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Summary and Recommendations: Efforts to Expand Broadband Access and Encourage Adoption Should Continue

If broadband is not yet an essential resource, it is fast becoming one. Defined by the Federal Communications Commission (FCC) as high-speed internet service with a capacity of at least 25 megabits per second download and three megabits per second upload (25/3) that "enables users to originate and receive high-quality voice, data, graphics, and video," broadband has been described as a "critical enabler," without which individuals and communities risk being left behind. For many Americans, access to broadband is no longer simply a useful addition to their lives, it has become an expectation.

Recognizing broadband's growing importance to Tennesseans, the Tennessee Advisory Commission on Intergovernmental Relations (TACIR) initiated a study of broadband access and adoption in Tennessee in 2015. The Commission's report—released in 2017—identified existing public- and private-sector initiatives for expanding coverage and increasing broadband adoption in the state. It also made several recommendations, which emphasized opportunities for government to work with the private sector—both for-profit and non-profit—to fill remaining coverage and adoption gaps in the manner least costly to taxpayers without expanding the role of government. The Commission's recommendations helped guide policy changes included in the Tennessee Broadband Accessibility Act (Public Chapter 228, Acts of 2017), which

- established a grant program to help offset the cost of expanding coverage in unserved areas, while also authorizing the program to grant funds to libraries to help facilitate broadband adoption;
- established a tax credit for broadband investment in tier 3 and tier 4 enhancement counties;
- removed barriers to entry for would-be providers by authorizing electric cooperatives to provide broadband within their electric service areas; and
- established a pathway for communities to signal providers that they have streamlined local permitting processes and removed regulatory barriers to broadband investment.

Public Chapter 228 further directed the Commission to prepare an update to its 2017 broadband report by January 15, 2021 (see appendix A). Broadband remains a critical need, and awareness of its importance has only been heightened by the COVID-19 pandemic. The good news is that Tennessee continues to make progress eliminating

coverage gaps and increasing rates of broadband adoption through a combination of public- and private-sector initiatives, including several recommended in the Commission's 2017 report and authorized under the 2017 Act. But despite these and other efforts, gaps in broadband access and adoption remain.

What speeds do users need?

- An internet connection's speed is affected both by its capacity—the amount of data measured in binary units of computer code called bits that it can send or receive per second—and by its latency—the lag or the amount of time it takes signals to travel from one end of a network to another or from one user's device to another.
- The FCC has adopted a minimum capacity of 25 megabits per second download and three megabits per second upload (25/3) for connections to be considered broadband. It has not set a maximum latency for broadband, but it has adopted a preference for connections with latencies of no more than 100 milliseconds in its most recent offer of funding for unserved areas.
- For now, both the FCC's 25/3 capacity standard and its 100-millisecond latency threshold appear capable of supporting the *minimum* needs of typical users—excluding industries, schools, libraries, and hospitals—based on commonly performed tasks, though they may not meet all current or future needs.
- Ultimately, networks that can be scaled to accommodate new applications or patterns of use can help ensure that communities continue to receive broadband service that meets current and future needs.

Improvements continue, but gaps in broadband access and adoption remain.

Broadband access continues to increase in Tennessee, according to data reported to the FCC by broadband providers. Approximately 93.7% of Tennesseans live in census blocks where at least one provider reported offering service with a capacity of at least 25/3 as of December 2019, the most recent publicly available data. This is an increase of more than five percentage points compared with coverage reported in December 2015, the dataset used for the Commission's 2017 report. However, because the data do not show whether everyone in these census blocks has access to service at the reported speeds, this represents the *maximum* extent of coverage. Despite these increases, there are still 432,627 Tennesseans living in census blocks where no provider reported at least 25/3 service as of December 2019. Coverage gaps also remain persistent in rural areas of the state, which still lag urban areas in terms of access, though gains have been made.

Who has broadband? The limitations of current FCC data

- Coverage data are reported to the FCC by providers at the census block level rather than for individual addresses.
- According to the FCC, "a provider that reports deployment of a particular technology and bandwidth in a census block may not necessarily offer that service everywhere in the block."
- As a result, the FCC coverage data represent the *maximum* extent of broadband access at the time at which they were reported.
- Despite these limitations, the Commission has again chosen to use FCC data to assess broadband access and adoption in Tennessee because they allow for comparisons across years and across states.

Rates of broadband adoption have increased, as well, but there are still a significant number of households that could be subscribing to broadband but aren't. In Tennessee, 58% of households in census blocks where at least one provider reported offering broadband subscribed to the service, according to the FCC's 2020 broadband progress report, which relies on December 2018 data. Four years earlier, the rate was only 40%. Increases aside, Tennessee's 2018 rate is lower than expected, based on TACIR staff estimates assuming Tennesseans subscribe to home broadband at the same rate as others in similar demographic groups nationwide.

The increases in broadband access and adoption are encouraging. Although gaps remain, Tennessee is well placed to address them based on the public and private initiatives already in place. Further, the lessons learned from policy changes implemented in 2017 can help inform any future changes or new policies to help maximize their effectiveness at improving broadband access and adoption.

Maximizing the number of Tennesseans who use broadband requires more than simply expanding coverage.

There are multiple barriers to broadband adoption in addition to lack of access. Cost—including both the cost of service and the cost of devices—is among the most cited reasons why individuals say they don't subscribe to home broadband service, particularly for those in low-income households. Aside from cost, many individuals often cite a lack of interest or need. Given these differing barriers, there is no single broadband adoption program that will work for every community. While the Tennessee Department of Economic and Community Development (ECD) provides links on its website with information on low-cost service and device options, as well as information to help communities develop broadband adoption strategies that fit their needs, local libraries and schools are continuing their efforts to help the populations they serve get online.

Libraries and schools remain important local resources for facilitating broadband adoption and access.

Libraries and schools not only help individuals improve their computer- and internet-skills but also provide access to broadband service and devices for those who are either unable to afford them or who live in unserved and underserved areas. Tennessee libraries have had success offering digital literacy classes. Participant evaluations have been positive, with well over 80% reporting increased confidence in using what they learned. At least one library reported participants decided to purchase their own computers after taking its classes. Other participants told libraries that what they learned helped them get jobs.

Libraries throughout the state are also addressing affordability and coverage gaps in their communities by lending wireless hotspot devices that provide access to mobile wireless service. Although the hotspots are not long-term substitutes for home broadband, they are a short-term solution for providing internet access when people most need it, for school projects or when applying for jobs. The devices remain very popular, and libraries report that waitlists are common. Currently, 75 libraries in the state's regional library system lend hotspots, with a median of five hotspots per library.

Schools are working to close broadband adoption gaps for students in their communities, as well. While the Commission described ways schools could help facilitate broadband adoption in its 2017 report, the onset of the COVID-19 pandemic has heightened awareness of the remaining adoption gaps and the role that schools can play in filling them. For some school systems, this has meant ensuring that students have access to laptops or other devices that can be taken home and used for schoolwork. And like libraries some systems have obtained hotspots for students who live in areas without access to wireline broadband service or whose families cannot afford it, though representatives for several systems noted in interviews with TACIR staff that the effectiveness of hotspots in some areas is limited because of gaps in mobile wireless service.

Additional federal, state, and local funding for libraries and schools has helped support their broadband efforts in Tennessee.

Consistent with the Commission's 2017 recommendations, the state's broadband grant program—established under Public Chapter 228, Acts of 2017—has awarded 133 grants for a combined total of $443,500 to libraries in 54 of the state's 95 counties. So far, the grants have helped libraries provide 1,565 digital literacy classes to 10,534 participants and funded 210 hotspots. The Tennessee State Library and Archives (TSLA) also received approximately $600,000 in federal funding from the state's share of the

Coronavirus Aid, Relief, and Economic Security (CARES) Act, which TSLA used to fund grants to 137 libraries for hotspots, computers, and videoconferencing equipment. For schools, the state made approximately $61 million of its share CARES Act funding available for laptops and hotspots, as well as one-to-one technology initiatives. Several local governments also provided CARES Act funding to local school systems for use on devices for students. At least one school system has partnered with local governments, businesses, and non-profit organizations to pay for home broadband service for families with students eligible for free or reduced lunch in its district.

Given the role libraries and schools play in their communities and the importance of tailoring broadband adoption efforts to meet local needs, **state and local governments should continue to identify opportunities to increase funding for libraries and schools to assist their efforts to facilitate broadband adoption and short-term access in their communities—including support for digital literacy classes, devices, hotspots, and other efforts to make broadband available to those who either don't have or cannot afford service.**

For libraries, in particular, the state should continue to provide funding for broadband adoption efforts through the state's broadband grant program.

Cost remains a barrier to broadband expansion in many unserved areas, but incentives for providers tied to buildout requirements have proved effective.

The challenging economics of providing broadband in some unserved areas remains no less a problem today than at the time of the Commission's 2017 report, according to those in the broadband industry. For some communities, low population densities, which result in fewer potential customers and therefore less revenue per mile of line constructed, can make it particularly difficult for providers to cover their costs. As the US Government Accountability Office summarized in a 2014 report, "stakeholders told us that being able to cover costs with potential revenues and thus make a return on investment is a key issue to deploying broadband in unserved and underserved areas."

Policies intended to promote coverage expansion by reducing the cost to providers of broadband deployment were included among the Commission's recommendations in 2017. Consistent with these recommendations, Public Chapter 228, Acts of 2017, established the broadband ready community designation for local governments, a franchise and excise tax credit for providers, and a state grant program for broadband projects in unserved areas. The effectiveness of these policies at encouraging broadband expansion has varied.

The broadband ready community designation does not appear to affect providers' deployment decisions.

Under the Public Chapter 228, local governments that adopt specified policies can apply to ECD to be designated as "broadband ready communities" to signal providers that those jurisdictions have removed regulatory barriers to broadband expansion. Currently, 58 local governments—including nine cities and 49 counties—have received the designation from ECD. However, the designation does not appear to have had much if any effect on providers' deployment decisions in Tennessee, though applications for projects in broadband ready communities receive points under one of the categories used in ECD's scoring process for the state grant program.

The franchise and excise tax credit enacted under Public Chapter 228 has been repealed.

The Act also established a credit—since repealed—against franchise and excise taxes for providers that made broadband investments in underdeveloped counties. Unlike the state's grant program, which reimburses up to 50% of project costs for investments in unserved areas, the credit was equal to 6% of the purchase price of broadband equipment for providing service in tier 3 or tier 4 enhancement counties. Although credits were capped annually at $5 million combined for all providers statewide, only $2 million of credits were taken the year before it was repealed. No providers interviewed advocated for reinstating the credit.

State grants to providers are helping to expand broadband access.

The Tennessee Broadband Accessibility Grant program—established under the Act and administered by ECD—awards funding to offset the cost of expanding broadband in unserved areas. Grants are awarded through a competitive application process, using a combination of objective and subjective metrics (see appendix D); and in each of the first three rounds, ECD has received applications for more projects than it can fund. The program has awarded a total of more than $44.3 million, helping fund 39 projects in communities across the state. Because ECD limits grants to no more than 50% of overall costs for each project, more than $44.3 million in matching funds will also be invested in these projects, resulting in a total investment in broadband expansion of approximately $88.7 million—public and private. There is approximately $15 million available for projects in the fourth round, which will award grants in 2021.

Requirements to build out broadband to unserved homes and businesses included in each grant—which providers must meet to receive their full grant awards—help ensure that state funding spent through the program results in coverage expansions. Funds are disbursed to grantees only as reimbursable project-costs are incurred, and ECD

withholds 15% of the total grant amount for each project until the project is certified as complete by a licensed engineer or an ECD-approved consultant, who verifies that all obligations, including buildout requirements, have been met. The combined buildout requirements for grants awarded in the first three rounds total 26,300 previously unserved homes and businesses. Projects in round one, the only round to be completed so far, resulted in broadband access for more than 7,000 locations.

Remaining state-funded projects and projects awarded federal funding through a variety of programs—including 62 projects awarded a total of $61 million in 2020 from the state's share of the CARES Act—will further reduce coverage gaps in Tennessee. But there are still at least 131,000 homes in census blocks where no provider reported 25/3 service as of December 2019 that won't receive broadband from existing state- or federally funded projects, according to TACIR staff estimates. Based on the median cost per location for projects in the first three rounds of the state grant program—approximately $4,028 per location, including both the state's share and the applicant match—the total cost to cover these homes could be approximately $529 million.

Because of the challenging economics of providing broadband in some unserved areas, filling the remaining coverage gaps will likely require a combination of public and private resources. While only one round of projects funded by the state grant program has been completed, projects in that round not only met but collectively exceeded their buildout requirements. **The state should keep supporting efforts to expand broadband access in Tennessee by continuing to fund the broadband grant program and could consider increasing its annual appropriations to accelerate broadband expansion to more unserved areas.**

New state or local incentives for broadband providers should include protections to help ensure they result in coverage expansions.

Other government incentives for providers that could be enacted to facilitate the expansion of coverage were discussed by various stakeholders in interviews with TACIR staff. For example, local governments in Tennessee are generally limited in their authority to provide direct funding to private enterprises—including those deploying broadband—under the Tennessee State Constitution and state law. According to attorneys and a financial advisor who are working with one county, the state could authorize local governments to make multiyear funding commitments to broadband projects constructed by private sector entities—either through existing industrial development boards or by establishing a new entity similar to sports authorities. This would allow local governments to reduce the amount of money that these providers must borrow and could make these projects more attractive to lenders to the extent that local revenue streams could be pledged as collateral for loans.

But simply authorizing local governments to fund broadband projects carried out by private entities does not guarantee local funding will result in expansions of coverage in unserved areas. The 2008 Commission report *Getting It Right: The Effect on the Property Tax Base of Economic Development Agreements and Property Tax Incentives for Businesses* recommends including requirements, such as clawbacks, in incentive agreements to hold businesses accountable and protect taxpayers. Although it is not uncommon for IDBs in Tennessee to include performance criteria or clawbacks in contracts for projects receiving other incentives, they are not required by law.

Another incentive, proposed by a provider, would establish a tax credit to offset the cost of attaching cables to utility poles owned by entities that purchase electricity from the Tennessee Valley Authority (TVA). Pole attachment fees for these poles are regulated by TVA, which has adopted a formula for calculating them. TVA's formula results in greater fees than formulas adopted by the FCC that apply to poles owned by for-profit utilities, though the extent to which fees calculated using TVA's formula prevent broadband expansion in Tennessee is unproven at this time. The proposed credit would have been approximately equal to the difference between the pole attachment fees that companies pay under TVA's formula and what they would pay under the FCC's formulas. While this would offset providers' pole attachment costs, the credit as initially proposed would not have been tied to any buildout or investment requirements in Tennessee.

In contrast, the requirements included in the state grant program help protect the state if projects fail and tie receipt of state funding directly to the expansion of broadband access. Moreover, ECD caps the state's share of project costs under the grant program at 50%. While the exact structure of the grant program's requirements might not be transferrable to every state or local incentive, the goal of reducing risk to taxpayers is. **State and local governments should consider tying any new incentives for broadband providers directly to coverage expansions, while limiting the overall share of project costs that those incentives pay for.**

Many electric cooperatives are now providing broadband under authority granted to them in Public Chapter 228, Acts of 2017.

In addition to enacting policies for reducing cost barriers in unserved areas, Public Chapter 228, Acts of 2017, eased state restrictions that had prevented electric cooperatives from providing broadband. Consistent with the Commission's 2017 recommendations, the Act authorized electric cooperatives to become retail broadband providers either on their own or in partnership with other entities. Of the 22 electric cooperatives that serve parts of Tennessee, 13 are now either providing broadband or will be in the near future. Six of the 13 are partnering with other entities, including

telephone companies and telephone cooperatives, allowing each entity to leverage the expertise and resources of its partners, according to several interviewees involved in these partnerships. The other seven are providing service individually through wholly owned subsidiaries. Although TACIR staff were unable to obtain data showing the number of previously unserved homes and businesses that have or will receive service as a result of these electric cooperatives beginning to provide broadband, nine cooperatives have received funding for projects in unserved areas through the state and federal programs noted above.

While the Act eased restrictions on electric cooperatives providing broadband, it did not eliminate them entirely. Electric cooperatives—like municipal electric systems—remain subject to territorial restrictions that, with limited exceptions, prevent them from providing broadband outside of their electric service areas.

Removing territorial restrictions on electric cooperatives or municipal utilities without adopting safeguards could put electric ratepayers at risk.

Multiple bills in recent legislative sessions of the General Assembly would have decreased the territorial restrictions on electric cooperatives, municipal electric systems, or both. While some would have eliminated the restrictions outright, others would have done so subject to conditions, such as obtaining written consent from neighboring utilities and cooperatives. Proponents of eliminating or easing the restrictions say that they prevent electric cooperatives and municipal electric systems from providing broadband in areas they would otherwise be willing and able to serve. Moreover, these proponents say that in some cases, the restrictions prevent electric cooperatives and municipal electric systems from expanding coverage to areas that are currently unserved.

But even without the current territorial restrictions, cost will still be a barrier in some areas. The potentially high cost of building broadband networks introduces risks to which electric cooperatives and municipal electric systems are not immune. Who shoulders these risks is important.

Like any other provider, electric cooperatives and municipal electric systems often take on debt to finance the construction of their broadband networks. Some have financed the construction of their networks by pledging electric system assets or revenues as collateral for loans. Municipal electric systems have financed their networks using bonds backed either by revenue from electric ratepayers or municipal taxpayers. Both are also permitted under state law and their wholesale power contracts with TVA to make loans from their electric operations to their broadband operations, provided certain conditions are met.

For debts backed by electric system assets or revenues, if broadband revenue isn't enough to make debt payments, electric ratepayers shoulder the risk of repaying them. Those living outside a cooperative's or utility's electric service area don't share in these risks. While the risks can be justified inside a cooperative's or utility's electric service area at least in part based on the benefits to electric ratepayers that can result from communications networks that support management of the electric grid, this dual justification doesn't exist for a cooperative or utility outside its electric service area.

TVA already prohibits the electric cooperatives and municipal utilities it serves from using their electric operations to subsidize their broadband operations—or any other service—through the terms of its wholesale power contracts. Any use of electric system assets or revenues to support the operation of a cooperative's or utility's broadband operations—for example, interdivisional loans, sharing of staff, or the leasing of fiber—must be approved by TVA. TVA has not determined whether it would approve the use of electric system assets or revenues to finance the construction of broadband networks outside a cooperative's or utility's electric service area.

State law also prohibits electric cooperatives and municipal utilities from using their electric operations to subsidize their broadband operations. However, these provisions don't prevent cooperatives or utilities from pledging electric system assets and revenues to finance the construction of their broadband networks within their electric service areas. Because of the risks involved in broadband projects, **if the state were to eliminate or ease existing territorial restrictions on electric cooperatives and municipal electric systems, it should consider ways it can protect electric ratepayers, for example, by prohibiting these cooperatives and utilities from pledging, loaning, or otherwise using electric system assets or revenues to finance broadband projects outside their electric service areas.**

Analysis: Continuing Tennessee's Progress in Expanding Broadband Access and Encouraging Broadband Adoption

Americans have come to "expect broadband at home, at work, and while on the go."[1] This observation by the Federal Communications Commission (FCC) in 2018 remains true today. Defined by the FCC as high-speed internet service with a capacity of at least 25 megabits per second download and three megabits per second upload (25/3),[2] broadband has become a necessity in the 21st century.

Recognizing broadband's growing importance to Tennesseans, the Tennessee Advisory Commission on Intergovernmental Relations (TACIR) initiated a study of broadband access and adoption in Tennessee in 2015. The Commission's report—released in 2017—identified existing public- and private-sector initiatives for expanding coverage and increasing broadband adoption in the state. It also made several recommendations, which emphasized opportunities for government to work with the private sector—both for-profit and non-profit—to fill remaining coverage and adoption gaps in the manner least costly to taxpayers without expanding the role of government. The Commission's recommendations helped guide policy changes included in the Tennessee Broadband Accessibility Act (Public Chapter 228, Acts of 2017), which

- established a grant program to help offset the cost of expanding coverage in unserved areas, while also authorizing the program to grant funds to libraries to help facilitate broadband adoption;
- established a tax credit for broadband investment in tier 3 and tier 4 enhancement counties;
- removed barriers to entry for would-be providers by authorizing electric cooperatives to provide broadband within their electric service areas; and
- established a pathway for communities to signal providers that they have streamlined local permitting processes and removed regulatory barriers to broadband investment.

Public Chapter 228 further directed the Commission to prepare an update to its 2017 broadband report by January 15, 2021 (see appendix A). Broadband remains a critical need, and awareness of its importance has only been heightened by the COVID-19 pandemic.

[1] Federal Communications Commission 2018b.

[2] Federal Communications Commission 2015b.

Broadband remains a critical need for Tennesseans and their communities.

There is, perhaps, little left to say about broadband's importance for individuals and communities in the 21st century. Few today would argue against the FCC's 2010 assessment that broadband is

> a platform to create today's high-performance America—an America of universal opportunity and unceasing innovation, an America that can continue to lead the global economy, an America with world-leading, broadband-enabled health care, education, energy, job training, civic engagement, government performance and public safety.[3]

The overall body of evidence continues to support the conclusion that broadband is a "critical enabler,"[4] without access to which, individuals and communities risk being left behind. Whether for economic development, education, health care, or agriculture—the four areas analyzed in the Commission's 2017 report—if broadband is not yet an essential resource, it is fast becoming one.

Broadband remains an important tool for supporting educational opportunities, with awareness of its importance heightened as a result of the COVID-19 pandemic. Even before the pandemic, schoolwork was increasingly moving online, the Commission observed in 2017, requiring students to have reliable, high-speed connections to complete assignments and conduct research.[5] Students who lack home access to broadband, as noted by one organization that advocates for education technology, "are at a clear disadvantage compared to those who do not."[6]

The pandemic has only increased awareness of the importance of broadband access for education. Fifty-six percent of teachers statewide said that barriers to students accessing remote learning were among their biggest concerns, in response to a 2020 survey by a Vanderbilt University research group following the onset of the pandemic. The share was even greater among those in rural areas, where more than two-thirds of teachers cited better internet access as a need. In the same survey, more than half of teachers, principals, and assistant principals identified access to better internet, more reliable devices, or both among their top two most helpful supports that students need for remote learning, with approximately 70% of respondents from districts serving

[3] Federal Communications Commission 2010a.

[4] US Telecom Association 2013.

[5] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[6] CoSN 2019.

more low-income students citing the need for devices.[7] Frustration with the lack of home internet access has been a common theme among news articles covering families coping with remote learning during the pandemic.[8]

Similarly, broadband can help improve access to health care, both through video consultations with specialists, particularly in communities located far from major hospitals, saving patients time and expense related to travel, and through remote monitoring of patients, which can help doctors and nurses diagnose problems earlier, adjust medications, and prevent readmission to a hospital.[9] More patients are taking advantage of telehealth services during the pandemic. For example, Vanderbilt University Medical Center (VUMC) reported that it went from averaging 10 telehealth visits per day for its outpatient clinics to more than 2,000 per day less than a month after the first COVID case was reported in Tennessee. More than half of VUMC's outpatient visits were remote from early March through the end of April 2020.[10] In March 2020, BlueCross BlueShield of Tennessee announced it would cover telehealth visits at the same level as in-person visits for in-network services,[11] and in August, the General Assembly passed legislation requiring health insurers to cover telehealth visits in a manner consistent with in-person visits for the same services.[12]

Quantifying broadband's benefits has not always been easy, but recent studies have linked broadband access and investment with positive economic outcomes. A study on Tennessee that focused on the years 2011 through 2015 found that access to broadband at speeds of at least 100 megabits per second resulted in a 0.26% decrease in counties' unemployment rates, compared with counties without access to those speeds. The study further found that the effect is "disproportionately greater" in rural areas.[13] Other studies have estimated expected returns on investment for broadband. A Purdue University study of a proposed broadband expansion project in rural Indiana found that every $1 spent providing broadband in the project area could result in almost $4 in

[7] Kemper and Newsome 2020.

[8] Dorman 2020.

[9] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[10] Clendening 2020.

[11] BlueCross BlueShield of Tennessee 2020.

[12] Public Chapter 4, Second Extraordinary Session, Acts of 2020.

[13] Lobo, Alam, and Whitacre 2020.

benefits to the region's economy, including benefits related to telemedicine access, both K-12 and adult education, consumer savings, and farm income, among others.[14]

The USDA has estimated the benefits that broadband can have for agriculture if availability and adoption of service are widespread. Broadband facilitates the use of a host of technological and analytical tools that can improve planning, production, and access to new markets, according to the USDA. Together, the use of these tools in agriculture could result in annual benefits to the US economy ranging from $47 billion to $65 billion. The USDA estimates that approximately one-third of this benefit—ranging from $18 billion to $23 billion annually—would be attributable to broadband.[15]

The speeds users need and the technologies for delivering service will continue to evolve.

The FCC defines broadband based on users' needs. Broadband is, at a minimum, high-speed internet service that "enables users to originate and receive high-quality voice, data, graphics, and video," according to the FCC.[16] As TACIR discussed in its 2017 report, an internet connection's speed is affected both by its

- capacity—the amount of data measured in binary units of computer code called bits that it can send or receive per second—and by its
- latency—the lag or the amount of time it takes signals to travel from one end of a network to another or from one user's device to another.

Both factors are affected by the wired and wireless technologies used to provide service. Moreover, capacity is shared among all those simultaneously using a network, with individuals often using the internet for more than one task at once.[17] As a result, regardless of whether it is wired or wireless, the extent to which an internet connection is fast enough is dependent on the activities for which it is used and the number of individuals using it.

[14] Grant and Tyner 2018.

[15] US Department of Agriculture 2019.

[16] Federal Communications Commission 2015b.

[17] Tennessee Advisory Commission on Intergovernmental Relations 2017; and Federal Communications Commission 2015b.

FCC's minimum capacity standard of 25/3 is still enough for many individual tasks; users also need low latency connections for real-time communication.

Defining broadband based on users' needs creates a moving target for policymakers and, for that matter, providers. However, the FCC adopted a minimum capacity of 25 megabits per second download and three megabits per second upload (25/3) for connections to be considered broadband in 2015[18]—which remains unchanged. And while it has not similarly set a maximum latency for broadband, the FCC adopted a preference for connections with latencies of no more than 100 milliseconds in its most recent offer of funding for unserved areas, as it has for previous funding programs.[19] For now, both the FCC's 25/3 capacity standard from 2015 and the latency threshold used for its most recent funding program appear capable of supporting the *minimum* needs of typical users, based on commonly performed tasks, though they may not meet all current or future needs.

The FCC's 25/3 standard is enough to support many individual tasks (see appendix B). Basic tasks, such as accessing web pages, can currently be supported by even lower capacities. As described by the FCC,

> beyond 15 megabits per second, performance increases for basic web browsing diminish dramatically. The data indicate that a consumer subscribing to a 10 megabits per second speed tier is unlikely to experience a significant performance increase in basic web browsing—e.g., accessing web pages, but not streaming video or using other high-bandwidth applications such as video chat—by moving to a higher speed tier.[20]

Individuals can also stream video or participate in video conferences using connections with capacities of no greater than 25/3. For example, popular video conferencing platforms recommend minimum capacities of no greater than three megabits per second download and upload for group conferencing, depending on whether screen sharing is desired.[21] Similarly, the recommended minimum capacities for major video streaming services or online gaming platforms are often 10 megabits per second or less, unless users desire ultra-high definition quality.[22]

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[18] Federal Communications Commission 2015b.

[19] Federal Communications Commission 2020f; and Federal Communications Commission 2020h.

[20] Federal Communications Commission 2014b.

[21] GoToMeeting 2020; Microsoft 2020; and Zoom 2020.

[22] Netflix "Internet Connection Speed Recommendations"; Hulu 2020; Amazon 2020; and Google 2020.

A 2019 investigation by *The Wall Street Journal* found that its testers were able to stream multiple videos at once without needing connections faster than 25 megabits per second. Eight testers who each streamed seven videos at once on their individual connections used an average of approximately 7.1 megabits per second with all seven videos playing, despite subscribing to services of at least 100 megabits per second. Similar results were reported for 34 testers who ran either five, six, or seven streams at once, with only brief spikes in capacity used when videos began playing. One user subscribing to only 15 megabits per second service used all her connection's capacity for a significant portion of the test "but didn't report any issues with quality."[23]

While many tasks can be performed with slower connections, the 25/3 standard remains a better measure of the minimum that communities need to support residential and business users. This standard, according to the FCC, takes into account providers' statements regarding capacity needed for particular services and the fact that connections are often shared by multiple users who may each be performing multiple tasks at once.[24] Even 10 years ago, almost 25% of businesses surveyed by the US Small Business Administration said they need more than 10 megabits per second, and almost half said they want more than 10 megabits per second.[25]

Some entities—including industries and anchor institutions such as hospitals, schools, and libraries—need higher capacities than even 25/3. As the Commission described in 2017, industrial users and hospitals need high capacities to transfer large files in reasonable amounts of time (see appendix B for examples of the amount of time needed to transfer laboratory image collections or back up servers with connections of different speeds). Schools and libraries also need higher capacity networks to support multiple users at once. The FCC recommends that schools have networks with capacities of 100 megabits per second per 1,000 students and staff in the short term with a long-term goal of one gigabit per second per 1,000 students and staff. Similarly, the FCC adopted the American Library Association's targets that all libraries serving fewer than 50,000 patrons have networks with capacities of at least 100 megabits per second and that all libraries serving more than 50,000 patrons have networks with capacities of one gigabit per second.[26]

[23] Ramachandran et al. 2019.

[24] Federal Communications Commission 2015b

[25] Columbia Telecommunications Corporation 2010.

[26] Federal Communications Commission 2015b.

Over time, the 25/3 standard may not meet the minimum needs of households or businesses either. Broadband providers report that many customers have opted for faster connections with greater capacities since the onset of the COVID-19 pandemic, as more people began working and learning from home, and at least one major university recommends that online learners have minimum upload capacities of at least five megabits per second—greater than the FCC's three megabits per second upload standard.[27] Latency—or lag—remains less of a long-term concern, though it can render an internet connection too slow to support tasks that require real-time communication, including voice calling, even if it has enough capacity to support them. As TACIR described in 2017, latency of just one-fifth of a second—approximately 200 milliseconds, or twice the 100 millisecond threshold the FCC set for its recent funding program—can be unacceptable for calls, according to Skype.[28] Ultimately—whether for capacity or latency—networks that can be scaled to accommodate new applications or patterns of use can help ensure that communities continue to receive broadband service that meets current and future needs.

Broadband is provided over communications networks that can be made up of a variety of infrastructures.

Broadband is provided over wired infrastructures, such as fiber-optic cable and the same copper wire and coaxial cable originally deployed for telephone and cable television service respectively, as well as over wireless transmitters and receivers (see appendix C for an overview). Depending on users' needs, the differences between these infrastructures mean the various methods for delivering service are not all always interchangeable.[29]

As was true at the time of the Commission's 2017 report, each infrastructure has different physical properties and technical specifications that affect performance. The Commission found that fiber-to-the-premises networks—in which fiber-optic cables reach directly to users' homes and businesses—and networks where the final connection to end-users is provided over coaxial cables originally deployed for television service are generally capable of providing faster service than networks that rely on copper wires traditionally used for telephone service. The report found that

[27] Telephone interview with Katie Espeseth, vice president of new products, Electric Power Board of Chattanooga, October 7, 2020; telephone interview with Mike Browder, president and CEO, Bristol Tennessee Essential Services, October 7, 2020; and University of Wisconsin-Madison 2020.

[28] Skype 2011.

[29] Tennessee Advisory Commission on Intergovernmental Relations 2017.

fiber-to-the premises networks and coaxial cable networks are also faster than most wireless networks.[30]

Moreover, the FCC has recently questioned the extent to which two types of wireless service—satellite service and fixed wireless service—are widely available at broadband speeds, in its 2020 broadband deployment report. For satellite, in particular, the FCC notes that "while satellite signal coverage may enable operators to offer services to wide swaths of the country, overall satellite capacity may limit the number of consumers that can actually subscribe to satellite service at any one time."[31]

Traditionally, satellite service has also suffered from levels of latency—lag—that can degrade voice calls and other real time communications uses because of the distance signals must travel to and from the satellite itself. The median latency for satellite internet is approximately 600 thousandths of a second, according to the FCC,[32] three times more than Skype's recommended maximum for voice calling[33] and more than 15 times longer than the median for most other types of providers.[34] The FCC has said that the increased latency of traditional satellite service—the result of satellites orbiting high above the earth—raises concerns whether traditional satellites allow consumers to "originate and receive" high-quality broadband services.[35]

But advances in technology continue to be made. Providers were already offering service of 10 gigabits per second download and upload to residential customers using fiber-to-the-premises networks at the time of the Commission's 2017 report.[36] Cable providers have now made some progress toward offering the same level of service.[37] The latest advances in mobile wireless networks—those capable of providing fifth generation or "5G" mobile wireless service—have provided service faster than four gigabits per second in testing, with real-world speeds reported in excess of one gigabit per second. However, these speeds are not yet widely available, and the small cell wireless facilities used to achieve these higher speeds over mobile wireless networks are being deployed primarily in Tennessee's urban and suburban areas, rather than its rural

[30] Ibid.

[31] Federal Communications Commission 2020e.

[32] Federal Communications Commission 2018c.

[33] Skype 2011.

[34] Federal Communications Commission 2018c.

[35] Federal Communications Commission 2015b.

[36] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[37] Comcast 2020b.

areas.[38] Further, at least one company is now testing satellite service in the US using low-earth orbit satellites—so-named because the satellites orbit at lower altitudes than traditional satellites. Early results suggest these low-earth orbit satellites are providing testers with broadband speeds at latencies of less than 100 milliseconds; however, some remain skeptical about whether low-earth orbit satellites will become commercially viable for residential broadband service.[39]

In addition to technical differences, caps on monthly data use that are imposed by some providers mean that different broadband services are not always comparable substitutes for each other. Although some providers offer plans without data caps or with data caps up to 1,200 gigabytes,[40] others have much smaller caps. In particular, satellite and mobile wireless service plans limit the amount of data that subscribers can use compared with wireline providers. Even satellite providers and mobile wireless providers offering unlimited data plans say users' internet speeds may be reduced during months when they have used a specified amount of data, in most cases less than 100 gigabytes.[41] The average fixed broadband customer used approximately 250 gigabytes of data per month from October 2018 through September 2019, according to the FCC.[42] While average usage has been increasing from year to year, in 2020 average household use has increased to 384 gigabytes per month, following the onset of the COVID-19 pandemic.[43] Given the technical differences among various infrastructures and the business decisions affecting some services, the Commission continues to assess broadband availability based on access to wireline or fixed wireless service.

The percentage of Tennesseans with broadband access and the percentage who subscribe to service have increased.

Data reported to the FCC by broadband providers continue to show increases in broadband access and adoption in Tennessee. While the limitations of the FCC coverage data, in particular, are well known and were discussed in TACIR's 2017 report, they bear repeating: Coverage data are reported to the FCC at the census block level rather than for individual addresses. The data do not say whether everyone in each census block has access to service at the reported capacities. For wireline and fixed

[38] Tennessee Advisory Commission on Intergovernmental Relations 2020.

[39] Brodkin 2020b; Daehnick et al. 2020; and Jarvis and Stewart 2020.

[40] Google Fiber 2020; and Comcast 2020a.

[41] Verizon 2020; T-Mobile 2020; AT&T 2020c; and Viasat 2020.

[42] Federal Communications Commission 2020f.

[43] Brodkin 2020a; also see Comcast 2020d.

wireless service, "providers file lists of census blocks in which they can or do offer service to at least one location," according to the FCC, but "a provider that reports deployment of a particular technology and bandwidth in a census block may not necessarily offer that service everywhere in the block."[44] As a result, the FCC coverage data represent the *maximum* extent of broadband access at the time at which they were reported.

Despite the known limitations in the FCC data, TACIR chose to use them to assess broadband access and adoption in Tennessee because they allow for comparisons across years and across states. As in the 2017 report, staff have taken care to avoid overstating the conclusions that can be drawn from data.

[44] Federal Communications Commission 2020c.

Improving Broadband Coverage Data

The federal government has taken recent steps that could improve the FCC's coverage data in the future. The FCC adopted an order reforming its coverage data collection and reporting process in August 2019. Largely consistent with that order, Public Law 116-130, enacted in March 2020, requires the FCC to collect and report coverage data using "information for all broadband service locations," rather than census block level data, and establish "a challenge process to enable the submission of independent data challenging the accuracy of FCC broadband maps." The FCC subsequently adopted a second order to eliminate inconsistencies between the first order and the new law. How soon the new process will be implemented and how soon new data becomes available remain to be seen. In its second order, the FCC observes that it currently lacks the funding necessary to fully implement the changes required by Public Law 116-130.

Some states, including Georgia, have also created their own broadband coverage maps. Georgia developed a database of all homes and business in the state and asked providers to report for each location whether they could provide 25/3 service. The state produced a map designating census blocks as served only if more than 80% of the locations in them were reported as served by providers. Compared with the FCC coverage maps, Georgia's new map showed a 32% increase in the number of census blocks designated as unserved, accounting for more than 255,000 homes and businesses. To obtain the coverage data, the state had to reach agreements with each provider individually; 43 of 44 providers in the state participated. The budget for the project was $2 million.

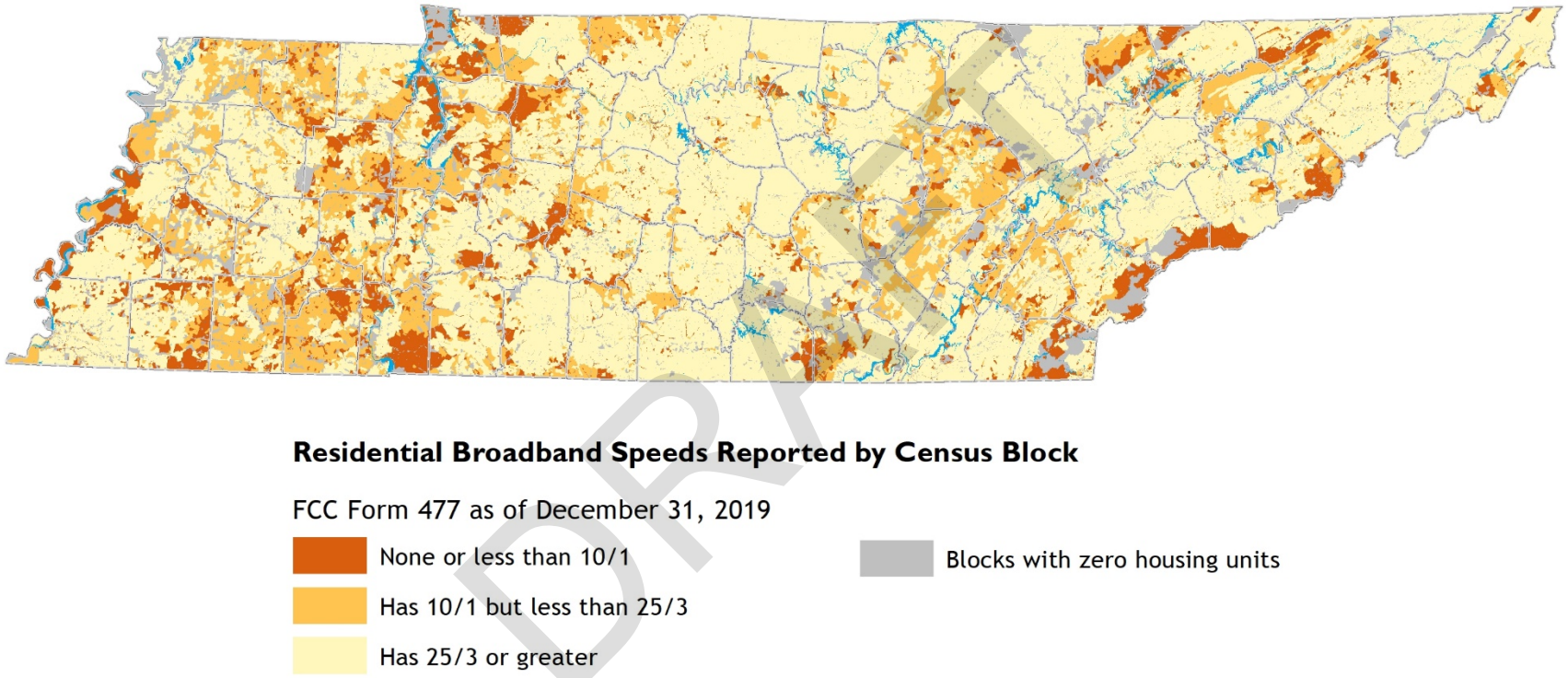
Source: Public Law 116-130; Congressional Research Service 2020; Federal Communications Commission 2019; Federal Communications Commission 2020d; Pressgrove 2019; Georgia Department of Community Affairs 2020a; and Georgia Department of Community Affairs 2020b.

Broadband Access: Gaps Remain, Particularly in Rural Areas

Approximately 93.7% of Tennesseans live in census blocks where at least one provider reported offering wireline or fixed wireless service with a capacity of 25/3 or better, according to data collected by the FCC in December of 2019, the most recent publicly available data. This represents an increase in availability, compared with TACIR's 2017 report, which relied on December 2015 data from the FCC. The most recently revised data show that 88.3% of Tennesseans lived in census blocks where at least one provider reported 25/3 service as of December 2015.[45] See map 1.

[45] TACIR staff analysis of FCC data for December 2019 and December 2015.

Map 1: Maximum Download and Upload Speeds Reported by Providers in each Census Block in Tennessee as of December 2019*



* Includes wireline and terrestrial fixed wireless service; excludes satellite and mobile wireless service.

Source: TACIR staff analysis based on FCC data for December 2019, which was published November 12, 2020.

Despite this increase in reported availability, there are still 432,627 Tennesseans living in census blocks where no provider reported 25/3 service as of December 2019—down from 768,893 as of December 2015.[46] Moreover, Tennessee ranked only 34th in coverage compared with all other states and is sixth among states in the southeast—including Florida, Louisiana, South Carolina, and the eight states that border Tennessee—according to the FCC's 2020 broadband deployment report, which relies on December 2018 data.[47] Both are comparatively worse than in December 2014—the ranking TACIR reported in 2017—when Tennessee was 29th overall and fifth in the southeast.[48] Because they were reported in December 2018, the data used in the FCC's 2020 broadband deployment report might not fully capture the effects of policy changes included in Public Chapter 228, Acts of 2017.

Although Tennessee's rural areas have also seen increases in reported coverage, they still lag behind the state's urban areas. Approximately 80% of residents in rural areas of Tennessee have broadband access, according to the FCC's 2020 broadband deployment report, an increase from 66% reported by the FCC in 2016. Comparatively, however, almost 99% of those living in Tennessee's urban areas have access to broadband.[49]

Broadband Adoption: Gains Made, More Are Needed

Broadband adoption also continues to increase, but like broadband access, gaps in adoption remain. In Tennessee, 58% of households in census blocks where at least one provider reported offering broadband subscribed to the service, according to the FCC's 2020 broadband progress report, which relies on December 2018 data.[50] This represents a sizeable increase from TACIR's 2017 report, which found that the adoption rate for 25/3 service was only 40% in Tennessee based on the FCC's 2016 progress report, which relies on December 2014 data.[51] As noted above, the data used in the FCC's 2020 broadband deployment report might not fully capture the effects of policy changes included in Public Chapter 228, Acts of 2017, because they were reported in December 2018.

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[46] TACIR staff analysis of FCC data for December 2019.

[47] Federal Communications Commission 2020e.

[48] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[49] Federal Communications Commission 2020e; and Tennessee Advisory Commission on Intergovernmental Relations 2017.

[50] Federal Communications Commission 2020e.

[51] Tennessee Advisory Commission on Intergovernmental Relations 2017.

This increase from 2014 to 2018 aside, there still appears to be a significant number of households that could be subscribing to broadband but aren't. Surveys conducted by the Pew Research Center show the percentage of adults who report having home broadband, with results broken out by different demographic characteristics, including age, education, and income, among others.[52] TACIR staff used results from Pew's 2019 survey, Census data, and FCC coverage data to make rough estimates of expected broadband adoption rates in Tennessee, assuming that Tennesseans subscribe to home broadband at the same rate as others in similar demographic groups nationwide. Based on TACIR staff analysis, the expected adoption rates range from 66% to 70%, after adjusting for broadband availability, approximately 10 percentage points greater than the 58% adoption rate reported in the FCC data.

Similar to broadband access, Tennessee's ranking for broadband adoption relative to other states decreased in December 2018 compared with December 2014. Tennessee ranked 31st nationally in broadband adoption percentage and sixth among southeastern states in December 2018.[53] But four years earlier, Tennessee was tied for 19th nationally and ranked second in the southeast.[54]

The increases in both broadband access and adoption are encouraging. Although gaps remain, the good news is that Tennessee is well placed to address these gaps based on the public and private initiatives already in place. The lessons learned from policy changes implemented in 2017 can help inform any future changes or new policies to help maximize their effectiveness at improving broadband access and adoption.

Cost remains a major barrier to providing broadband in some unserved areas.

The challenging economics of providing broadband in some unserved areas remains no less a problem today, according to consultants in the broadband industry, as well as representatives for broadband providers, in interviews with TACIR staff and in presentations to the Commission.[55] For some communities, low population densities,

[52] Anderson 2019.

[53] Federal Communications Commission 2020e.

[54] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[55] Telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020; telephone interview with Dan Rodamaker, CEO, Gibson Electric Membership Corporation, and Charles Phillips, engineer, Gibson Electric Membership Corporation, October 15, 2020; presentation of James Stegeman, president and CEO, CostQuest Associates, TACIR Meeting, December 11, 2019; and panel discussion by broadband providers on barriers to expanding coverage, TACIR Meeting, November 5, 2020.

which result in fewer potential customers and therefore less revenue per mile of line constructed, can make it particularly difficult for providers to cover their costs. As described by the US Government Accountability Office (GAO) in a 2014 report on policies for expanding broadband coverage,

> unserved and underserved areas tend to have conditions that increase the cost of constructing and maintaining broadband networks. These conditions include low populations who might also be widely dispersed and in remote areas that might have challenging terrain, such as mountains, that increase construction costs.[56]

The GAO summarizes the effect of low population density and difficult terrain on the economics of coverage expansion later in the same report, saying that

> *for these reasons, stakeholders told us that being able to cover costs with potential revenues and thus make a return on investment is a key issue to deploying broadband in unserved and underserved areas.*[57] (emphasis added)

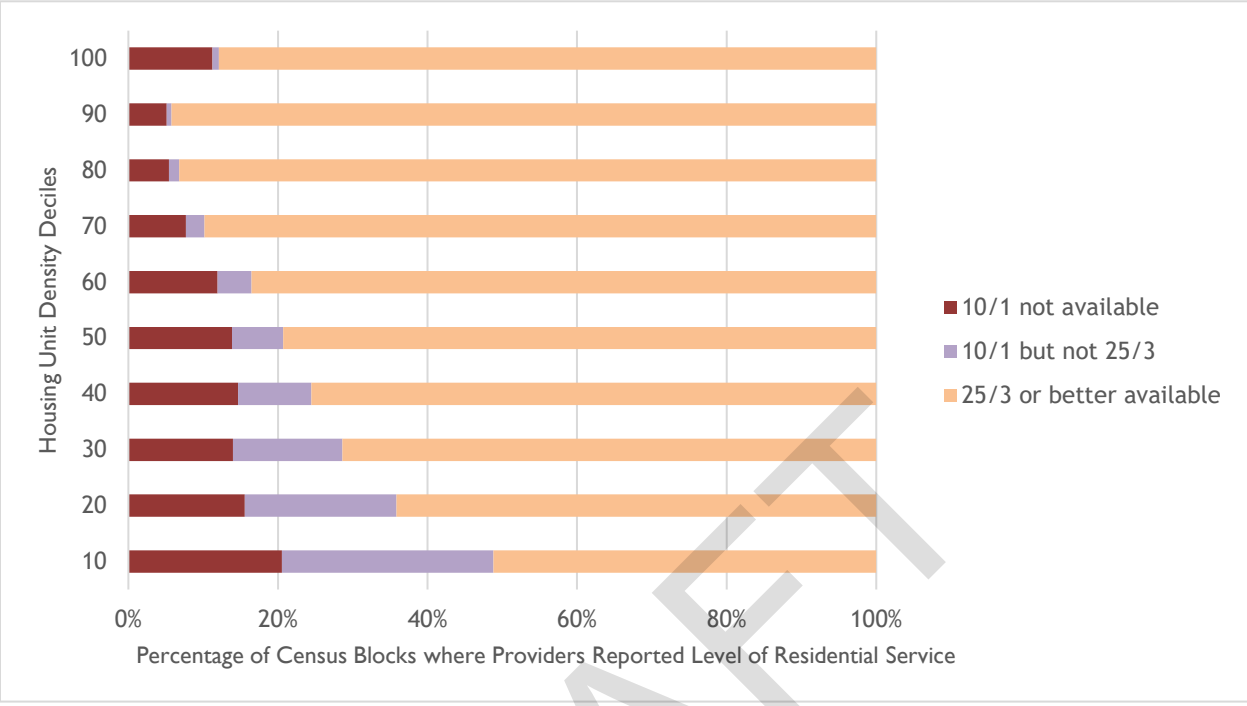
Just as the Commission found in 2017, the census blocks in Tennessee where no provider reports offering broadband have lower housing unit densities on average than those where service was reported. While the average housing unit density of blocks where no provider reported service of at least 25/3 as of December 2019 is approximately 18 units per square mile, the average housing unit density of blocks where providers reported offering at least 25/3 is 106 units per square mile. The likelihood that a census block will have service of at least 10/1 or 25/3 reported for it also rises as housing unit density increases. While only 51% of the 10% of census blocks with the lowest housing densities have access to service of at least 25/3, 88% of the highest density census blocks do. Over 90% of the blocks in second and third highest density deciles have access to at least 25/3 service.[58] See figure.

[56] US Government Accountability Office 2014.

[57] Ibid.

[58] TACIR staff analysis of FCC data for December 2019.

Figure: Percentage of Census Blocks with Access to Broadband as of December 2019 by Housing Unit Density Decile



Source: TACIR staff analysis of FCC data for December 2019, which was published November 12, 2020.

Tennessee's broadband grant program, along with several federal programs, is helping accelerate the expansion of coverage to unserved areas.

In 2017, the Commission recommended that the state consider providing grants to broadband providers to help offset the cost of expanding coverage to unserved areas not already receiving funding through federal broadband programs. Consistent with this recommendation, the General Assembly established a grant program for unserved areas as part of the Tennessee Broadband Accessibility Act (Public Chapter 228, Acts of 2017). This state program, along with several federal programs, has helped accelerate the deployment of broadband in Tennessee. In general, these programs offer funding in the form of grants—though some federal programs offer loans—to providers through competitive application or bidding processes in exchange for providers meeting obligations to expand coverage to a specified number of homes and businesses in unserved areas.

Tennessee Broadband Accessibility Grant Program

The Tennessee Broadband Accessibility Grant program is administered by the Tennessee Department of Economic and Community Development (ECD). The

program is funded by annual appropriations from the General Assembly and is currently in its fourth funding cycle, having received appropriations of

- $10 million for fiscal year 2017-18,
- $15 million for fiscal year 2018-19,
- $20 million for fiscal year 2019-20,[59] and
- $15 million for the current fiscal year, 2020-21 (grants to be announced in 2021).[60]

Through its first three rounds, the program has awarded a total of more than $44.3 million, helping fund 39 projects in unserved areas located in communities across the state (see map 2). Because ECD limits grants to no more than 50% of overall costs for each project, more than $44.3 million in matching funds will also be invested in these projects, resulting in a total investment in broadband expansion of approximately $88.7 million—public and private—for the first three rounds.[61] The program has already resulted in several thousand homes and businesses receiving access to broadband, and total funding requests from applicants continue to exceed funding available each cycle.[62]

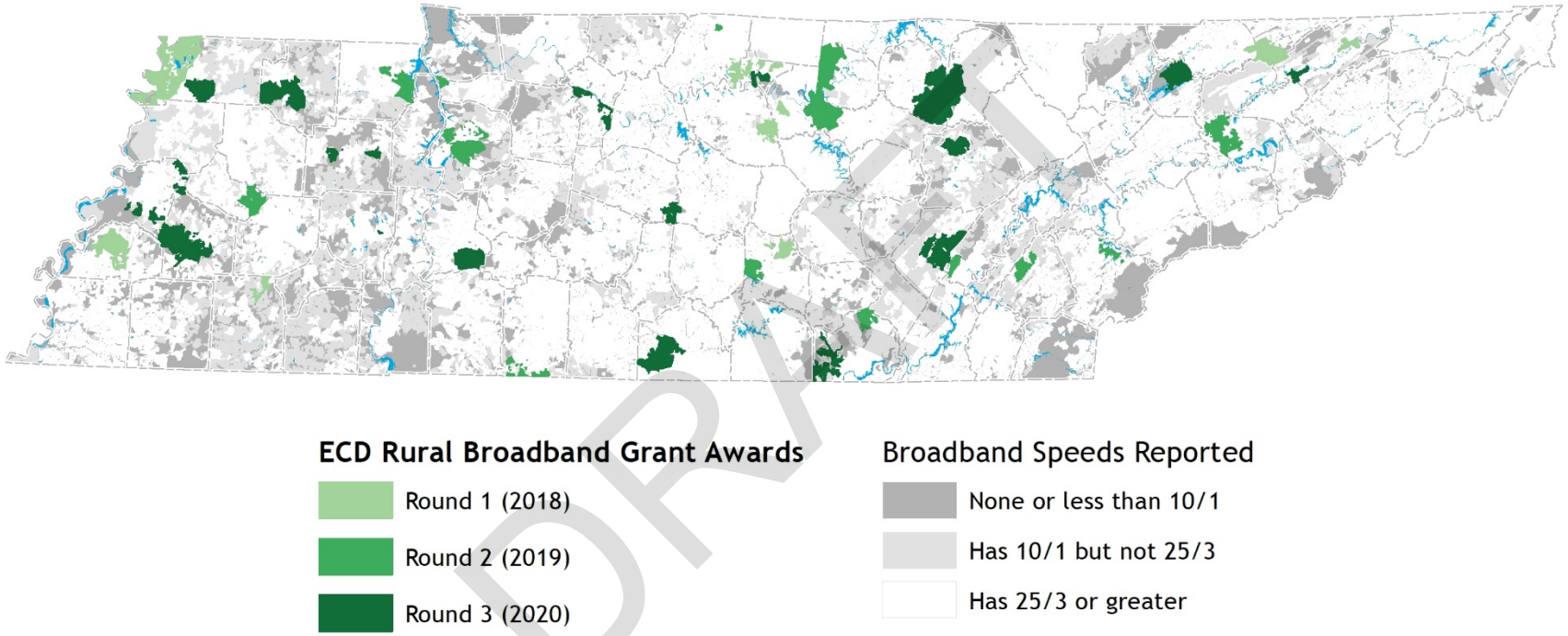
[59] Tennessee Comptroller of the Treasury 2020.

[60] Telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020.

[61] Tennessee Department of Economic and Community Development "Broadband Accessibility Grant: Program Guidelines"; email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; and telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, April 7, 2020.

[62] Telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020; and email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

Map 2: Project Areas for Grants Awarded Through First Three Rounds of the Tennessee Broadband Accessibility Grant Program



Source: TACIR staff, using project areas provided by ECD.

The grant program's buildout requirements help ensure that funding results in coverage expansions.

Requirements included in each grant help ensure that state funding awarded through the program will result in coverage expansions. Funds are disbursed to grantees only for reimbursable project costs, with grantees receiving funding only after showing proof of payment for work done in their project areas. Although grantees may submit requests and receive reimbursements as costs are incurred, ECD withholds 15% of the total grant amount for each project until the project is completed, creating an additional incentive for project completion. Before withheld funds are released, projects must be certified as complete by a licensed engineer or an ECD-approved consultant, who verifies that all obligations, including buildout requirements, have been met. The state's efforts to ensure that obligations are met and that funding results in wider coverage have been highlighted as a promising practice by the Pew Charitable Trusts in its evaluation of state efforts to expand broadband access.[63]

The buildout requirements for the first three rounds of funding total 26,300 homes and businesses. In some cases, grantees have been able to expand coverage to additional unserved locations outside of their grant areas. ECD reports that grants awarded in the first round of funding resulted in 7,019 previously unserved homes and businesses receiving coverage, almost 1,800 more than were required under the grants. Data from subsequent rounds is still incomplete.[64]

Areas without access to 25/3 service are eligible for funding, though the program prioritizes funding for areas without access to 10/1 service.

Eligibility requirements for project areas have evolved through the first four grant cycles. Consistent with the Commission's 2017 recommendations, funding for the first two cycles was limited to areas without access to service of at least 10 megabits per second download and one megabit per second upload (10/1) with priority given to areas meeting that requirement that also had not received funding for broadband expansion through other state or federal programs. Beginning with the third grant cycle, eligibility was expanded to include areas without access to service of at least 25 megabits per second download and three megabits per second upload (25/3), prioritizing areas that have not received other state or federal broadband funding.

[63] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 22, 2020; Tennessee Department of Economic and Community Development "Broadband Accessibility Grant: Program Guidelines"; and Stauffer et al. 2020.

[64] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

However, ECD is required under Public Chapter 228 to prioritize funding for areas without access to at least 10/1 service. ECD now awards extra points during the application review process to projects that would serve areas without access to 10/1.[65]

Although ECD relies on FCC data to help determine whether areas are unserved, it allows providers to challenge the data during the application review process. This gives applicants an opportunity to provide evidence that census blocks listed as served in the FCC data are in fact only partially served or in some cases have been reported as served in error. Similarly, because of the lag between when coverage data are reported to the FCC and publicly released, providers also have an opportunity to provide evidence that they have already expanded coverage to census blocks still listed as unserved.[66] The eligibility of areas is only one component of ECD's application review process.

ECD awards grants through a competitive application process.

ECD awards grants through a competitive application process, consistent with the Commission's 2017 recommendations. Grants are scored using a combination of objective and subjective metrics (see appendix D). Among categories considered in the scoring process are

- the need for grant funding, including not only whether the proposed grant area already has service, but also a description of why the proposed area is difficult to serve and won't be served without grant funding;
- the sustainability of the proposed project and implementation readiness of the applicant, including technical, managerial, and financial capabilities of the applicant and an assessment of the proposed business plan and the percentage of locations in the grant area—or take rate—that will need to subscribe to service for the business plan to be viable;
- whether required matching funds are available;

[65] Telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020; telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; and Tennessee Advisory Commission on Intergovernmental Relations 2017.

[66] Telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; and Tennessee Department of Economic and Community Development "Broadband Accessibility Grant: Program Guidelines."

- whether technology used for providing service is scalable to meet changes in future needs;
- whether service meeting the 25/3 standard will be available at affordable prices;
- whether a project is designed to meet specific community needs;
- whether there is identified community support for a project;
- whether the applicant has a plan to encourage broadband adoption in the grant area;
- whether the proposed grant area is located in a city or county that has been designated as a broadband ready community by ECD; and
- whether the project will primarily serve areas located in counties federally designated as "at-risk" or "distressed."[67]

Representatives for broadband providers were generally complimentary of the grant program and the application process in interviews and in presentations at TACIR meetings.[68]

But representatives for cable companies said the program could increase the number of homes and businesses receiving service per dollar of state funding awarded if it were to add a metric assessing applications based on the average cost to serve locations in proposed grant areas, also referred to as the cost per passing.[69] The median cost per passing to the state for the first three rounds of the grant program was approximately $2,000 per location—approximately $4,000 per location, in total, after including required matching funds. On an application-by-application basis the cost to the state ranged from $438 per location to $4,795 per location in state funding—ranging from $877 per

[67] Tennessee Department of Economic and Community Development "Tennessee Broadband Accessibility Grant"; telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; and Tennessee Advisory Commission on Intergovernmental Relations 2017.

[68] Telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020; telephone interview with Dan Rodamaker, CEO, Gibson Electric Membership Corporation, and Charles Phillips, engineer, Gibson Electric Membership Corporation, October 15, 2020; telephone interview with Jonathan West, general manager and CEO, Twin Lakes Telephone Cooperative, November 2, 2020; telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020; presentation to TACIR staff by Tennessee Cable and Broadband Association, June 23, 2020; and panel discussion by broadband providers on barriers to expanding coverage, TACIR Meeting, November 5, 2020.

[69] Presentation to TACIR staff by Tennessee Cable and Broadband Association, June 23, 2020.

location to $9,589 per location overall.[70] As part of the application scoring process, ECD already incorporates cost-related factors, including population density, when assessing the need for state funding and the sustainability of the proposed business plan for the grant area. However, the grant scoring process does not award points specifically based on cost per passing.[71] Four of the 28 other states with broadband grant programs prioritize projects with lower costs per location served.[72]

Unsurprisingly, adding cost per passing as metric in the grant scoring process could shift funding to areas with greater population densities. For rounds two and three of the grant program, ECD collected data on the average number of locations per mile in the areas that were awarded grants. Of the 16 projects in these two rounds where cost per location to the state was less than the three-round median of $2,000 per location ($4,000 per location after adding matching funds), the average number of locations per mile was 17.6. For the 14 projects where cost per location was greater than the median, the average number of locations per mile was only 7.9.[73] As a result, although all areas eligible for the grant program are by definition unserved, adding a cost-per-passing metric could have the consequence of drawing state resources away from more rural and more costly areas where it is already hardest for providers to make a business case to expand broadband access.

Representatives for cable companies also recommended that more individuals outside ECD be included in the scoring process.[74] ECD staff report that those who have scored grants in prior rounds aside from the Department's broadband team include the "Senior Rural Policy Advisor, the Deputy Assistant Commissioner of Rural Development, the Rural Development Grants Coordinator and members of the Center for Economic

[70] TACIR staff calculations based on information provided in email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

[71] Telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020; and telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

[72] TACIR staff review of broadband grant programs in other states; see, Code of Alabama, Section 41-23-213; Kentucky Revised Statutes Annotated, Section 224A.1121; 35-A Maine Revised Statutes 9211-A; and North Carolina General Statutes, Sections 143B-1373.

[73] TACIR staff calculations based on information provided in email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

[74] Panel discussion by broadband providers on barriers to expanding coverage, TACIR Meeting, November 5, 2020.

Research in Tennessee. Additionally . . . ECD consults a network engineer obtained by a competitive [request for proposal] process through [the state's Central Procurement Office] for technical review of applications."[75] In its discussion of the grant program, the Tennessee Comptroller of the Treasury's 2020 performance audit for ECD emphasizes the importance of adopting written policies and procedures to ensure that the process detailed by ECD staff is being consistently applied. The audit did not identify any instances where the process outlined by ECD has been applied inconsistently—and no applicants provided evidence to TACIR staff of inconsistency in scoring or oversight of grants.[76]

Federal Programs and Funding for Expanding Broadband Access

In addition to the state's broadband grant program, several federal programs administered by multiple different agencies can be used to support the expansion of broadband access (see appendix E). Some of these programs are either broadband-specific or have been used to support broadband projects in Tennessee. In particular, a sizeable amount of federal funding for Tennessee broadband projects has been awarded by the FCC, the US Department of Agriculture (USDA), and the Appalachian Regional Commission (ARC):

FCC Programs: Connect America Fund and Rural Digital Opportunity Fund

The FCC continues to support broadband expansion through a variety of programs. Several—including the Connect America Fund Phase II (CAF II), Connect America Fund Alternative Model (ACAM), Connect America Fund Broadband Loop Support (CAF BLS), and the Connect America Fund Auction (CAF Auction)—were described in TACIR's 2017 report and are in various stages of implementation. In addition to these programs, the FCC is providing support through the Connect America Fund Alternative Model II (ACAM II) program, and it is in the process of awarding funding through the Rural Digital Opportunity Fund Auction (RDOF). For each program, providers receive funding in exchange for a requirement that they expand broadband to a set number of homes and businesses, though for some programs the minimum capacity required for some or all locations is 10/1 rather than 25/3.

- CAF II: FCC funding over seven years for the three[77] providers in Tennessee receiving support through the CAF II program will total approximately $209 million if all requirements are met. Combined, the three providers are required

[75] Tennessee Comptroller of the Treasury 2020.

[76] Ibid.

[77] AT&T, CenturyLink, and Frontier Communications.

to expand service with a capacity of at least 10/1 to 93,422 homes and businesses. At the end of 2019, the three providers collectively had 1,152 locations remaining to meet their obligations.[78]

- ACAM: FCC funding over 10 years for the three[79] providers in Tennessee receiving support through the CAF Alternative Model program will total approximately $127 million if all requirements are met. Combined, the three providers are required to offer service with a capacity of at least 25/3 to 25,276 homes and business and are required to offer service with a capacity of at least 10/1 to another 4,462 homes and locations. At the end of 2019, the three providers collectively had 15,090 locations remaining to meet their 25/3 obligations and 334 locations remaining to meet their 10/1 obligations.[80]
- ACAM II: FCC funding over 10 years for the two[81] providers in Tennessee receiving support through the CAF Alternative Model II program will total approximately $43 million. Combined, the two providers are required to offer service with a capacity of at least 25/3 to 10,732 homes and businesses. At the end of 2019—the year the program began—the two providers still had all 10,732 locations remaining to meet their obligations.[82]
- CAF BLS: FCC funding for the five years from 2019 to 2024 for the eight[83] providers in Tennessee receiving support through the CAF BLS program will total approximately $124 million. Combined, the eight providers are required to expand service with a capacity of at least 25/3 to 23,023 homes and businesses.

[78] Tennessee Advisory Commission on Intergovernmental Relations 2017; Federal Communications Commission 2014a; Federal Communications Commission 2015a; and TACIR staff calculations based on data reported in Universal Service Administrative Company 2020.

[79] DeKalb Telephone Cooperative, TDS, and TEC.

[80] Federal Communications Commission 2016a; Universal Service Administrative Company. "ACAM, ACAM II and CAF BLS Buildout Requirements"; and TACIR staff calculations based on data reported in Universal Service Administrative Company 2020.

[81] E. Ritter Communications and Highland Telephone Cooperative.

[82] Federal Communications Commission 2018a; Universal Service Administrative Company. "ACAM, ACAM II and CAF BLS Buildout Requirements"; and TACIR staff calculations based on data reported in Universal Service Administrative Company 2020.

[83] Ardmore Telephone Company, Ben Lomand Telephone Cooperative, Bledsoe Telephone Cooperative, Loretto Telephone Company, North Central Telephone Cooperative, Twin Lakes Telephone Cooperative, UTC of Tennessee, and West Kentucky and Tennessee Telecommunications Cooperative.

At the end of 2019, the eight providers collectively had 10,879 locations remaining to meet their obligations.[84]

- CAF Auction**:** FCC funding over 10 years for the five[85] providers in Tennessee receiving support through the CAF Auction will total approximately $8 million. Combined, the five providers are required to expand service at capacities meeting the terms of their bids—which were all greater than 25/3—to 3,290 homes and businesses. At the end of 2019, the five providers still had all 3,290 locations remaining to meet their obligations.[86]
- RDOF Auction: FCC funding over 10 years for 11 providers[87] in Tennessee receiving support through phase I of the auction will total approximately $149 million. Combined, the 11 providers are required to expand service at capacities meeting the terms of their bids—which were all greater than 25/3—to 155,220 homes and businesses. Winning bids for phase I were announced on December 7, 2020. The FCC has not set a date for phase II of the auction, which will award $4.4 billion nationwide and will target census blocks that are partially served at capacities of at least 25/3 as well as any unserved census blocks that did not receive funding through phase I.[88]

USDA Programs: ReConnect Grants and Loans, Community Connect Grants, and Infrastructure Loans

The USDA has also supported broadband expansion in Tennessee through a variety of programs. This support includes grants, loans, or both, depending on the program. Three programs through which providers in Tennessee have received funding are the

[84] Federal Communications Commission 2016a; Universal Service Administrative Company. "ACAM, ACAM II and CAF BLS Buildout Requirements"; and TACIR staff calculations based on data reported in Universal Service Administrative Company 2020.

[85] Ben Lomand Telephone Cooperative, Holston Electric Cooperative, Meriwether Lewis Electric Cooperative, and Sunset Digital Communications, as well as the Rural Electric Cooperative Consortium.

[86] Federal Communications Commission 2016b; Federal Communications Commission "Connect America Fund Phase II: Assignments Winning Bidders"; Federal Communications Commission "Connect America Fund Phase II: Assignments Assigned Bids"; and TACIR staff calculations based on data reported in Universal Service Administrative Company 2020.

[87] Bay Springs Telephone Company, Charter Communications, Newport Utilities, Scott County Telephone Cooperative, and SpaceEx, as well consortiums including Co-Op Connections Consortium, NexTier Consortium, Prospero Broadband Consortium, RDOF USA Consortium, Rural Electric Cooperative Consortium, and Tennessee Cooperatives Group Consortium.

[88] Federal Communications Commission 2020a; Federal Communications Commission 2020i; Federal Communications Commission "Rural Digital Opportunity Fund: Assignments Assigned Bids"; and Federal Communications Commission "Fact Sheet."

ReConnect Program, the Community Connect Program, and the Infrastructure Loan Program. While the Infrastructure Loan Program remains open for new applicants, the Community Connect Program was not funded in fiscal year 2019-20 and the latest round of applications for the ReConnect Program closed in April 2020.

- ReConnect Program: Through the ReConnect Program, the USDA awarded approximately $10 million in grants, $18 million in loans, and $2 million in grant-loans combinations to providers[89] for projects in Tennessee in fiscal year 2019-20, for a total of approximately $30 million. Based on information provided by the USDA, there are approximately 8,303 homes located these project areas.
- Community Connect Program: Through the Community Connect Program, the USDA awarded approximately $13 million in grants to providers[90] for projects in Tennessee from fiscal year 2015-16 through fiscal year 2017-18. Based on information provided by the USDA, there are approximately 3,287 homes located these project areas.
- Infrastructure Loan Program: Through the Infrastructure Loan Program, the USDA awarded approximately $72 million in loans to providers[91] for projects in Tennessee from fiscal year 2017-18 through fiscal year 2019-20. Based on information provided by the USDA, there are approximately 117,941 homes located these project areas.

The USDA has also awarded approximately $1.9 million in grants to community colleges and K-12 schools for distance learning projects in Tennessee from fiscal year 2014-15 through fiscal year 2018-19, and it has awarded approximately $1.6 million in grants hospitals for telemedicine projects in Tennessee from fiscal year 2014-15 through fiscal year 2018-19. All of these grants are awarded through the USDA's Distance Learning and Telemedicine Grant Program. The program does not include information on the number of subscribers, if any, gaining access to broadband from these grants.[92]

[89] People's Telephone Company, Gibson Electric Membership Corporation, United Communications, Ben Lomand Telephone Cooperative, and North Central Telephone Cooperative.

[90] West Kentucky and Tennessee Telecommunications Cooperative, French Broad Electric Membership Cooperative, North Central Telephone Cooperative, Ben Lomand Telephone Cooperative, and Highland Telephone Cooperative.

[91] Ardmore Telephone Company, Ben Lomand Telephone Cooperative, Bledsoe Telephone Cooperative, North Central Telephone Cooperative, and Twin Lakes Telephone Cooperative.

[92] TACIR staff calculations based on information provided in email from James R. Combs, government information specialist, Enterprise Services Division, Rural Development, United States Department of Agriculture, December 1, 2020.

ARC Programs: Area Development, Central Appalachia, Distressed Counties, and POWER

The ARC has provided support for broadband expansion in Tennessee through a variety of programs, only one of which—the Central Appalachia Broadband program—is broadband-specific. For the programs listed below, TACIR staff have obtained information on the number of homes and businesses that will receive service through broadband projects funded by ARC. Information on the amount of funding those individual projects received has not been obtained at this time.

- Area Development Program: The ARC has funded six broadband projects in Tennessee through its Area Development Program since the beginning of 2017. Of these projects, four will bring WiFi access to several communities' downtown areas that combined are home to 212 businesses,[93] and two[94] will expand wireline access to homes and businesses. Buildout requirements for the wireline projects total 818 homes and businesses.
- Central Appalachia Broadband Program: The ARC has funded two projects[95] in Tennessee through the Central Appalachia Broadband Program. Buildout requirements for these projects total 979 homes and businesses.
- Distressed Counties Program: The ARC has funded five projects[96] that will expand broadband access through the Distressed Counties program since the beginning of 2017. Buildout requirements for these projects 2,709 homes and businesses.
- Partnerships for Opportunity and Workforce and Economic Revitalization (POWER) Initiative: The ARC has funded seven broadband projects in Tennessee since 2017 through its POWER initiative. Of these projects, two were feasibility studies, and the other five[97] will expand wireline access to homes and businesses. Buildout requirements for the wireline projects total 7,987 homes and businesses.[98]

[93] Athens, McMinnville, Rogersville, and Winchester.

[94] Sequatchie Valley Electric Cooperative and Appalachian Electric Cooperative.

[95] One was located in Campbell County; the other is for Newport Utilities.

[96] Includes projects in Sneedville, Cocke County, and Fall Creek Falls as well as projects by Twin Lakes Telephone Cooperative and Bledsoe Telephone Cooperative.

[97] Duck River Electric Membership Corporation, French Broad Electric Membership Corporation, Volunteer Energy Cooperative, and Holston Electric Cooperative, as a well as a project in areas around Rocky Fork State Park.

[98] TACIR staff calculations based on information provided in email from Nancy Eyl, deputy general counsel, Office of the General Counsel, Appalachian Regional Commission, November 9, 2020.

Coronavirus Aid, Relief, and Economic Security (CARES) Act: Tennessee Emergency Broadband Fund

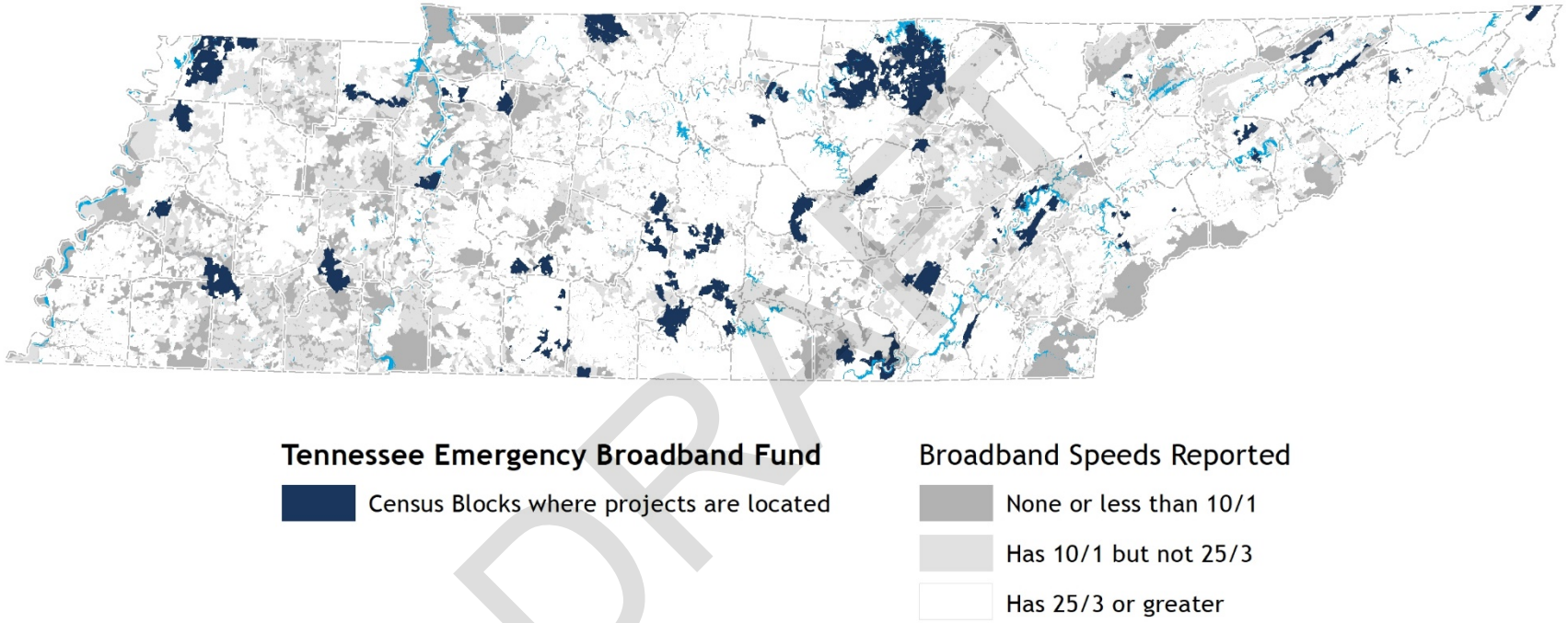
In August 2020, ECD awarded a total of $61 million in grants through the Tennessee Emergency Broadband Fund to providers for 62 projects across the state (see map 3). Funding for the grants will come from a portion of the federal aid the state received through the State Coronavirus Relief Fund of the CARES Act. Required matching funds from grantees will total approximately $20 million, bringing total investment resulting from the program to $81 million. Similar to the state grant program, the Emergency Broadband Fund grants include buildout requirements that will result in 23,985 locations receiving broadband access. Several grants include the deployment of public WiFi. Under the terms of the CARES Act, projects must be completed before the end of 2020 to receive funding.[99]

Grants were awarded through a competitive application process and not every application was approved. In addition to the 62 applications awarded funding, the state received another 22 applications for $27 million that weren't funded.[100]

[99] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020 and Tennessee Governor's Office 2020.

[100] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; and telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020.

Map 3: Project Areas for Grants Awarded Through the Tennessee Emergency Broadband Fund (Funded by CARES Act)



Source: TACIR Staff, using project areas provided by ECD.

The Estimated Cost of Covering Remaining Unserved Areas in Tennessee

There are 194,407 housing units located in census blocks where no provider reported 25/3 service as of December 2019. For projects that were awarded funding in the first three rounds of the state's grant program, ECD reports a minimum cost per passing of $877 per location, a maximum of $9,589 per location, and a median of $4,028 per location. Based on ECD's cost-per-passing data, TACIR staff estimate the cost to serve these 194,407 unserved housing units could be $170 million using the minimum reported cost from the state grant program, $1.8 billion using the maximum, and $783 million using the median.[101] See table.

Some of these housing units will likely receive service as part of projects that have received funding from either the state grant program or the federal programs discussed above. Because of the lag in FCC data and a lack of available information on the exact boundaries of each project area awarded funding through federal programs, TACIR staff were unable to calculate the exact number of housing units remaining in unserved census blocks after accounting for the unfinished buildout requirements of projects that have received funding through state and federal programs. Moreover, the estimates below do not account for the FCC's RDOF auction, for which winning bidders were announced on December 7, 2020.

However, based on TACIR staff estimates, there are at least 131,268 housing units in census blocks where no provider reported 25/3 service as of December 2019 that won't receive broadband from existing state- or federally funded projects. Using ECD's cost-per-passing data, TACIR staff estimate the cost to serve these 131,268 unserved housing units could be $115 million using the minimum reported cost from the state grant program, $1.3 billion using the maximum, and $529 million using the median.[102] See table.

[101] TACIR staff calculations based on data from state and federal broadband programs and December 2019 FCC Form 477 data.

[102] Ibid.

Table: Estimated Cost to Expand Coverage to Housing Units in Unserved Census Blocks After Accounting for Federal and State Programs*

	Housing Units	Cost to Expand Coverage		
		Cost Per Location Based on First Three Rounds of State Grant Program		
		Minimum ($877 per location)	Median ($4,028 per location)	Maximum ($9,589 per location)
Number of Housing Units Remaining in Census Blocks Where No Provider Reported 25/3 as of December 2019	194,407	$ 170,427,531	$ 783,035,142	$ 1,864,176,712
Number of Housing Units Remaining in Those Blocks After Accounting for State and Federal Programs*	131,268	$ 115,076,520	$ 528,723,024	$ 1,258,734,247

* The data used in this table don't account for awards made through the FCC's Rural Digital Opportunity Fund auction. Auction winners were announced December 7, 2020. Eleven providers in Tennessee were awarded funding that will total approximately $149 million of 10 years.

Source: TACIR staff calculations based on data from state and federal broadband programs and December 2019 FCC Form 477 data.

Local governments are currently limited in their authority to provide direct funding to private enterprises for deploying broadband.

Local government incentives for providers that could be enacted to facilitate the expansion of broadband access were discussed by representatives for one county in interviews with TACIR staff. However, local governments in Tennessee are limited in their authority to provide direct funding to private enterprises—including those deploying broadband. Under Article II, Section 29 of the Tennessee Constitution,

> the credit of no County, City or Town shall be given or loaned to or in aid of any person, company, association or corporation, except upon an election to be first held by the qualified voters of such county, city or town, and the assent of three-fourths of the votes cast at said election. Nor shall any county, city or town become a stockholder with others in any company, association or corporation except upon a like election, and the assent of a like majority.

As a result of these provisions, according to the Tennessee Court of Appeals in 2001,

> political subdivisions were not absolutely forbidden to use their credit in aid of private enterprises, *but the three-fourths vote required for this action was a powerful limitation*.[103] (emphasis added)

Local governments are currently authorized under Tennessee Code Annotated, Section 7-59-316 to participate in joint ventures with private entities to provide broadband but only in historically unserved areas—which are limited to those areas that as determined by the Tennessee Public Utility Commission (TPUC) lack access to broadband, have been developed for residential use for at least five years, lie outside the service area of a company that holds a local- or state-issued cable television franchise, and which no other provider intends to serve.[104] As TACIR noted in its 2017 report, no joint ventures have been established for providing broadband under Tennessee Code Annotated, Section 7-59-316, according to TPUC staff.[105] Moreover, the statute authorizing joint ventures does not explicitly address whether local governments have the authority to provide funding to the joint venture.

According to attorneys and a financial advisor who are working with one county to develop legislation that would allow local governments to directly fund broadband projects by private entities, one alternative would be to

1. add broadband projects to the list of authorized projects for industrial development boards (IDB) and
2. authorize local governments to pledge local revenue streams—other than property tax revenue—in support of those projects with funding flowing from the local government to the project through the IDB.[106]

IDBs are already authorized to participate in and provide funding for other types of projects,[107] and local governments with central business improvement districts are authorized to make multiyear pledges of local revenues—except property tax revenue—to IDB projects that "consist of public infrastructure, public improvements or

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[103] Ragsdale v. City of Memphis, 70 S.W.3d 56 (Court of Appeals of Tennessee at Memphis 2001).

[104] Tennessee Code Annotated, Section 7-59-316.

[105] Email from John Hutton, telecom consultant, Tennessee Public Utility Commission, November 22, 2016.

[106] Telephone interview with Jeff Oldham, attorney, Bass Berry and Sims, Richard Dulaney, managing director, Public Finance, Debt Investment Banking, Raymond James, Mark Smith, attorney, Miller and Martin, Brent Greer, mayor, Henry County, and Terry Wimberley, general manager, Paris Utility Authority, October 22, 2020; and email from Tracy Johnson, Raymond James, November 5, 2020.

[107] Tennessee Code Annotated, Section 7-53-101 et seq.

other public facilities" located in areas designated by a resolution or ordinance as center city areas.[108] Similar local authority to make multiyear pledges of revenues other than property taxes for specific types of projects also exists under statutes authorizing the creation of sports authorities and convention center authorities.[109] According to the attorneys and financial advisor interviewed by TACIR staff, authorizing local governments to make similar multiyear funding commitments to broadband projects would not only reduce the amount of money that private providers must borrow for projects, but could also make these projects more attractive to lenders and reduce interest rates for them to the extent that local revenue streams could be pledged as collateral for loans.[110]

However, authorizing local governments to make multiyear pledges of local revenue for broadband projects carries risks to taxpayers. The Commission found several examples of failed broadband projects in its 2017 report, noting that publicly funded projects are not immune to the risks faced in competitive markets.[111] Simply authorizing local governments to directly fund broadband projects carried out by private entities does not guarantee that local funding will result in expansions of coverage.

It is not uncommon for IDBs in Tennessee to include performance criteria or clawbacks in contracts for projects receiving other incentives, such as payment in lieu of tax (PILOT) agreements—which allow businesses to reduce or eliminate the amount they would otherwise owe in property taxes. But the inclusion of performance criteria or clawbacks is not required by law. As the Commission found in its 2018 report on Industrial Development Boards and PILOTs,

> PILOT agreements usually include goals that businesses are expected to meet, such as creating a certain number of jobs or making a certain capital

[108] Tennessee Code Annotated, Section 7-53-315; and email from Tracy Johnson, Raymond James, November 5, 2020.

[109] Tennessee Code Annotated, Sections 7-67-116 and 7-89-115; telephone interview with Jeff Oldham, attorney, Bass, Berry and Sims, Richard Dulaney, managing director, Public Finance, Debt Investment Banking, Raymond James, Mark Smith, attorney, Miller and Martin, Brent Greer, mayor, Henry County, and Terry Wimberley, general manager, Paris Utility Authority, October 22, 2020; and email from Tracy Johnson, Raymond James, November 5, 2020.

[110] Telephone interview with Jeff Oldham, attorney, Bass, Berry and Sims, Richard Dulaney, managing director, Public Finance, Debt Investment Banking, Raymond James, Mark Smith, attorney, Miller and Martin, Brent Greer, mayor, Henry County, and Terry Wimberley, general manager, Paris Utility Authority, October 22, 2020.

[111] Tennessee Advisory Commission on Intergovernmental Relations 2017.

> investment amount. . . . To hold the businesses accountable, a clawback provision or a list of performance criteria is often included in the agreements. A clawback provision requires the business to repay the amount of the taxes that were abated if they fail to reach the goals in the agreement or possibly pay a financial penalty in addition to the amount of taxes that were abated. With performance criteria, if the business fails to reach its goals, the time period for the PILOT may be reduced or the PILOT may be eliminated entirely. In Tennessee, businesses seem to prefer performance criteria. It has been estimated that 80% of PILOT agreements have these performance criteria or clawbacks in them, and 80% of these provisions are enforced. Clawbacks and performance criteria are not required by law to be a part of the PILOT agreements. Several reports including the 2008 Commission report *Getting It Right: The Effect on the Property Tax Base of Economic Development Agreements and Property Tax Incentives for Businesses* recommend using clawbacks to hold the businesses accountable and protect taxpayers in case the business fails to meet the objectives set forth in the agreement.[112]

As described above, the state's broadband grant program assesses the need for funding; applicants' business plans; and the technical, managerial, and financial capabilities of applicants when scoring grant applications. The program's inclusion of buildout requirements and partial withholding of funds until those requirements are met also helps ensure that state funding through the program results in coverage expansions.

Reducing state restrictions has resulted in electric cooperatives providing broadband; territorial restrictions on electric cooperatives and municipal utilities remain.

In addition to establishing a grant program for unserved areas, Public Chapter 228, Acts of 2017, eased state restrictions that had prevented electric cooperatives from providing broadband. Consistent with the Commission's 2017 recommendation, the Act authorized electric cooperatives to become retail broadband providers either on their own or in partnership with other entities.[113] Previously, electric cooperatives had been authorized to provide broadband only through joint ventures in historically unserved areas as determined by TPUC, under Tennessee Code Annotated, Section 7-59-316—

[112] Tennessee Advisory Commission on Intergovernmental Relations 2018.

[113] Tennessee Advisory Commission on Intergovernmental Relations 2017; and Public Chapter 228, Acts of 2017.

and no such joint ventures had been established for providing broadband.[114] Although remaining restrictions in state law generally prohibit electric cooperatives—and municipal electric systems—from providing service outside their service areas, many electric cooperatives appear to be using their new authority under the Act to provide broadband within their electric service areas.

Electric Cooperatives, Broadband, and Public Chapter 228, Acts of 2017

Of the 22 electric cooperatives that serve parts of Tennessee, 13 are now either providing broadband or will be in the near future—as a result of Public Chapter 228.[115] Although TACIR staff were unable to obtain data showing the number of previously unserved homes and businesses that have or will receive service as a result of these electric cooperatives beginning to provide broadband, nine cooperatives have received funding to help expand coverage to unserved areas through the state and federal programs described above.[116] Public Chapter 228 also requires each electric cooperative that provides broadband through a wholly owned subsidiary to provide broadband on an area coverage basis to its entire electric service territory, thereby eliminating any remaining unserved areas.[117] Seven of the 13 electric cooperatives that are providing broadband use wholly owned subsidiaries and are subject to this provision.[118] Most of these are operating on five or six year timelines to complete the expansions of their networks, and some are almost finished—according to the Tennessee Electric Cooperative Association, the industry association for electric cooperatives in Tennessee.[119]

The six other electric cooperatives providing broadband in Tennessee are doing so in partnership with other entities, including several existing telephone companies and

[114] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[115] Email from Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020.

[116] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; email from James R. Combs, government information specialist, Enterprise Services Division, Rural Development, United States Department of Agriculture, December 1, 2020; and email from Nancy Eyl, deputy general counsel, Office of the General Counsel, Appalachian Regional Commission, November 9, 2020.

[117] Public Chapter 228, Acts of 2017.

[118] Email from Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020.

[119] Telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020; and panel discussion by broadband providers on barriers to expanding coverage, TACIR Meeting, November 5, 2020.

telephone cooperatives.[120] These partnerships have been mutually beneficial, according to participants in them, because they allow the entities involved to use the expertise and resources of their partners. For example, telephone companies, telephone cooperatives, or other entities that already provide broadband may have additional staff or other operational resources related to services like billing or customer support among others. By partnering with an existing entity, an electric cooperative or other new entrant may be able to avoid some of the startup costs that would otherwise be necessary to develop this operational capacity on its own. So far, electric cooperatives in these partnerships have often been responsible for deploying the fiber used to provide service. While those interviewed acknowledged that partnerships do not eliminate risks related to broadband expansion projects, particularly in high-cost areas, they said that partnerships can help the entities involved merge their "skillsets."[121]

The decision of whether to provide broadband through a subsidiary or in partnership with other entities ultimately rests with each cooperative. It does, however, alter some of the obligations and restrictions placed on the cooperative by state law. Electric cooperatives providing broadband through partnerships are not subject to requirements that they expand coverage to their entire electric service areas. Moreover, they are not always subject to the same territorial restrictions as those that provide broadband through a wholly owned subsidiary.[122] Municipal electric systems in Tennessee are also subject to territorial restrictions when providing broadband; the restrictions on municipal electric systems have been in place since 1999 when they were first authorized to provide broadband under state law.[123]

Territorial Restrictions on Electric Cooperatives and Municipal Electric Systems

With limited exceptions, electric cooperatives and municipal electric systems in Tennessee are authorized to provide broadband only within their own electric service

[120] Email from Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020.

[121] Telephone interview with Jonathan West, general manager and CEO, Twin Lakes Telephone Cooperative, November 2, 2020; telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020; and telephone interview with Levoy Knowles, executive director, Tennessee Broadband Association, October 21, 2020.

[122] Tennessee Code Annotated, Sections 65-25-134(a)(2) and 7-52-601; telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020; and telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020.

[123] Tennessee Advisory Commission on Intergovernmental Relations 2017; and Public Chapter 481, Acts of 1999.

areas.[124] The exceptions include electric cooperatives that merge with, acquire, or consolidate with entities that provide broadband in communities adjacent to or concurrent with their electric service areas. These cooperatives are authorized to provide broadband not only within their electric service areas but also outside of them in the territory that the acquired entity was already authorized to serve. Similarly, one of the 15 municipal electric systems that currently provide broadband in Tennessee is authorized to provide service anywhere in the county in which it is located, though it has not chosen to expand service beyond a few communities because of the cost of doing so—a second municipal utility was also authorized to provide broadband outside its electric service area but has since sold its broadband network. All other electric cooperatives and municipal electric systems are subject to tighter territorial restrictions, which limit them to providing broadband only within their electric service areas.[125]

Multiple bills in recent legislative sessions of the General Assembly would have eliminated or eased the territorial restrictions on electric cooperatives, municipal electric systems, or both. Examples of bills that would have eliminated the restrictions outright for both electric cooperatives and municipal electric systems include Senate Bill 1045 by Senator Bowling and House Bill 1410 by Representative Weaver in the 110th General Assembly and Senate Bill 489 by Senator Bowling and House Bill 821 by Representative Rudder in the 111th General Assembly. Several other bills in the 110th and 111th General Assemblies that would have eliminated the restrictions applied only to municipal electric systems[126] or only to electric cooperatives.[127]

Examples of bills that would have eased the territorial restriction include two that did not explicitly eliminate the restriction but would have effectively authorized many

[124] Tennessee Code Annotated, Sections 65-25-134(a)(2) and 7-52-601. Note that for both electric cooperatives and municipal electric systems further restrictions under Tennessee Code Annotated, Sections 65-25-134 and 7-52-601, prohibit them from providing broadband *within* their electric service areas in communities that are within the service areas of telephone cooperatives; a similar restriction also applies to municipal electric systems in areas served by small cable providers.

[125] Tennessee Code Annotated, Sections 65-25-134(a)(2) and 7-52-601; Tennessee Advisory Commission on Intergovernmental Relations 2017; telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020; and telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020.

[126] From the 110th General Assembly, see Senate Bill 1058 by Senator Bowling and House Bill 970 by Representative Howell. From the 111th General Assembly, see Senate Bill 494 by Senator Bowling and House Bill 819 by Representative Rudder, as well as Senate Bill 79 by Senator Kurita and House Bill 130 by Representative Reedy.

[127] From the 110th General Assembly, see Senate Bill 301 by Senator Haile and House Bill 950 by Representative Williams.

electric cooperatives and municipal utilities to provide broadband outside their electric service areas. Senate Bill 1057 by Senator Bowling and House Bill 969 by Representative Howell in the 110th General Assembly and Senate Bill 490 by Senator Bowling and House Bill 820 by Representative Rudder in the 111th General Assembly would have authorized any entity—including municipal electric systems and electric cooperatives—that has provided broadband to at least 1,000 customers for at least one year using a fiber-to-the-premises network to provide broadband either individually or in a partnership to any communities outside its existing service area where no other provider has an existing fiber-to-the-premises network.

One other bill and an amendment that was drafted but never raised in committee would have eased the territorial restriction without eliminating it entirely. Senate Bill 1058 by Senator Bowling and House Bill 970 by Representative Howell in the 110th General Assembly would have authorized municipal electric systems to provide broadband outside their electric service territories in areas where they obtained written consent from any other municipal electric systems, electric cooperatives, or telephone cooperatives whose service territory they would be entering. Similarly, an amendment that was drafted but never raised in committee for Senate Bill 210 by Senator Haile and House Bill 172 by Representative Marsh in the 111th General Assembly would have authorized electric cooperatives to provide broadband in the service areas of neighboring electric cooperatives if they received prior written consent from those cooperatives.[128]

Proponents of eliminating or easing these territorial restrictions say that the restrictions prevent electric cooperatives and municipal electric systems from providing broadband individually or as part of partnerships in areas they would otherwise be willing and able to serve. Moreover, these proponents say that in some cases, the restrictions prevent electric cooperatives and municipal electric systems from expanding coverage to areas that are currently unserved. The restrictions may even affect the ability of electric cooperatives and municipal electric systems to take advantage of certain federal funding opportunities that would allow them to expand access within their existing electric service areas but would also require them to provide broadband to some communities outside those service areas in violation of the current restrictions.[129]

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[128] Amendment number 004393 to Senate Bill 210 and House Bill 172 in the 111th General Assembly.

[129] Tennessee Advisory Commission on Intergovernmental Relations 2017; telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, October 13, 2020; and telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020; interview with Senator Ferrell Haile, October 16, 2020; and interview with Senator Janice Bowling, November 18, 2020.

But even without the current territorial restrictions, cost will still be a barrier in some areas. Morristown Utilities—one of the two municipal systems authorized to provide broadband outside its electric service area—has only expanded service to a few communities. The utility provides electric service within the city limits of Morristown, and its broadband network has been built out to all its electric customers. While Morristown Utilities is authorized to provide broadband throughout Hamblen County outside its electric service area, the cost is too high in many areas, according to representatives from the utility.[130] Electric cooperatives have also found cost to be a barrier even within their electric service areas.[131] The number of cooperatives that have applied for and received state and federal funding for broadband projects—some for multiple projects—demonstrates the difficulty of making a successful business case for expanding coverage in many areas of the state.[132] For some cooperatives, the cost of expanding coverage to their entire electric service area will be the largest single investment they have made in their history, and it may even be greater than their overall investment in their electric networks to date adjusted for inflation.[133]

Risks to Electric Ratepayers and Removing the Territorial Restriction

The potentially high cost of building broadband networks introduces risks to which electric cooperatives and municipal electric systems are not immune. Who shoulders these risks is important.

Like any other provider, electric cooperatives and municipal electric systems often take on debt to finance the construction of their broadband networks. Some have financed the construction of their networks by pledging electric system assets or revenues as

[130] Telephone interview with Clark Rucker, chief financial officer, Morristown Utilities, August 8, 2016; and telephone interview with Jody Wigington, general manager and CEO, Morristown Utilities, October 21, 2016.

[131] Telephone interview with Dan Rodamaker, CEO, Gibson Electric Membership Corporation, and Charles Phillips, engineer, Gibson Electric Membership Corporation, October 15, 2020.

[132] For data on grants, see email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020; email from James R. Combs, government information specialist, Enterprise Services Division, Rural Development, United States Department of Agriculture, December 1, 2020; and email from Nancy Eyl, deputy general counsel, Office of the General Counsel, Appalachian Regional Commission, November 9, 2020.

[133] Panel discussion by broadband providers on barriers to expanding coverage, TACIR Meeting, November 5, 2020.

collateral for loans.[134] Municipal electric systems have financed their networks using bonds backed either by revenue from electric ratepayers or municipal taxpayers.[135] Both are also permitted under state law and their wholesale power contracts with the Tennessee Valley Authority (TVA) to make loans from their electric operations to their broadband operations, provided certain conditions are met.[136]

For debts backed by electric system assets or revenues, if broadband revenue isn't enough to make debt payments, electric ratepayers shoulder the risk of repaying them, even if a network is sold. Those living outside a cooperative's or utility's electric service area don't share in these risks, though they may benefit from the provider expanding its network outside its electric service area. Cooperatives and utilities can justify pledging electric system assets or revenues to secure financing for providing broadband inside their electric service areas at least in part based on the benefits to electric ratepayers that can result from the construction of communications networks that support management and operation of the electric grid. But this dual justification doesn't exist for cooperatives or utilities when providing broadband outside their electric service areas.[137]

State law already prohibits electric cooperatives and municipal electric systems from using their electric operations to subsidize their broadband operations.[138] However, these provisions don't prevent cooperatives and utilities from pledging electric systems assets and revenues to finance the construction of their broadband networks within their electric service areas.

In addition to the state, TVA prohibits the electric cooperatives and municipal utilities it serves from using their electric operations to subsidize their broadband operations—or any other service—through the terms of its wholesale power contracts. Any use of electric system assets or revenues to support the operation of a cooperative's or utility's broadband operations—for example, interdivisional loans, sharing of staff, or the

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[134] Telephone interview with Dan Rodamaker, CEO, Gibson Electric Membership Corporation, and Charles Phillips, engineer, Gibson Electric Membership Corporation, October 15, 2020; and telephone interview with Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, October 26, 2020.

[135] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[136] Tennessee Code Annotated, Section 7-52-603; Tennessee Advisory Commission on Intergovernmental Relations 2017; and telephone interview with Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, October 26, 2020.

[137] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[138] Tennessee Code Annotated, Section 7-52-603.

leasing of fiber—must be approved by TVA. TVA last updated its approval process in 2019; the process includes a review of the cooperative's or utility's business plan for its broadband network, a financial analysis of how any loans or pledging of electric systems assets or revenues will affect electric operations, a risk analysis, and a credit analysis and insurance review.[139]

Terms and conditions for any approved loans or use of electric system assets and revenues to support broadband operations are spelled out in use-of-funds agreements between the cooperative or utility and TVA. These agreements—which are amendments to the wholesale power contracts—require the cooperative or utility to report annually to TVA on the current condition of its broadband operations and can require that the broadband operation achieve certain milestones before drawing down loan funds. The agreements also allocate joint costs among a cooperative's or utility's electric and broadband divisions. According to TVA, divisions that use assets owned by another division, such as fiber-optic cables, must pay the division that owns the assets for their use or for services provided in accordance with cost allocation formulas agreed to in these use-of-funds agreements.[140]

TVA monitors compliance in several ways. It requires cooperatives and utilities to submit annual audits performed by independent certified public accountants. TVA reviews each electric system's audit every year. In addition to its annual audit review, TVA performs compliance assessments on each cooperative and utility every few years. According to TVA, these assessments include a review of an electric system's accounts to ensure compliance with its use of funds agreement. TVA reviews whether repayments of principal and interest are being made in accordance with these agreements both in its compliance assessments and its review of annual audits. If TVA finds that a cooperative or utility is using electric system funds to subsidize broadband service, it can require repayment of those funds. Because it is the sole regulator of retail electric rates for the cooperatives and utilities it serves, TVA can also refuse requests for

[139] Tennessee Advisory Commission on Intergovernmental Relations 2017; and telephone interview with Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, October 26, 2020.

[140] Telephone interview with Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, October 26, 2020; and interview with Jennifer Brogdon, director, Regulatory Policy and Compliance, Tennessee Valley Authority, and Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, November 3, 2016.

electric rate increases from these cooperatives and utilities if they are not in compliance with their use-of-funds agreements.[141]

TVA has not determined whether it would approve the use of electric system assets or revenues to finance the construction of broadband networks outside a cooperative's or utility's electric service area. TVA staff interviewed said that TVA would want safeguards in place to ensure that electric ratepayers are protected and to prevent the ratepayers of one cooperative or utility from subsidizing the ratepayers of another.[142]

The effect of the broadband ready community designation and franchise and excise tax credit for providers has been mixed.

Two other provisions in Public Chapter 228 were enacted to encourage the expansion of broadband access in Tennessee. One established the "broadband ready community" designation for local governments that adopted a specified set of policies to signal broadband providers that those jurisdictions had streamlined local permitting process and removed regulatory barriers to broadband expansion. The second established a credit—since repealed—against franchise and excise taxes for providers that made investments in broadband networks in underdeveloped counties in the state. Both were consistent with recommendations in the Commission's 2017 report. But their effect on expanding broadband coverage has been mixed.

Broadband Ready Community Designation: Limited Evidence of Effectiveness

To be designated as a broadband ready community in Tennessee, a local government is required to adopt an ordinance or policy that includes a

- single point of contact for all matters related to broadband projects;
- provision setting a time limit of 30 days for the local government to act on all applications related to broadband projects; and an
- authorization that all forms, applications, or documents related to broadband projects may be signed electronically.[143]

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[141] Telephone interview with Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, October 26, 2020; and interview with Jennifer Brogdon, director, Regulatory Policy and Compliance, Tennessee Valley Authority, and Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, November 3, 2016.

[142] Telephone interview with Cameron Heck, senior manager, Regulatory Policy and Compliance, Tennessee Valley Authority, October 26, 2020.

[143] Public Chapter 228, Acts of 2017.

This ordinance or policy cannot

- require applicants to designate a final contractor for completing projects;
- impose fees exceeding $100 for reviewing applications or issuing permits;
- impose seasonal moratoriums on issuing permits for broadband projects; and
- discriminate among providers or utilities regarding access to public rights-of-way, infrastructure or poles, and any other physical assets owned or controlled by the local government.[144]

Local governments apply to ECD to be designated as broadband ready communities.[145] Currently, 58 local governments—including nine cities and 49 counties—have received the designation.[146] See map 4.

Representatives for broadband providers interviewed gave mixed reviews of the broadband ready community designation. Some spoke favorably about it.[147] The Tennessee Cable and Broadband Association recommended that the designation become a requirement for communities to participate not only in the state's broadband grant program but also in other economic incentive programs administered by ECD, specifically the Fast Track grant program.[148] A few said the designation has had little effect on deployment decisions.[149]

[144] Public Chapter 228, Acts of 2017.

[145] Tennessee Code Annotated, Section 4-3-709.

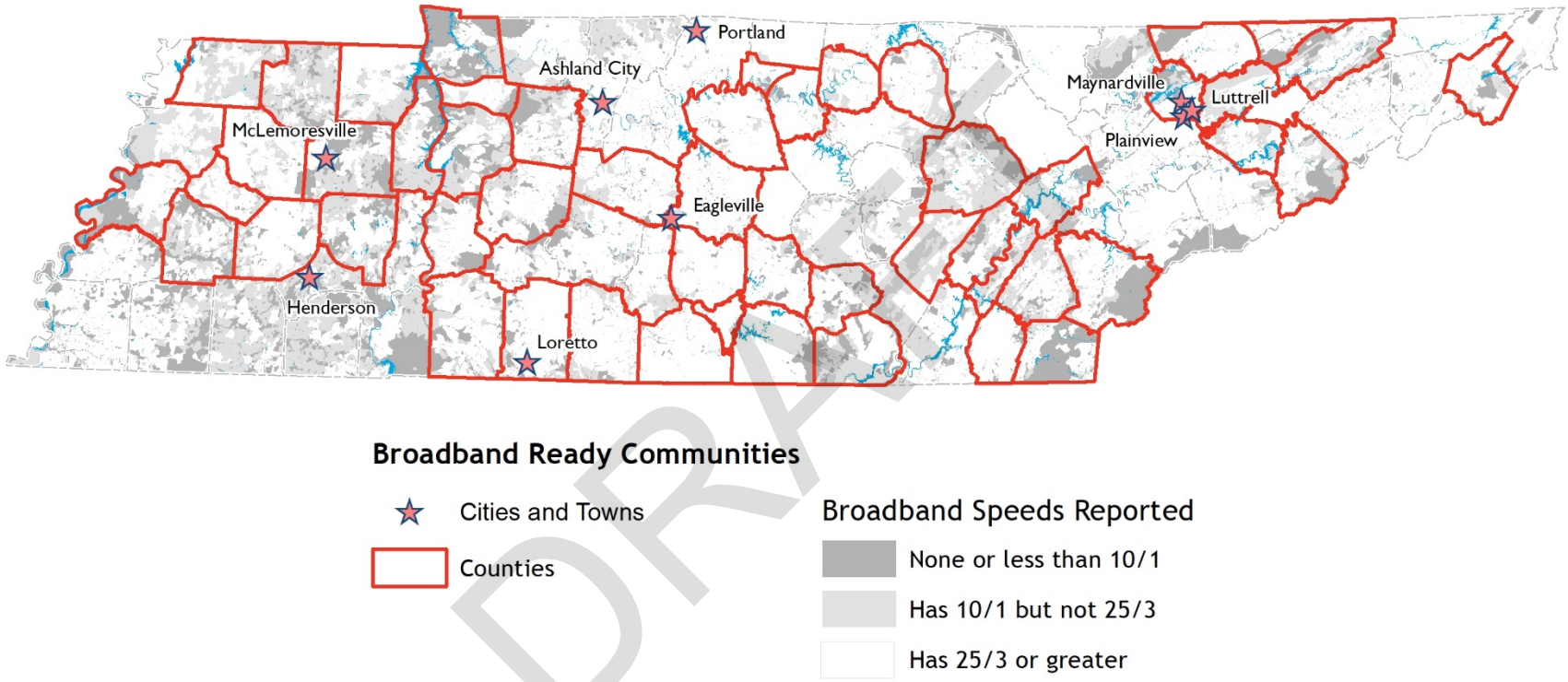
[146] Tennessee Department of Economic and Community Development "Broadband Ready Communities"; and telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020.

[147] Telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020.

[148] Presentation to TACIR staff by Tennessee Cable and Broadband Association, June 23, 2020; and discussion by broadband providers on barriers to expanding coverage, TACIR Meeting, November 5, 2020.

[149] Telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020; and telephone interview with Levoy Knowles, executive director, Tennessee Broadband Association, October 21, 2020.

Map 4: Counties and Cities Designated as Broadband Ready Communities by ECD



Source: TACIR staff, using information provided at Tennessee Department of Economic and Community Development "Broadband Ready Communities."

Despite recommending creation of a broadband ready designation in 2017 as a means to signal providers that communities have removed local barriers to broadband expansion,[150] TACIR staff have not found any examples where the designation was a deciding factor in a provider's decision to expand coverage. Projects located in communities that have received the designation are awarded points in ECD's process for scoring applications for the state grant program.[151] And providers applying for state grants have encouraged local governments in their project areas to apply for the designation.[152] But outside of its use in the grant scoring process, the broadband ready community designation does not appear to have had much if any effect on providers' deployment decisions in Tennessee.

Franchise and Excise Tax Credit: Underutilized and Repealed

Consistent with the Commission's 2017 recommendations, the broadband tax credit enacted in Public Chapter 228 authorized companies to claim credits in exchange for investment in underdeveloped areas.[153] Unlike the state's grant program, which reimburses up to 50% of project costs for investments in unserved areas, the credit was equal to 6% of the purchase price of equipment placed into service for providing broadband offering at least 25 megabits per second download and three megabits per second upload to locations in counties designated as tier 3 or tier 4 enhancement counties by ECD. They were to be taken against companies' franchise and excise taxes. For each company, the maximum allowable credit each year was capped at 50% of the company's combined franchise and excise taxes. Statewide the credit was capped at $5 million per year; if the statewide cap was exceeded, companies received a prorated share of the credits they would otherwise be eligible for. Unused credits could be carried forward for up to 15 years. The credit was repealed in Public Chapter 501, Acts of 2019, which exempted the cost of labor for installing fiber optic cable from state and local sales tax.[154]

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[150] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[151] Tennessee Department of Economic and Community Development "Tennessee Broadband Accessibility Grant"; and telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

[152] Telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020; and telephone interview with Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 5, 2020.

[153] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[154] Public Chapter 228, Acts of 2017; and Public Chapter 501, Acts of 2019.

While it was active, the credit was underutilized. The year prior to it being repealed, the total value of credits taken by providers was only $2 million statewide.[155] Unlike the state's grant program, which offers providers a dollar-for-dollar match for investments in unserved areas, the credit—equal to 6% of investment—represented a match of $1 in state incentives for every $16.67 invested.

No providers interviewed advocated for reinstating the credit. Some providers—such as electric cooperatives—are not subject to franchise and excise taxes, while others—such as telephone cooperatives—are subject to franchise and excise taxes for only part of their operations.[156] Although a representative for electric cooperatives said that tax credits are not always an effective incentive for expanding broadband,[157] representatives for one of the state's cable companies said there were several specific issues with the franchise and excise tax credit that made it less effective as an incentive for providers.[158] They said that because the credits were not transferable among members of a partnership, it made it difficult for some companies that operate as large partnerships to be able to claim credits, depending on which of their subsidiaries were responsible for a specific investment in an tier 3 or tier 4 enhancement county and which had accrued franchise and excise tax liabilities in Tennessee. Moreover, because the credit was capped at $5 million statewide instead of the cumulative total of franchise and excise taxes, the possibility that they might have to accept a prorated share of the credits they otherwise would have qualified for made the incentive less useful.[159]

Pole attachment fees remain a concern for some providers.

Fees paid by broadband providers to attach cables and other equipment to utility poles owned by electric utilities and telephone companies affect the cost of service. Regulatory oversight for these pole attachment fees depends on several factors,

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[155] Fiscal memorandum for Amendment 009020 to House Bill 605 and Senate Bill 1458, Joint Fiscal Review Committee, April 30, 2019.

[156] Tennessee Code Annotated, Sections 65-25-122 and 65-29-129; telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020; and telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020.

[157] Telephone interview with Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, April 16, 2020.

[158] Telephone interview with Jamie Fenwick, vice president of tax, Charter, Jason Keller, senior director, Government Affairs, Charter, and Zachary Bates, senior manager, State Government Affairs, Charter, November 12, 2020.

[159] Ibid.

including whether a pole is owned by a for-profit or non-profit entity and whether a state has adopted its own regulations. The maximum fees charged for attaching to poles owned by for-profit companies are calculated using formulas adopted by the Federal Communications Commission (FCC) unless a state has opted out of the FCC's pole attachment regulations; Tennessee has not.[160] But fees for attaching to most utility poles in Tennessee are not subject to the FCC formulas because the majority of poles in the state—approximately 80%, according to the Tennessee Cable and Broadband Association—are owned by municipal electric systems or electric cooperatives, and the FCC's authority over pole attachment fees doesn't apply to poles owned by non-profit entities.[161]

While fees for attaching to most utility poles in Tennessee are not regulated by the FCC, they are regulated by TVA. TVA adopted a formula in 2016 for calculating the fees for attaching to poles owned by the municipal electric systems and electric cooperatives that it serves.[162] TVA's formulas result in fees that are greater than those that result from the FCC's formulas. Using data provided by TVA, TACIR staff calculated that fees for a broadband provider with an attachment taking up one foot of space on a generic utility pole would be approximately four times greater under TVA's formula than the FCC's formulas.[163]

These differences result because TVA and the FCC have divergent goals when regulating pole attachments. Although TVA's statutory mandate is to provide its service area with electricity at rates as low as feasible,[164] the FCC's formulas are based on its goal of "promoting consistent, cross-industry attachment rates that encourage deployment and adoption of broadband internet access services."[165] Because these costs are ultimately passed on to customers, the question becomes how much of overall pole costs should be paid by a pole owner's customers and how much should be paid by each additional attacher's customers. TACIR has previously found that neither TVA's

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[160] 47 US Code 224; 47 Code of Federal Regulations 1.1401 et seq.; Federal Communications Commission 2015c; and Federal Communications Commission 2010b.

[161] 47 US Code 224; 47 Code of Federal Regulations 1.1401 et seq.; and panel discussion of regulatory landscape for broadband providers, TACIR Meeting, May 26, 2016.

[162] Memorandum from John M. Thomas, III, executive vice president and chief financial officer, Tennessee Valley Authority, to Tennessee Valley Authority Board of Directors, January 22, 2016; and Minutes of the Meeting of the Board of Directors, Tennessee Valley Authority, February 11, 2016, approved May 5, 2016.

[163] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[164] 16 US Code 831; and email from Cameron Heck, senior program manager, regulatory assurance, Tennessee Valley Authority, December 1, 2016.

[165] Federal Communications Commission 2015c.

formula nor the FCC's formulas result in unfair subsidies because they both produce fees that fall between the added annual costs to pole owners resulting from additional attachments and the costs to attachers of installing and maintaining their own poles.[166]

The extent to which the greater pole attachment fees produced under the TVA formula prevent broadband expansion in Tennessee is unproven at this time. According to representatives for one provider, pole attachment fees for one of its projects in West Tennessee increased by 150% when TVA's formula was implemented.[167] But according to the Tennessee Electric Cooperative Association, the Utilities Telecom Council—a trade association for representing the interests of electric, gas, water, pipeline, and other critical infrastructure companies—has estimated that "pole attachments constitute as little as 1% to 2% of the overall cost of deploying broadband."[168] TACIR staff have not found examples of any projects that would have been built but for their pole attachment costs.

Moreover, TVA's authority to regulate the utilities and cooperatives it serves, means that Tennessee likely lacks authority to override TVA's formula, according to an opinion by the state's attorney general written prior to TVA adopting its pole attachment fee formula. The opinion says that

> [i]f the TVA were to assert its discretionary control over the rates and revenues of its distributors in a manner that directly affected pole attachments, regulation by the State would likely be preempted.[169]

In lieu of attempting to regulate pole attachment fees in Tennessee, draft legislation prepared by cable companies in the 111th General Assembly would have established a new credit for cable service providers against franchise and excise taxes to help offset the greater pole attachment fees they pay under the TVA formula. The credit would have been approximately equal to the difference between fees companies pay under the TVA formula and what they would pay under the FCC formula. Unlike the franchise and excise credit for investment in underdeveloped areas that was repealed in 2019, the proposed credit would have been transferable among members of an entity classified as a partnership for federal income tax purposes. And for each company, the maximum credit each year would have been capped at the combined total of its franchise and

[166] Tennessee Advisory Commission on Intergovernmental Relations 2007.

[167] Presentation to TACIR staff by Tennessee Cable and Broadband Association, June 23, 2020.

[168] Memorandum from Tennessee Electric Cooperative Association to TACIR, October 21, 2015.

[169] Tennessee Office of the Attorney General 2014.

excise tax liability.[170] According to analysis by staff of the Joint Fiscal Review Committee, the difference in pole attachment fees is estimated to be at least $27 million, but total franchise and excise taxes for cable providers statewide were less than $5 million.[171] As a result, the factor limiting the amount of credit taken each year would likely be companies' franchise and excise tax liability rather than their pole attachment fees.[172]

Although the credit as initially proposed would have helped offset providers' pole attachment costs, it would not have required providers to invest any of the savings from the credit in Tennessee. Representatives for cable providers interviewed by TACIR staff said their companies have pledged to expand coverage in Georgia after legislation to reduce pole attachment fees—which also was not tied to any buildout requirements—was passed in that state.[173] But as initially drafted, receipt of the proposed pole attachment credit for Tennessee would not have been tied to any buildout or investment requirements,[174] unlike state funding provided through Tennessee's grant program and unlike the credit on franchise and excise taxes repealed in 2019.

As noted above, Tennessee's broadband grant program requires recipients to expand coverage in unserved areas,[175] and the repealed franchise and excise credit was available only to those companies that made broadband investments in underdeveloped areas of the state.[176] Moreover, ECD caps the state's share of project costs under the Tennessee Broadband Accessibility Grant at 50% of each project's total investment in unserved areas, and the repealed franchise and excise credit was equal to only 6% of the amount invested in providing broadband to locations in tier 3 or tier 4 enhancement counties.

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[170] Email from Zachary Bates, senior manager, State Government Affairs, Charter, June 23, 2020.

[171] Memorandum from Austin Wouters, fiscal analyst, Joint Fiscal Review Committee, to Chairman Robin Smith, January 13, 2020.

[172] Telephone interview with Jason Keller, senior director, Government Affairs, Charter, and Zachary Bates, senior manager, State Government Affairs, Charter, October 23, 2020.

[173] Presentation to TACIR staff by Tennessee Cable and Broadband Association, June 23, 2020.

[174] Presentation to TACIR staff by Tennessee Cable and Broadband Association, June 23, 2020; and email from Zachary Bates, senior manager, State Government Affairs, Charter, June 23, 2020.

[175] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 22, 2020; Tennessee Department of Economic and Community Development "Broadband Accessibility Grant: Program Guidelines"; and Stauffer et al. 2020.

[176] Public Chapter 228, Acts of 2017.

At least one provider interviewed was open to the possibility of revising the proposal so that receipt of the credit would be tied to investment in underdeveloped areas.[177]

Efforts to encourage broadband adoption continue to help more Tennesseans get online.

Maximizing the number of Tennesseans who use broadband requires more than simply expanding coverage, as there continue to be multiple non-coverage-related barriers to broadband adoption. Cost—including both the cost of service and the cost of devices—continues to be among the most cited reasons why individuals say they don't subscribe to home broadband service. Half of respondents to a 2019 survey conducted by the Pew Research Center cited the cost of service among the reasons why they don't have home broadband service, and nearly one-third cited the cost of computers. More than one in four cited the cost of service or devices as their primary reason for not subscribing.[178] Studies continue to show that cost is a greater barrier for low-income households. Almost 50% of households with school age children and annual incomes less than $25,000 that don't use the internet at home cited lack of affordability as the most important reason, according to a 2019 analysis of Census data by the US Government Accountability Office (GAO). The share of households not using the internet at home that cited cost as the most important reason decreased to 34% among those incomes of at least $25,000 but less than $50,000, 20% among those with incomes of at least $50,000 but less than $75,000, and only 17% among those with incomes of at least $75,000.[179]

Aside from cost, many of those who haven't adopted broadband often cite a lack of interest or need. The GAO's 2019 analysis found that lack of interest or need was the most commonly cited reason for not using internet at home for households with school age children and annual incomes of at least $25,000.[180] Similarly, Pew's 2019 survey found that 80% of respondents who didn't subscribe to home broadband were uninterested in having it in the future, and 60% had never had home broadband at any point in the past.[181]

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[177] Telephone interview with Jamie Fenwick, vice president of tax, Charter, Jason Keller, senior director, Government Affairs, Charter, and Zachary Bates, senior manager, State Government Affairs, Charter, November 12, 2020; and email from Zachary Bates, senior manager, State Government Affairs, Charter, June 30, 2020.

[178] Anderson 2019.

[179] US Government Accountability Office 2019.

[180] Ibid.

[181] Anderson 2019.

Given the differing barriers that individuals face when getting online, the Commission found in its 2017 report that there is no single broadband adoption program that will work for every community. Instead, programs tailored to meet the specific needs have been effective.[182]

There are currently a variety of public and private resources available to help Tennesseans get online. Community anchor institutions—including libraries and schools, medical and healthcare providers, public safety entities, institutes of higher education and other community support organizations—can be important resources for individuals and families who don't have broadband at home—and have become more important during the COVID-19 pandemic. Programs at libraries and schools, in particular, not only provide digital literacy classes but also access to broadband service and devices for those who are either unable to afford them or who live in unserved and underserved areas. Other existing resources for encouraging adoption include the federal E-Rate and Lifeline programs—which both provide discounts on broadband service, the former to libraries and schools, the latter to individual households—and adoption programs run by non-profit organizations as well as those run by broadband providers. ECD provides links on its website to several broadband adoption resources that provide information on low-cost service and device options, as well as information to help communities develop adoption strategies that fit their needs.[183]

Libraries: The state's broadband grant program has supported digital literacy classes and short-term connectivity solutions provided by local libraries.

Tennessee's local library system continues to be an important resource for helping residents get online both by providing digital literacy classes and by offering short-term broadband access to overcome affordability and coverage gaps. Tennessee libraries have had success in the past offering digital literacy classes to patrons, and they are encouraged by the Tennessee State Library and Archives (TSLA) to provide classes several times a year depending on their size.[184] Libraries have also received funding for digital literacy classes through ECD's broadband grant program[185]—consistent with the

[182] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[183] Tennessee Advisory Commission on Intergovernmental Relations 2017; and Tennessee Department of Economic and Community Development "Digital Inclusion Toolkit."

[184] Tennessee Advisory Commission on Intergovernmental Relations 2017.

[185] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020; and telephone interview with Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, and Jennifer Cowan-Henderson, director of planning and development and state E-Rate coordinator, Tennessee State Library and Archives, April 9, 2020.

Commission's 2017 recommendations, the state's grant program is authorized under Public Chapter 228, Acts of 2017, to provide funding for digital literacy to libraries in addition to the grants it makes to providers for broadband expansion.[186]

The first two rounds of funding from the state's broadband grant program helped libraries across Tennessee provide 1,565 digital literacy classes that had a combined total of 10,534 participants. Feedback that TSLA received about the classes and the benefits to participants has been positive. Many libraries reported anecdotally that participants' comfort levels with using computers and the internet increased after taking their classes, while participants' anxieties and fears related to technology use decreased. At least one library reported that participants had decided to purchase their own computers as a result of what they learned in their classes. In other cases, participants told libraries that what they learned in the classes helped them get jobs. Participant evaluations were also positive, with well over 80% of participants each year reporting increased confidence in using what they learned. Almost every participant said they would be able to use what they had learned in the classes.[187]

TSLA noted few issues with the digital literacy classes in interviews with TACIR staff. Some libraries found that the $50 per class they were authorized to pay instructors for the first two rounds of the grant program was not enough to find or retain quality instructors. Starting with the third round TSLA permitted libraries to exceed the $50 per class maximum. TSLA also reported that if more libraries were equipped with better videoconferencing equipment, they would be able to provide training through remote instruction, which could help some libraries that have had difficulty finding instructors in their community and could be used by patrons to access remote learning opportunities for K-12 or higher education.[188]

Libraries throughout the state are also addressing affordability and coverage gaps in their communities by lending wireless hotspot devices that allow patrons to access mobile wireless service. Although the hotspots are not long-term substitutes for home

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[186] Public Chapter 228, Acts of 2017; and Tennessee Advisory Commission on Intergovernmental Relations 2017.

[187] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020; and telephone interview with Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, and Jennifer Cowan-Henderson, director of planning and development and state E-Rate coordinator, Tennessee State Library and Archives, April 9, 2020.

[188] Telephone interview with Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, and Jennifer Cowan-Henderson, director of planning and development and state E-Rate coordinator, Tennessee State Library and Archives, April 9, 2020.

broadband, they are a short-term solution for providing internet access when patrons most need it, for school projects or when applying for jobs. Libraries report that hotspots have been particularly useful for high school students needing to complete homework assignments. Another reported that some of its hotspots were used for five to eight hours each day while checked out. The devices remain very popular, and libraries report that waitlists are common—the only complaint from patrons reported aside from waitlists is that the hotspots don't work in areas without mobile wireless service.[189]

Currently, there are 75 libraries in the state's regional library system that lend hotspots to patrons. For these 75 libraries, the median number of hotspots per library is five, and the combined total of hotspots statewide is 861.[190] Approximately 210 of these hotspots were funded through the state's broadband grant program. According to TSLA staff, mobile wireless service for each hotspot costs approximately $35 per device per month, and some wireless providers don't charge libraries for the devices themselves, though two that do charge approximately $72 per device and $198 per device, respectively. Service for individual devices can be shut off remotely if they are not returned, and most providers don't charge for replacement hotspots.[191]

Combined funding for digital literacy classes and hotspots that libraries were awarded through the first three rounds of the state broadband grant program totaled $443,500. A total of 133 grants to libraries in 54 of the state's 95 counties have awarded so far.[192] TSLA also received approximately $600,000 in federal funding from the state's share of the CARES Act. TSLA used most of this amount for additional grants to the state's local libraries to fund hotspots, computers, and videoconferencing equipment. A total of 137 libraries received grants from TSLA's share of CARES Act funding.[193]

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[189] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020; and telephone interview with Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, and Jennifer Cowan-Henderson, director of planning and development and state E-Rate coordinator, Tennessee State Library and Archives, April 9, 2020.

[190] TACIR staff calculations based on data received in email from Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, October 27, 2020.

[191] Telephone interview with Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, and Jennifer Cowan-Henderson, director of planning and development and state E-Rate coordinator, Tennessee State Library and Archives, April 9, 2020

[192] Email from Crystal Ivey, broadband director, Community and Rural Development, Tennessee Department of Economic and Community Development, October 2, 2020.

[193] Email from Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, October 27, 2020.

K-12 Schools: Schools systems continue working to close connectivity gaps in their communities.

Tennessee's K-12 schools are helping close broadband adoption gaps for students in communities across the state. For some school systems, particularly during the COVID-19 pandemic, this has meant ensuring that students that need devices have access to laptops or other devices that can be taken home to be used for schoolwork.[194] However, schools systems have found that devices alone aren't enough for students who don't have broadband access at home.[195] As a result—similar to the state's libraries—some systems have also obtained hotspots that can be sent home with students who live in areas without access to wireline broadband service or whose families cannot afford it.[196] Following the onset of the pandemic, at least one school system has partnered with local governments, businesses, and non-profit organizations to pay for home-broadband service for families in its district with students eligible for free or reduced lunch, which will result in approximately 28,500 students receiving service and is expected to cost $8.2 million over 10 years.[197]

But these solutions may not work for every school system or for all the students in them. For example, representatives for several school systems interviewed by TACIR staff reported that hotspots are only partial solutions for their communities because they have many areas without adequate mobile wireless service.[198] One said that providing WiFi hotspots at fixed locations around their district, including in areas such as church parking lots, could be a potential solution given the limited availability of

[194] Telephone interview with Corby King, director of schools, Putnam County Schools, April 21, 2020; telephone interview with Tony Seal, director of schools, Hancock County Schools, May 1, 2020; telephone interview with Kelly Wade, director of instructional technology, Williamson County Schools, April 23, 2020; telephone interview with Gary Lilly, director of schools, Collierville City School District, and Lisa Higgins, chief technology officer, Collierville City School District, April 15, 2020; Roberts 2020; and Mangrum 2020.

[195] Telephone interview with John Barker, deputy superintendent of operations, Shelby County Schools, April 22, 2020.

[196] Telephone interview with Corby King, Director of Schools, Putnam County Schools, April 21, 2020; and telephone interview with Kelly Wade, director of instructional technology, Williamson County Schools, April 23, 2020.

[197] Brand 2020; Flessner 2020; and telephone interview with Katie Espeseth, vice president of new products, Electric Power Board of Chattanooga, October 7, 2020.

[198] Telephone interview with Rujena Dotson, FHS Curriculum – CTE, Fayetteville City School District, June 16, 2020; telephone interview with Randy Frazier, director of schools, Weakley County Public Schools, April 21, 2020; and telephone interview with Kelly Wade, director of instructional technology, Williamson County Schools, April 23, 2020.

mobile wireless service in their area. It is also possible to put hotspots on buses and park them in areas with adequate wireless service, but this can be expensive for some districts.[199]

Cost can be a barrier to schools' efforts to reduce broadband adoption gaps, according to representatives for school systems interviewed by TACIR staff, particularly for devices.[200] A purchasing model described in the Commission's 2017 report that was being developed by the Tennessee Department of Education and would have allowed districts to enter three-year contracts with approved vendors to lease devices for approximately $5 per student per month, with devices replaced every three years, has been implemented. However, the contract involved has proven too difficult for school systems to use, and none currently use it, according to Department staff.[201] While some school systems have found it beneficial to use similar lease-to-own models to spread the cost of each device over multiple years and replace a portion of their old devices every year,[202] others prefer one-time, lump-sum purchases.[203]

In response to the COVID-19 pandemic, additional federal funding through the CARES Act has been designated for use by schools to purchase devices, hotspots and other technology. The state made available approximately $61 million of its share of federal CARES Act funding to school systems for laptops and hotspots, as well as one-to-one technology initiatives.[204] Several local governments also provided at least a portion of

[199] Telephone interview with John Barker, deputy superintendent of operations, Shelby County Schools, April 22, 2020; and telephone interview with Randy Frazier, director of schools, Weakley County Public Schools, April 21, 2020.

[200] Telephone interview with David Williams, interim chief academic officer, Metro-Nashville Public Schools, and Doug Renfro, executive director of learning technology, Metro-Nashville Public Schools; April 16, 2020; telephone interview with John Barker, deputy superintendent of operations, Shelby County Schools, April 22, 2020; and telephone interview with Kelly Wade, director of instructional technology, Williamson County Schools, April 23, 2020.

[201] Tennessee Advisory Commission on Intergovernmental Relations 2017; and telephone interview with Vijay Gollapudi, chief information officer, Tennessee Department of Education, April 24, 2020.

[202] Telephone interview with Corby King, director of schools, Putnam County Schools, April 21, 2020; telephone interview with Kelly Wade, director of instructional technology, Williamson County Schools, April 23, 2020; and telephone interview with Gary Lilly, director of schools, Collierville City School District, and Lisa Higgins, chief technology officer, Collierville City School District, April 15, 2020.

[203] Telephone interview with David Williams, interim chief academic officer, Metro-Nashville Public Schools, and Doug Renfro, executive director of learning technology, Metro-Nashville Public Schools; April 16, 2020.

[204] Tennessee Department of Education 2020; and Tennessee Department of Education "TN Department of Education Technology Grant for Remote Learning FAQ."

their federal CARES Act funding to local school systems for use on devices for students.[205]

Federal E-Rate and Lifeline Programs

Several federal programs exist for improving access to affordable service, including both the E-Rate program and the Lifeline program. The federal E-Rate program provides service subsidies to schools and libraries, which can serve as resources for increasing access to broadband for individuals and families who cannot otherwise afford it. The Lifeline program, in contrast, provides service discounts to residential customers.

The E-Rate program helps schools and libraries afford broadband access.

The federal E-Rate program covers up to 90% of the cost of broadband service for schools and libraries. The size of the subsidy varies depending both on whether a school or library is located in an urban or rural area and on the level of poverty in the community a school or library serves. The program relies on proceeds from the Universal Service Fund, which is funded by a tax on wired and wireless telephone service.[206]

With the help of E-Rate funding, every school in the state has access to broadband meeting the FCC's recommended minimum capacity for schools of 100 megabits per second per 1,000 students, according to Tennessee Department of Education staff. The statewide consortium developed by the Department in 2016 to assist school systems with the competitive bidding process required under the E-Rate program is still in place. All districts are currently receiving E-Rate funds.[207]

However, even with E-Rate, cost can still be a barrier. For example, approximately 50% to 60% of schools have already met the FCC's long-term goal of having capacities of one gigabit per second per 1,000 students. For the remaining schools, increasing their capacity to meet this long-term goal is too expensive, despite E-Rate funding of approximately $165 per student, according to Tennessee Department of Education staff.[208]

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[205] Kelman 2020; Mangrum 2020; and Roberts 2020.

[206] Federal Communications Commission 2020b; and 47 Code of Federal Regulations 54.706.

[207] Tennessee Advisory Commission on Intergovernmental Relations 2017; and telephone interview with Vijay Gollapudi, chief information officer, Tennessee Department of Education, April 24, 2020.

[208] Tennessee Advisory Commission on Intergovernmental Relations 2017; and telephone interview with Vijay Gollapudi, chief information officer, Tennessee Department of Education, April 24, 2020.

Cost is also an issue for libraries, despite E-Rate funding. Although the number of libraries in Tennessee that have connections meeting the American Library Association's standard of at least 100 megabits per second continues to increase, there are still 79 libraries with access to service that meets the standard that don't subscribe to it. Of these 79 libraries, 46 said that the cost of subscribing to faster service is a hurdle and 14 said that their current slower service is free. TSLA staff said that because the E-Rate program only reimburses libraries after the fact, they must still pay the full price of service up front, which prevents some libraries from being able to take advantage of the program. Further, libraries must be prepared to pay the full cost of service if their applications for E-Rate reimbursement are denied.[209]

Other restrictions on the use of E-Rate funding can create barriers. According to the US Government Accountability Office,

> rules for the Federal Communications Commission's E-rate program, which allows schools to purchase discounted internet equipment, may limit schools' ability to provide wireless access off-premises. Specifically, off-premises access is not eligible for E-rate support, and schools that provide such access using existing services supported by E-rate must reduce their E-rate discounts.[210]

This restriction has prevented at least one school system in Tennessee from implementing plans to provide WiFi off school grounds to help students in its community access broadband.[211]

The Lifeline program remains available for low-income households.

The FCC expanded its Lifeline program from mobile and wireline telephone service to include broadband as of December 2016. Lifeline initially offered discounts on landline telephone service in the 1980s but was expanded in 2008 to include mobile phones.[212] Like E-Rate, Lifeline is supported by proceeds from the Universal Service Fund's tax on

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[209] Email from Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, October 27, 2020; and telephone interview with Chuck Sherrill, state librarian and archivist, Tennessee State Library and Archives, and Jennifer Cowan-Henderson, director of planning and development and state E-Rate coordinator, Tennessee State Library and Archives, April 9, 2020.

[210] US Government Accountability Office 2019.

[211] Telephone interview with Rujena Dotson, FHS Curriculum – CTE, Fayetteville City School District, June 16, 2020.

[212] Federal Communications Commission 2016c.

wired and wireless telephone service.[213] As of December 1, 2020, participants receive a $9.25 per month discount but only for service with a capacity of at least 25/3 and a data cap of at least 1024 gigabytes per month for fixed broadband. In areas where a provider does not offer service of at least 25/3, fixed service of at least 4/1 is also eligible for the Lifeline program.[214] For mobile broadband, participants will receive a $9.25 per month discount for service of at least 3G[215]—corresponding to expected capacities of up to 7/1, according to one major provider.[216] The minimum data cap eligible for Lifeline for mobile broadband will be 11.75 gigabytes per month as of December 1, 2020.[217]

Eligibility for Lifeline is restricted to household's that make no more than 135% of the federal government's poverty guidelines or household's with members eligible for other federal or state assistance programs that as of December 1, 2016, include the

- Supplemental Nutrition Assistance Program (SNAP)—food stamps,
- Medicaid,
- Supplemental Security Income (SSI),
- Federal Public Housing Assistance, and
- Veterans Pension and Survivors Benefit.[218]

Private Sector Resources

Many of the private sector resources to help households overcome the barriers to broadband adoption discussed in the Commission's 2017 report remain available. Broadband providers continue to offer discounted plans to low-income households, with service available for approximately $10 per month. Since the Commission's 2017 report, several of these providers increased the speeds available through their discounted plans to 25/3.[219] Other examples of provider-led efforts to facilitate broadband adoption include one in which Ben Lomand—a telephone cooperative serving parts of Middle Tennessee—has worked with local American Legion posts to

[213] Federal Communications Commission 2020j.

[214] Federal Communications Commission 2020k; and Federal Communications Commission 2020g.

[215] Federal Communications Commission 2020k; and Federal Communications Commission 2020g.

[216] AT&T 2020b.

[217] Federal Communications Commission 2020k; and Federal Communications Commission 2020g.

[218] Federal Communications Commission 2020g.

[219] Tennessee Advisory Commission on Intergovernmental Relations 2017; AT&T 2020a; and Comcast 2020c.

make telehealth service more accessible to veterans. By providing the posts with videoconferencing equipment, the effort helps veterans receive medical services without having to drive as far to medical centers.[220]

Non-profits also continue to help communities get online. For example, the Tech Goes Home Chattanooga program, which was created in 2015, facilitates broadband adoption by providing digital literacy classes, access to low-cost service, and devices. Participants complete 15 hours of training offered through schools, libraries, churches, and community centers after which they receive assistance finding low-cost broadband service. Those who complete the training also have the option to purchase a new device for $50 if they have

- annual income below $30,000, with exceptions for large families;
- a disability or a family member with a disability;
- been unemployed or underemployed for an extended period;
- don't have a desktop or laptop computer at home; or
- are an English language learner.[221]

To date the program has held 200 classes reaching a total of 4,580 participants and distributing 3,100 devices.[222] Follow-up surveys with participants show that 91% subscribe to broadband six months after completing the program, compared with 64% before starting the program. In fall 2016, the average cost per participant was $150. Tech Goes Home Chattanooga is operated in conjunction with the Enterprise Center, an organization dedicated to establishing Chattanooga as a hub of innovation.[223]

[220] Telephone interview with Lisa Cope, general manager and CEO, Ben Lomand Connect, October 20, 2020.

[221] Tech Goes Home Chattanooga 2016; and email from Kelly McCarthy, program director, Tech Goes Home Chattanooga, January 11, 2017.

[222] Tech Goes Home Chattanooga "Home."

[223] Telephone interview with Kelly McCarthy, program director, Tech Goes Home Chattanooga, January 4, 2017; Flessner 2015; and The Enterprise Center 2020.

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Persons Interviewed

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