

CONNECTED COMMUNITIES

Broadband Assessment

VERSION ONE: 12/2022

Note to Readers

The Tennessee Valley Authority's (TVA) Connected Communities initiative focuses on enhancing the quality of life in the seven-state region served by TVA through four focus areas: Broadband and Digital Literacy, Economic Empowerment, Energy and Environmental Justice and Enhanced Community Resiliency. This report focuses on Broadband and Digital Literacy and is meant to be an overview of the current status of broadband in TVA's service area.

For more information on Connected Communities, please visit tva.com/connectedcommunities or email: connectedcommunities@tva.gov

Sources used to inform analysis include:

- Census Bureau 2020 American Community Survey (ACS) 5-year estimates
- Department of Housing and Urban Development (HUD) 2022 Qualified Census Tracts
- Federal Communications Commission (FCC) Form 477 Fixed data (Dec. 2020)
- Measurement Lab (M-Lab) Median Speed Tests (June 2021)
- Ookla Median Speed Tests (June 2021)
- Ookla Market Analysis (Q2 2020, Q2 2022)

Broadband Overview

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Broadband **Overview** Methodology

Background and Factors Affecting Legislation Infrastructure Market Broadband

Introduction

Stakeholders across the area served by the Tennessee Valley Authority (TVA) prioritize Broadband and Digital Literacy through high-speed broadband internet availability, affordability and adoption as one of the focus areas for the TVA Connected Communities initiative. While federal and state agencies have billions of dollars available through various funding sources to tackle the digital divide, many communities in the TVA service area need help understanding current and future opportunities so they can plan accordingly.

This document outlines the current state of broadband in the **TVA** service area and notes how **TVA** may support communities in accessing funding opportunities.

Needs in the Area

It is estimated that 800,000 households in TVA's service area are not subscribed to a broadband internet plan. All TVA regions lag the national average of broadband subscriptions with only 80% of households in the TVA service area subscribed compared to the national average of 85% subscribed. The North region of the service area fares best at 83% while the West is behind at 77%.

The magnitude of need may be even greater than what the current picture shows. There are an additional 580,000 households only connected by a cellular data plan, and the minimum definition of broadband speeds



in TVA's service are not subscribed to a broadband plan.

may soon increase from 25/3 megabits per second (Mbps) to 100/20 Mbps as data demands expand. If this definition expands, these 580,000 households in the TVA service area will be considered underserved.

Urban and rural areas both lack adoption, with only 84% and 78% subscribed, but for different reasons. Urban areas tend to have infrastructure but lack adoption due to high-priced broadband plans and devices, while rural areas may not even have infrastructure or the availability of adequate broadband speeds. Roughly 16,000, or 0.6%, of urban households are unserved or underserved as it relates to infrastructure according to Federal Communications Commission (FCC) data, compared to over 200,000, or 13%, of rural households.

Lack of access to broadband is not just an infrastructure or availability issue; it is also an equity issue. 56% of households with less than \$20,000 in income are subscribed to an internet plan compared to 94% of households with income greater than \$75,000.

West Memphis, southwest Nashville, rural Mississippi and rural parts of Central and Northeastern Tennessee are the areas that have the largest gaps in both adoption and availability of broadband and are the places TVA's support could make the greatest impact.

and Policy

Structure Factors

INTERNET PLAN SUBSCRIBERS

56%

of households

with less than \$20,000 income.

94%

of households

with greater than \$75.000 income.

AREAS THAT NEED SUPPORT

- West Memphis
- Southwest Nashville
- Rural Mississippi
- Rural Tennessee



TVA SERVICE AREA DETAILS

Population 202	20					
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
3.47 million	2.80	1.23	2.4 million	6.41	3.53 million	
Median House	hold Income	National average \$6	4,994			
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
\$54K	\$49K	\$50K	\$44K	\$ 52K	\$49K	
Households W	ithout Broadb	and National aver	rage 15%			
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
17%	20 %	19 %	23 %	16 %	22 %	
Households Se	erved Below 2	5/3				
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
43K	27K	24K	72K	6K	161K	
Median Download/Upload Ookla Q2 2022 results						
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
179/36 Mbps	143/20 Mbps	176/23 Mbps	160/36 Mbps	201/31 Mbps	113/22 Mbps	
Qualified Cens	sus Tracts (QC	Ts)				
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
93	110	0	116	225	94	
Total LPCs Off	ering Broadba	ind				
NORTH	EAST	SOUTH	WEST	URBAN	RURAL	
21	14	4	18	17	39	

Broadband Overview

Background and Factors Affecting Legislation Infrastructure Market Methodology Broadband

Market Structure Overview

Six large providers cover most of TVA's service area at varying speeds. For example, 95% of the population has access to internet plans, but only 89% of these plans are at broadband speeds. There are an additional 130 small providers, including local power companies (LPCs), that cover half the service area with 96% of plans at broadband speeds of 25/3 Mbps and above.

Small providers often favor technologies, such as cable and fiber, that support faster, cheaper plans, while large providers employ a mix of technologies. Cable and fiber offer the most Mbps per dollar value, and they are often the cheapest plans. Both technologies have comparable download speeds, but fiber outperforms all other technologies in upload speeds. In areas where large providers use digital subscriber lines (DSL), fixed wireless or satellite, plans are slow and/or costly.

Communities tend to benefit from increased options when smaller providers are active in the broadband space.

and Policv

Structure Factors



of small provider plans

are at broadband speeds of 25/3 Mbps and above.



The small provider market is rapidly growing with more LPCs offering broadband services, contributing to healthy market diversity and improved speeds and pricing. December 2020 data from the FCC showed 31 LPCs that actively provide broadband services. More recent TVA data from the third quarter of 2022 shows dramatic growth in this value, with 42 LPCs actively supplying broadband services and 14 more LPCs in the implementation or study stages. Where large internet service providers (ISPs) fall short in speed and/or coverage, LPCs can take the lead with their symmetrical-speed fiber. Competition from LPCs' high-value, low-cost fiber service may also increase pressure on existing ISPs to offer more affordable plans.



Background and Factors Affecting Legislation Infrastructure Market Methodology Broadband

Funding Opportunities

There are multiple funding options and opportunities to help address broadband and connectivity needs, but communities will need time and money to invest and prepare. Identified steps to help streamline this process include verifying unserved and underserved areas by referencing included maps, conducting surveys of the community, running feasibility studies and reviewing available FCC broadband maps.

Distinguishing which solutions and broadband models best address the unique needs of each community is also key. Do they need infrastructure built, or do they need adoption-focused assistance? The answers to those two questions will help determine potential partners and assist in establishing scale of impact, including required resources. Finally, building up the capacity to identify funding opportunities and submit competitive applications will ensure the ability to develop and track best-fit grants.

and Policy

Structure Factors

COMMUNITY **QUESTIONS**

1

Do you need infrastructure built?

2

Do you need adoptionfocused assistance?



Community Needs for Funding Pursuits

While funding is available for projects, communities will need to invest time and money to prepare. Through research and community interviews, it was determined that TVA could support in the following areas.

1

Community Level Research

Verify unserved and underserved areas by referencing maps, engaging the community (e.g., through surveys), running feasibility studies and reviewing available FCC maps.

2

Solution Identification

Identify desired solutions and broadband models to address the unique needs of each community by determining whether infrastructure is required (e.g., middle mile, last mile, type of last mile technology) and/or if needs are adoption focused (e.g., internet affordability, digital literacy, devices).



Partner Identification

Identify potential partners based on desired solutions and broadband models. This may include seeking out interested ISPs, digital literacy training providers, feasibility study consultants, community anchor institutions not already served, etc.

4

3

Determination of Scale

Determine the scale of impact and required resources by establishing which households, buildings or community anchor institutions to include in project(s), what the proposed network will look like and total cost impacts.

5

Capacity Building

Build capacity to identify funding opportunities and submit competitive applications. Tracking and responding to funding opportunity timelines, navigating complex or burdensome applications and reporting requirements is needed. Preparations and responses may require technical consultants and implementation partners.

and Policy

Structure Factors





Background and Methodology

Current Broadband Status

TVA has set out to define broadband needs and opportunities across its communities as part of the Broadband and Digital Literacy focus area.

Improving access to broadband has been recognized as a high priority for TVA, which currently has about 80% of households subscribed to broadband internet service. However, FCC data estimates that approximately 95% of households in the TVA region are in range of infrastructure that could provide 25/3 Mbps service and approximately 86% are in range of 100/20 Mbps infrastructure. These figures point to a dual problem, in which both access and adoption must be addressed in order to achieve Connected Communities' Broadband and Digital Literacy goals. Closing the digital divide will require strategically addressing market failures to deploy infrastructure where it is needed most, as well as addressing adoption barriers in those areas where infrastructure already exists.

To drive forward initiatives that support the Broadband and Digital Literacy focus area, it is important to understand the current state of broadband access and factors influencing adoption across a range of areas to identify relevant needs, gaps and potential opportunities. 80% of households subscribed to broadband.

HOWEVER

95%

are in range of infrastructure that could provide 25/3 Mbps.

Background and Methodology

Factors Affecting Broadband



TVA BROADBAND FUNDING GUIDE





Legislation and Policy

Infrastructure Market

Structure Factors

This report provides an assessment of broadband in the TVA service area as it relates to legislation and policy, market structure, infrastructure and socioeconomic factors and needs.

The companion TVA Broadband Funding Guide provides a look at how TVA communities can utilize funding opportunities to meet their needs.

Factors Affecting Broadband

Definition of Broadband

Internet speeds can vary depending on the type of access technology, but the FCC defines broadband as "highspeed internet access that is always on and faster than the traditional dial-up access." If minimum speed and reliability requirements are met (25/3 Mbps upload/download), then the internet service can be defined as broadband. However, there is a strong push from the FCC to increase the standard to be 100/20 Mbps to accommodate evolving internet needs.

Some communities, designated as underserved or unserved, still lack access to broadband services. Underserved households are those that do not meet the "high-speed" requirements set by the FCC of at least 100/20 Mbps. Unserved households are those without access to a broadband (i.e., 25/3 Mbps) speed connection.

Different internet speeds are required for different online activities. Since there can be significant variability in the speeds provided, this can impact what activities users can engage in and how many devices can be supported. MINIMUM SPEEDS
DOWNLOAD
25
Mbps
UPLOAD
HIGH SPEEDS
DOWNLOAD
UPLOAD

100 Mbps 20 Mbps

HOW INTERNET SERVICE WORKS

Broadband Background and Factors Affecting

Overview

Broadband

Internet Backbone

A conglomeration of multiple overlapping long-haul networks that create a worldwide network owned and operated by numerous telecommunications entities (public and private). It is typically built with fiber optic cables.



Last Mile Connections

The final leg of a network that provides service to the home, business or community institution. Last mile can be a combination of multiple access technologies: fiber, fixed wireless and other legacy technologies such as coaxial cable and DSL.

Legislation and Policy Infrastructure

Market Socioec Structure Factors

ocioeconomic actors Conclusion



Middle Mile Connections

The middle mile is the physical mid-section of the infrastructure required to enable internet connectivity for homes, businesses and community institutions.

IVA



Factors Affecting Broadband

Barriers to Broadband

Barriers to broadband availability and adoption often stem from a combination of factors. Promoting a healthy broadband ecosystem requires navigating legislation, understanding market conditions, knowing various infrastructure technologies and interpreting socioeconomic conditions and needs. Any entity seeking to maximize their impact in the broadband space will need to understand all of these factors and how they connect to each other before deciding where to focus their efforts. A broadband and digital equity framework combining relevant factors is the basis for the current state assessment research and analysis.

Broadband and Digital Equity Framework



Infrastructure

Knowledge of existing or potential broadband infrastructure, including performance data.



Market Structure

Understanding of existing broadband market structure, including major players, market segmentation and pricing.

Socioeconomic Factors & Needs

Comprehension of relevant socioeconomic variables and the needs of residents and communities.

	How Do Speeds T	ransla
	DOWNLOAD SPEED	CAP
	0 – 5 Mbps	• (• E • §
	5 – 40 Mbps	• 9 • \
	40 – 100 Mbps	• 9 • \
	100 – 500 Mbps	• 5 • F • [()
	500 Mbps – 1 Gbps	• S
1 miles		

*Source: HighSpeedInternet.com

and Policy

Structure Factors

ate to Activities?*

ABILITY

- Check email
- Browse web
- Stream audio on one device
- Stream video on one device
- Video calls or conferencing sessions
- Stream video on one device
- Video calls or conferencing sessions
- Stream HD video on one device Remote monitoring for telehealth
- Download large files
- e.g., working from home)

Simultaneous activities on numerous devices



Legislation and Policy

Broadband Background and Factors Affecting **Overview**

Broadband

Broadband Policies

Guided by the three Es of energy, economic development and the environment, along with its mission to improve lives in the TVA service area, TVA is well positioned to use its convening powers to facilitate and advance broadband in unserved and underserved areas to close the broadband service gap.



Energy

Provide reliable. low-cost energy through a dynamic and adaptable power portfolio.



Environment

Provide safe and reliable power, work to improve air quality, water quality, measure effects on public lands and conduct environmental reviews.



HIRING

Economic Development

Foster investment and job growth by creating incentives to help companies locate, maintain and expand operations in the TVA service area.

Infrastructure deployment is a critical and complicated step for every community working toward broadband access. While many states within TVA's service territory are implementing or intending to implement leading practices for infrastructure deployment, ISPs, LPCs, local governments and community organizations can help raise awareness of broadband-enabling policies in partnership with TVA.

Some examples of best practices for communities interested in broadband infrastructure policy development include:



2

Diq Smart

The highest cost of developing a broadband network is the installation of the fiber and/or conduit in underground trenches where other utilities are often located. Dig smart policies install broadband infrastructure when the street is open for construction. This lowers costs and decreases interruptions in the public right-of-way.

One Touch Make Ready

competition.

4

Require Conduit to the Home in Building Code or Subdivision Ordinance

It is more cost effective to install conduit during the construction process as it allows for fiber or other cable to run through it later when the home is ready to connect to the internet. Governments can amend local codes or ordinances to require conduit installation during home construction.

5

A confusing, long or inflexible permitting process could discourage investors and impede broadband expansion. Municipalities that streamline the permitting process provide a clear pathway for investment and signal to investors that the municipality is interested in working with them.

and Policy

Legislation Infrastructure Market

Structure Factors

3

Utility Municipal Broadband

Small, municipal providers can fill coverage gaps that other ISP segments may not find costeffective. Guidance from both the Coronavirus State and Local Fiscal Recovery Funds (SLFRF) and Capital Projects Fund (CPF) encourages prioritization of projects involving fiber broadband networks owned, operated by or affiliated with local governments, nonprofits and cooperatives.

6

Electricity Area Easements

Broadband providers often must secure an easement to construct broadband infrastructure on property that they do not own. Streamlined and transparent right-ofway processes can help reduce delays in broadband deployment.

This policy requires the owners of utility poles to allow a single construction crew to make changes to multiple utility wires. It reduces the cost of broadband infrastructure deployment and encourages

Clear and Simple Permitting



Geographic **Considerations**

The geographical makeup and population density of a community impacts its suitability for broadband access.

Terrain may be a significant factor for infrastructure buildouts, especially in rural areas like those north of Knoxville, where terrain may be difficult to dig in or cross with fiber lines. Mountainous regions, complicated hydrology, gorges and more all play a significant role for ISPs deciding on where to invest in broadband, especially if an area has low population density. Additionally, permitting for broadband infrastructure installation in and around protected lands, such as national forests and bodies of water, may further complicate a buildout and discourage investment.

To overcome geographic barriers, vertical assets may be used to deploy wired broadband or fixed wireless at a low cost. Existing vertical assets can be used to serve or increase the service level in areas where terrain is unsuitable for infrastructure buildouts. Public-private partnerships have commonly been used to share assets and expand investment to rural areas through vertical assets.



Geographic conditions like mountains and bodies of water can influence the type of broadband infrastructure that is deployed in a specific region.

Overview

Broadband Background and Factors Affecting Legislation Infrastructure Market Methodology Broadband

Infrastructure **Types**

Wired Broadband

Fiber optic cables typically provide the fastest speeds and can be deployed in two ways: underground and aerial. While underground deployment is more robust and resilient to extreme weather and wildlife, aerial is less expensive, particularly when using existing poles, though this approach does require pole access and preparation costs.

Combined, cable and fiber cover large portions of the TVA service area, which provides an opportunity to expand wired buildouts. In areas where wired connections do not exist or are outdated, wired middle mile buildouts can enable TVA partners to deliver high speed internet.

Though widely available, DSL provides slower speeds. Aging DSL infrastructure is quickly becoming outdated, though some larger entities offer broadband internet in packages bundled with television or landline service. Areas served largely by DSL may require new middle mile buildouts of cable and fiber broadband technologies to meet customer needs in the near future.

and Policy

Structure Factors



Two types of wired broadband:

- Underground
- Aerial



WIRED BROADBAND OVERVIEW*

Fiber	Cable	DSL
Fiber Optic Cable	Coaxial and Hybrid Fiber Coaxial	Digital Subscriber Line
SPEED Indicates how much data can be	be transmitted within a specific amount of tin	ne (e.g., Mbps).
Fastest symmetric speeds typically 1 Gbps up to 10 Gbps	Next fastest 20-100 Mbps up to 1 Gbps	Slow to medium typically <100 Mbps <i>up to</i> 200 Mbps
LATENCY Refers to how long it takes	a signal to travel to its destination and back	(e.g., delay in loading a webpage).
Very low 10-12 milliseconds	Low 13-27 milliseconds	Low 11-40 milliseconds
PROS		
 Fastest data transmission technology Future proofing 	Widely used for urban/suburbanCan use existing cabling	 Uses existing telephone lines Widely available, but phasing out
CONS		

 High initial capital cost

W.

- Asymmetric speeds
- Lower speeds overall, especially in rural areas

Broadband Background and Factors Affecting Legis

WIRELESS BROADBAND OVERVIEW*

FWA Fixed Wireless Access	LEO Satellite Low Earth Orbit	GEO Satellite Geosynchronous Equatorial Orbit	TVWS TV White Space
 SPEED indicates how much Medium to fast 25 Mbps up to 1 Gbps 	data can be transmitted within a specif Medium to fast >100 Mbps	ic amount of time (e.g., Mbps). Slow <25 Mbps	Slow <25 Mbps
LATENCY refers to how long Very low 30-40 milliseconds	it takes a signal to travel to its destinat Low 30-50 milliseconds	tion and back (e.g., delay in loading a Low 500-600 milliseconds	webpage). Very low 10-15 milliseconds
 PROS Relatively low- cost to deploy Reasonable speeds 	Can potentially cover remote areas	• Widest coverage area	 Long transmission range Non-line-of sight performance
 Potentially high maintenance costs and lower reliability 	 Relatively new and untested 	 High latency and expensive 	 New tech, relatively slow speeds

to transmit signals to each other, making it dependent on the presence of local wired infrastructure. Fixed wireless works best in flat areas where tree cover or elevation changes do not block signals. Though it does not provide the fastest speeds, fixed wireless requires minimal investment if vertical assets already exist.

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*Sources: NTIA pre-NOFO 23-Mar-22 Webinar 1, HighSpeedInternet.com, BroadbandNow; FCC

sla	tion	
Pol	licy	

Infrastructure Market

Structure Factors



Internet Speeds

From 2020 to 2022, both the TVA and national speed averages increased dramatically, likely due to work-fromhome demand. The TVA median gains outpaced national gains, suggesting TVA's service area is moving in the right direction for expanding broadband access and upgrading infrastructure. The mean speeds are significantly higher than the median (typical) speeds, suggesting TVA's service area has high-speed plan availability that may not be accessible to the average national consumer.



Broadband Background and Factors Affecting Legislation Infrastructure Market **Overview** Methodology

Broadband

While FCC data indicates that 94.9% of the population in the TVA service area has access to broadband offerings, Microsoft data estimates that only 49.6% of internet users are using broadband speeds. This is likely due to FCC data overestimating broadband coverage due to collection methodology and self-reported data.



% of Population with Access

	OVERALL 25/3	OVERALL 100/20	URBAN 25/3	URBAN 100/20	RURAL 25/3	RURAL 100/20	
West	91 %	79 %	99%	93%	69 %	48 %	
North	96%	91 %	99%	99%	86%	74 %	
East	97 %	88%	~100%	95 %	84 %	68 %	
South	94%	82 %	99%	92 %	76 %	60 %	
MS	81%	59 %	97%	76 %	60 %	41 %	
GA	98%	87 %	~100%	96 %	92 %	76 %	
КҮ	90%	84%	99%	98%	81 %	71 %	
AL	94%	82 %	99%	92 %	76 %	60 %	
TN	97 %	90%	99%	97 %	84 %	68 %	
VA	99 %	95 %	~100%	~100%	97%	91 %	
NC	91 %	72 %	N/A	N/A	91 %	72 %	

and Policy

Structure Factors

The West region has the lowest rural and overall access to highspeed internet as demonstrated by user speed tests.



Ookla

When broken down regionally, the West region has both the lowest overall and rural access to high-speed internet, as demonstrated by user speed tests. Further confirming this, Ookla speed tests, which provide analysis of internet access performance metrics, show that the West region has the lowest average speeds, while central Tennessee and major municipal areas across the TVA service region have the highest.





Broadband Background and Factors Affecting Legislation Infrastructure Market Broadband **Overview**

The Measurement Lab

The Measurement Lab (M-Lab) speed tests assess internet speeds in a different way than Ookla, giving a more comprehensive picture of overall network strength and often showing different results. For the TVA service area, M-Lab speed tests show weaker overall network speeds when downloading but confirm strong networks in central Tennessee and slower networks in Mississippi.









Market Structure Analysis

To understand the different factors and features of broadband offerings in the TVA service area, market structure was analyzed through three focus areas.



ISP Segmentation

ISPs operating in the TVA service area were identified and categorized into three segments, with profiles developed for each segment. LPCs were given their own separate analysis. Information for this analysis was sourced from the FCC, BroadbandNow and ISP websites.



Speed and Pricing

A speed and pricing analysis was then performed by calculating and comparing the dollar per Mbps and average cost for plans across the different technology types.

ACP Participation

The number of ISPs participating in the Affordable Connectivity Program (ACP) were determined by segment, including which providers are including devices and committing to offer eligible plans that are fully covered by the ACP subsidy amount.

Broadband Overview

Background and Factors Affecting Legislation Infrastructure Market Methodology Broadband

Affordable Connectivity Program

The Affordable Connectivity Program (ACP) succeeded the Emergency Broadband Benefit program to assist eligible households with paying for internet service, providing a discount of up to \$30 per month, or up to \$75 per month on gualifying tribal lands. A one-time discount of up to \$100 for a laptop, tablet or desktop computer can also be included, but not all providers participating in the program offer devices.

To be eligible for ACP, households must have an income below 200% of the Federal Poverty Guidelines or have a member of the household meet at least one of several criteria. These criteria include receiving a Federal Pell Grant, meeting existing criteria for participating ISP's existing low-income internet program or participating in a federal assistance program.

A majority (61%) of ISPs in the TVA service area currently participate in the ACP for fixed income service plans. All 16 medium and large providers, as well as 73 (56%) of small providers, including LPCs, currently participate in ACP. Of these 89 providers, only three are offering financial assistance for the purchase of connected devices. Additionally, eight providers have committed to providing ACP-eligible households with high-speed internet plans (greater than or equal to 100 Mbps where infrastructure permits) for no more than \$30 per month.

and Policy

Structure Factors



Even with lowcost plans, many households may not subscribe to broadband without affordability assistance.



participate in the ACP for fixed income service plans.



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Broadband

PROVIDERS OFFERING PLANS



Small, medium and large designations are based on market structure local to the TVA service area; designations do not imply scale relative to broadband utilities nationwide or outside of the TVA service area.

While most households have access to at least one ACP plan, increasing the number of participating providers may improve speed and affordability. Although only 61% of internet providers currently participate in ACP, together, they cover most of the TVA service area with some level of service. However, this coverage does include some areas below broadband speeds. Increasing

the number of participating providers may lead to increased competition and variety in provider choice, potentially improving speed and pricing. Participation in ACP is required for Broadband Equity, Access and Deployment Program (BEAD) funding, which may serve as an additional incentive for internet providers to join the program.

Availability and Affordability

Market structure is an important lens for examining the current state of broadband availability and affordability in the TVA service area. Geography and population density most directly impact return on investment for ISPs, thus influencing where, at what level and at what price point they provide their service.

For the purposes of this assessment, providers were split into three groups. Large providers in the TVA area are organizations that serve five or more states. Medium providers in the TVA area serve between three and four states. Small providers in the TVA area serve only one to two states and often in smaller markets where large and medium TVA area providers do not have a significant presence.

In the West region, pockets with the lowest provider counts also tend to have lower broadband internet subscription rates compared to average rates in other regions. The West region is mostly served by a few large ISPs, as well as several small providers, including LPCs. In areas with lower speed offerings from the large providers and gaps in service from LPCs, residents often have little to no access to service at 25/3 Mbps.

and Policy

Structure Factors

Providers were split into three groups:

SMALL 1-2 states

MEDIUM

3-4 states

LARGE

5+ states



In the northern tip of the East region, there is a pocket of moderate provider counts but extremely low subscription rates. This area is mostly unserved by the large providers, instead relying on various small and medium providers for service. Lack of competition from large providers, along with limited resources from small providers, may lead to issues with affordability of available plans.

Metropolitan areas, such as those surrounding Nashville and Huntsville, tend to have more provider choices through a higher number of options, along with high subscription rates. These areas are served by a mixture of large, medium and small providers, which greatly increases competition and therefore accessibility and affordability.

Broadband Background and Factors Affecting Legislation Infrastructure Market **Overview**

Small

28

102

Broadband

Service Provider Analysis



51% of the population has access to service at any speed.

49% has access to service at 25/3+ Mbps.

has access to service at any speed.

10% at 25/3+ Mbps.

NUMBER OF PROVIDERS ABOVE 25/3 MBPS



- In the northern tip of the East region, there is a pocket of extremely low subscription rates, but moderate provider counts. This area relies mostly on various small local and medium regional providers for service.
- Metropolitan areas, like those surrounding Nashville and Huntsville, tend to have high provider choice and subscription rates. These areas are served by a mixture of providers, which greatly increases competition, accessibility and affordability.
- In the West region, pockets with the lowest provider counts also tend to have lower broadband internet subscription rates. This area is mostly served by a few large ISPs as well as several smaller providers.

and Policy

Structure Factors

17%

of the population

has access to service

Large **Providers**

Number of providers that cover:



1

95%

of the population has access to service at any speed.

85%

has access to service at 25/3+ Mbps.



Broadband Overview

Background and Factors Affecting Legislation Infrastructure Market Broadband

Small Providers

Small providers, including LPCs, offer moderate coverage with 100/20 Mbps speeds in some areas but no coverage at all in equally large areas. This segment's high provider count, 130 out of 146 providers, means that there are many different players offering service to consumers at this level, as many of these providers are LPCs. However, the high provider count does not directly correspond to high provider choice for each consumer. These providers are characterized by their small service areas, leading to relatively low overlap between them. Small provider infrastructure is available to about 51% of the population and offers broadband speeds to about 96% of those, or about 49% of the total population.



With the infrastructure to serve %

of population.

Medium Providers

Medium providers primarily offer coverage in border regions of the TVA service area at speeds above 100/20 Mbps. With the second-lowest provider count, there are relatively few unique players competing against each other to serve consumers. Unlike with small and large providers, the low provider choice in this segment has a clear relationship with coverage level. Medium providers have infrastructure available to about 17% of the population but only offer broadband speeds to about 59% of those, or about 10% of the total population.







and Policy

Structure Factors

10

providers designated as medium in TVA's service area.

With the infrastructure to serve

17% of population.



Overview

Background and Factors Affecting Legislation Infrastructure Market Broadband Methodology

Large Providers

Large providers offer some level of coverage across most of the TVA service area, but speeds range widely. Of the 146 providers in TVA's service area, only six are designated as a large provider. However, the low provider count does not directly correspond to low provider choice for each consumer, as these providers are characterized by their large service areas, leading to varying degrees of overlap between them. Together, these large providers have infrastructure available to about 95% of the population and offer broadband speeds to about 85% of the population.

6 providers designated as large in TVA's service area.

With the infrastructure to serve

95% of population.



Value Analysis

Knowing the value per dollar for each internet technology is beneficial for understanding the competition level and consumer offerings in the market. Value per dollar is measured by Mbps per dollar for a plan and the typical reliability of broadband technology. Overall, fiber and cable plans tend to deliver reliable speeds at reasonable prices, while other technologies fall short on value delivered per dollar paid.

Fiber and cable plans offer the best value per dollar overall, with cable winning in download speeds and fiber winning in upload speeds. At the lower end of the spectrum, cable plans generally offer similar download speeds at a lower cost point than fiber. However, for the more premium plans, fiber download speeds increase steeply and quickly begin to match cable plans in value, offering higher speeds at correspondingly higher prices. Fiber upload speeds are unmatched in value. Only fiber plans reliably offer symmetrical upload and download speeds, which means that for the same price as cable, fiber consumers receive notably higher upload speeds.

DSL and fixed wireless values can be misleading, as many plans advertise a max speed but warn that these speeds may vary greatly. Most of these plans do not advertise their upload speeds at all, but those that do are comparatively slow. Satellite plans typically have very restrictive "soft data caps," which are not reflected in the dollar value of a plan. After consumers have used up

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Structure Factors



Value per dollar is measured by Mbps per dollar.



their allotment of high-speed service, their traffic is deprioritized and speeds drop. Entrylevel satellite plans can have data caps as low as 15 gigabytes per month, but even the most premium plans fall short of the average North American's monthly bandwidth consumption of more than 512 gigabytes.

PRICE PER ME	BPS	# slowest plan # fastest plan		
Fiber	Cable	DSL	Fixed Wireless	Satellite
DOWNLOAD				
\$.64 \$.08	\$.23 \$.08	\$1.49 \$1.25	\$22.40 \$3.69	\$4.22 \$6.20
UPLOAD				
\$1.87 \$.10	\$9.10 \$2.79	\$2.08 \$2.08	\$43.58 \$25.43	\$22.50 \$76.67

While plan pricing depends on both technology type and speed tier, some technologies are consistently more affordable than others at any speed. Fiber and cable plans offer some of the lowest average prices in the 100 Mbps – 500 Mbps download speed range. While technologies such as DSL and fixed wireless appear to have relatively affordable low-speed plans, their minimum speeds are so low that a household would still be considered unserved at that level (i.e., below 25/3 Mbps). Satellite average costs are the highest, and according to according to released BEAD Program guidance, areas that are only served by a satellite service will be considered as unreliable and unserved, regardless of speed. Additionally, fixed wireless with unlicensed spectrum is also deemed as unreliable.

Broadband Background and Factors Affecting Legis Methodology **Overview**

Broadband

PRICE AND SPEED

Fiber	Cable	DSL	Fixed Wireless	Satellite
DOWNLOAD				
50 Mbps - 10 Gbps	50 Mbps - 1.2 Gbps	15 Mbps - 200 Mbps	1 Mbps - 182 Mbps	12 Mbps - 50 Mbps
UPLOAD				
8 Mbps - 10 Gbps	1Mbps - 50 Mbps	15 Mbps - 20 Mbps	512 Kbps - 23 Mbps	3 Mbps
PRICE RANGE				
\$ 50- \$300	^{\$} 20- ^{\$} 95	^{\$} 25- ^{\$} 77	^{\$} 45- ^{\$} 100	\$ 65- \$300
LOW-SPEED AVG.				
^{\$} 66	^{\$} 36	^{\$} 50	^{\$} 50	^{\$} 68
HIGH-SPEED AVG.				
^{\$} 138	\$83	\$53	\$77	\$ 230



Some technologies are consistently more affordable than others at any speed.

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Policy	

Infrastructure Market

Structure Factors

Pricing and plan speed data for each technology are based on that category's top five providers (measured by area served) that publish their pricing information on their websites. Numbers may vary based on location or other factors and are meant to provide context relative to each other rather than to serve as definitive pricing estimates in themselves.

Layered Socioeconomic Factors

Understanding socioeconomic factors is critical to identify underserved and unserved geographic areas related to broadband and digital equity. Multiple layers of socioeconomic factors were considered to understand broadband adoption trends in households across TVA's service area. Socioeconomic factors and systemic barriers contribute to a household's ability to access broadband service at the speeds they need, afford monthly payments for broadband plans and digital devices and successfully navigate signing up for broadband and using the internet.

Because of its size and diversity, socioeconomic factors can vary across the TVA service region. Due to this variation, promoting digital equity to the region's 10.7 million residents, spread across four TVA service regions, requires solutions tailored to unique regional and community needs.

10.7M residents across four TVA service regions will require tailored solutions.

Overview

Broadband Background and Factors Affecting Legislation Infrastructure Market Broadband

Research revealed that the following socioeconomic factors tend to have the most influence on household broadband adoption rates.



The Urban and Rural Divide

What disparities exist between urban and rural areas? How can we ensure rural areas have the necessary infrastructure and are connected at similar rates as urban areas?



Education

Are educational needs related to broadband being met? How does educational attainment compare with national averages?



Race and Language

Where are residents located who may face a language barrier?

and Policy

Structure Factors

Socioeconomic Conclusion



Housing

Which TVA residents are "housing burdened"? Do they have less available funds for other essentials like broadband?



Health and Age Disparity

Where in the TVA service area are businesses and residents who may have unique health- or age-related needs connected to broadband internet and digital device adoption?



Income

Which communities in the TVA service area struggle to afford broadband internet and digital devices?

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The Urban and Rural Divide

When comparing an area's socioeconomic factors to broadband subscriptions, TVA found that rural areas subscribed at lower rates than urban areas. Low broadband subscription rates in rural areas can be attributed to lack of adequate speeds or basic service available as rural census tracts are more likely to be unserved or underserved and face affordability challenges as well.



Rural areas subscribe at lower rates than urban areas.

Housing

Housing burdened households, classified as households paying more than 30% of their gross income on their rent or mortgage, account for almost one in four households across the TVA service area. Residents hit the hardest by housing costs tend to be located near large metropolitan cities in all TVA regions. The West region has the lowest median income and the highest percentage of households classified as housing burdened, with 24% of households considered housing burdened. While the North region has the highest median income in the TVA service area, 23.3% of households are still housing burdened. This indicates that housing costs are accounting for a disproportionate amount of household income which can make affordability a barrier to broadband adoption, even in areas with generally higher household income.



HOUSING BURDENED HOUSEHOLDS PAY

of their gross income on their rent or mortgage. Overview

Background and Factors Affecting Legislation Infrastructure Market Methodology Broadband

Education

Bachelor's Degree or Higher

In the TVA service area, broadband adoption increases with higher levels of education. It is also important to note that increasing broadband access can increase educational opportunities, and ultimately, employment opportunities for residents. 26.2% of residents in the TVA service area have a bachelor's degree or higher (nearly 7% below the national average of 33%) with the West and East regions at 24%. The West and East regions also have the lowest median income and lowest rates of adoption, indicating that educational outcomes are tied to other socioeconomic factors. Educational opportunities can be leveraged through greater broadband availability.

Major metropolitan areas such as Jackson, Memphis, Nashville, Chattanooga, Huntsville and Knoxville have the highest concentration of residents with a bachelor's degree or higher and may also have the easiest access to broadband plans.

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Socioeconomic Conclusion

26.2%

of residents in the **TVA** service area have a bachelor's degree or higher.

THAT IS

7%

below the national average.



Overview

Background and Factors Affecting Legislation Infrastructure Market Methodology Broadband

School-Aged Children

Additionally, 2.8 million school-aged children reside in the TVA service area with the North region having the highest share. The highest concentration of residents under 18 can be found in areas bordering major metropolitan areas such as Memphis, Huntsville, Chattanooga and Knoxville but are also well represented in rural census tracts across much of the TVA service area.

While households with school-aged children tend to be better connected, households that fare poorly economically can have affordability challenges and therefore, less disposable income to spend on an internet subscription. This is reflected in the correlation between SNAP benefits (indicating low household income) and broadband rates: areas of higher rates of households receiving SNAP benefits also have lower broadband adoption rates. This is especially important as children often require internet access with reliable speeds for schoolwork.

Lack of reliable broadband access can lead to poor educational outcomes for low-income youth and compound other socioeconomic inequities.

THERE ARE

2.8M school-aged children in the TVA service area.

Higher Education

Residents aged 20-34 years old, the group that tends to be the most online globally, serve as a larger subset of the population in counties with large metropolitan areas such as Memphis, Nashville, Chattanooga, Knoxville and census tracts bordering metropolitan cities. This age group includes the majority of college students. Students attending higher education institutions are likely to be economically vulnerable but gain economic security after graduation.

Regions that have a higher number of students enrolled in college or graduate school also tend to be correlated with a higher percentage of residents working from home, although the percent of employees working from home in the TVA service area (5.5%) and the region with the highest percentage of residents working from home (North region at 6.9%) are still below the national average of 7.3%.

Supporting students in higher education is critical to poverty reduction and social mobility.

and Policy

Structure Factors

Socioeconomic Conclusion

7.3% of U.S. residents work from home.

5.5%

of residents living in TVA service area work from home.



Methodology Overview

Background and Factors Affecting Legislation Infrastructure Market Broadband

Health and Age Disparity

Older residents of the TVA service area aged 65+, who are often more affected by health and disparity issues, are more heavily concentrated within the East region. Specifically, these residents reside in northeastern Tennessee and census blocks on the borders of Georgia and North Carolina. High concentrations of older populations can also be found across the inner rural census tracts throughout all of the regions in the TVA service areas and typically away from major metropolitan areas. Broadband access and adoption is important for senior populations as it can be used to facilitate telehealth and access social services. The East region is reported to have the highest number of households without a computing device or a broadband subscription in the TVA service area indicating that population age partly explains lower broadband subscription in the region. For this particular demographic, digital literacy initiatives are of particular importance; without education efforts, access to broadband or devices will not necessarily lead to adoption.



Race and Language

TVA service area population is predominantly white identifying, with non-white populations concentrated in the southwestern census tracts in the West region. The West region also maintains the lowest rates of broadband adoption and the lowest income in the TVA service area.

Major metropolitan cities in the TVA service area tend to be more diverse with a higher percentage of the nonwhite population whereas surrounding rural census tracts are predominately white identifying. Improving internet affordability can be a mechanism to improve digital and social inequities in the TVA service area.

While there are some rural census tracts where 5% of households or more speak a language other than English at home, the vast majority of the TVA service area does not have many challenges concerning limited Englishspeaking abilities.

However, to promote greater broadband access while also promoting digital equity, the use of other languages to supplement English should be considered in outreach and application materials to ensure that these households are not at a disadvantage. Limited English-speaking abilities can serve as a hindrance to knowing about important social assistance such as the ACP.

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Outreach and application materials in languages other than English can help promote digital equity.



Overview

Background and Factors Affecting Legislation Infrastructure Market Broadband Methodology

Income

Low-income Qualified Census Tracts (QCTs) within urban areas also likely to struggle with affordability, as broadband subscription rates by total population are lowest in low-income inner urban areas where poverty rates are above 25% and median incomes are low. These areas are serviced by adequate speeds but are subscribed at lower rates than census tracts with higher median incomes.

Median household income in the TVA service area (\$49,800) is significantly lower than the national median (\$64,994), suggesting that affordability will be a major challenge for increasing broadband access. Low-income areas tend to be in inner urban pockets and rural areas further out from metropolitan cities. This is important to note as these areas are often correlated with a greater number of households with an income under the federal poverty line.

The West region experiences the highest rates of poverty and lowest rates of household broadband adoption. This demonstrates that addressing affordability concerns should be a target initiative in increasing broadband adoption in the TVA service area. Merely expanding the availability of broadband infrastructure is not enough to expand broadband adoption if households are unable to afford subscription rates set by ISPs.

High income census tracts are often located in suburban neighborhoods on the perimeter of urban and metropolitan cities such as Nashville, Memphis and Huntsville.



BROADBAND SUBSCRIPTION RATES

are lowest where poverty rates are above

25%

Wealthier. suburban neighborhoods close to metropolitan areas maintain higher rates of broadband adoption across the TVA service area.





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Conclusion

Broadband accessibility and affordability vary in the seven-state region served by TVA, and some communities lack this necessary service. As effective internet access becomes more integral with everyday life, communities without reliable access risk falling behind. By providing a comprehensive overview of the challenges as well as opportunities for communities to increase broadband accessibility, TVA hopes to inspire communities to work with ISPs and LPCs on expanding broadband.

Large infusions of federal and state funding for broadband offer a breakthrough opportunity for new investments in the TVA area and could bring broadband access to communities across the region. TVA has developed publicly available resources to help communities in its service area capture broadband funding and maximize their impact. Interested organizations should start now by referring to the TVA Broadband Funding Guide and Funding Database.

Overview

Broadband Background and Factors Affecting Legislation Infrastructure Market Methodology



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