Environmental and Energy Study Institute

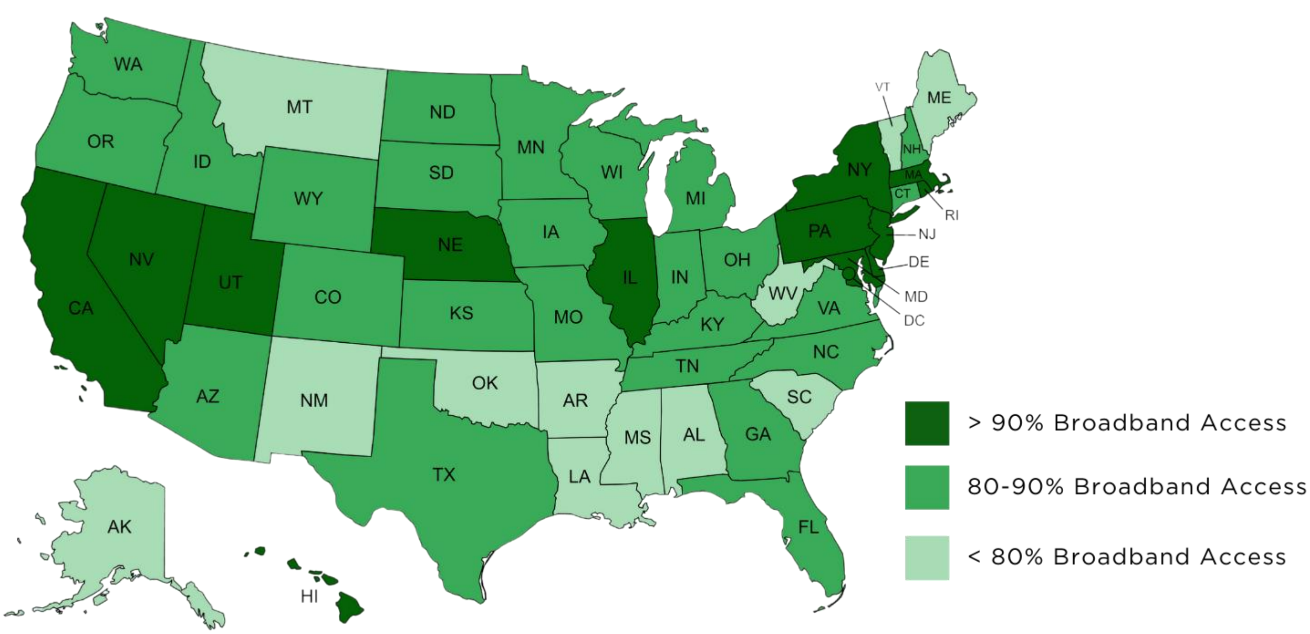
Issue Brief

Closing the Digital Divide: How Rural Broadband Benefits Communities and the Climate

October 2021

In 2019, at least 14.5 million Americans lacked broadband (or high-speed internet) access, with rural communities and tribal lands bearing a disproportionate share of the burden. The inaccessibility or unaffordability of broadband leads to the "digital divide" phenomenon—the socioeconomic gaps that arise between communities that have reliable access to high-speed internet and those that do not. A lack of broadband access often exacerbates the pre-existing burdens of underserved communities by impacting services that increasingly depend on the internet, including education and healthcare. Broadband also facilitates many energy-efficiency technologies that reduce carbon emissions and save customers money. In other words, broadband expansion is essential to a successful transition to a clean energy economy. This issue brief will explore the current state of U.S. internet access, how more broadband deployment could improve the equity and well-being of communities, the potential for broadband to unlock greater energy efficiency, and what the United States has accomplished so far in closing the digital divide.

Percent of Population with Broadband Access



Graphic By: Jaxon Tolbert and Sydney O'Shaughnessy

Environmental and Energy Study Institute

What is Broadband?

Broadband is the infrastructure that connects users to the internet at high speeds and allows them to share data between devices. In 2015, the Federal Communications Commission (FCC) established a minimum broadband standard of 25 megabits per second (Mbps) download speed and 3 Mbps upload speed (the 25/3 Mbps standard). The United States Government Accountability Office (GAO), however, is among the organizations that consider this standard likely too slow to meet the internet needs of many users.[1] Broadband services can be delivered using a wide variety of technologies, including through cable, DSL (digital subscriber line), fiber-optic, satellite, and wireless (both fixed and cellular).[1]

Types of Broadband

Satellite: Satellite internet is the only high-speed internet option available to approximately nine million Americans. These are primarily customers in remote rural areas, since satellite internet does not rely on ground infrastructure beyond a dish. Satellite internet speeds typically range from 12 to 100 Mbps, but they can vary due to signal transmission time delays or weather obstructions. While satellite internet is the most widely available form of broadband, it becomes an increasingly expensive option if faster speeds are required.[2]

DSL (Digital Subscriber Line): DSL internet is an older form of broadband in which service can be transmitted through existing telephone lines. DSL's utilization of pre-existing telephone infrastructure makes it a more affordable option, and it is more commonly available in rural areas lacking significant broadband infrastructure.[2] While DSL internet is often less expensive than other broadband options and available to nearly 89 percent of the country, only 42 percent of Americans have access to DSL that meets the FCC's minimum for broadband.[2]

Fixed Wireless: Fixed wireless internet is another viable broadband option for rural areas that works similarly to satellite internet, though it typically uses a small antenna rather than a satellite dish. Fixed wireless speeds range between 5 and 50 Mbps, though providers can deliver point-to-point fixed wireless speeds of 200 Mbps or higher to multifamily residential buildings.[2]

Cellular Wireless: Cellular wireless connects users to the nearest cellular tower, typically through the use of a smartphone. While cellular availability in more developed rural areas exceeds 95 percent on the most widespread network, download speeds only peak at 20 Mbps, with upload speeds peaking at 5 Mbps.[3] Cellular coverage in remote areas is less than 84 percent, even on the best network, delivering upload download speeds of only 12.3 Mbps and upload speeds of less than 4 Mbps.

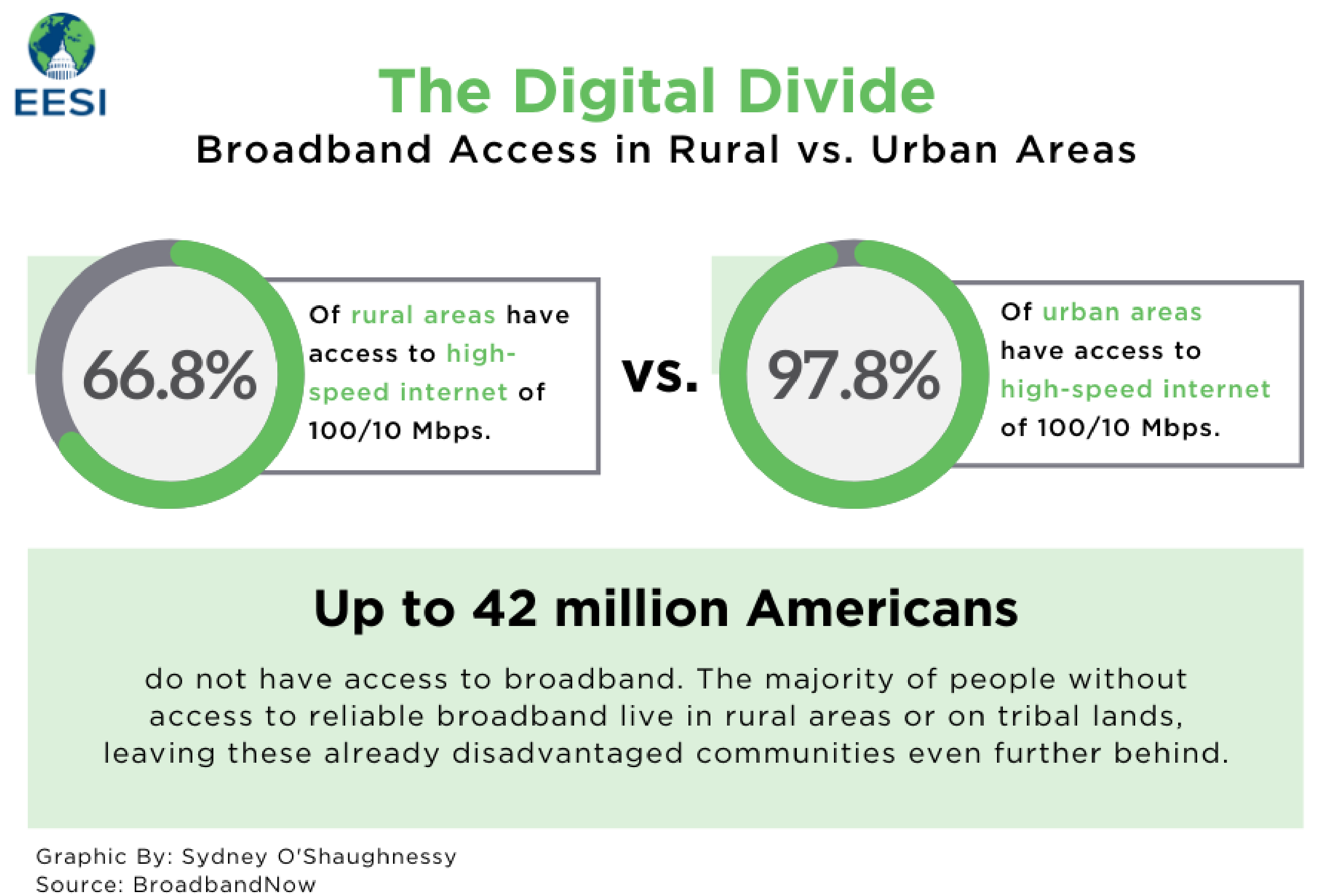
Cable: Cable internet is one of the most common and affordable types of broadband, with nearly 90 percent of the U.S. population having access to it. Cable internet is delivered via the same coaxial cables as cable television and is frequently included as part of a phone and TV service package from many providers. With download speeds of up to 940 Mbps and upload speeds of at least 50 Mbps, cable is one of the fastest forms of broadband.[2]

Fiber: Fiber-optic internet is the quickest and most dependable type of broadband available. Service is delivered to a home via a ground-laid fiber optic cable that transmits data as light pulses along thin strands of plastic or glass. Although fiber-optic download speeds can reach 2,000 Mbps, most providers offer maximum speeds of around 1,000 Mbps. The most significant limitation of fiber is its low rate of accessibility, with only about 45 percent of U.S. households having access to it, primarily in highly urban and suburban areas. Approximately 24 percent of rural households have access to fiber internet.[2]

Rural America's Lack of Universal Broadband Access

According to the FCC's 14th *Broadband Development Report*, more than 14 million Americans, or about 4 percent of the U.S. population, lacked access to the minimum 25/3 Mbps broadband standard in 2019.[4] This number was likely an underestimate. As many as 42 million Americans may lack broadband access, according to a study by BroadbandNow that points out inaccuracies in past FCC mapping data.[5] For example, until 2020, FCC maps counted all houses in a census block as adequately served if only one home in the area had internet service.

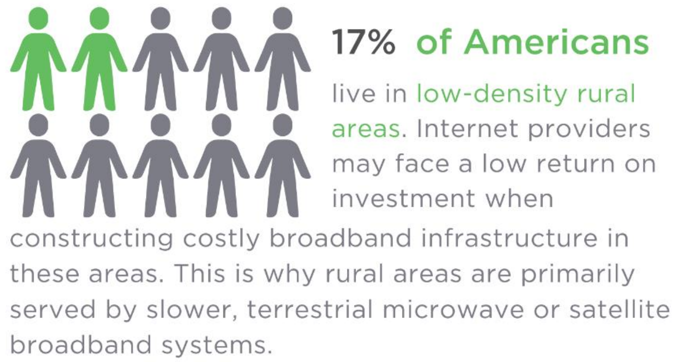
According to the FCC's report, rural and tribal communities experience the lowest rates of broadband access.[5] For example, in 2019, 98.8 percent of urban areas had access to 25/3 Mbps internet, compared to 82.7 percent of rural areas and 79.1 percent of tribal lands. This disparity becomes more pronounced with faster broadband services, with 97.8 percent of urban areas having access to 100/10 Mbps internet, compared to only 66.8 percent of rural areas and 63.7 percent of tribal lands.



A January 2021 statement by the FCC noted that the digital divide is closing quickly, as the percentage gap between urban and rural rates of access to 25/3 Mbps has decreased by 14 points between the end of 2016 and the end of 2019.[6] The statement notes that this increase is primarily due to expansion efforts by fixed and mobile providers. However, despite these recent advancements in broadband progress, the rural-urban disparities in broadband access are still significant, especially at higher internet speeds.

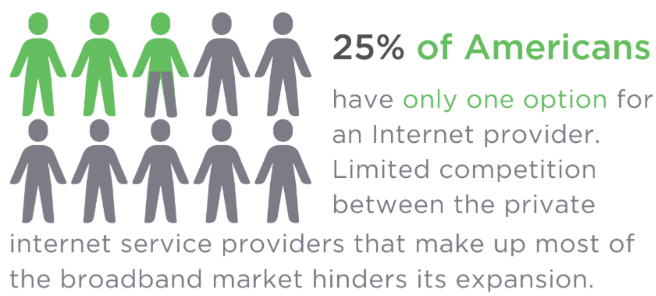
Factors Leading to Broadband Disparities

Geographic Divides: More than 57 million people, about 17 percent of the U.S. population, live in a low-density rural area.[7] Rural areas present unique challenges to broadband deployment. Because of low population densities and often rugged terrain, providers may face a low return on investment when constructing costly broadband infrastructure such as cable or fiber in rural areas. Ongoing network and maintenance costs are also a concern. In 2017, the FCC estimated that it would cost $40 billion to build out broadband networks to 12 of the remaining 14 percent of residential and smaller commercial locations that lacked 25/3 Mbps service—but that it would cost an additional $40 billion to reach the final two percent. Additionally, the final two percent of these locations would require $2 billion in continued annual funding for maintenance costs after a fiber or cable buildout, as subscriber revenues in these low-density areas would not be sufficient to cover network costs.[8]



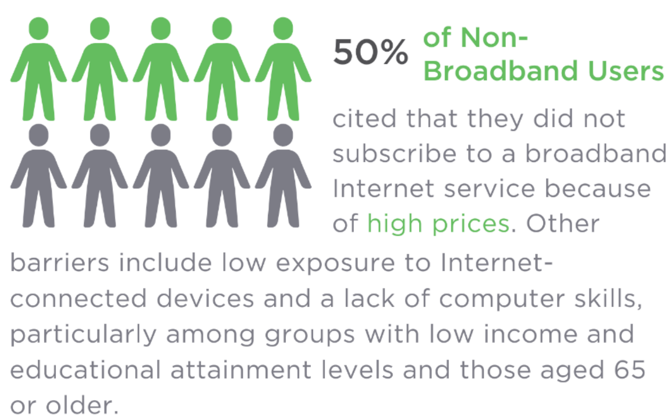
Graphic by: Sydney O'Shaughnessy

Competition: Limited market competition between private internet service providers (ISPs) that make up most of the broadband market also hinders broadband expansion. In 2018, four private companies—AT&T, Charter Communications, Comcast Corp, and Spectrum—made up 66 percent of U.S. broadband market share, with 73.9 million subscribers between them.[9] The top 12 private ISPs claimed 85.6 percent of the internet subscriber market share, or 95.8 million subscribers. The Government Accountability Office reported in 2017 that competition between private ISPs was limited in non-urban and lower-density areas.[10] The report also noted that factors limiting competition include high barriers to entry (because of the large investments needed to install wires, cables, and other broadband infrastructure), combined with a lower return on investment in less populated areas. Obtaining permits to access existing infrastructure, such as utility poles, is difficult, and mergers are reducing the number of competitors, resulting in limited provider choices for customers.



Graphic by: Sydney O'Shaughnessy

Affordability: Even if broadband service is available in an area, high prices may stop customers from signing up for it. According to a study of non-broadband users by the Pew Research Center, high monthly subscription cost was the most-cited reason (50 percent of respondents) for not having broadband at home, followed by exclusive reliance on smartphones, the ability to access internet outside of the home, and the high cost of purchasing a computer.[11] The other factors causing broadband disparities, particularly limited competition among ISPs, keep prices high.



Graphic by: Sydney O'Shaughnessy

Socioeconomic Status: Rural communities often experience higher rates of poverty and lower levels of educational attainment,[12] and the digital divide disproportionately impacts communities of lower financial status, lower educational levels, and communities of color.[13] Broadband is in 72.8 percent of households with annual incomes below $50,000, compared to 93.5 percent of households making more than $50,000.[14] Age is another factor, as those under 24 years of age are less likely to be able to afford broadband service payments and those aged 65 or older are more likely to lack computer skills. Additionally, lower broadband demand in low-income communities and communities of color may result in profit-based discrimination: broadband services do not expand to these communities because they expect returns will be low. For this reason, addressing the cost-benefit factor is a necessary part of successful broadband expansion.

Impacts of the Digital Divide

Educational Impacts: Lack of broadband access adversely affects the education system. Fifty percent of eighth-grade students in rural areas and 58 percent of all U.S. students reported that they use the internet at home to do homework almost every day.[15] However, in 2018, 35 percent of teens said they had to do their homework on a cellphone, 17 percent were unable to complete homework assignments, and 12 percent had to use public Wi-Fi for schoolwork because of a lack of broadband access at home.[16] These divides were worsened by the COVID-19 pandemic, as schools switched to teaching online. Multiple reports surfaced of students in rural and underserved urban communities accessing their online classes and homework from parking lots with Wi-Fi.[17]

Economic Impacts: Increased broadband access contributes to job and population growth, lower unemployment rates, and more business formation.[18] Farming operations also benefit from higher broadband adoption, with one study finding that increasing broadband deployment could lead to a three percent increase in farm profits.[19] The U.S. Department of Agriculture estimates that universal broadband deployed in tandem with digital farming technologies could create an extra $47 to $65 billion in the United States economy.[20]

Increased access to broadband could also help address the disproportionately high rural energy burden. The share of annual income spent on energy, or energy burden, is 4.4 percent for rural areas, compared to 3.3 percent for urban areas.[21] This disparity is more pronounced for rural low-income households, whose energy burden is three times greater than the burden for higher-income rural households. Reasons for higher rural energy burdens include older homes, energy-inefficient heating systems, chronic economic hardship due to low income, and a lack of financial assistance and energy efficiency programs in rural areas. Smart energy devices could help alleviate energy costs, but they are currently out of the question for homes without broadband.

Public Health Impacts: Quality healthcare is increasingly dependent on the internet. Electronic health records, exchanges between healthcare providers and patients, and online health services like telemedicine are on the rise.[22] Telemedicine can be an effective stop-gap tool to serve rural communities facing shortages of local healthcare providers. For this and other reasons, a recent article in the *American Journal of Public Health* declared broadband access to be a social determinant of health.[23,24] The deployment of broadband in rural areas, tribal lands, and other burdened communities serves to improve the socioeconomic conditions that affect the overall health of entire regions.

Energy and Precision Technology Requiring Broadband

Smart Devices

Smart home energy devices are increasingly common and can help their users save energy and money. They include new models of thermostats, heat pumps, electric water heaters, and other appliances that connect to the home's internet service. Smart thermostats, for example, are expected to account for 70 percent of the thermostat market by 2022.[25] Consumers can adjust smart devices according to their needs and make optimization decisions to reduce energy consumption. The Information Technology Industry Council reports that the United States could reduce energy use between 12–22 percent by taking full advantage of currently available internet-connected efficiency upgrades.[26]

Many of these smart devices require high-speed broadband service to function optimally.[27] For example, some residential renewable technologies, like solar inverters, may require broadband access to monitor and manage the flow of energy to a building.[28] The savings provided by more intelligent energy devices are thus inaccessible to the many who lack access to broadband in rural areas and tribal lands—including public institutions like hospitals and schools.

Precision Agriculture

Broadband also allows for precision agriculture, or the use of sensors and data collection on farms to improve resource use efficiency, yield, and profitability. For example, sensor-based irrigation systems optimize the volume of water used and the time taken to water crops, saving on water and costs. Yield monitors, another internet-requiring precision technology, provide farmers with data on grain yields, moisture levels, and soil properties, and could save them $25 per acre on input costs.[29] The implementation of broadband in agricultural spaces allows farmers to use precision farming technologies that benefit their operations and the larger economy.

Smart Grids

Smart energy technologies deployed throughout the grid, both in front of and behind the meter, can create benefits that reach beyond the location of their installations. Smart energy devices use broadband to send information back to the grid and grid operators (when authorized by the consumer), which improves utility load management, forecasting, and energy savings.

Electric utilities can run demand-side management (DSM) programs that provide consumers with financial incentives to encourage energy efficiency.[30] DSM programs encourage customers to modify their usage patterns to reduce their costs and empower utilities to actively manage energy loads and shift electricity where it is most needed on the grid. Demand-response (DR) programs are a type of DSM aimed at reducing customer demand during peak times or energy emergencies. By reducing peak electricity demand, utilities can rely less on expensive power from peaker plants and limit the need to invest in new power plants. Demand-side energy efficiency programs saved 32.8 million megawatt-hours in 2019.[31]

Electric vehicles (EVs), which can be used for energy storage, also call for a form of internet access. Two-way communication between EVs and the grid, enabled by broadband, will allow the grid to balance energy loads and charging times and optimize the deployment of public EV charging stations.[32] Utilities could also implement time-of-use pricing and other DSM programs to help avoid demand spikes in the evening when most EVs return home and are plugged for charging.

A broadband-connected network of grid-enabled smart devices increases utilities' control and knowledge of the grid, giving utilities increased forecasting and peak optimization abilities. Sensors that gauge grid stability and respond using a smart device network can lead to a more resilient distribution system that reduces outages and is better prepared for storms and natural disasters. Combined cost savings could be even more significant than individual savings when smart devices share information on the grid.[33]

Broadband improves communication between the customer and utility in a smarter grid, which benefits both parties. When done effectively, this communication improves trust between customers and their utilities, increasing customer willingness to participate in utility programs and helping utilities provide better service.[34]

Rural and Tribal Broadband Deployment Initiatives and Challenges

The widespread availability of broadband would provide many benefits, including the ability to roll out smart grids throughout the nation, with all their efficiency and resilience benefits. But high deployment costs and low population densities have disincentivized private internet providers from expanding broadband to many rural and tribal communities. Industry experts also cite the high cost of broadband deployment, which can cost $27,000 per mile of fiber-optic cable, as one of the most imposing barriers to deployment.[35,36] Supply chain concerns can also emerge, with lead times for buying fiber technology from foreign producers as high as one year. And broadband initiatives can have trouble receiving federal funds on time, even when approved for a grant or loan.

As a result, many municipalities, tribal governments, and local electric cooperatives (co-ops) have pursued independent broadband investments. They can also deploy broadband through public-private partnerships, where local laws allow for them.[37]

Tribal Broadband Initiatives and Challenges

Barriers for emerging, non-private internet service providers can be substantial, especially for tribal nations. From 2010 to 2017, only 0.6 percent of FCC funding and 11 percent of the USDA's Rural Utilities Service (RUS) funding for broadband services were allocated directly to tribes or to tribally-owned providers.[38] Many of the barriers to financing that tribes face are regulatory. For example, as of 2018, only 11 out of 573 tribes had ISPs designated as an eligible telecommunications carrier (ETC) under the FCC's Connect America Fund (CAF), the most significant source of federal funding for high-speed internet access. When the FCC investigated whether it could make CAF support payments to tribes without an ETC designation, it concluded that the authorizing statute prohibited it from doing so. Tribes also encounter barriers when applying for RUS grants, such as difficulty preparing the proposed network design, demonstrating the financial sustainability of the broadband project, and obtaining matching funds for grants.

The GAO identified seven tribes that leveraged partnerships with private and tribally-owned ISPs, an electrical cooperative, a community access provider, and a regional consortium to improve broadband service in their communities. However, these partnerships relied on funds originating in the *American Recovery and Reinvestment Act of 2009* (P.L. 111-5) that are no longer available.[39]

Municipally-Owned Broadband Initiatives and Challenges

Municipally-owned, citywide fiber-optic networks, known as fiber-to-the-home (FTTH) services, provide many benefits, including increased access to jobs and economic development, improved utility efficiency, and city cost savings on energy.[40,41] For example, in Chattanooga, Tennessee's municipal broadband network created approximately 5,200 new jobs, generated $1.3 billion in community economic benefits between 2011 and 2015, and continues to save the city an estimated $500,000 per year in potential ISP service fees. The Institute for Self-Reliance has identified over 50 municipally-owned FTTH services across 28 states.[37] Costs to build the programs ranged from $750,000 to $500 million, depending on population size (which ranged between 150 and 453,000). The programs were funded through revenue bonds, grants, loans, and other methods.

Municipalities can also face a range of barriers to deployment, including state government roadblocks. For example, 18 states have legislation that hinders the establishment of public broadband, while an additional five states have legislation that limits public broadband to a lesser degree.[42] These laws range in their restrictions, from limiting public funds for public-private broadband partnerships to preventing municipal service if a private ISP offers service in the municipality's jurisdiction, regardless of the quality or price of the service. Other laws prohibit municipalities from selling broadband directly to the consumer through a retail model and instead require a wholesale model, where the city must sell to a third party that then sells to the consumer.

Broadband Through Rural Electric Cooperatives

Electric cooperatives (co-ops) are non-profit utility service providers, often located in rural areas. Over 900 co-ops provide 12 percent of U.S. electricity and cover service areas that span more than 50 percent of the country's landmass.[43] Over 200 electric co-ops are deploying internet services through various broadband technologies, with 90 of these using fiber broadband.[44,42]

For more information on how electric cooperatives can implement broadband, see EESI's case study on the Orcas Power and Light Cooperative on-bill program. www.eesi.org/obf/case-study/OPALCO

The National Rural Electric Cooperative Association (NRECA) surveyed 20 electric co-ops across 16 states that have deployed broadband infrastructure in their communities.[45] While the methods and technologies used varied by location, the co-ops invested $700 million in broadband infrastructure, laying a total of 26,900 miles of cable to provide internet service. As a result, 100,000 subscribers gained broadband service at a 42 percent take-rate. The service areas were low density, with a weighted average of 7.5 members per mile of electric line. The co-ops also received a total of $150 million in federal, state, and local grant funding to help cover the high deployment costs. Such funding can enable electric co-ops to provide affordable internet to their unserved communities.

Existing Federal Broadband Support Programs

The federal government houses its existing broadband expansion initiatives primarily in the Federal Communications Commission (FCC), the Rural Utilities Service (RUS) within the U.S. Department of Agriculture (USDA), and the Department of Commerce's National Telecommunications and Information Administration (NTIA). The FCC houses the largest share of federal support. Federal investments in deploying broadband to unserved and underserved areas totaled about $47.3 billion from 2009 to 2017.[46]

June 2021 marked the announcement of an interagency agreement between FCC, USDA, and NTIA to share information and coordinate broadband development funding.[47]

Federal Communications Commission (FCC)

The largest share of broadband support funding between 2009 and 2017 came from the Federal Communications Commission. The FCC's Universal Service Fund provides support through mechanisms that target four types of communities: low-income customers, healthcare providers, schools and libraries (supported through the E-Rate Program), and high-cost areas of deployment, which are often rural.[48,49] Between 2009 and 2017, $41.7 billion was allocated to high-cost areas, through programs such as the Connect America Fund that subsidizes ISPs building infrastructure in unserved areas and a Mobility Fund that supports mobile broadband service in rural areas.[45, 50] The FCC's programs targeting high-cost areas now include the Rural Digital Opportunity Fund, established in January of 2020 to further support broadband deployment in rural areas where service speeds are less than 25/3 Mbps.[51] The Rural Digital Opportunity Fund is committed to deploying high-speed broadband to over 5.2 million residents and businesses over a ten-year period, while the Connect America Fund has expanded broadband access to over 5.5 million locations as of the end of 2020.[52,53]

National Telecommunications and Information Administration (NTIA)

The *American Recovery and Reinvestment Act of 2009* was the first significant broadband investment legislation in the United States. It allocated $7.2 billion for broadband deployment to programs within the National Telecommunications and Information Administration (NTIA) and the Rural Utilities Service; it made up the entirety of NTIA's share in federal broadband investments from 2009 to 2017. In addition, the Act gave $3.3 billion to the NTIA to provide grants through the Broadband Technology Opportunities Program (BTOP).[54] BTOP awarded grants to 116 private, non-profit, state, and municipality broadband infrastructure projects for both residents and public institutions like libraries and universities. All but two projects were completed as of November of 2020.[55]

In 2016, NTIA reported that BTOP led to 117,072 miles of new and upgraded broadband infrastructure. It also reportedly connected 14,149 homes and businesses and about 26,000 public institutions such as schools, libraries, and healthcare centers to high-speed internet service.

Rural Utilities Service (RUS)

The USDA's Rural Utilities Service funds a variety of grants and loan programs for rural infrastructure. About $2.2 billion from the *American Recovery and Reinvestment Act of 2009* funded grants for a Broadband Initiatives Program, which primarily funded broadband infrastructure projects in rural areas and is no longer active.[56] The Broadband Initiatives Program reportedly improved or added broadband infrastructure for 334,830 subscribers through 66,521 miles of fiber-optic cable and 5,468 wireless access points.

RUS also houses the Community Connect Grant Program, which provides grants for broadband deployment in rural areas where service does not exist. RUS loan programs for broadband include the Rural Broadband Access Loan Program, the Telecommunications Infrastructure Loans Program, and loans included in the Broadband Initiatives Program.[57,58] Overall, RUS provided about $4 billion in loans to private providers for rural broadband deployment, loans that were repaid to the government with interest.

RUS launched the Rural e-Connectivity Pilot Program "ReConnect" in 2018.[59] The program was created through the *Consolidated Appropriations Act of 2018* (P.L. 115-141) and was originally given a budget authority of $6 billion to provide loans and grants to electric cooperatives, private corporations, and state, tribal, and local governments for rural broadband deployment.[60] An additional $550 million was provided by Congress in 2019 (P.L. 116-6) followed by an additional $555 million in 2020 (P.L. 116-93). Later in 2020, another $100 million in grant funding was added through the *Coronavirus Aid, Relief, and Economic Security Act* (P.L. 116-136).[61,62,63] In fiscal year (FY) 2019, Reconnect awarded $661 million to 76 projects in 33 states. In FY 2020, Reconnect awarded $673 million to 87 projects in 35 states.[64,65]

Recent Legislation Supporting Broadband Deployment

Despite federal funding and rural broadband deployment initiatives from private companies, municipalities, and co-ops, millions of Americans still lack access to high-speed broadband. In 2017, the FCC estimated that it would cost an additional $80 billion to deploy broadband nationwide, although the actual cost could be higher given the previously cited inaccuracy of FCC broadband adoption maps.[9] Some estimates place costs as high as $150 billion, depending on the type of broadband technology used.[66]

Broadband deployment has been a focus of recent federal legislation. For example, the *Coronavirus Aid, Relief, and Economic Security (CARES) Act of 2020* (P.L. 116-136) included funding that several states used to improve broadband infrastructure, telehealth, and digital learning in their communities.[62,67]

The Consolidated Appropriations Act of 2021 (P.L. 116-260), building upon the *CARES Act*, included $7 billion specifically for broadband infrastructure improvement.[60] The bill used $3.2 billion to create the Emergency Broadband Benefit program within the FCC, a temporary program that provides $50 subsidies on monthly internet bills for qualifying residents of rural areas and $75 subsidies for residents of tribal lands.[68,69] An additional $1 billion established the Tribal Broadband Connectivity Program grant within the NTIA, meant to fund broadband access, deployment, and programs in tribal lands.[70]

The *Broadband Deployment Accuracy and Technological Availability (DATA) Act of 2020* (P.L. 116-130) required the FCC to improve the accuracy of their broadband availability maps.[71]

The *American Rescue Plan Act of 2021* (P.L. 117-2) allocated $7.1 billion toward a new, temporary Emergency Connectivity Fund under the FCC to support eligible learning institutions seeking to improve their broadband infrastructure.[72,73] It also provided additional funds to states to fund broadband deployment. Broadband is also a significant focus in the Biden-Harris Administration's $2 trillion infrastructure plan, which notably commits $100 billion to deploy high-speed internet to every American.[74] The plan increases broadband affordability, prioritizes networks "owned, operated by, or affiliated with local governments, non-profits, and cooperatives," includes tribal nations in the program design for broadband deployment, and creates an "even playing field" to make municipally-owned and rural electric co-ops competitive with private providers.

More recently-proposed legislation has also emphasized funding broadband expansion, including the *Leading Infrastructure For Tomorrow's America Act*, or *LIFT America Act* (H.R. 1848), introduced by 32 Democrats on the House Energy and Commerce Committee, and the *Accessible, Affordable Internet for All Act* (H.R.1783), introduced by Senator Klobuchar (D-Minn.) and Representative Clyburn (D-S.C.).[75,76] These bills would commit over $94 billion toward broadband deployment, with $80 billion reserved for high-speed broadband expansion to underserved and unserved urban and rural areas. Sixty billion dollars of this would be deployed through a competitive bidding process to optimize aid distribution, while the remaining $20 billion would be distributed to states to fund their deployment processes. An additional $5 billion would serve as capital for low-interest financing for broadband infrastructure projects. Finally, $9.3 billion would fund broadband affordability and equity, $6 billion of which would be distributed to the Emergency Broadband Benefit program within the FCC.

Conclusion

Despite recent progress in rural broadband expansion, it is becoming increasingly clear that expanding access to high-speed broadband services should be a top priority for the United States, as between 14.5 to 42 million Americans still lack access to reliable, high-speed internet. Growing requests for universal broadband highlight the importance of this technology for communities, but various financial and economic barriers continue to impede the deployment of broadband services to unserved and underserved areas. While funding for broadband deployment must compete with other high-priority programs relating to food insecurity, infrastructure, healthcare, or education, high-speed internet access is critical for many of these priorities. Rural electric co-ops, local governments, and the federal government have all made significant strides in funding new broadband deployment. Continuing to do so will further close the digital divide, providing countless socioeconomic and equity benefits to underserved regions and facilitating greater community inclusion in the transition to a cleaner economy.

Authors: Rachel Snead and Jaxon Tolbert
Editor: John-Michael Cross
Graphics: Sydney O'Shaughnessy

This issue brief is available electronically (with hyperlinks and endnotes) at *www.eesi.org/papers*.

The Environmental and Energy Study Institute (EESI) is a non-profit organization founded in 1984 on a bipartisan basis by members of Congress to help educate and inform policymakers, their staff, stakeholders, and the American public about the benefits of a low-emissions economy that prioritizes energy efficiency, renewable energy, and new clean energy technologies. In 1988, EESI declared that addressing climate change is a moral imperative, which has since guided our work toward our vision: a sustainable, resilient, and equitable world.

ENDNOTES

[1] "Broadband: FCC Should Analyze Small Business Needs" (July 8, 2021). U.S. Government Accountability Office, www.gao.gov/products/gao-21-494 (accessed July 23, 2021)

[2] "Fixed Broadband Deployment Data" (June 2020). Federal Communications Commission, https://broadbandmap.fcc.gov/#/area-summary?version=jun2020&type=nation&geoid=0&tech=a&speed=25_3. (accessed July 23, 2021).

[3] "Mobile Experience in Rural USA: An Operator Comparison" (September 24, 2019). OpenSignal, www.opensignal.com/2019/09/24/mobile-experience-in-rural-usa-an-operator-comparison. (accessed July 23, 2021).

[4] "Fourteenth Broadband Deployment Report" (January 19, 2021). Federal Communications Commission, https://docs.fcc.gov/public/attachments/FCC-21-18A1.pdf (accessed June 24, 2021)

[5] "BroadbandNow Estimates Availability for all 50 States; Confirms That More Than 42 Million Americans Do Not Have Access to Broadband" (May 27, 2021). BroadbandNow, https://broadbandnow.com/research/fcc-broadband-overreporting-by-state. (accessed July 8, 2021)

[6] "FCC Annual Broadband Deployment Report Shows Digital Divide Is Rapidly Closing" (January 19, 2021). Federal Communications Commission, https://docs.fcc.gov/public/attachments/DOC-369393A1.pdf (accessed June 24, 2021)

[7] "Size of the Urban and Rural Population of the United States from 1960 to 2020" (2020). Statista, www.statista.com/statistics/985183/size-urban-rural-population-us/ (accessed August 9, 2021)

[8] "Improving the Nation's Digital Infrastructure" (January 19, 2017). Federal Communications Commission, www.fcc.gov/document/improving-nations-digital-infrastructure (accessed June 25, 2021)

[9] "Cable is Main Form of Broadband Access in North America" (November 8, 2018). Telegeography.com, https://blog.telegeography.com/cable-is-main-form-of-broadband-access-in-north-america (accessed June 25, 2021)

[10] "Broadband - Additional Stakeholder Input Could Inform FCC Actions to Promote Competition" (September 2017). United States Government Accountability Office, www.gao.gov/assets/gao-17-742.pdf (accessed June 25, 2021)

[11] "Mobile Technology and Home Broadband 2019" (June 13, 2020). Federal Communications Commission, https://docs.fcc.gov/public/attachments/FCC-18-181A1.pdf (accessed June 25, 2021)

[12] "Rural Poverty & Well-Being" (June 17, 2021) U.S. Department of Agriculture, www.ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being/ (accessed August 9, 2021)

[13] **"**Determinants Of Broadband Access And Affordability: An Analysis Of A Community Survey On The Digital Divide**"** (September 9, 2020). College for Health, Community, and Policy, The University of Texas at San Antonio, www.ncbi.nlm.nih.gov/pmc/articles/PMC7480260/. (Accessed June 30, 2021).

[14] "Computer and Internet Use in the United States: 2018" (April 2021). American Community Survey Reports. U.S. Census Bureau, https://www.census.gov/content/dam/Census/library/publications/2021/acs/acs-49.pdf (accessed September 29, 2021)

[15] "As Schools Close Due to the Coronavirus, Some U.S. Students Face a Digital 'Homework Gap'" (March 16, 2020). Pew Research Center, www.pewresearch.org/fact-tank/2020/03/16/as-schools-close-due-to-the-coronavirus-some-u-s-students-face-a-digital-homework-gap/ (accessed June 25, 2021)

[16] "Nearly One-in-Five Teens Can't Always Finish Their Homework Because of the Digital Divide" (October 26, 2018). Pew Research Center, www.pewresearch.org/fact-tank/2018/10/26/nearly-one-in-five-teens-cant-always-finish-their-homework-because-of-the-digital-divide/ (accessed June 25, 2021)

[17] "Without Internet Access, Students and Teachers in Rural Areas Struggle to Keep Up" (May 23, 2020). National Public Radio, www.npr.org/2020/05/23/861577381/without-internet-access-students-and-teachers-in-rural-areas-struggle-to-keep-up (accessed June 25, 2021)

[18] "Bringing Broadband to Rural America: Report on Rural Broadband Strategy" (December 2020). Federal Reserve Bank of Richmond, www.richmondfed.org/publications/community_development/community_scope/2020/comm_scope_vol8_no1#footnote23 (accessed June 25, 2021)

[19] "The Impact of Broadband on U.S. Agriculture: An Evaluation of the USDA Broadband Loan Program" (2011). Applied Economic Perspectives and Policy, https://core.ac.uk/download/pdf/6620722.pdf (accessed June 25, 2021)

[20] "A Case for Rural Broadband" (April 2019). United States Department of Agriculture, www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf (accessed June 25, 2021)

[21] "The High Cost of Energy in Rural America: Household Energy Burdens and Opportunities for Energy Efficiency" (July 2018). American Council for an Energy-Efficient Economy, www.aceee.org/sites/default/files/publications/researchreports/u1806.pdf (accessed June 25, 2021)

[22] "Broadband Access as a Public Health Issue: The Role of Law in Expanding Broadband Access and Connecting Underserved Communities for Better Health Outcomes" (June 2019). J Law Med Ethics, www.ncbi.nlm.nih.gov/pmc/articles/PMC6661896/ (accessed June 25, 2021)

[23] "Social Determinants of Health" (May 6, 2021). Centers for Disease Control and Prevention, www.cdc.gov/socialdeterminants/index.htm (accessed June 25, 2021)

[24] Natalie C. Benda, Tiffany C. Veinot, Cynthia J. Sieck, Jessica S. Ancker, "Broadband Internet Access Is a Social Determinant of Health!", American Journal of Public Health 110, no. 8 (August 1, 2020): pp. 1123-1125. (accessed September 29, 2021)

[25] "Smart & Connected Thermostats in the U.S. to 2025: Market Leaders Implement Strategies to Penetrate New Consumer Markets - ResearchAndMarkets.com" (October 10, 2018). Business Wire, www.businesswire.com/news/home/20181010005442/en/Smart-Connected-Thermostats-U.S.-2025-Market-Leaders (accessed June 25, 2021)

[26] "Intelligent Efficiency." Information Technology Industry Council, https://www.itic.org/policy/energy/intelligent-efficiency (accessed September 29, 2021)

[27] "Can You Create a Smart Home Without the Internet?" (November 14, 2019). New York Magazine, https://nymag.com/intelligencer/2019/11/can-you-create-a-smart-home-without-the-internet.html (accessed August 9, 2021)

[28] "Here Is What You Need to Know About Solar Monitoring" (January 17, 2019). Green Power Energy, https://greenpowerenergy.com/here-is-what-you-need-to-know-about-solar-monitoring/ (accessed August 9, 2021).

[29] "Four Ways That Rural Broadband Fights Climate Change" (June 8, 2020) Bipartisan Policy Center, https://bipartisanpolicy.org/blog/four-ways-that-rural-broadband-fights-climate-change/ (accessed June 25, 2021)

[30] "Demand-side Management Programs Save Energy and Reduce Peak Demand - Today in Energy" (March 29, 2019). U.S. Energy Information Administration, www.eia.gov/todayinenergy/detail.php?id=38872 (accessed June 25, 2021)

[31] "State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts 2020" (July 2021). Consortium for Energy Efficiency, www.cee1.org/annualindustry-reports, (accessed October 6, 2021).

[32] "A Survey on Communication Technologies and Requirements for Internet of Electric Vehicles" (December 16, 2014). EURASIP Journal on Wireless Communications and Networking, https://doi.org/10.1186/1687-1499-2014-223 (accessed June 25, 2021)

[33] "More High-Speed Broadband Access Could Help Lower Utility Bills" (July 30, 2019). Alliance to Save Energy, www.ase.org/blog/what-can-expansion-high-speed-broadband-do-americans-help-lower-utility-bills (accessed June 25, 2021)

[34] "How Can Consumer Trust in Energy Utilities Be Increased? The Effectiveness of Prosocial, Pro Environmental, and Service-oriented Investments as Signals of Trustworthiness" (October 10, 2018). Organization and Environment, https://doi.org/10.1177%2F1086026618803729 (accessed June 25, 2021)

[35] "Rural Broadband - Examining Internet Connectivity Needs and Opportunities in Rural America" (April 20, 2021). House Agriculture Committee, https://agriculture.house.gov/calendar/eventsingle.aspx?EventID=2161 (accessed June 25, 2021)

[36] "Dig Once: A Solution for Rural Broadband" (April 12, 2017). United States Telecom Association, www.ustelecom.org/dig-once-a-solution-for-rural-broadband/ (accessed June 25, 2021)

[37] "An Introduction to Effective Public-private Partnerships for Broadband Investments" (January 2015). BroadbandUSA, www.ntia.doc.gov/files/ntia/publications/ntia_ppp_010515.pdf (accessed June 25, 2021)

[38] "Tribal Broadband - Few Partnerships Exist and the Rural Utilities Service Needs to Identify and Address Any Funding Barriers Tribes Face" (September 2018). United States Government Accountability Office, www.gao.gov/assets/gao-18-682.pdf (accessed June 25, 2021)

[39] "H.R.1 - American Recovery and Reinvestment Act of 2009" (2009). Library of Congress, www.congress.gov/bill/111th-congress/house-bill/1/text (accessed August 9, 2021)

[40] "Municipal FTTH Networks". Community Networks, https://muninetworks.org/content/municipal-ftth-networks (accessed June 25, 2021)

[41] "Issue Brief: The Opportunity of Municipal Broadband" (September 2019). Next Century Cities, https://nextcenturycities.org/fact-sheet-the-opportunity-of-municipal-broadband/. (Accessed July 1, 2021).

[42] "Municipal Broadband is Restricted in 18 States Across the U.S. in 2021" (April 7, 2021). BroadbandNow, https://broadbandnow.com/report/municipal-broadband-roadblocks/ (accessed June 25, 2021)

[43] "Cooperatives Build Community Networks". Community Networks, https://muninetworks.org/content/rural-cooperatives-page (accessed June 25, 2021)

[44] "Written Testimony of Timothy R. Johnson - Rural Broadband - Examining Internet Connectivity Needs and Opportunities in Rural America" (April 20, 2021). U.S. House of Representatives Document Repository, https://docs.house.gov/meetings/AG/AG00/20210420/112463/HHRG-117-AG00-Wstate-JohnsonT-20210420.pdf (accessed June 25, 2021)

[45] "Electric Cooperatives Bring High-Speed Communications to Underserved Areas" (February 2020). National Rural Electric Cooperative Association, www.cooperative.com/programs-services/bts/Documents/Reports/Report-Broadband-Case-Studies-Summary-Updated-Feb-2020.pdf (accessed June 25, 2021)

[46] "Broadband - Observations on Past and Ongoing Efforts to Expand Access and Improve Mapping Data" (June 2020). United States Government Accountability Office, www.gao.gov/assets/gao-20-535.pdf (accessed June 25, 2021)

[47] "Interagency Agreement Between The Federal Communications Commission, U.S. Department Of Agriculture, And The National Telecommunications And Information Administration Of The U.S. Department Of Commerce" (June 25, 2021) USDA Rural Development, www.rd.usda.gov/sites/default/files/bicasection904iaafcc_ntia_usdasigned.pdf. (accessed July 2, 2021).

[48] "Universal Service Fund" (November 18, 2010). Federal Communications Commission, www.fcc.gov/general/universal-service-fund (accessed June 25, 2021)

[49] "Telecommunications Access Policy Division" (April 18, 2012). Federal Communications Commission, www.fcc.gov/general/e-rate-schools-libraries-usf-program (accessed June 25, 2021)

[50] "Connect America Fund (CAF)" (April 25, 2012). Federal Communications Commission, www.fcc.gov/general/connect-america-fund-caf (accessed June 25, 2021)

[51] "Auction 904: Rural Digital Opportunity Fund" (February 20, 2020). Federal Communications Commission, www.fcc.gov/auction/904 (accessed June 25, 2021)

[52] "Rural Digital Opportunity Fund" (2020). Universal Service Administrative Company, www.usac.org/high-cost/funds/rural-digital-opportunity-fund/ (accessed August 9, 2021)

[53] "Connect America Fund (CAF) Brought Broadband To More than 5.5M Locations, HUBB Dashboard Shows" (June 16, 2021). Universal Service Administrative Company, www.usac.org/high-cost/resources/announcements/#connect-america-fund-caf-brought-broadband-to-more-than-5-5m-locations-hubb-dashboard-shows (accessed August 9, 2021).

[54] "Broadband Technology Opportunities Program". National Telecommunications and Information Administration, www.ntia.doc.gov/legacy/broadbandgrants/projects.html (accessed June 25, 2021)

[55] "Broadband Technology Opportunities Program - 46th Quarterly Report to Congress" (November 2020). National Telecommunications and Information Administration, www.ntia.doc.gov/files/ntia/publications/ntia_btop_46th_quarterly_congressional_report.pdf (accessed June 25, 2021)

[56] "Broadband Initiatives Program (BIP) Guide" (2009). Senate Small Business Committee, www.sbc.senate.gov/public/_cache/files/f/0/f0fc95ef-18ef-4f1b-a1cc-0cab31394b1c/11824FA937892AEF65A916A2803681F3.bip-grant-guide.pdf (accessed June 25, 2021)

[57] "Rural Broadband Access Loan and Loan Guarantee" (May 2020). United States Department of Agriculture, www.rd.usda.gov/programs-services/rural-broadband-access-loan-and-loan-guarantee (accessed June 25, 2021)

[58] "Telecommunications Infrastructure Loans & Loan Guarantees" (April 2021). United States Department of Agriculture, www.rd.usda.gov/programs-services/telecommunications-infrastructure-loans-loan-guarantees (accessed June 25, 2021)

[59] "Reconnect Program Overview". United States Department of Agriculture. www.usda.gov/reconnect/program-overview (accessed June 25, 2021)

[60] "H.R.1625 - Consolidated Appropriations Act" (2018). Library of Congress, www.congress.gov/bill/115th-congress/house-bill/1625/text (accessed June 25, 2021)

[61] "H.J.Res.31 - Consolidated Appropriations Act" (2019). Library of Congress, www.congress.gov/bill/116th-congress/house-joint-resolution/31/text (accessed June 25, 2021)

[62] "H.R.1158 - Consolidated Appropriations Act" (2020). Library of Congress, www.congress.gov/bill/116th-congress/house-bill/1158/text (accessed June 25, 2021)

[63] "H.R.748 - CARES Act" (2020). Library of Congress, www.congress.gov/bill/116th-congress/house-bill/748 (accessed June 25, 2021)

[64] "Reconnect Program FY 2019 Funding Opportunity Announcement Awardees". United States Department of Agriculture, www.usda.gov/reconnect/round-one-awardees (accessed June 25, 2021)

[65] "Reconnect Program FY 2020 Funding Opportunity Announcement Awardees". United States Department of Agriculture, www.usda.gov/reconnect/round-two-awardees (accessed June 25, 2021)

[66] "Bringing Broadband to All Rural Americans Could Cost Up to $150 Billion" (April 21, 2021). Successful Farming, www.agriculture.com/news/business/bringing-broadband-to-all-rural-americans-could-cost-up-to-150-billion (accessed June 25, 2021)

[67] "States Tap Federal CARES Act to Expand Broadband" (November 16, 2020). The PEW Charitable Trusts, www.pewtrusts.org/en/research-and-analysis/issue-briefs/2020/11/states-tap-federal-cares-act-to-expand-broadband (accessed June 28, 2021)

[68] "The Consolidated Appropriations Act, 2021 Broadband Provisions: In Brief" (March 2, 2021). Congressional Research Service Reports, https://crsreports.congress.gov/product/pdf/R/R46701 (accessed June 28, 2021)

[69] "Emergency Broadband Benefit" (February 11, 2021). Federal Communications Commission, www.fcc.gov/broadbandbenefit (accessed June 28, 2021)

[70] "NTIA Announces Tribal Consultations on New Program to Increase Broadband Access Across Indian Country" (February 5, 2021). National Telecommunications and Information Administration, www.ntia.doc.gov/blog/2021/ntia-announces-tribal-consultations-new-program-increase-broadband-access-across-indian (accessed June 28, 2021)

[71] "S.1822 - Broadband DATA Act" (2020). Library of Congress, www.congress.gov/bill/116th-congress/senate-bill/1822 (accessed June 28, 2021)

[72] "H.R.1319 - American Rescue Plan Act of 2021" (2021). www.congress.gov/bill/117th-congress/house-bill/1319/text/pl?overview=closed (accessed June 28, 2021)

[73] "FCC Seeks Comment on Emergency Connectivity Fund for Educational Devices and Connections to Address the Homework Gap During the Pandemic" (March 17, 2021). Federal Communications Commission, www.fcc.gov/fcc-seeks-comment-emergency-connectivity-fund-educational-devices-and-connections-address-homework (accessed June 28, 2021)

[74] "Issue brief: The American Jobs Plan" (March 31, 2021) The White House, www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/ (accessed June 28, 2021)

[75] "E&C Democrats Introduce LIFT America Act that Invests in Clean Energy, Broadband & Public Health Infrastructure" (March 11, 2021). House Committee on Energy and Commerce, https://energycommerce.house.gov/newsroom/press-releases/ec-democrats-introduce-lift-america-act-that-invests-in-clean-energy (accessed June 28, 2021)

[76] "S.4131 - Accessible, Affordable Internet for All Act" (2020). Library of Congress, https://www.congress.gov/bill/116th-congress/senate-bill/4131?overview=closed. (accessed June 28, 2021)