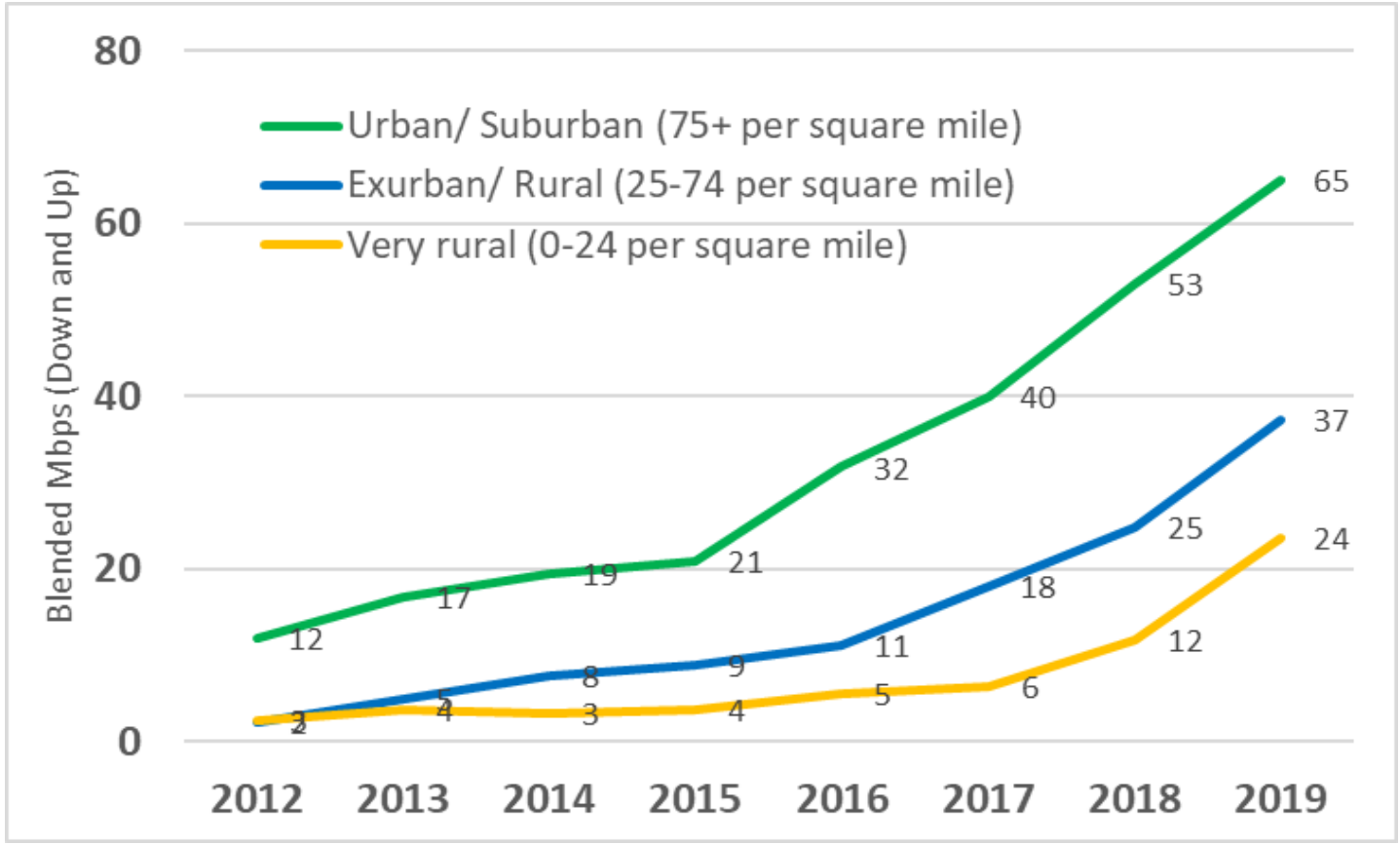



**Canadian take-rates have been constrained by rapid growth and the fact that builds are in dense competitive areas.**

# How Is U.S. FTTH Deployment Distributed?

# Average Blended* Broadband Speeds Vary By Living Density

## From RVA Consumer Study Speed Tests

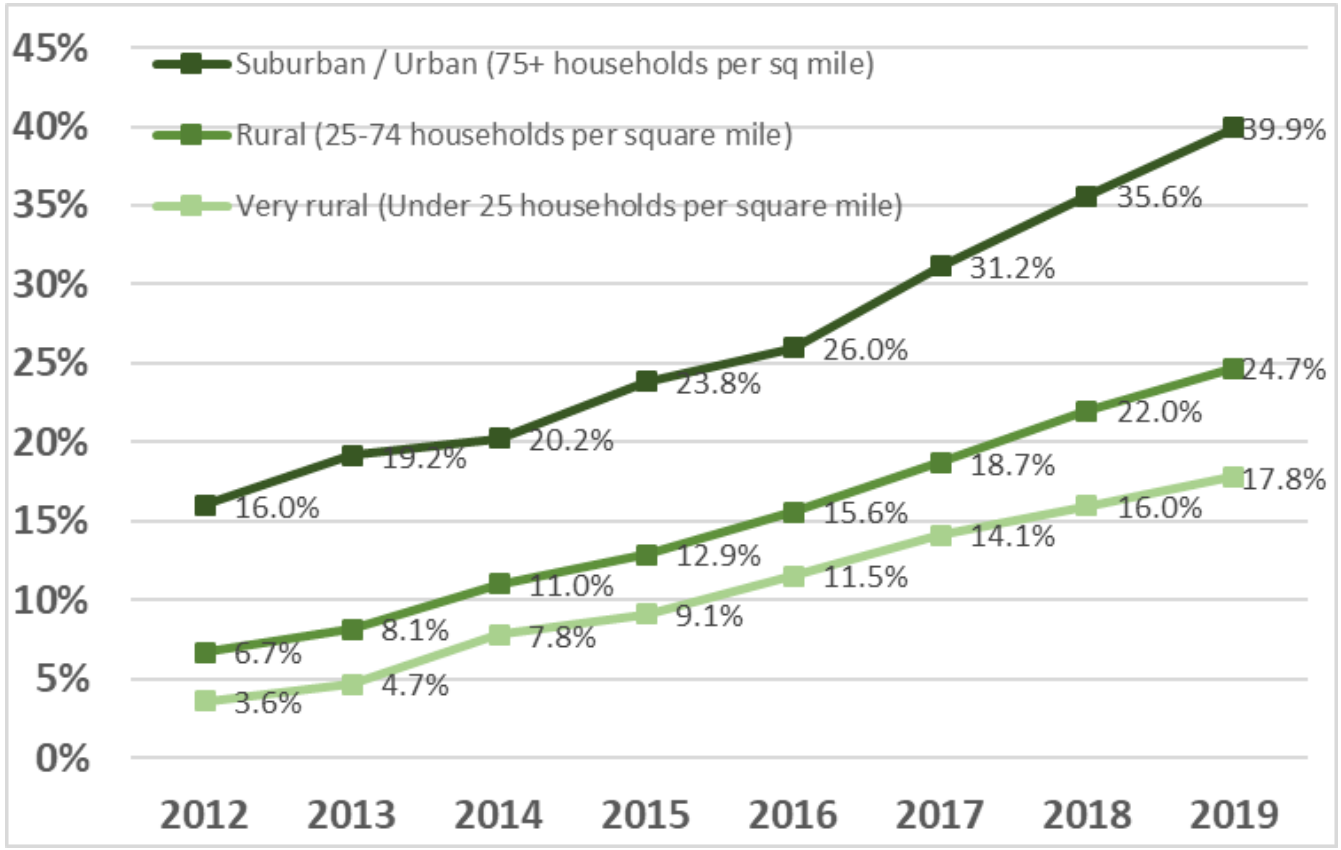



* Average of Download and Upload speeds

# FTTH Availability Varies By Living Density

## Estimated Availability As A Percent Of All Residents In Each Segment

## From RVA Consumer Studies



# North American
# 2019 Advanced Broadband Report
# December 17, 2019

FiberBroadband ASSOCIATION
Accelerating the Connected Future

# All-Fiber Deployment Cost Study 2019

## Executive Summary

September 10, 2019

Prepared for: Fiber Broadband Association

Cartesian®

www.cartesian.com

# Background & Context

In 2009, Cartesian* estimated the additional cost – beyond existing trends – to deploy all-fiber networks passing 80% of the US households (HHs) to be $70B

## A decade later, we revisit our work and find that:

- In 2019, 39.2M HHs are passed by all-fiber networks; by 2025, an estimated 25.9M additional HHs will be passed for a total of 65.1M – about 50% of US HHs
  - These accelerated all-fiber builds are driven by increasing consumer use of multiple devices and bandwidth intensive apps/content which require higher performance broadband, provider willingness to focus on long-term returns, and government efforts to lower barriers to deployment costs and provide targeted subsidies
- The additional cost to pass **80%** of HHs is now **$52B**
- The additional cost to pass the **next 10%**, for **90%** total coverage, is **$18B**
- A mixture of lowered deployment costs, driven by private and public efforts, and government support, which together total **$7B/**year, could push coverage to **90%** in 10 years
  - The private sector is working on lower-cost construction processes and synergies with 5G and other services
  - Government could facilitate access to poles, ducts, and conduit, and public/private rights-of-way
  - The current FCC high cost subsidy program spends $4B annually, which could be further directed to all-fiber builds

*Cartesian is a consulting firm specialized in the technology, media and telecom (TMT) sector. Our Strategy practice has considerable experience assisting service providers in network planning and cost modeling, particularly as it relates to all-fiber deployment. Cartesian has been engaged to refresh prior research completed in 2009 by assessing how fiber deployment has advanced in the last decade and the remaining investment required for economical all-fiber majority coverage in the United States

Source: FCC, US Telecom, Cartesian



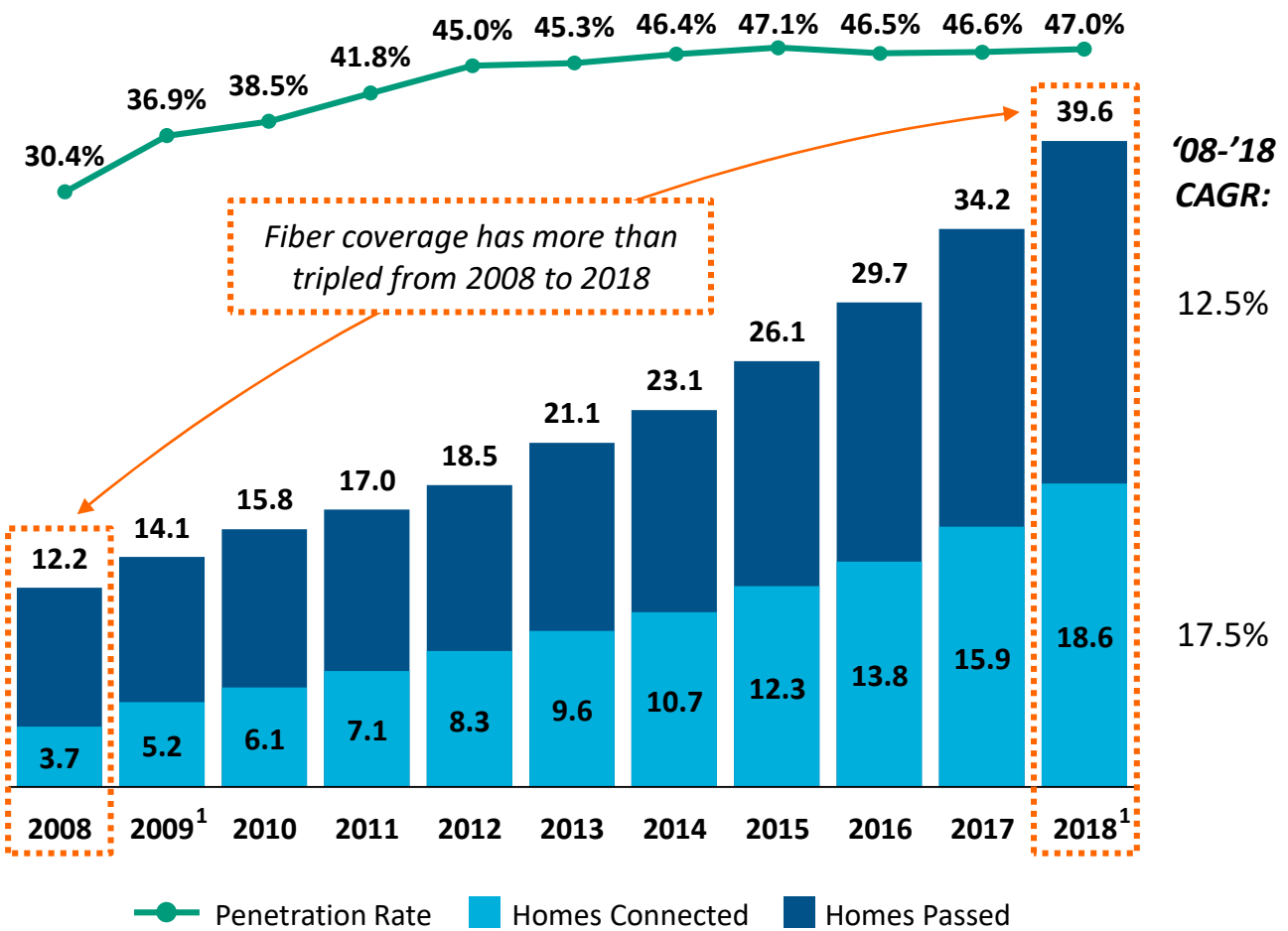


Cartesian®

# US Market Developments

Over the past decade, all-fiber homes passed have more than tripled, growing at 12.5% CAGR – today, every 1 out of 2 homes passed by fiber is connected with fiber

## *Unique Homes Passed and Connected, 2008-2018*




### Comments

- Homes passed have more than tripled over 10 years owing to a vast amount of fiber deployed by ILECs, CLECs, pure-play fiber providers, municipalities / electric corporations and small fiber builders
- Homes passed by and connected with FTTH have grown rapidly since 2008 at a double digit CAGR of 12.5% and 17.5% respectively
- Take up rates in fiber connected areas have also increased by 16.6 percentage points since 2009

[1] Number differs slightly from estimate used in study due to differing adjustment and deduplication methodology

Source: RVA for the Fiber Broadband Association, Cartesian





Cartesian®

# Primary Research

Interviews with fiber operators and vendors consistently revealed that FTTH costs in both urban and rural markets has remained roughly the same

"No big increase in cost in the last 10 years. Although the cost of labor has gone up, **the cost has remained constant due to the compensating effect of gains on labor productivity and reductions on equipment cost.**" – *Midwest Rural Fiber Provider*

"The **high share of aerial deployments** has helped a lot to keep the deployment costs constant over the last 10 years." – *FTTH Vendor*

"**5G and other technologies reliant on fiber deployment** are helping to improve the business case of deploying fiber." – *FTTH Vendor*

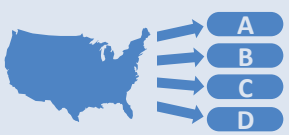
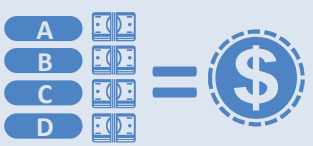
"**Government funds and partnerships** with utility companies and municipalities have helped to keep the cost down in the most rural areas. These rural areas show **very high take-up rate** which also helps the business case for those deployments."
– *Mid-Atlantic Rural Fiber Provider*

"There are still opportunities to lower the cost of fiber deployment by **having the government coordinate deployment efforts** to avoid labor shortages." – *Telecom Engineering Consultancy*

Source: Cartesian Primary Research

# Fiber Study Methodology

US HHs were segmented in five groups based on the area's HH density; after removing current and near-future passed HHs, cost estimates per group were applied

| Step | 1 HH Segmentation by Density | 2 Allocation of Homes Passed, 2019-2024 | 3 Development of FTTH Cost Estimates | 4 Fiber Investment Calculation |
|---|---|---|---|---|
| **Objective** | **Segment US into density-based buckets to replicate 2009 study methodology**   | **Determine where new fiber builds in the next 5 years will occur**  | **Estimate costs to pass a HH with fiber based on density of the area it is located**   | **Use density segmentations and cost relationship to estimate total costs**   |
| **Approach** | • Consistent with the 2009 study, HHs were grouped based on density, into groups A, B, C and D<br>• To keep groups consistent with the past study, HH density thresholds were determined on Form 477 in a way that the percentiles distribution and the sizes of the groups remain the same | • In the 2009 analysis, HHs passed were only assumed as part of the densest group, i.e. Group A assuming that fiber providers would only deploy in the less costly areas<br>• Evidence from FCC's Form 477 has found this not to be the case – fiber passed HHs were therefore allocated to each of the groups proportional to past fiber deployments | • Cartesian conducted interviews with subject-matter experts on costs to pass HHs<br>• Using data points collected from interviews and past cost benchmarks, we developed a regression model to estimate cost to pass based on HH density<br>• We used the model's outputs to estimate cost to pass per group | • Given the allocation of Step 2, we multiplied the number of remaining HHs in each group (excl. D2 as most expensive) with the average cost to pass each group<br>• We projected penetration rates in 2025 and used that to estimate the total cost to connect<br>• Total investment equals total cost to pass and cost to connect |

Source: Cartesian



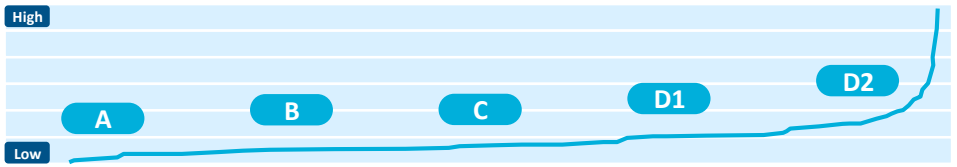


Cartesian®

# Estimated FTTH Investment Required

Cartesian estimates 90% of US HHs can be passed with fiber for an estimated amount of $70B

## *Investment Required by Deployment Type*




| FTTH Network Deployment Costs per HH | Dense Urban/Suburban Deployments | More Costly | Significantly More Costly | Rural & Complex Deployments | Most Expensive |
|---|---|---|---|---|---|
| # 2025 HHs Not Already Covered by FTTH (M) | 33.9 | 9.8 | 7.3 | 5.1 | 13.5 |
| Cutoff HHs per Sq. Mile[1] | 1,525 | 767 | 302 | 63 | NA |
| Percentiles Covered | 0-54% | 55-69% | 70-80% | 81-90% | 91-100% |
| Modeled Cost to Pass per HH[2] | $668 | $1,313 | $2,187 | $3,656 | NA |
| Incremental Cost to Connect per Sub | $550 | $550 | $550 | $550 | NA |
| Assumed Penetration | 45% | 50% | 60% | 70% | NA |
| **Cost to Pass ($B)** | **$22.6B** | **$12.9B** | **$16.0B** | **$18.6B** | **NA** |
| Cost to Connect ($B) | $8.4B | $2.7B | $2.4B | $2.0B | NA |
| **Total Investment Requirement ($B)** | **$31.0B** | **$15.6B** | **$18.4B** | **$20.6B** | **NA** |

## Comments

- HHs passed or planned to be passed with fiber by 2025 have been allocated across all groups, based on past FTTH deployment density profiles
- At the end of 2018 there were 39.2 million US HHs with FTTH availability, plus an additional 25.9 million forecasted by 2025
- To pass 80% of the HHs (as in the 2009 study) it will require today an investment of $51.5B vs. $70.9B in 2009
- Based on current FTTH build investment requirements, Cartesian estimates that the average cost to pass all but the 10% most expensive remaining non-FTTH HHs in 2025 is ~$1,250 per HH
- Penetration rates across groups A, B, C and D1 expected to average 50.1% in 2025

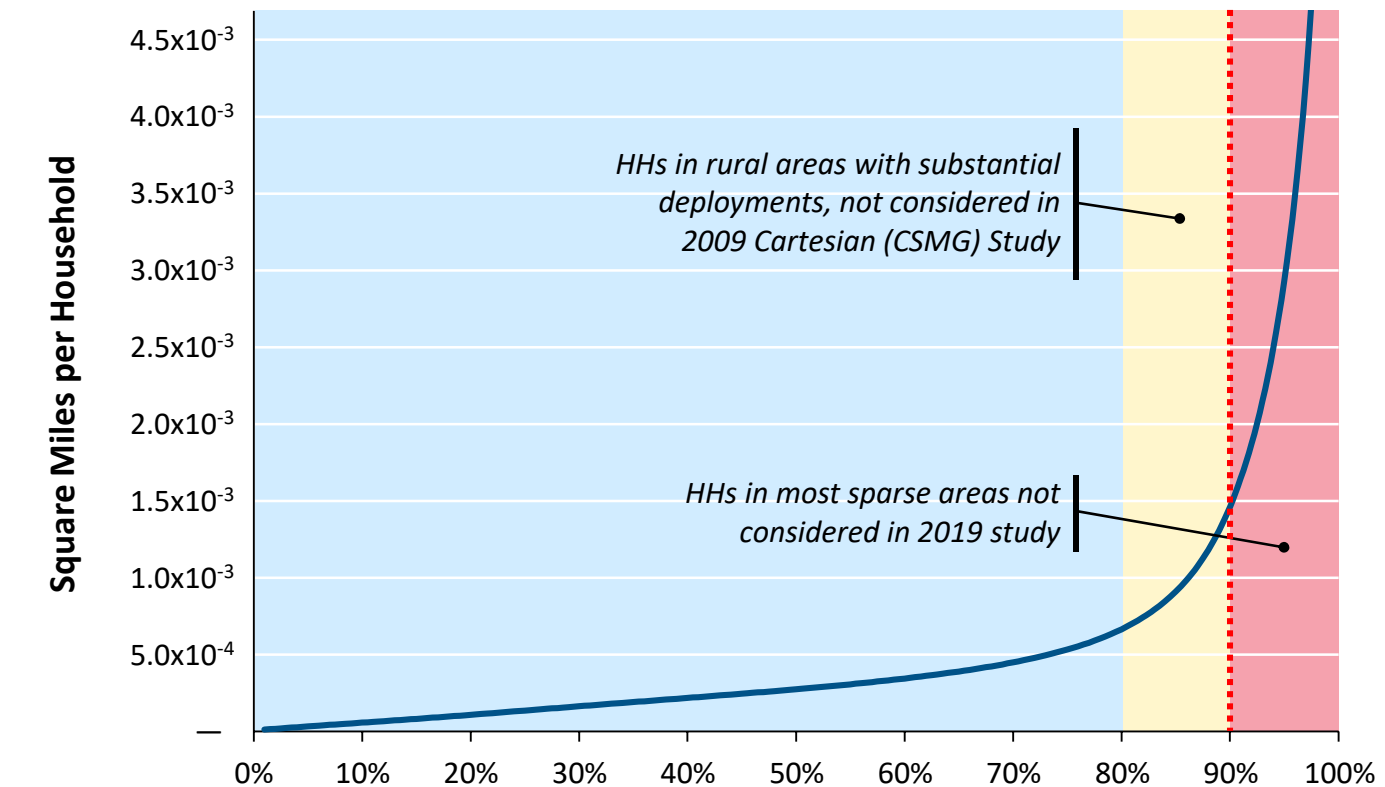
| *Totals* |
|---|
| ***$70.1B*** |
| ***$85.6B*** |

[1] HH density estimated using Census block groups as opposed to FCC wire center data in the past study
[2] Based on logarithmic regression model estimating effect of HH density on cost to pass a home across multiple real-world fiber deployments
Source: Cartesian, FCC Form 477, US Census, American Community Survey, Company Presentations

# US Household Density Cutoff

Past FTTH deployments demonstrate that deployment in the 80-90th density percentiles is more achievable than previously thought

## *US HHs Inverse Density Curve*




| Distribution of Current HHs with FTTH | 14.4% | 11.1% | 10.2% | 9.8% | 10.1% | 10.4% | 10.8% | 10.4% | 7.8% | 5.0% |
|---|---|---|---|---|---|---|---|---|---|---|
| *Density Segment* | A *(0-54%)* | | | | | | B *(55-69%)* | C *(70-80%)* | D1 *(81-90%)* | D2 *(91-100%)* |

## Comments

**An inverse density plot represents a proxy for FTTH cost to pass:**

- Previously, in 2009, fiber connected HHs were allocated to highest densities and lowest cost percentiles
- Since then, deployments have occurred in lower-density areas, owing to government subsidies and high take-up rates (as high as 80%) which have translated into NPV positive FTTH deployments

**Our study does not account for future developments that may lower costs in the next several years, such as:**

- Wide adoption of new materials, architectures, and processes, e.g. micro-trenching or distribution TAPs
- Savings on new infrastructure builds and improvements from 5G deployment (ducts, poles, etc.)
- Synergies and partnerships with utility companies for smart grid and other uses

Source: Cartesian, National Broadband Map (FCC Form 477 December 2017 – version 2), 2010 US Census, American Community Survey





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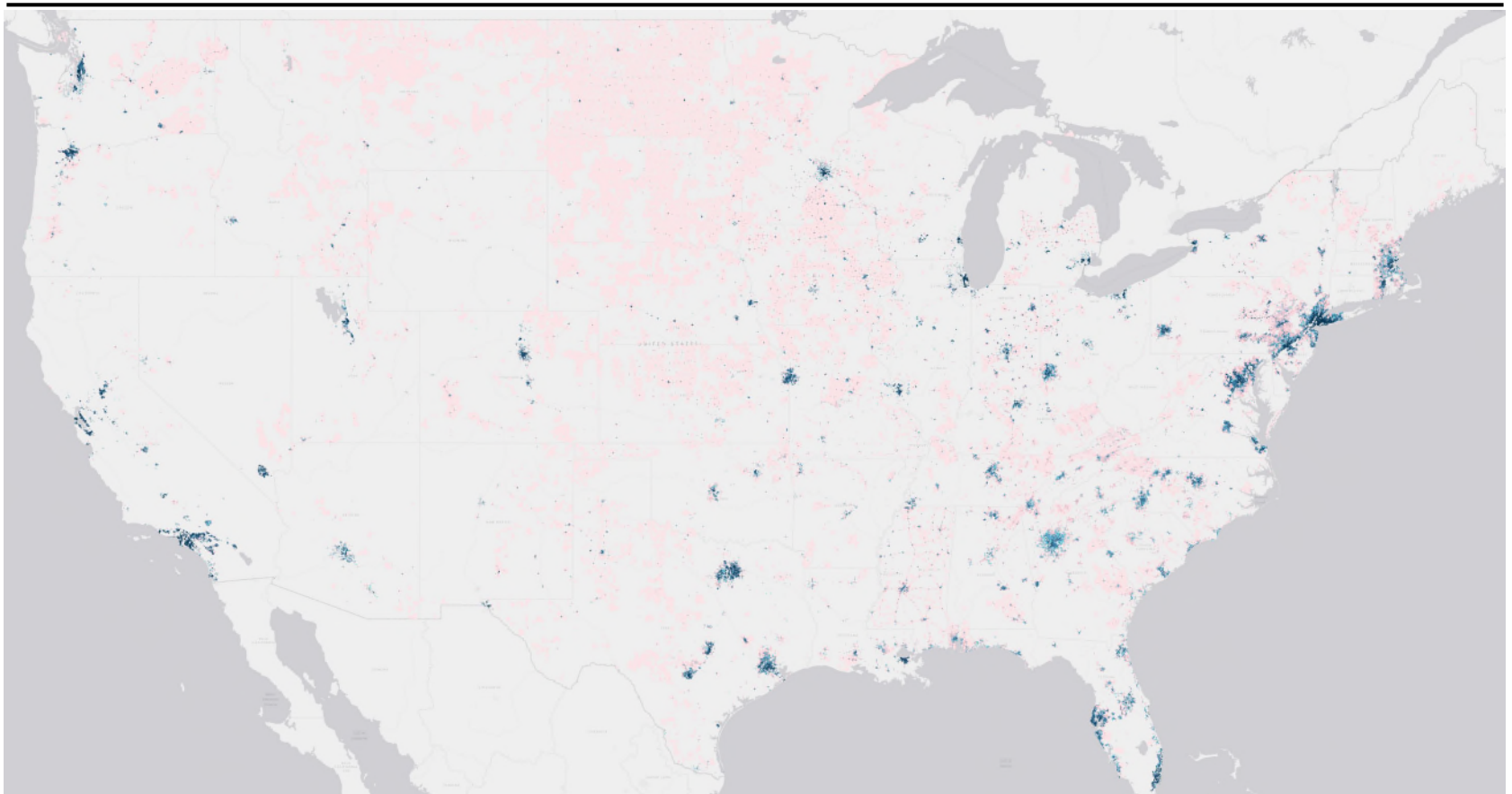
# FTTH Map

Group D2, containing the top 10% of most sparse US households, covers the vast majority of US land (>90%), implying higher costs to connect

***Fiber-Served Census Blocks***



| Density Segment | A | B | C | D1 | D2 |
|---|---|---|---|---|---|
| Total Area ($mi^2$) | 19K | 17K | 27K | 93K | 3.6M |

Source: Cartesian, National Broadband Map (FCC Form 477 December 2017 – version 2), 2010 US Census, American Community Survey





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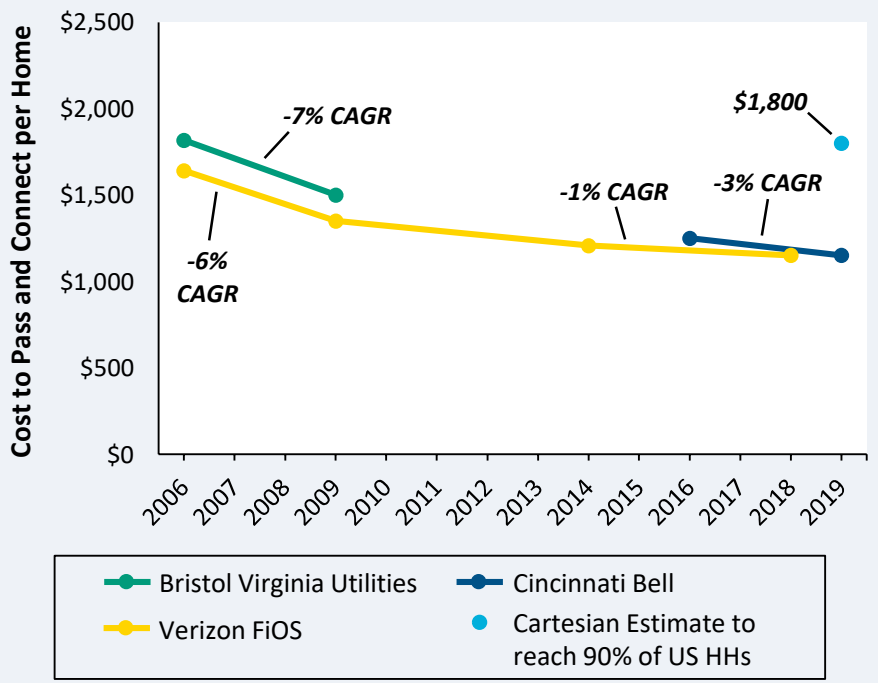
# FTTH Cost Drivers

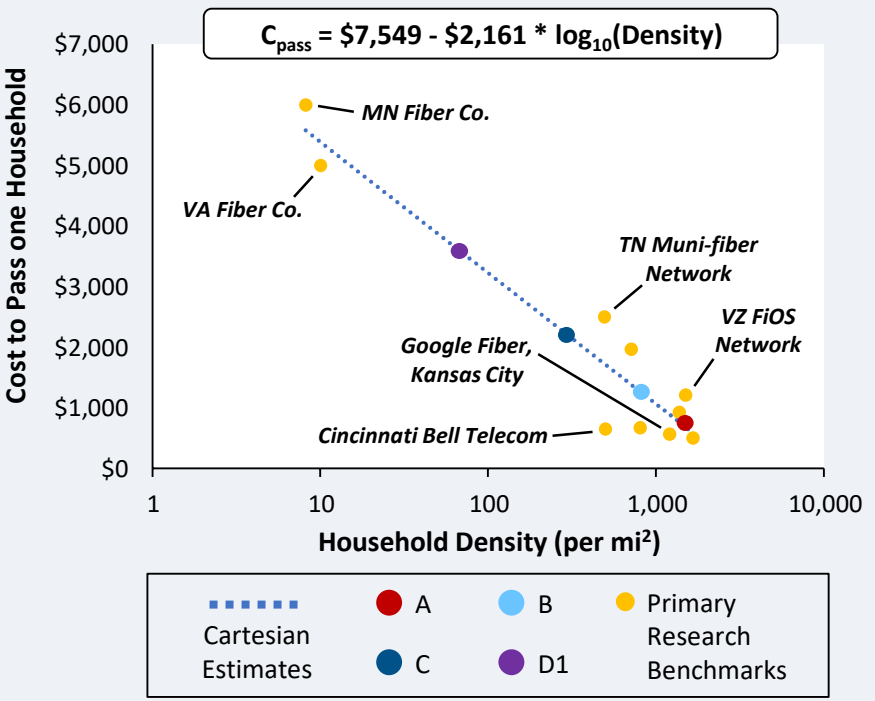
FTTH deployment costs have remained roughly the same over the past several years and are primarily dependent on HH density

## *2006-2019 FTTH Cost to Pass and Connect[1]*




- The Cartesian estimate represents the average cost to build to the remaining HHs to reach 90% coverage. This is higher than current build costs due to different mixes in density
- While equipment and materials costs have decreased and labor usage has become more efficient, labor rates and scarcity of resources have balanced out efficiency gains and kept deployment costs relatively constant
- Cost efficiencies have also been offset as operators have been deploying FTTH in increasingly higher cost areas, i.e. rural or complex areas

## *2019 FTTH Costs to Pass per HH*




- Similar to the 2009 study, logarithmic regression analysis was used to model the relationship between household density and cost to pass
- Analysis reveals no significant change in the relationship between density and incremental cost from 2009 study
- Urban areas see costs at around $700-1,500 per home passed, while rural areas can range from $3,000-6,000, corresponding to a 4-fold increase

[1] FTTH cost to pass and connect data points represent different household deployment densities
Source: Bristol Virginia, Cincinnati Bell, Verizon, SNL Kagan, Google Fiber, Corning, Cartesian

# Case Study: Rural FTTH Deployment

Southwest Minnesota Broadband Systems reached many rural communities and demonstrates the effect of regulatory support of fiber deployment

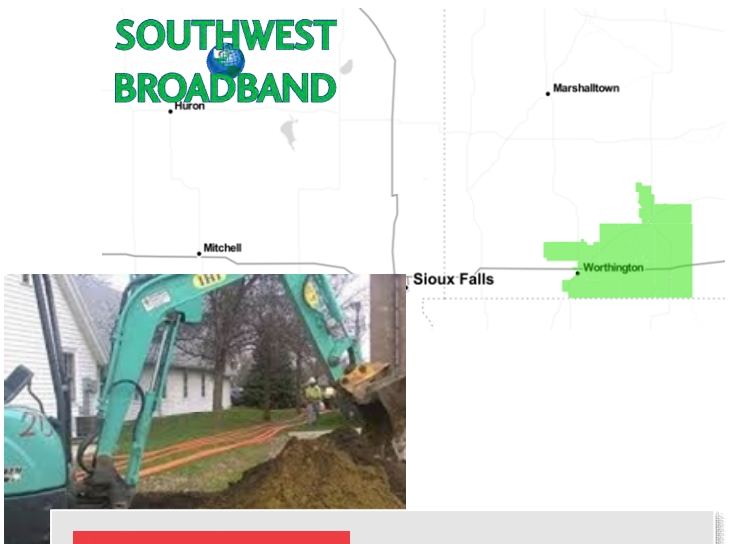
## BACKGROUND & CONTEXT

- Southwest Minnesota Broadband Systems (SMBS) is a consortium of several rural municipalities committed to increasing connectivity in the area
- Incumbent service providers in southwest Minnesota had not deployed any speeds faster than dial-up due to a poor business case
- SMBS received a $6.4M grant and a $6.4M loan through the Rural Utilities Service Broadband Initiatives Program to expand an existing FTTH network in nearby Windom, MN into surrounding communities

## CONSUMER IMPACTS & SYNERGIES

- WindomNet and SMBS helped keep a large employer that was using dial-up from leaving southwest Minnesota by connecting it with fiber
- The fiber network has helped expand 4G coverage in the area thanks to cheaper backhaul
- Consumer savings from having an alternative to satellite internet are estimated at around $200K a year

| SMBS FIBER AT A GLANCE | |
|---|---|
| Service Start Year | 2011 |
| FTTH Homes Passed | ~3.6K |
| FTTH Subscribers | ~1.9K |
| Total Cost of Project | $12.8M |
| Cost per Home Passed | $3.6K |
| Amount Received in Subsidy[1] | $6.4M |




**CITY PAGES**

"Asked if he'd still be in business without high-speed internet, Kent Kelly offers a blunt reply: "No." He's the general manager of Fortune Transportation, a testament to how even old-line industries like trucking are reliant on connectivity**… Fortune's success comes courtesy of WindomNet**… 'Pricewise, people here don't pay more than you do in a metro area,' says Kelly. 'But **the speeds are five to 10 times faster**.'" – City Pages, 2018

[1] Subsidy used for expansion of network rather than original build.
Source: Cartesian, ILSR, Muni Networks, SMBS, City Pages





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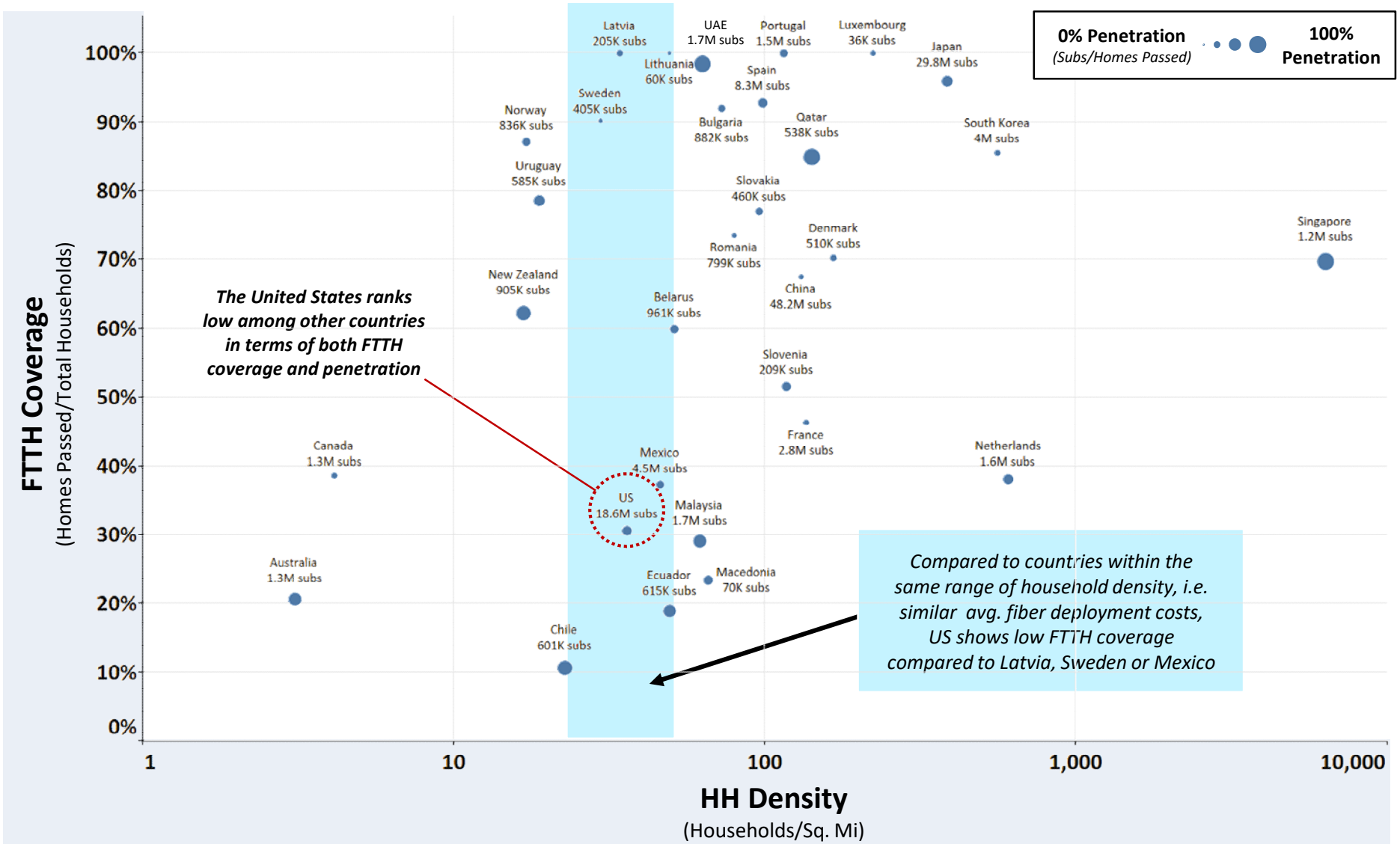
# Worldwide FTTH Developments

The US lags behind many other countries in terms of both HHs with access to fiber and fiber penetration rates




Source: Cartesian, FTTH Council, Euromonitor





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LONDON

NEW YORK

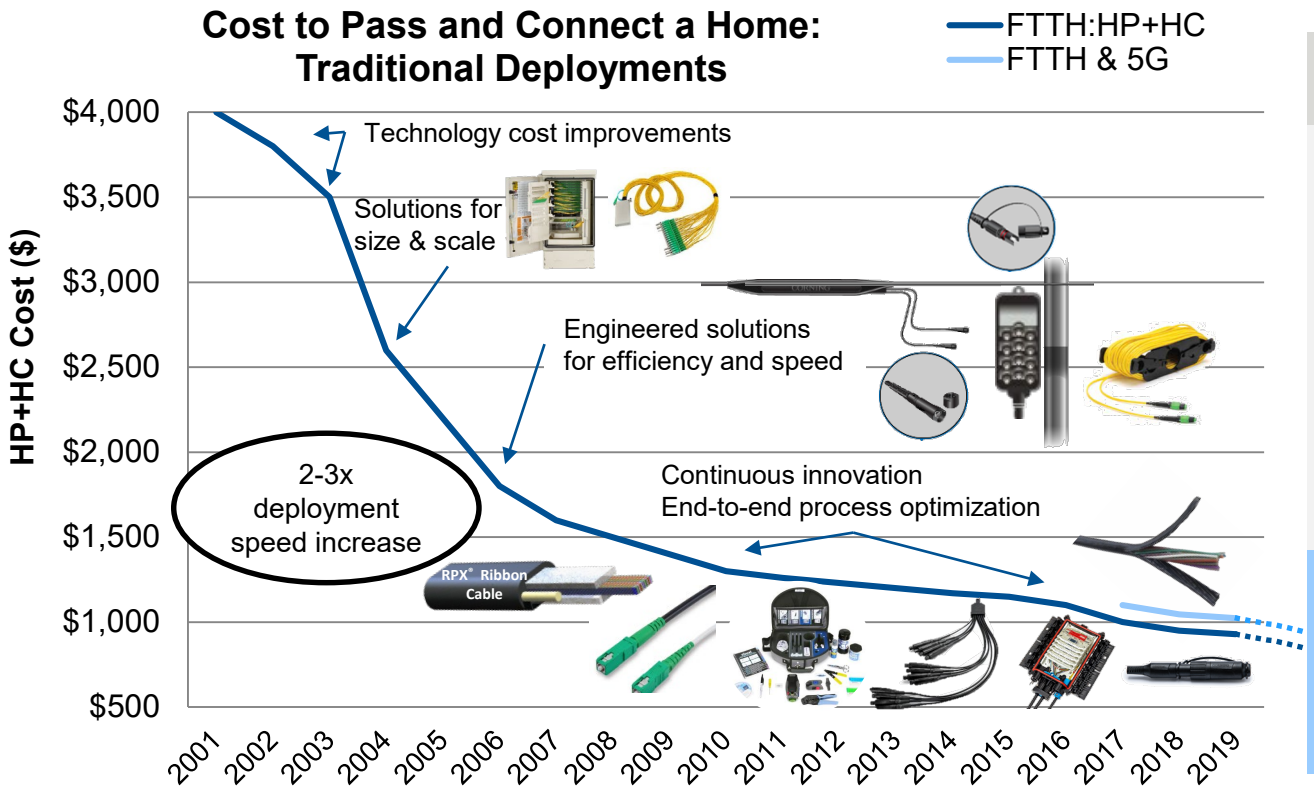
PARIS

CORNING

# Getting More Gigabit Service from the Rural Digital Opportunity Fund

Clark Kinlin
Executive Vice President
Corning Incorporated
December 19, 2019

# Corning invested $300M in RDE to Make FTTH Affordable



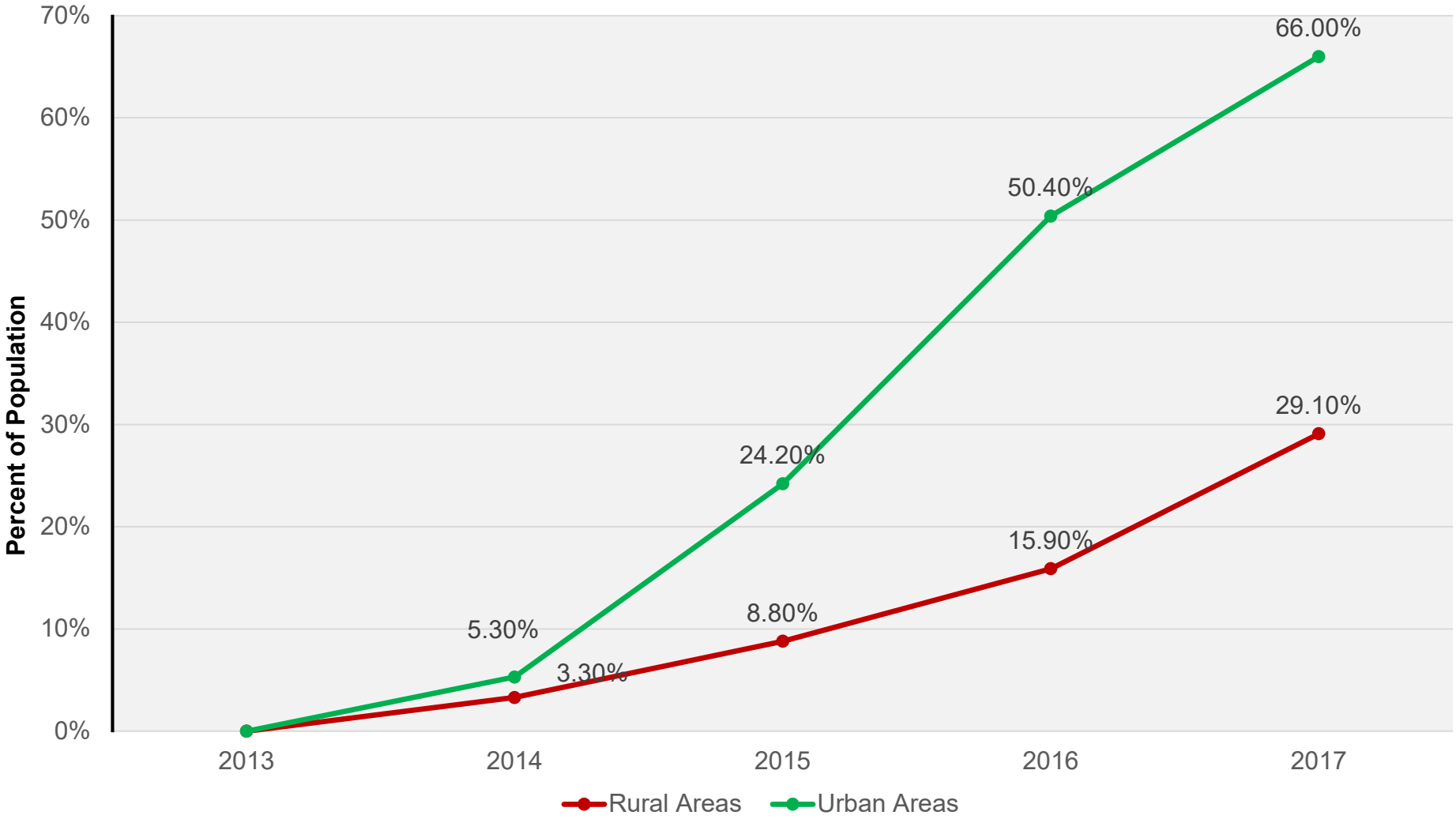

## Path to Rural Cost Savings

- Innovative pathway creation methods
- Lean fiber architectures
- Craft-friendly cables, closures, and connectors
- Smaller precon systems
- Design software systems

*Technology intended for Dense deployment challenges can be leveraged for Rural developments*

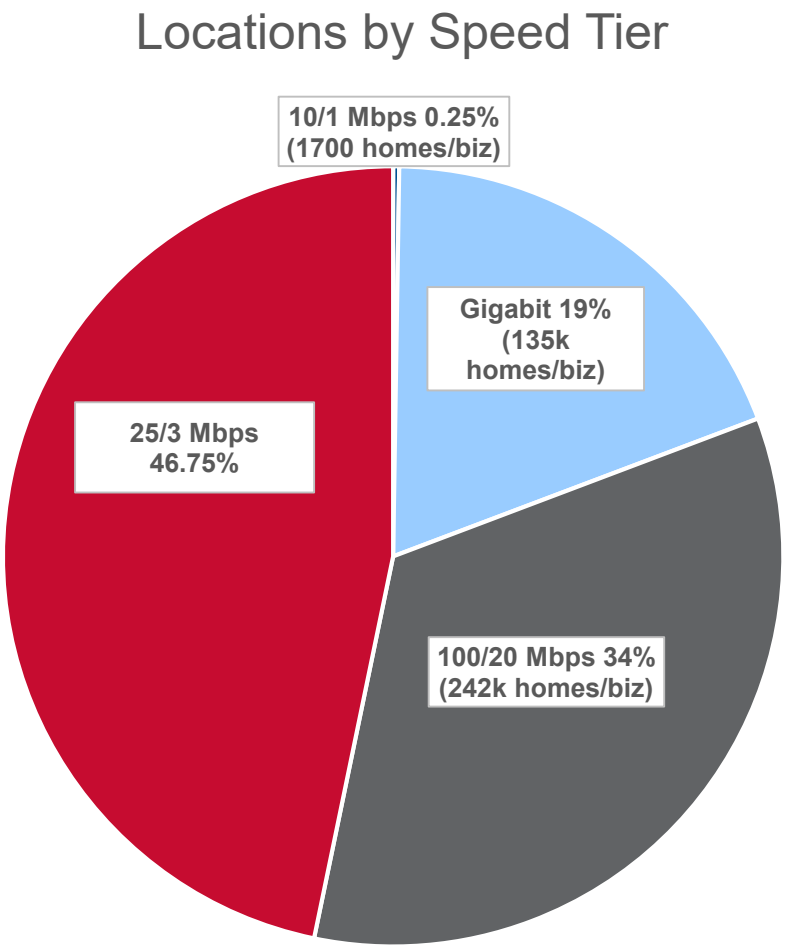
# RURAL AREAS LEFT BEHIND

## Percent of Population with Access to 250/25 Mbps Service (FCC data)




**Source: FCC 2019 Broadband Deployment Report, Figure 4. (250/50 Mbps=fastest category in report.)**

# CAF II Resulted in Little Support For Gigabit Services



# Proposed Change to Reverse Auction Process to Get Maximum Gigabit Service Within Budget

## CURRENTLY

When budget clears, auction continues, lowest-cost bidder wins – often the lowest performing.

## PROPOSED

When budget clears, highest performing bidder wins.

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