September 12, 2019

Via ECFS

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: Notice of *Ex Parte* Submission of the Fiber Broadband Association, WC Docket Nos. 19-126 and 10-90

Dear Ms. Dortch:

The Federal Communications Commission ("Commission") has been focused on developing policies to bridge the digital divide and bring residents, businesses, and institutions in unserved areas broadband service that is comparable to that received by urban consumers. To help further shape that mission, the Fiber Broadband Association recently released a study by the consulting firm Cartesian that finds that between reasonable additional actions by Congress, the Commission, and other government agencies, coupled with the efforts of private broadband providers, we can deploy future-proof, all-fiber networks to 90% of households in the next decade. By achieving this goal, we will ensure that rural consumers have full access to economic, social, and political opportunities to participate in and drive our country's future. These all-fiber networks also will be the underlying inputs for 5G and other next-generation wireless networks, smart communities, and IoT applications. The study is just a start, and the Fiber Broadband Association stands ready to support the Commission's efforts to make all-fiber networks a reality throughout the country.

On September 10, 2019, I emailed the study and our press release to Nirali Patel, Wireline Advisor to Chairman Pai; Aaron Goldberger, Wireless & International Advisor to Chairman Pai; Preston Wise, Special Counsel to Chairman Pai; Arielle Roth, Wireline Legal Advisor to Commissioner O'Rielly; Evan Swarztrauber, Policy Advisor to Commissioner Carr; Travis Litman, Chief of Staff and Senior Legal Advisor to Commissioner Rosenworcel; and Randy Clarke, Acting Legal Advisor for Wireline and Public Safety to Commissioner Starks. Both are attached.

This letter is being filed electronically pursuant to Section 1.1206 of the Commission's rules.[1]

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

Attachments: "All-Fiber Deployment Cost Study 2019, Executive Summary," Cartesian, Inc. (Sept. 10, 2019); "New Study Finds All-Fiber Deployments to 90% of Households Achievable in Next Decade," Fiber Broadband Association Press Release (Sept. 10, 2019).

cc: Nirali Patel
Aaron Goldberger
Preston Wise
Arielle Roth
Evan Swarztrauber
Travis Litman
Randy Clarke

[1] 47 C.F.R. § 1.1206.

New Study Finds All-Fiber Deployments to 90% of Households Achievable in Next Decade

Washington, DC (September 10, 2019) — Today, the Fiber Broadband Association and strategy consulting firm Cartesian released a study that explores the costs associated with deploying all-fiber networks to all households across the entire United States.

The study finds that:

- Today, we are on a pace to deploy all-fiber networks to about 50% of US households by 2025.
- These accelerated all-fiber builds are driven by increasing consumer demand for higher performance broadband, provider willingness to focus on long-term returns, and government efforts to lower barriers to deployment costs and provide targeted subsidies.
- By 2029, we can pass 90% of US households by increasing current spending on all-fiber networks by approximately an additional $70B. (Passing 80% of U.S. households with fiber will require spending approximately an additional $50B.)
- We can achieve this objective and ensure virtually everyone has access to future-proof networks through innovative deployment models, government efforts to lower access to essential infrastructure, and efficiently provided government support.

“Building all-fiber networks throughout America is not a pipe dream,” said Lisa R. Youngers, President and CEO of the Fiber Broadband Association. “We have long known that having access to all-fiber networks is far superior than other technologies in driving economic growth, social interaction, and political engagement. Now we know that deploying all-fiber networks to most parts of the country within the next decade is feasible. If we want to close the digital divide, it is essential that we make all-fiber networks a reality for all of America’s communities.”

More than 19 million Americans lack access to broadband — and the vast majority live in rural communities. In fact, 24% of rural Americans lack access to 25 Mbps service, but less than 2% of urban Americans lack this same broadband access. Deploying fiber in rural communities will be a key step to solving the digital divide in the United States.

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About the Fiber Broadband Association
The Fiber Broadband Association is the largest and only trade association in the Americas dedicated to the pursuit of all- fiber-optic network infrastructure to the home, to the business and to everywhere. The Fiber Broadband Association helps providers make informed decisions about how, where, and why to build better broadband networks with fiber optics while working with its members to lead the organization forward, collaborate with industry allies and propel the deployment of fiber networks. Since 2001, these companies, organizations and members have worked with communities and consumers in mind to build a better broadband future here and around the world. Learn more at fiberbroadband.org.

Media Contact
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akeeney@glenechogroup.com

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

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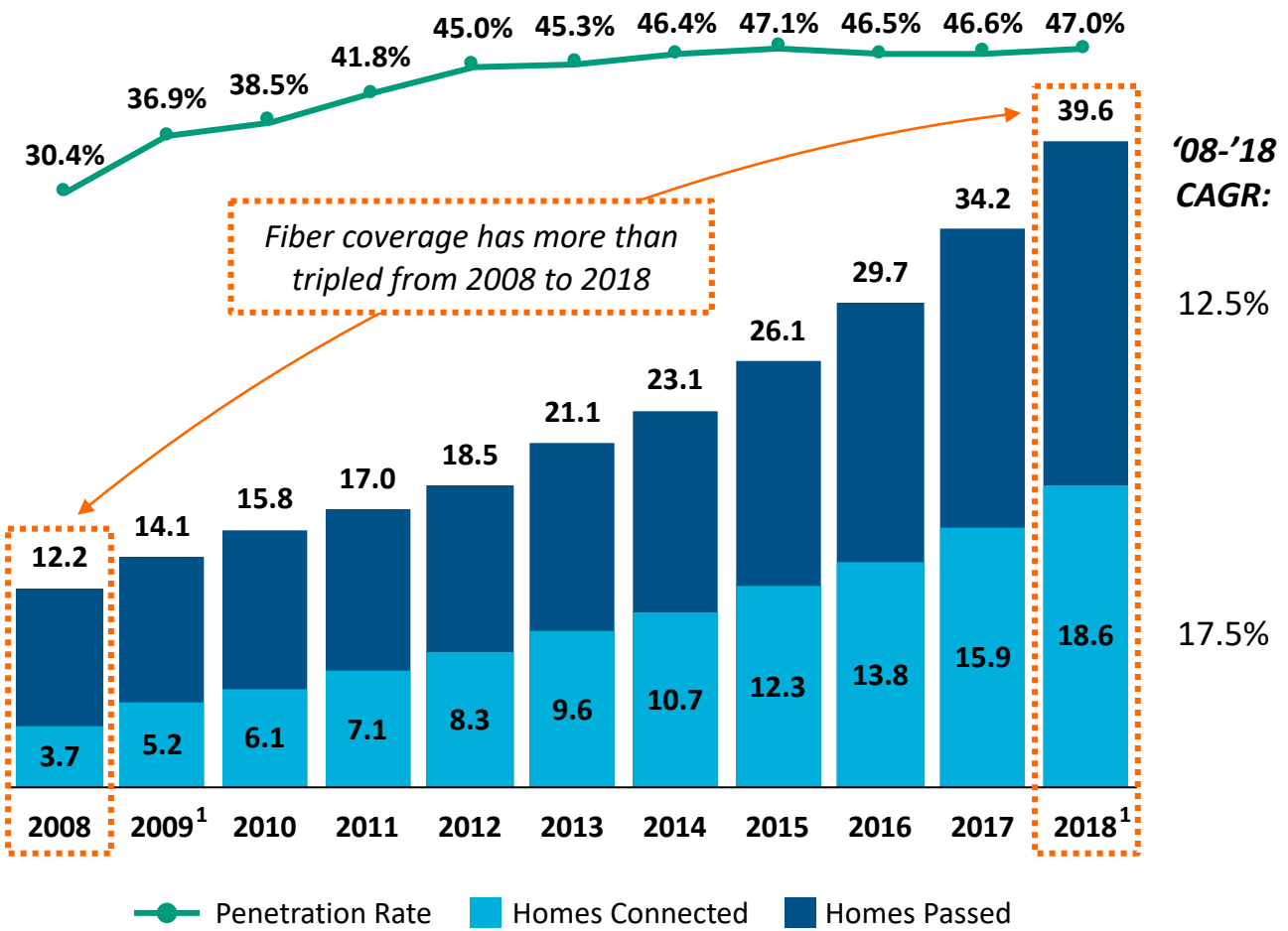
US Market Developments

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

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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*

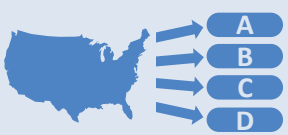
"**Government funds and partnerships** with utility companies and municipalities have helped to keep the cost down in the most rural areas. These rural areas show **very high take-up rate** which also helps the business case for those deployments."
– *Mid-Atlantic Rural Fiber Provider*

"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 • 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 • 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 • Using data points collected from interviews and past cost benchmarks, we developed a regression model to estimate cost to pass based on HH density • 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 • We projected penetration rates in 2025 and used that to estimate the total cost to connect • Total investment equals total cost to pass and cost to connect

Source: Cartesian

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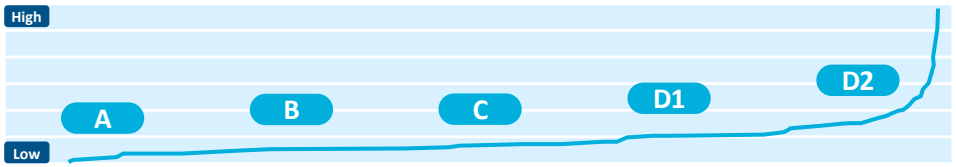
Estimated FTTH Investment Required

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

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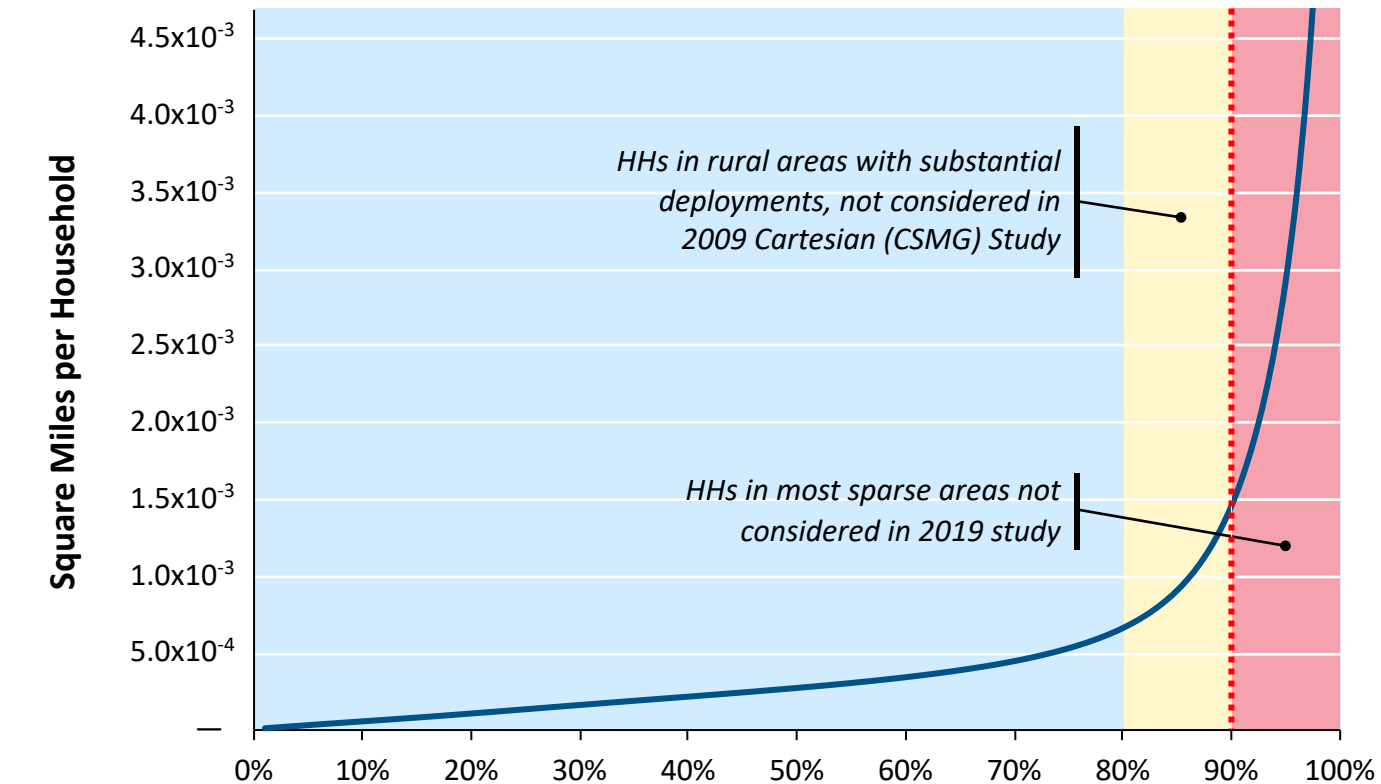
US Household Density Cutoff

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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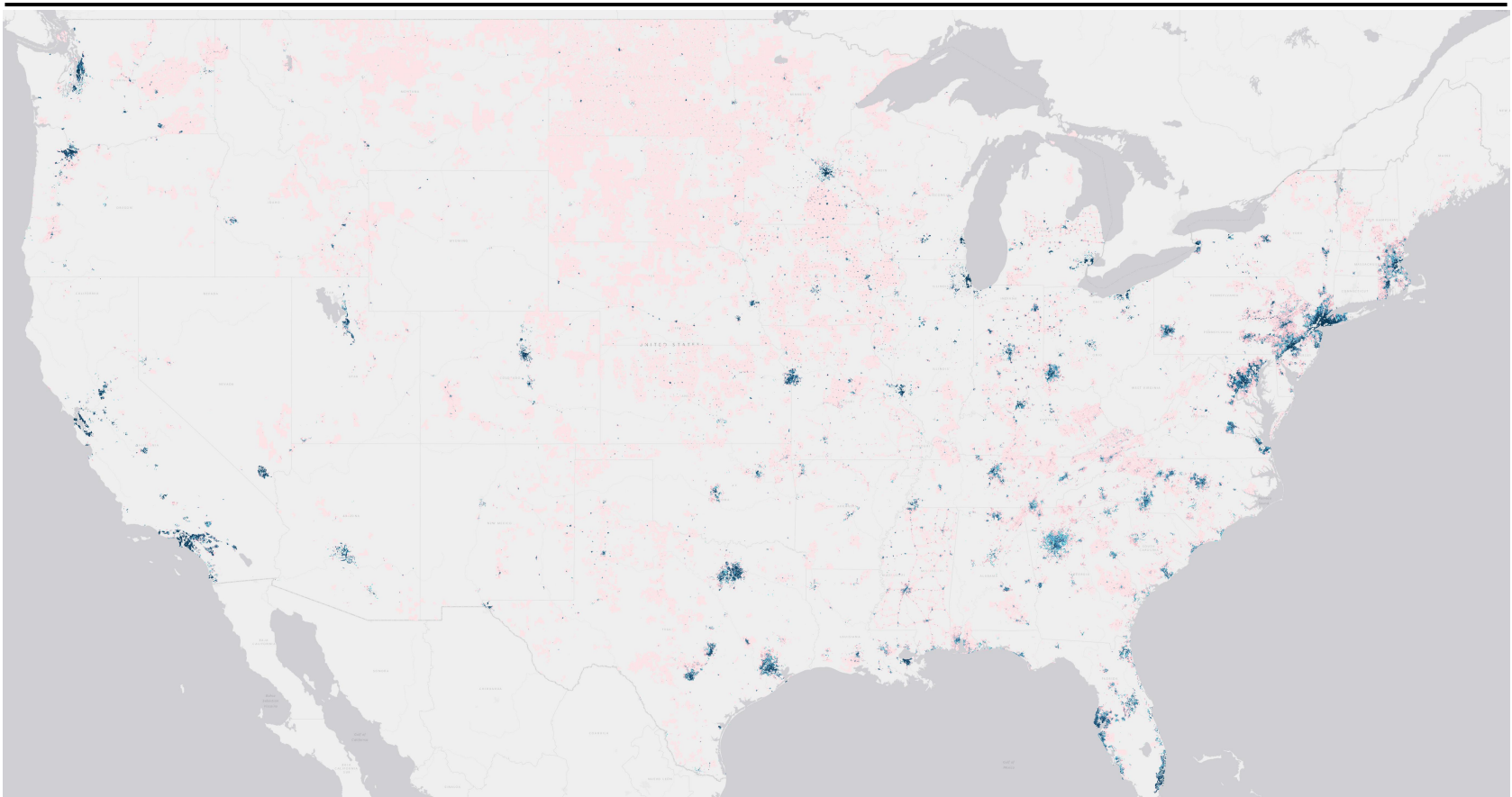
FTTH Map

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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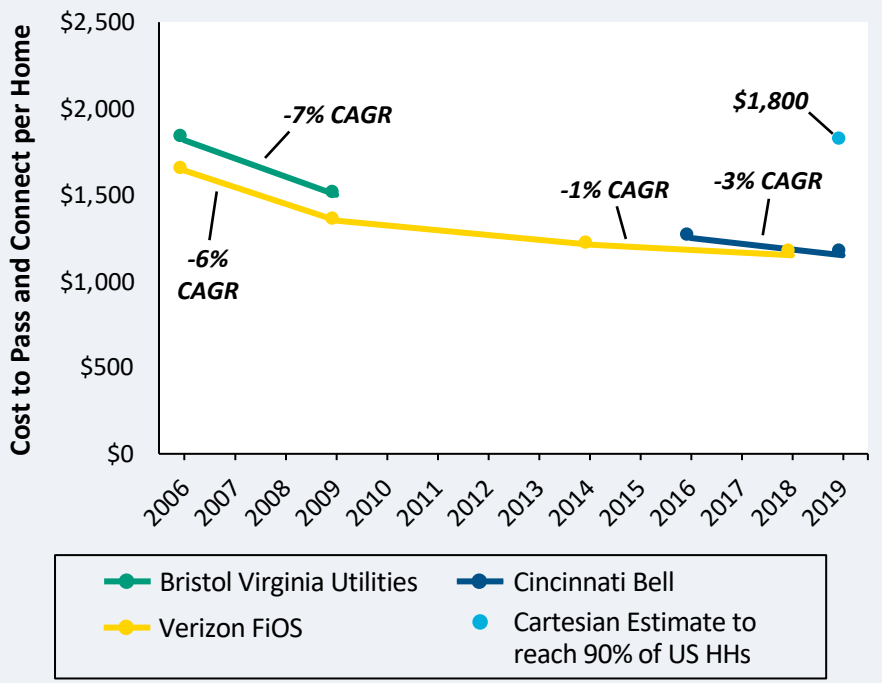
FTTH Cost Drivers

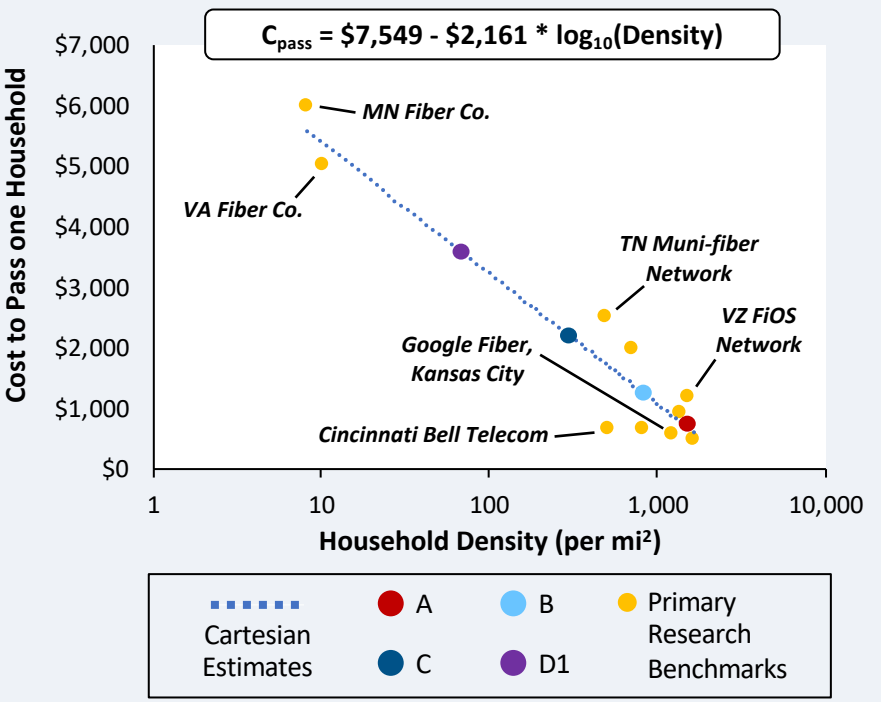
FTTH deployment costs have remained roughly the same over the past several years and are primarily dependent on HH density

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

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Case Study: Rural FTTH Deployment

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

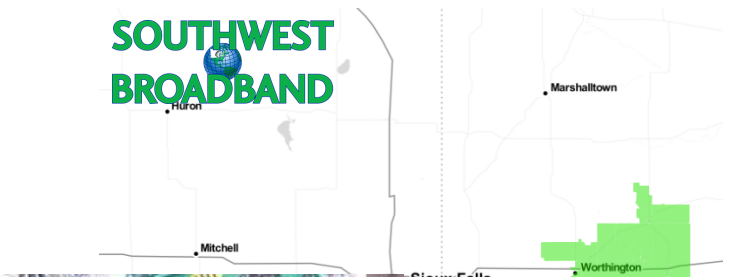
BACKGROUND & CONTEXT

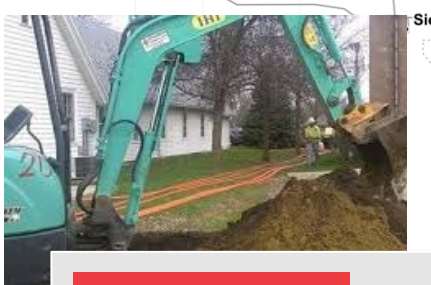
- Southwest Minnesota Broadband Systems (SMBS) is a consortium of several rural municipalities committed to increasing connectivity in the area
- Incumbent service providers in southwest Minnesota had not deployed any speeds faster than dial-up due to a poor business case
- SMBS received a $6.4M grant 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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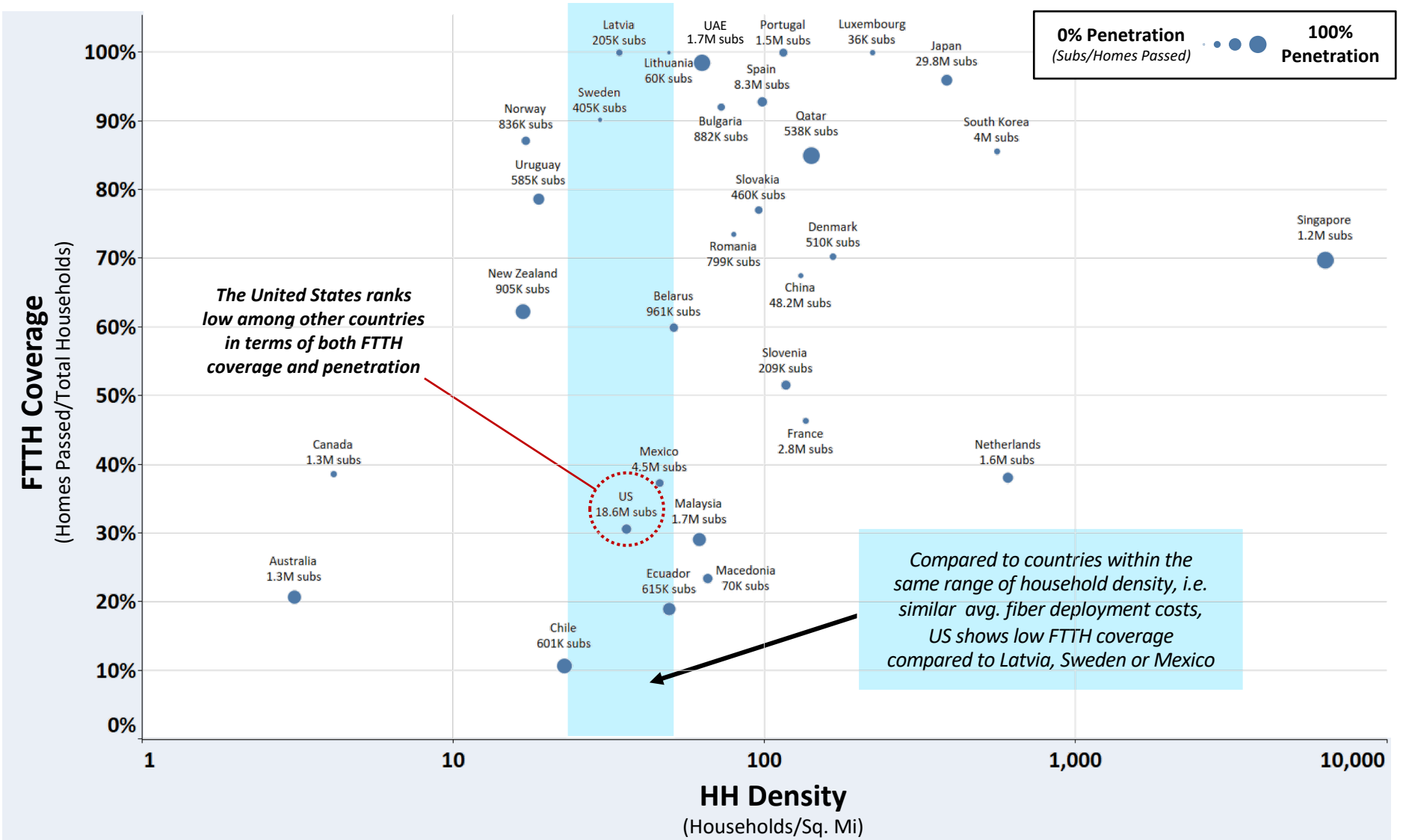
Worldwide FTTH Developments

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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