

EXPLORING BARRIERS TO KENTUCKY BROADBAND EXPANSION



A PEGASUS INSTITUTE REPORT

JORDAN HARRIS

NOVEMBER 2020

A PEGASUS INSTITUTE REPORT

Introduction

The People's Rural Telephone Cooperative is a great Kentucky success story, and today, embodies one of its chief ambitions. Like much of Kentucky's rural telecom infrastructure, the cooperative was formed from a combination of necessity, private sector ingenuity, and public sector support. Nearly a decade after the end of the Second World War, even as global technology had advanced in every field from the atom bomb to velcro, the counties of Jackson and Owsley, nestled among the hills of Eastern Kentucky, remained without a telephone provider. When none of the larger telephone companies would agree to provide the service, residents of the two counties banded together to form the People's Rural Telephone Cooperative (PRTC).

Their efforts would not have been possible even a few years earlier. The Rural Electrification Act (REA) had been signed by President Roosevelt in 1936, eventually aiding the expansion of electricity across 80 percent of America's land mass, and in 1949, it was amended to allow co-ops to apply for low interest loans to build telephone services. By 1953, the PRTC was up and running, servicing over five hundred residents in Jackson and Owsley county.¹

The counties had been behind the curve in the early days of telephone expansion. Today, they are ahead of the curve. In 2009, sixty years after the amended REA had opened the door for co-ops like PRTC, few homes in the counties had access to the next great wave of telecom innovation. The co-op's CEO Keith Gabbard saw an opportunity. It was just as easy, he reasoned, to lay fiber optic cable as it was to lay old copper wiring, so with the help of a USDA backed loan and grant, they set out to bring broadband to the region.²

The quest for modern technology required the aid of a timeless one. The building efforts breakout star was Old Bub, a Kentucky mule who helped crews carry the fiber wire throughout the rough Appalachian terrain, providing, as Gabbard would later say, the work of "eight to ten men."³ The combination of vision, funding, and the mule's hard work led to thousands of miles fiber optic cable being laid in two of Kentucky's most distressed communities. It was a vital lifeline to the future.

Today, both counties have 100 percent broadband access at much faster speeds than national average. This achievement is a celebrated benchmark for a nation seeking to implement universal broadband and building the infrastructure needed to reach communities just like the ones served by the PRTC. Never has the urgency been greater than it is now.

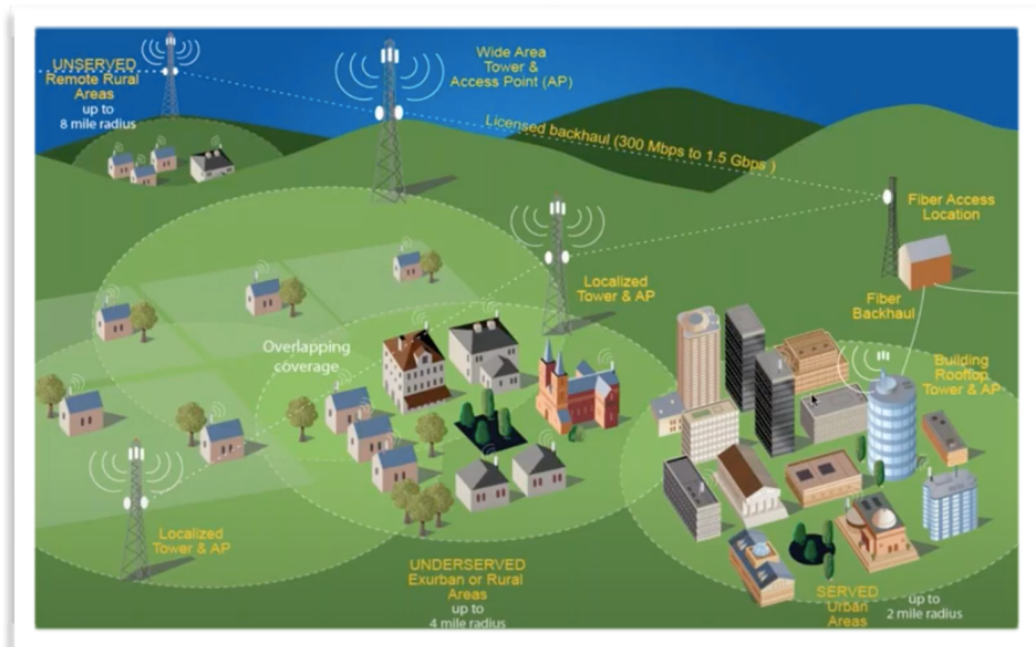
The coronavirus pandemic which has dominated and altered life in 2020 has elevated broadband access to the forefront of the national policy agenda. Census Bureau estimates at the beginning of the fall semester suggested that as many as 93 percent of America's K-12 students are engaged in some form of remote learning.⁴ A Stanford University study found that 42 percent of Americans are working from home full time and that only about a quarter of Americans are working on their business premises.⁵ After expansion to tele-health in the CARES Act, the CDC has urged providers to use the technology for patient screenings, low-risk urgent care, physical therapy, patient follow-ups, and other non-emergent care for patients.⁶

In Kentucky, this is no different. Many of the state's K-12 school districts are not engaged in in-person learning, including the state's largest district in Jefferson County.⁷ The state had the largest percentage of its workforce, more than half, of any state in America file for unemployment, and is still struggling to recover.⁸ Critically though, Kentucky faces these challenges with a broadband infrastructure that is ranked as the 11th worst in the nation.⁹

Research Question

What state government action can Kentucky take to expand broadband access in the Commonwealth?

In light of the coronavirus pandemic, this paper explores the current state of broadband access in Kentucky with a focus on the steps needed for further expansion. The primary effort of this paper is to examine regulatory barriers that government might remove or suggested policy changes, but should not be confused to suggest that elimination of barriers alone will lead to full scale broadband implementation.



Background

Delivery of broadband service is subject, first and foremost, to the laws of finance. Understanding this reality is essential to understanding the existing marketplace and charting a pathway to wider broadband availability. As a whole, the broadband industry is one of the most capital intensive sectors in the United States, with more than \$1.6 trillion of capital investment in broadband service nationwide in the last 25 years.¹⁰

The underlying economics speak to the unique challenges that such a capital intensive sector faces in rural areas. More than 50 percent of all capital costs incurred by providers are in “last mile” service. The often repeated term “last mile” refers not to a specific distance, rather to the final step in a communications network which delivers a service, in this case broadband internet access, from the distribution network to the end use consumer — homes and businesses. Challenges in last mile delivery are not new to broadband or unique to telecommunications. Every industry that delivers a consumer service directly to a home or business faces the logistical question of last mile delivery.

The delivery of last mile broadband service is not done exclusively through fiber optic cables, contrary to common misunderstanding. Today, technology has allowed for several

methods of broadband delivery. In addition to fiber optic cables, service might be provided through satellite, mobile, cable wiring, or ADSL (copper wires).¹¹

Economic Impact of Broadband Expansion

Policy experts almost uniformly agree that access to high performance broadband service is essential to the American economy in the next decade. Over the past two decades, the digital economy in the United States has grown at nearly four times the rate of GDP overall. A study from the Richard Paul Richman Center at Columbia University noted that though the annual GDP growth per capita had slowed in the United States in recent decades compared to its post WWII average, the internet sector has seen rapidly increasing growth since 2007.¹² Beyond internet specific sectors, there is consensus that broadband has been important to improving productivity in nearly all business sectors.

Some studies have suggested that the economic benefit of broadband is larger than its impact on GDP, noting that the metric is not meant to capture the value of services that are free thanks to internet service, or efficiencies made possible by access which cannot be easily measured. A 2017 Technology CEO Council report noted found that:

Our assessment, based on an analysis of recent history, suggests this transformation could boost annual economic growth by 0.7 percentage points over the next 15 years. That may not sound like much, but it would add \$2.7 trillion to annual U.S. economic output by 2031, in 2016 dollars. Wages and salary payments to workers would increase by a cumulative \$8.6 trillion over the next 15 years. Federal revenues over the period would grow by a cumulative \$3.9 trillion, helping to pay for Social Security and Medicare. State and local revenues would rise by a cumulative \$1.9 trillion, all without increasing the tax share of GDP.¹³

Even beyond the elevated need brought on by the coronavirus pandemic, the economic upsides of broadband access are widespread.

In addition to the measurable impact to economic productivity, prior to the pandemic, 52 percent of hospitals in the United States were using some form of tele-health, with another 10 percent saying that they were beginning tele-health services.¹⁴ The CARES Act included

significant changes to encourage tele-health expansion, as have state law changes around the country.¹⁵ By 2035 the US Census Bureau estimates that there will be more Americans over the age of 65 than under the age of 18.¹⁶ These combined factors contribute to economic opportunities for healthcare providers and relevant industries, and add to the necessity of widespread broadband access. Similar cases can be made in relation to K-12 education and other business sectors.

Federal Efforts to Expand Rural Broadband Service in the United States

Approximately 94 percent of Americans have access to broadband service as of 2020 with approximately 80 percent having access to speeds of a gigabit or higher.¹⁷ The remaining 6 percent is significant, not merely because the goal should be universal access, but because the over 20 million Americans that lack service are predominately concentrated in rural areas, according to the Federal Communications Commission.¹⁸

Approximately one in five Americans live in rural areas, as defined by the US Census Bureau, meaning regions outside of an urban cluster. Urban areas and urban clusters are home to an overwhelming majority of the US population, but these areas make up only 3 percent of the country's land mass. This is uniquely relevant when considering national strategies for a capital intensive industry where more than 50 percent of the costs are associated with last mile service. This concentration has significantly benefited urban areas where the return on investment is high and reliable as compared with rural areas where the costs of providing service can be near, or exceed, the return on investment.

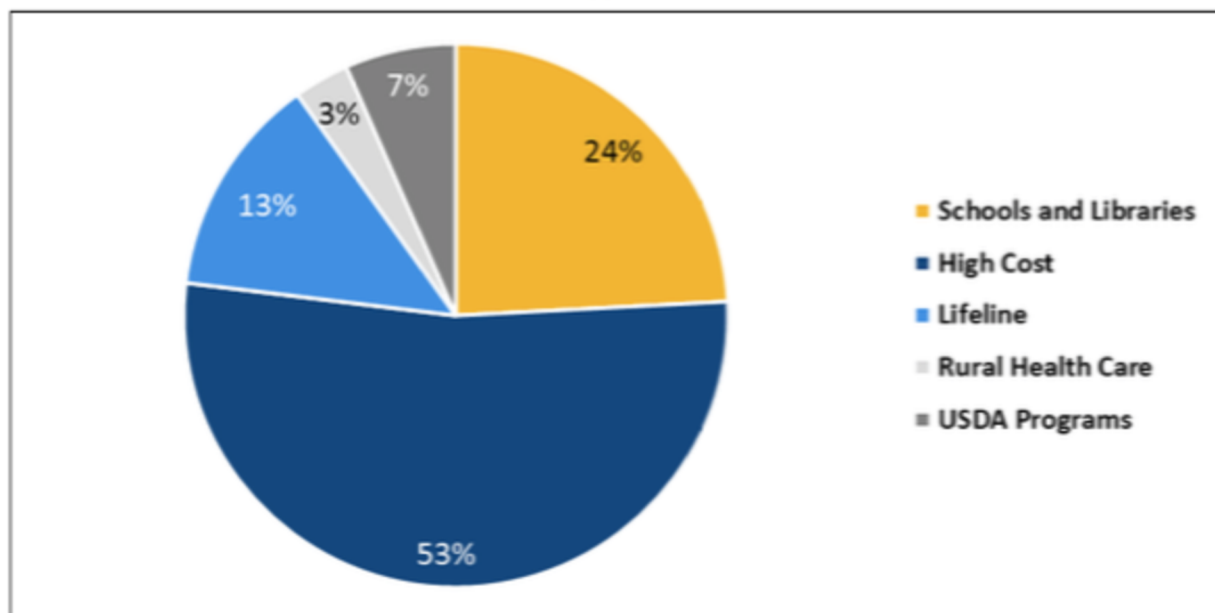
Numerous federal programs have sought to balance these costs by offering grants, loans, and direct support to providers. For example, in 2018, the Federal Communication Commission and US Department of Agriculture spent a combine \$9.1 billion on broadband programs with most of the funds going to rural areas.¹⁹ For several years, the two agencies have combined to provide resources to rural areas.

The USDA effort has largely come through its Rural Utilities Service (RUS). The RUS currently operated three programs, the Rural Broadband Access Loan and Loan Guarantee Program, the Community Connect Grant Program, and the ReConnect Program, which focus on

broadband deployment. The Telecommunications Infrastructure Loan and Loan Guarantee Program are two additional USDA programs. According to the Congressional Research Service:

Congress funds RUS programs through annual appropriations. For FY2019, the Consolidated Appropriations Act, 2019 (P.L. 116-6) provided \$5.83 million to subsidize a Rural Broadband Access loan level of \$29.851 million; \$30 million for Community Connect broadband grants; \$550 million for the ReConnect Program (in addition to \$600 million provided for that program in FY2018); \$1.725 million to subsidize a total loan level of \$690 million for the Telecommunications Infrastructure Loan and Loan Guarantee Program; and \$47 million for DLT grants.²⁰

Additional efforts are made through programs at the FCC. In 1997, the FCC established the Universal Service Fund Programs to provide support for broadband infrastructure. Between FY2016 and FY2018 the USF High Cost Program alone provided \$14 billion in support.²¹ The funds provide subsidies in high cost areas to ensure economic viability for providers. Additionally, USF runs a “Lifeline” program which provides direct support for low income households, the “Schools and Libraries” program, and “Rural Health Care” program which cover broadband subscription costs for eligible schools, libraries, and health care facilities.²²



Source: Universal Service Administrative Company and USDA.

In total, more than half of federal broadband support goes to the FCC's High Cost Program while another quarter supports schools and libraries. Programs administered by the USDA represent only 7 percent of federal broadband support. Rural health care facilities make up the smallest share. These expenditure should demonstrate that there is, nor has there been, no shortage of federal efforts to expand broadband service. It equally demonstrates that the federal government is not capable of successful expansion alone.

Status of Broadband in Kentucky

Kentucky is ranked in the bottom fifth of broadband access nationwide. National website BroadbandNow places the state 40th in the United States.²³ While 92.2 percent of Kentuckians have access to a broadband connection of 25 mbps or faster, this percentage still falls below the national average. The speed of 25 mbps represents the threshold used by the FCC to categorize service as broadband service. Nearly the same amount, 91.4 percent, have access to speeds at 100 mbps or faster. Only 45 percent of Kentuckians have access to speeds of 1 gigabit or faster.²⁴

More than a quarter million Kentuckians do not have access to a wired connection that meets the FCC standard for broadband service, and 142,000 Kentuckians do not have access to a wired internet connection of any speed, from any provider. More than half a million do have access but only have one provider servicing their area.²⁵

Only twelve of Kentucky's one hundred and twenty counties are rated as having 100 percent broadband access, though 29 have higher than 98 percent.²⁶ Unsurprisingly, many of these are the most urban in the commonwealth. Counties that include Louisville, Lexington, and the suburbs of Cincinnati are all among the communities with the highest percentage of access. High percentages are not reserved for the most urban counties though. The aforementioned Jackson and Owsley county both have 100 percent broadband access and boast some of the fastest speeds in the state.

Those areas of the state also boast some of the highest numbers of providers. In 22 of Kentucky's counties fewer than three-quarters of residents have access to broadband.²⁷ Though a handful of these communities are in the eastern half of the state a higher number are concentrated in the West. A full breakdown of county figures is included below as an addendum.

Government Barriers to Expansion

As previously noted, the elimination of government barriers are unlikely to lead to universal expansion alone but will provide a substantial boost to efforts. Achieving full implementation will require the same combination of necessity, private sector ingenuity, and public sector support that has allowed the United States to solve rural telecommunications questions in previous generations. How federal and state governments might approach grants, loan programs, and direct support is worthy of serious scrutiny, but not within the purview of this report.

The most important thing that governments can do in the short term is act to eliminate regulatory, structural, and economic barriers. For Kentucky specially, there are three actions that can be taken, in relatively short order, that will aid private sector efforts to expand broadband service. The following actions are recommended:

1. Permanently suspend Kentucky Wired

It should not be treated as inherently evident that the Kentucky Wired statewide broadband program would be a failure. In fact, the program began with a great deal of promise. This was dissolved quickly, however. Unforeseen expenditures and delays have increased costs to taxpayers far beyond reasonable expectation. State Auditor Mike Harmon's thorough 2018 Audit of the program's contracts found that: "Significant structural changes occurred between initial procurement and the final version of the project that shifted costs and responsibilities to the Commonwealth."²⁸

What was originally intended to be a \$30 million direct investment by Kentucky taxpayers, representing 7.7 percent of the project's funding, has ballooned to a conservative estimate of \$1.5 billion.²⁹ These issues are well documented, both in government reports and journalistic investigations, and need not be duplicated in this piece. State policymakers should take them in to serious consideration when considering strategy for wider broadband expansion around the state.

The primary reason that the state should move to suspend the project has less to do with the granular contract details and more to do with the direct economic disruption the program is responsible for — a less documented but more important factor. The network being developed by Kentucky Wired does not provide last mile service to homes and private sector businesses. Instead, it builds rings that provide service to schools, post offices, and other government buildings, all of which were previously being served by private providers. The substantial investment by taxpayers therefore, is providing duplicative services which do not actually expand the state's broadband infrastructure at all.

Even this does not fully capture why the program is a failure. Delivery of broadband service is subject, first and foremost, to the laws of finance, a previously noted fact. Private providers who, prior to Kentucky Wired, were providing broadband services to schools, post offices, and other government buildings, relied on them as network anchors which made rural last mile service economically feasible. These customers provided an essential foundation that made the economics of continued broadband expansion possible.

The removal of this customer base, especially for the regional and rural providers that provide the backbone of Kentucky's telecommunications infrastructure, severely complicates the economics of expansion. At best, the reality for rural broadband, should Kentucky Wired be completed, is that a higher level of government subsidies and grants will be required to maintain the system. It is more likely however, that should Kentucky Wired be completed, it will not be economically feasible for private sector providers to ever reach full implementation of broadband service in the commonwealth. Stated more plainly, it is likely that Kentucky will never reach 100 percent broadband access with the Kentucky Wired program in place.

2. Develop universal rules for pole attachments and pole replacements

The primary method used by telecommunications providers to expand service in rural areas is to connect and attach equipment to existing utility poles, referred to as pole attachments. This is done as a matter of economic efficiency, environmental protection, and ascetics. Despite the ongoing issues with Kentucky Wired, one benefit of the program is to highlight issues with pole attachment policies in the commonwealth.

Nationally, addressing the expenses incurred during the pole attachment process has been highlighted as a way to expand broadband service. Several studies have cited unexpected expenses and delays caused by pole attachment issues.³⁰ A 2020 petition filed to the FCC by the Internet & Television Association referenced that: “In a major expansion to over 57,000 rural homes and small businesses, *pole replacement costs alone have accounted for approximately 25 percent of the total cost of construction* (including applications, surveys, permitting, labor, and material).”³¹

The issue has likewise been highlighted in Kentucky, noted by Auditor Harmon in his report on Kentucky Wired, and cited as a cause of delay in the project. In comments to the Kentucky Public Service Commission (PSC), the Kentucky Broadband and Cable Association suggested “having new pole attachment rules that will reduce the time and expense of deploying fast, reliable broadband service to more Kentuckians, including those living in rural and underserved communities, has never been more important.” Though Kentucky has retained the regulatory authority over rates, terms, and conditions of pole attachments since 1981, PSC has never issued uniform regulations.³² Instead, each pole owner around the commonwealth has developed its own application process and standards.

The granularity of a uniform regulatory structure is important, however it is beyond the scope of this paper. The challenges caused by an absence of uniformity are easily recognizable and well documented, and Kentucky should act quickly towards a remedy. Other states have taken action on this subject. The Georgia General Assembly recently passed legislation to empower its own PSC to promulgate regulations to align with FCC standards. Observers contend that the move will “reduce the costs and complexities of pole attachment will result in more investment and competition from the private sector, and thus bring more choices, better service, and lower prices to consumers.”³³

3. Eliminate Taxes on Capital Expenditures for Telecommunication Equipment

Since the 2018 session of the Kentucky General Assembly, the state has worked to improve its tax code with a handful of basic principals in mind. Among them, the state has worked to improve the business climate, eliminate business to business taxes, and shift the

burden of taxation away from production. Few states in America have experience greater success in the two interim years, with Kentucky making the largest jump in business competitiveness in the nation in 2018, and making important improvements in the legislative sessions since.³⁴

As of 2019, thirty three states in the United States levied sales taxes on telecommunication equipment, an increase from only thirty states doing so in 2012.³⁵ Raul Katz PhD, the Director of Business Strategy at the Columbia Institute for Tele-Information, has conducted multiple studies on the impact of this taxation finding that every decrease of one percentage in the average state and local sales tax on initial equipment purchases would increase investment by 1.97%. Nationally, Katz found in 2019, that this would yield an additional investment of \$847 million. Katz's research has found an average sales tax rate among the states that levy the tax on telecommunications and cable equipment was 4.40 percent in 2018, a rate which has increased since 2010.³⁶

Kentucky is among the states that levy such a tax and is, regrettably, above the national average with a rate of 6 percent. As compared to neighboring states, only Tennessee and Illinois had higher rates on wired, wireless, and cable purchases, with Missouri levying a tax only on cable purchases, also at a higher rate. Many neighboring states however, are among the states that levy no such tax, including Indiana, West Virginia, and Ohio. Virginia levies a tax on wireless and wired equipment, though it is marginally lower than Kentucky's tax.³⁷

Katz has used econometric models to determine how reductions or eliminations in taxation might impact investment and consumers in states where taxes are levied. A 2019 report highlighted Kentucky specifically. His modeling found that a three year elimination of sales tax on equipment would generate \$167 million in economic activity. An estimated 700 jobs would be created from the increased investment. Critically, Katz estimates, an additional 4,750 broadband connections would be made as a result.³⁸

Conclusion

It is essential to reenforce that none of the recommended actions should be confused as a silver bullet. Were broadband expansion simple, the problem would have been resolved long ago. But, the absence of a singular critical action should not encourage inaction. The coronavirus

pandemic has brought renewed attention to issue of connectivity, and made the stakes more serious than ever before. Access to fast, reliable, and affordable broadband service is no longer about watching Youtube videos or catching up with former classmates. It has become an essential part of schooling, work, and health.

It is equally essential for Kentucky's future. A 2012 study of broadband usage among Kentucky farmers found higher propensity for broadband usage in younger farmers, highlighting the potential future importance of rural access. Less than a decade later, the Kentucky Department of Agriculture's 2019 demographic profile showed an increasing number of young producers in the state.³⁹

Jonathan Sallet of the Benton Institute demonstrated the wide importance of this shift in his *Broadband for the Future: Vision of the 2020's Report*:

With access to high-Performance Broadband, farmers can take advantage of a new generation of precision-farming technologies that experts project will help boost global crop yields as much as 67 percent. With global populations rising, by 2050 farmers will need to produce 50 percent to 70 percent more food than today using the same amount of land—or less. Farming devices and machinery are rapidly incorporating broadband-enabled practices. For example, every large John deere agricultural machine now comes equipped with a touch-screen display, a GPS-based auto-steering system, a 4G LTE modem, and a wi-Fi hotspot. When broadband-enabled precision technologies are pervasively deployed, they are predicted to cut water use by up to 30 percent, reduce herbicide use by 99.99 percent, reduce fuel use by 10 percent, boost yields by 70 percent, and cut food prices in half.⁴⁰

This of course only represents one industry, but underlies the urgency that policymakers should approach the issue with. The recommendations made here can be acted on quickly and will yield expedient results. By removing barriers, and through necessity, private sector ingenuity, and public sector support, Kentucky can lead the way.

EXPLORING BARRIERS TO KENTUCKY BROADBAND EXPANSION

Appendix 1: Broadband Coverage by County in Kentucky⁴¹

County Name	% Broadband Coverage*
Adair	78.5%
Allen	99.0%
Anderson	84.9%
Ballard	80.0%
Barren	85.9%
Bath	87.3%
Bell	98.6%
Boone	99.4%
Bourbon	86.6%
Boyd	96.7%
Boyle	84.9%
Bracken	87.2%
Breathitt	70.5%
Breckinridge	80.3%
Bullitt	99.6%
Butler	55.9%
Caldwell	77.0%
Calloway	99.3%
Campbell	99.5%
Carlisle	95.3%
Carroll	75.1%
Carter	82.1%
Casey	93.7%
Christian	93.4%
Clark	93.3%
Clay	96.7%

EXPLORING BARRIERS TO KENTUCKY BROADBAND EXPANSION

County Name	% Broadband Coverage*
Clinton	93.3%
Crittenden	69.9%
Cumberland	70.1%
Daviess	94.3%
Edmonson	92.9%
Elliott	100.0%
Estill	97.2%
Fayette	99.7%
Fleming	83.5%
Floyd	73.1%
Franklin	98.1%
Fulton	72.5%
Gallatin	83.4%
Garrard	90.9%
Grant	95.8%
Graves	95.5%
Grayson	91.7%
Green	88.2%
Greenup	94.6%
Hancock	21.2%
Hardin	100.0%
Harlan	92.5%
Harrison	70.3%
Hart	93.0%
Henderson	95.5%
Henry	68.4%
Hickman	40.7%
Hopkins	90.4%

EXPLORING BARRIERS TO KENTUCKY BROADBAND EXPANSION

County Name	% Broadband Coverage*
Jackson	100.0%
Jefferson	100.0%
Jessamine	98.6%
Johnson	99.4%
Kenton	99.6%
Knott	99.0%
Knox	87.0%
Larue	88.5%
Laurel	98.6%
Lawrence	100.0%
Lee	51.9%
Leslie	79.5%
Letcher	92.1%
Lewis	80.8%
Lincoln	81.3%
Livingston	82.9%
Logan	75.3%
Lyon	32.0%
Madison	96.7%
Magoffin	100.0%
Marion	88.8%
Marshall	98.4%
Martin	86.8%
Mason	90.9%
McCracken	97.9%
McCreary	100.0%
McLean	57.4%
Meade	100.0%

EXPLORING BARRIERS TO KENTUCKY BROADBAND EXPANSION

County Name	% Broadband Coverage*
Menifee	100.0%
Mercer	80.2%
Metcalfe	80.9%
Monroe	88.4%
Montgomery	93.5%
Morgan	100.0%
Muhlenberg	81.2%
Nelson	96.5%
Nicholas	43.8%
Ohio	57.4%
Oldham	99.4%
Owen	66.5%
Owsley	100.0%
Pendleton	81.4%
Perry	90.8%
Pike	80.8%
Powell	44.8%
Pulaski	97.8%
Robertson	46.5%
Rockcastle	95.4%
Rowan	98.7%
Russell	87.7%
Scott	90.6%
Shelby	91.3%
Simpson	67.6%
Spencer	88.3%
Taylor	93.2%
Todd	72.2%

EXPLORING BARRIERS TO KENTUCKY BROADBAND EXPANSION

County Name	% Broadband Coverage*
Trigg	80.0%
Trimble	81.3%
Union	82.1%
Warren	96.5%
Washington	36.5%
Wayne	82.2%
Webster	71.3%
Whitley	96.8%
Wolfe	100.0%
Woodford	98.8%
	*Broadband is measured as a download speed of 25 mbps and an upload speed of 3 mbps. This standard is set by the Federal Communications Commission (FCC).

Citations

- ¹ Miller, Alfred. “Kentucky's \$1.5 Billion Information Highway to Nowhere.” ProPublica, Courier Journal, 8 May 2019, www.propublica.org/article/matt-bevin-kentucky-information-highway-high-speed-internet.
- ² Halpern, Sue, and Rena Xu. “The One-Traffic-Light Town with Some of the Fastest Internet in the U.S.” The New Yorker, 3 Dec. 2019, www.newyorker.com/tech/annals-of-technology/the-one-traffic-light-town-with-some-of-the-fastest-internet-in-the-us.
- ³ *ibid*
- ⁴ Bureau, U.S. Census. “Schooling During the COVID-19 Pandemic.” The United States Census Bureau, 26 Aug. 2020, www.census.gov/library/stories/2020/08/schooling-during-the-covid-19-pandemic.html.
- ⁵ Wong, May. “A Snapshot of a New Working-from-Home Economy.” Stanford News, Stanford University, 26 June 2020, news.stanford.edu/2020/06/29/snapshot-new-working-home-economy/.
- ⁶ “Using Telehealth to Expand Access to Essential Health Services during the COVID-19 Pandemic.” Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, June 2020, www.cdc.gov/coronavirus/2019-ncov/hcp/telehealth.html.
- ⁷ Kobin, Billy. “With COVID-19 Cases Still High, JCPS Will Not Resume in-Person Learning as Planned.” Courier-Journal.com, Louisville Courier Journal, 15 Oct. 2020, www.courier-journal.com/story/news/education/2020/10/15/covid-19-jcps-not-resume-in-person-classes-yet-due-case-data-louisville/3644346001/.
- ⁸ Broadus, Erinn. Nearly Half of Kentucky's Workforce Has Filed for Unemployment. Pegasus Institute, 24 June 2020, www.pegasuskentucky.org/post/kentucky-unemployment-second-worst-in-nation.
- ⁹ “Kentucky Internet Service Providers: Availability; Coverage.” BroadbandNow, broadbandnow.com/Kentucky.
- ¹⁰ Brogan, Patrick. “Broadband Capital Expenditures Once Again on Upward Trajectory.” USTelecom, 2 Jan. 2020, www.ustelecom.org/ustelecom-broadband-capital-expenditures-once-again-on-upward-trajectory/.
- ¹¹ Hamilton, Eric. “Broadband Connectivity Delivery Methods.” Science Times, 29 July 2020, www.sciencetimes.com/articles/26648/20200729/broadband-connectivity-delivery-methods.htm.
- ¹² Adler, Richard. Towards a Better Understanding of Internet Economics. Internet Association, internetassociation.org/wp-content/uploads/2018/06/IA-Toward-A-Better-Understanding-Of-Internet-Economics-2018-1.pdf.

¹³ Mandel, Michael, and Brett Swanson. The Coming Productivity Boom. The Technology CEO Council , 2017, www.techceocouncil.org/clientuploads/reports/TCC%20Productivity%20Boom%20FINAL.pdf.

¹⁴ Gordon, Debra. “Telemedicine: Using Remote Monitoring to Reduce Hospital Readmissions.” Telemedicine: Using Remote Monitoring to Reduce Hospital Readmissions - Resources, George Washington University , 30 Oct. 2015, onlinepublichealth.gwu.edu/resources/telemedicine-reduce-hospital-readmissions/.

¹⁵ United States, Congress, Cong. Senate, McConnell, Mitch. CARES Act, 2020. 116th Congress Congress, 2D session, bill S. 3548.

¹⁶ Nasser, Haya El. “The Graying of America: More Older Adults Than Kids by 2035.” The United States Census Bureau, 8 Oct. 2019, www.census.gov/library/stories/2018/03/graying-america.html.

¹⁷ “Six Things States Can Do to Promote Private Sector Investment in Broadband.” ATR, Americans for Tax Reform, www.ATR.org/sites/default/files/assets/ATR_Promote%20Private%20Sector%20Investment%20in%20Broadband.pdf.

¹⁸ *ibid*

¹⁹ Humphreys, Brian. “Demand for Broadband in Rural Areas: Implications for Universal Access.” CRS Reports, Congressional Research Service, 9 Dec. 2019, crsreports.congress.gov/product/pdf/R/R46108.

²⁰ *ibid*

²¹ *ibid*

²² *ibid*

²³ Kentucky Internet Service Providers: Availability; Coverage.” BroadbandNow, broadbandnow.com/Kentucky.

²⁴ *ibid*

²⁵ *ibid*

²⁶ *ibid*

²⁷ *ibid*

²⁸ Harmon, Mike. “EXAMINATION OF CERTAIN CONTRACTS, OPERATIONS, AND ACTIVITIES OF THE KENTUCKY COMMUNICATIONS NETWORK AUTHORITY .” Kentucky State Auditor, Commonwealth of Kentucky, 2018, apps.auditor.ky.gov/Public/Audit_Reports/Archive/2018kentuckywiredreport.pdf.

²⁹ Miller, Alfred. “Kentucky's \$1.5 Billion Information Highway to Nowhere.” ProPublica, Courier Journal, 8 May 2019, www.propublica.org/article/matt-bevin-kentucky-information-highway-high-speed-internet.

³⁰ McAuliffe, Katie. “How to Expand Rural Broadband, Fast and Affordably.” TheHill, The Hill, 19 Oct. 2020, thehill.com/opinion/technology/521351-how-to-expand-rural-broadband-fast-and-affordably.

³¹ Chessen, Rick, et al. Petition to FCC: Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment. The Internet & Television Association (NCTA), 16 July 2020, www.ncta.com/sites/default/files/2020-07/071620_17-84_NCTA_Petition_for_Declaratory_Ruling.pdf.

³² Kentucky Public Service Commission, Werner, Paul, and James Gardner. Comments of the Kentucky Broadband and Cable Association on the Kentucky Public Service Commission's Proposed Pole Attachment Regulations.

³³ “Six Things States Can Do to Promote Private Sector Investment in Broadband.” ATR, Americans for Tax Reform, www.atr.org/sites/default/files/assets/ATR_Promote%20Private%20Sector%20Investment%20in%20Broadband.pdf.

³⁴ Harris, Jordan. “Amid Distractions and Controversies, the 2018 Kentucky Legislative Session Was a Success.” Journal, Courier Journal, 17 Apr. 2018, www.courier-journal.com/story/opinion/columnists/2018/04/17/2018-kentucky-legislative-session-successesful/520686002/.

³⁵ Katz, Raul. Assessment of Impact of Taxation on Communications Investment in the United States. Broadband Tax Institute, Nov. 2019.

³⁶ *idib*

³⁷ *ibid*

³⁸ *ibid*

³⁹ Humphreys, Brian. “Demand for Broadband in Rural Areas: Implications for Universal Access.” CRS Reports, Congressional Research Service, 9 Dec. 2019, crsreports.congress.gov/product/pdf/R/R46108.

⁴⁰ Sallet, Jonathan. “Broadband for America's Future: A Vision for the 2020's.” Benton, Benton Institute for Broadband & Society, www.benton.org/sites/default/files/BBA_full_F5_10.30.pdf.

⁴¹ Kentucky Internet Service Providers: Availability; Coverage.” BroadbandNow, broadbandnow.com/Kentucky.