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Electric Co-operatives as Rural Retail Broadband Network Providers: Opportunities and Challenges

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I am submitting herewith a dissertation written by Jamie Alexander Greig entitled "Electric Co-operatives as Rural Retail Broadband Network Providers: Opportunities and Challenges." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Communication and Information.

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Electric Co-operatives as Rural Retail Broadband Network Providers: Opportunities and Challenges

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DEDICATION

I would like to thank the members of my committee, Dr. Mark Harmon, Dr. Mike Fitzgerald, Dr Michael Wirth, and Professor Stuart Brotman for their feedback and advice during this process.

To my wife Kaylen Mallard, I express extreme gratitude and full-hearted love for her patience and for providing the support needed to accomplish this goal together. I hope that in whatever endeavors she chooses to commit herself to I can show as much dedication to providing love and encouragement as she has done for me.

To my parents Bill and Elizabeth Greig, I thank you for supporting my dreams and encouraging me to make the move to another country to further my studies.

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For all the people living without adequate access to internet service, especially those living in rural areas, I hope that this dissertation can in some way result in helping to identify a solution so that high-speed internet can benefit your communities.

ABSTRACT

Multiple studies have shown that access to high-speed broadband networks significantly improves the economies, education, and lifestyle benefits in rural areas. Consequently, this dissertation seeks to show how electric co-operatives could be an effective means for providing rural and cash-poor communities with this vital access. It analyzes the history of electric co-operatives, the legislative and regulatory status of electric co-operatives, funding processes, and the current energy/telecommunications marketplace. In light of the opportunities presented, challenges regarding how they should be regulated, legislated, and funded are addressed as well.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Purpose/Objectives and Scope of the Dissertation

Electric co-operatives are the primary source of electricity to farms, homes, and businesses across 47 states. They deliver power to approximately 42 million people across 57 percent of U.S. land mass. With their existing infrastructure ready to be built upon to create residential broadband networks these entities could serve an important purpose in delivering broadband networks to currently unserved rural areas.

The purpose of this dissertation is to analyze from a marketplace, funding, and public policy perspective the historical and current role of electric co-operatives as electric utility providers and their potential role as rural retail advanced telecommunications network (broadband) providers. This includes:

a) The reality of rural access as presented by digital divide literature.
b) The opportunities for electric co-operatives to address the problem.
c) The challenges they will face in order to capitalize on these opportunities

In doing so this dissertation identifies the opportunities that exist for electric cooperatives in the rural telecommunications marketplace and the challenges that may be hindering their ability to build broadband networks.

1.2 Background

Legislators, industry stakeholders, and concerned citizens continually have attempted to identify solutions to the lack of affordable and reliable high-speed internet services in rural or

cash-poor urban populations.[1] One of the proposed solutions emphasizes publicly-owned/accountable or subsidized broadband network expansion.[2]

North Carolina and Tennessee are two states with statutes that allow local governments to construct and operate broadband telecommunications networks to provide high-speed internet access and video services. However, both states' laws contain limitations of broadband authority to local governments. The Tennessee law[3] allows municipalities operating electric plants to offer cable, video, and internet services – but only within their service areas (the area served by the municipality's electric plant). The North Carolina law[4] allows cities to provide broadband service, but only within their corporate limits (and contained additional restrictions). In 2014, Chattanooga, Tennessee and Wilson, North Carolina petitioned the FCC to preempt their states from enforcing those limitations so that they could provide broadband beyond the service area (Chattanooga) and beyond the corporate limits (Wilson).

In 2015, the FCC granted Chattanooga and Wilson the requested relief and preempted both states' laws, relying on Section 706 of the Telecommunications Act of 1996 (Communications Act of 1934, as amended). Though not mentioned in Section 706, the FCC concluded that those methods include preempting (in reference to the term "forbearance") state laws which it believed were inhibiting broadband deployment. This ruling was appealed by both North Carolina and Tennessee resulting in a case before the United States Court of Appeals for the Sixth Circuit.

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[1] USAID, Caribou Digital and the Digital Impact Alliance. "Closing the Access Gap: Innovation to Accelerate Universal Internet Adoption." (February, 2017). Available at https://www.usaid.gov/sites/default/files/documents/15396/Closing-the-Access-Gap.pdf

[2] The Fiber Broadband Association, "Municipal Broadband." Available at https://www.fiberbroadband.org/page/municipal-broadband

[3] TCA 6-51-101 (2013)

[4] §392.410(7)

The Sixth Circuit reversed the order, which "essentially serves to re-allocate decision-making power between the states and their municipalities."[5] Finding that no federal statute or FCC regulation requires the municipalities to expand or otherwise to act in contravention of the preempted state statutory provisions. This preemption by the FCC of the allocation of power between a state and its subdivisions requires at least a clear statement in the authorizing federal legislation. Section 706 of the Telecommunications Act of 1996, cited by the FCC, states that the FCC "shall" take action to promote broadband deployment, but "falls far short of such a clear statement."

At the same time, and acknowledging that the digital divide in broadband services had not been adequately addressed by the private market, the Tennessee legislature set out to identify ways to stimulate broadband expansion into unserved areas.[6] The body tasked with identifying pathways to rural broadband expansion, the Tennessee Advisory Committee on Intergovernmental Relations (TACIR), released a report[7] in 2016 stating that one of the solutions to the lack of broadband access in rural areas was to allow member-owned electric co-operatives the ability to provide broadband.

In 2017, the Tennessee legislature passed the "Broadband Accessibility Act,"[8] (BAC) this act enabled member-owned electric co-operatives to supply retail broadband services, specifically it:

(1) Authorizes electric co-operatives to provide broadband internet access or related services. Under the Rural Electric and Community Services Co-operative Act in present law, co-operatives are authorized to provide telephone, telegraph, and telecommunications services.

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[5] State of Tenn. v. Fed. Commc'n Comm'n, No. 15-3291 (6th Cir. 2016)
[6] The Tennessee Department of Economic & Community Development, "Broadband Study" (July, 2016). Available at https://tnecd.com/news/broadband-study-finds-13-percent-of-tennesseans-without-access/.
[7] Tennessee Advisory Commission on Intergovernmental Relations. "Broadband Internet Deployment, Availability, and Adoption in Tennessee," (January, 2017). Available at http://www.tn.gov/tacir/section/tacirpublications.
[8] TN HB0529/SB1215

This bill adds the provision of broadband internet access to the services that a co-operative may provide. This bill adds that any of the services that may be provided pursuant to the Act, including broadband internet access, outside the service area of the co-operative requires the permission of any municipal electric plant or co-operative in whose service area the services will be provided. This bill also requires that any of the authorized services be furnished on an area coverage basis. Generally, the provision of broadband internet services will be subject to the same present law provisions that apply to the provision of telephone, telegraph, and telecommunications services by a co-operative;

> *(2) Requires co-operatives that elect to provide any of the above-described services to:*
>
> *(A) Grant to other providers of such services non-discriminatory access to locate such other providers' equipment on infrastructure or poles owned or controlled by the co-operative; and*
>
> *(B) Administer, operate, and maintain its electric system as a separate department; establish a separate fund for the revenue from the electric operations; and not mingle electric system funds or accounts, or otherwise consolidate or combine the financing of the electric system with those of any other of its operations;*

There are currently 23 electric co-operatives in Tennessee with the potential to utilize their existing fiber structure to expand broadband service into rural communities.[9] However, Section 2 (B) of the BAC states that in order to provide this service electric co-operatives must not "cross subsidize" their different business operations. This is further explained in Section 7 (B) (1) of the act:

"*A co-operative providing any of the services authorized by subsection (a) shall not provide subsidies for such services. A co-operative shall administer, operate, and maintain the electric system as a separate department in all respects, shall establish and maintain a separate fund for the revenues from electric operations, and shall not directly or indirectly mingle electric system funds or accounts, or otherwise consolidate or combine the financing of the electric system, with those of any other of its operations."*

[9] The Tennessee Electric Cooperative Association, "Member Utilities." Available at http://www.tnelectric.org/members/

At the same time, funding agencies, such as the Federal Communications Commission (FCC) and United States Department of Agriculture (USDA), have funding mechanisms designed to distribute funds to entities for the provision of home broadband, however these entities must also show that they have experience in delivering successful broadband projects.

1.3 Electric Co-operatives as Broadband Network Providers

America's 930 electric co-operatives[10] are the primary electricity source for homes, farms, and businesses across 47 states.[11] There are 66 wholesale generation and transmission ("G&Ts") co-ops and 864 distribution co-ops that resell and deliver electricity to retail customers across the "last mile"[12] between the national electric power grid and the end-user.

When discussing broadband networks in rural communities, industry and media draw parallels to the 1930s-era efforts by electric co-operatives to bring electricity to communities that investor-owned utilities refused to serve. A 2016 article in *The New York Times* stated:[13]

> The parallels between bringing electricity and bringing broadband to rural areas run deep. In the 1930s, about 90 percent of urban residents in the United States had access to power, compared to just 10 percent in rural areas, according to the New Deal Network research group. At the time, President Roosevelt warned that the "electricity divide" excluded farm families from economic benefits provided by power.
>
> But private power companies said that it was too expensive to electrify rural areas and that even if they did, there was little profit to be made. So, President Roosevelt established the Rural Electrification Administration in 1936, a centerpiece of the New Deal, which led to the creation of thousands of small electric co-operatives using federal funds.

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[10] The National Rural Electric Co-operative Association, "Co-Operative Facts." Available at http://www.nreca.org/AboutUs/Co-op101/Co-operativeFacts.htm.
[11] *Ibid.*
[12] This term from the telecommunications industry refers to the connection between the cable, trunk or optic fiber lines and homes and businesses. This connection may be a few feet or a few miles.
[13] Cecelia Kang, "How to Give Rural America Broadband?," New York Times (August 7, 2016). Available at https://www.nytimes.com/2016/08/08/technology/how-to-give-rural-america-broadband-look-to-the-early-1900s.html

Today, electric co-operatives are reinventing themselves as broadband network providers. Of the over 900 electric co-ops nationwide, which serve mostly rural areas and small towns, estimates indicate that a significant[14] percentage of them may ultimately launch some type of broadband deployment to remedy a lack of services from incumbent providers to their members.

Currently 66 electric co-operatives serve as retail broadband network providers in the United States. The first of these projects, Oregon's Douglas Fast Net,[15] was established in 2002. However, the majority of electric co-operative projects were established after 2010 and the awarding of roughly $7.2 billion in broadband stimulus funding through the National Telecommunications and Information Administration, along with the Department of Agriculture's Rural Utilities Service.[16]

1.4 Scope of Problem

1.4.1 Ambiguity and Consistency

Despite investment in electric co-operatives, an overwhelming majority (around 835 out of approximately 900) have refrained from entering the telecommunications marketplace.

In the 1930s, the federal government had not yet developed a cost effective method of electrifying rural communities. Since the New Deal there has been a rapid expansion of electricity into previously unserved areas. Whereas electric co-operatives played an important role in that expansion, the infrastructure landscape has since changed dramatically.

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[14] Craig Settles, "Electric Co-ops build broadband networks," Gigabit Nation (July, 2014). Available at http://www.bbcmag.com/2014mags/July/BBC_Jul14_ElectricCo-ops.pdf..
[15] Douglas Fast Net. Available at https://dfn.net/
[16] Masha Zager, "Broadband Stimulus Program Funds Fiber," BBCMag (October, 2010). Available at http://www.bbcmag.com/2010mags/oct10/BBP_Oct10_Deployments.pdf

"Where the original program served mainly farmsteads, today's rural electric co-operative program serves essentially every type of commercial and business enterprise imaginable as well as suburban subdivisions and entire communities."[17]

Today, 870 distribution co-operatives and 60 G&T co-operatives serve over 19 million homes delivering electricity to over 42 million consumers, about 11 percent of the U.S. population, in 47 states.[18] Co-operatives have grown an average of 4.3 percent yearly, higher than the annual U.S. market growth rate of 2.4 percent. [19] After the 1960s the mission of achieving rural electrification had been largely completed by co-ops. Since then these entities have diversified their services to include other energy services, water infrastructure, cable and satellite television. The next phase of this diversification appears to be the development of fiber optic and wireless telecommunications. As Gene Argo, Midwest Energy's President and General Manager, said in 1999, "Just because you're an electric co-operative doesn't mean you're restricted from doing other things, and what you are today doesn't necessarily mean that's what you're going to be tomorrow."[20]

However, current policies governing the electric co-operatives were mostly created in a different era from a specific purpose.

Consequently, this research aims to identify whether the legislative and regulatory framework in which electricity co-operatives operate needs to be updated to reflect the many

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[17] Steven Lindberg, "Electric Co-operatives in a Deregulated Market," *Forum for Applied Research and Public Policy 15*, (Summer 2000), p. 41.
[18] The Rural Electric Magazine, "Power Point," (March, 2018), p. 7.
[19] Department of Energy, Energy Information Administration, "Electric Sales and Revenue Report(s)" (Washington, D.C., 1992, 1999).
[20] Jody Garlock, "Ahead of the Game," *Rural Electrification*, (December 1999), p. 19.

changes in the electricity industry and the way that co-operatives do business currently and in the anticipated future.

1.4.2 A Changing Electric Co-operative Environment

The landscape of energy distribution has changed significantly since electric co-operatives were funded to bring energy to rural communities in the 1930s. Most importantly, advanced telecommunications infrastructure has become an integral part of energy distribution infrastructure.

As part of this endeavor, electric co-operatives have invested in mobile radio systems, private dispatch, microwave, and tracking systems. Since the 1990s, these co-operatives have generally relied on radio communications for access and control of downline devices on their electric grid. This includes reclosers, capacitor banks, meters, and voltage regulating stations. Although the radio systems have been reliable, fiber-optic infrastructure allows for faster communications and the ability to implement outage management, load management, distribution automation, and other programs that enhance and improve their electric grids. This expansion of fiber infrastructure means that electric co-operatives already have the machines, equipment, poles and towers that are used in the deployment of retail fiber broadband networks.[21]

[21] For the purpose of this study, broadband network deployment will be discussed in terms of "fixed" or fiber deployment. Of the 65 active electric co-operative broadband projects in the United States, all involve fixed line deployment (via Passive Optical Networking). That is not to say that mobile broadband cannot be a viable option for rural broadband deployment. However, given that utility power companies rely on fiber networks to construct their smart grids, it seems that their retail operations have become extensions of that central core fiber grid. A topic for future studies could be an assessment of the viability of mobile (4 or 5g) technology as a replacement for fiber deployment by utility power companies such as electric co-operatives. Of note is the growth of fixed wireless as a technology option in rural areas.

2 RESEARCH APPROACH, METHODOLOGY, AND LITERATURE REVIEW

2.1 Research Questions

Primary RQ: Should the legislative and regulatory framework in which electric co-operatives operate be updated to reflect the many changes in the electricity industry, and the way that co-ops do business, to increase co-ops ability to provide broadband network service to rural communities?

Alongside this primary analytic research question this dissertation also answers the following research questions:

RQ1. What is the legislative status of electric co-operatives and how can it be updated to reflect the changing status of electric co-operatives?

RQ2. How are mixed utility (energy/telecommunication) providers regulated and how can this be applied to electric co-operatives?

RQ3. What is the current funding process for potential broadband providers in the United States?

RQ4. How can the broadband funding process be revised to facilitate electric co-operative's entry into the telecommunications marketplace?

RQ5. How can the experience of legislators, regulators, and industry members inform new policy and funding initiatives?

2.2 Study Procedures

Data were gathered using academic and governmental databases.[22] Historical analysis was applied using historical records.[23] Academic, industry-focused documents, and trade reports were examined to identify and examine the broadband funding process, treatment of mixed-utility providers, and the current energy/telecommunications marketplace.[24]

In-depth interview techniques were used to gather data from industry members, regulators, and legislators. These data were analyzed using qualitative thematic analysis and the results were used to inform the recommendations.[25]

2.3 Literature Review

To fully analyze this topic, it is necessary first to explore some key elements of previous research. This research can be categorized under the following headings:

a) Economic and social analyses (both in theory and practice).
b) Universal service (as implemented under the Communications Act of 1934, as amended, including recent FCC reforms)
c) The rural-urban digital divide; and
d) Federal and state funding mechanisms for rural broadband networks.

[22] USDA, FCC, RUS public filings.
[23] Nexis Uni, Library of Congress congressional records, and physical library resources
[24] *Id* and various electric co-operative member newsletters
[25] Academic databases were used to gather historical records and academic studies. Newspaper or trade publications, congressional testimonies and Federal Communications Commission and USDA public filings were gathered from publicly-available databases. FCC, National Telecommunications and Information Association (NTIA), USDA, and RUS filings associated with funding applications and processes were gathered from publicly-available records. Collected records start January 1, 2002 (the date of the first electric co-operative filings) and include records up to and including July 31, 2018.

2.3.1 Economic and Socio-Economic Analyses

Among economists and digital divide researchers, there are two factors at play when it comes to explaining the broadband disparity between urban and rural locations. The first focuses on models that calculate infrastructure decisions based on population density. Low population density equates to smaller revenues therefore a lower return on investment.[26] This "supply side" economic analysis determines that rural areas lag behind urban areas because of a lack of access to infrastructure and small customer-base. The second form of rural–urban digital divide economic analysis focuses on the lack of demand in rural areas. This analysis takes a socio-economic approach, focusing on indicators such as income and education to suggest that rural populations are less likely to adopt the Internet even when it is available. Economic analyses of rural broadband expansion thus can be divided into two sub-categories:

1) Supply-cost (Economic) analyses; and
2) Demand (Socio-Economic) analyses.

2.3.1.1 Supply-Cost Analysis

Supply costs analyses, such as a 2016 study by Schneir and Xiong,[27] attempt to assess the supply cost implications of deploying broadband network infrastructure in rural locations. Schneir and Xiong's study, for example, assessed the cost of deploying 30 Mbps or 100 Mbps downstream capable "fixed" using a cost-model based on analysis of UK rural infrastructure by

[26] Downes, T., & Greenstein, S. (2002). Universal access and local Internet markets in the U.S. *Research Policy*, 31, 1035-1052

[27] Rendon Schneir, & Xiong. (2016). A cost study of fixed broadband access networks for rural areas. *Telecommunications Policy*, 40(8), 755-773.

Analysis Mason.[28] In their cost analysis, a cost model was employed to determine the cost of a home passed and the cost of a home connected for various fiber and copper-based networks in rural areas. They determined that the cost to deploy fixed networks in rural areas surrounding UK towns and villages was 80 percent higher than within the towns and villages.

In similar studies, Frias et al. performed cost comparisons of deploying 30 Mbps through Fiber To The Home (FTTH) and Long-Term Evolution (LTE)[29] networks to rural areas in Spain.[30] Their analysis showed that in Spanish municipalities with between 10,000 and 100,000 inhabitants, it is economically viable to deploy FTTH networks, whereas in municipalities with between 1,000 and 10,000 inhabitants, LTE wireless networks are more cost-effective. They deemed municipalities with fewer than 1,000 inhabitants not to be cost-effective for either fixed or wireless systems, based on traditional for-profit models. Tahon et al. explored FTTH cost models based on co-operative infrastructure projects between multiple utility operators.[31] Their analysis showed that "synergetic deployment" of new infrastructures could reduce deployment costs by up to 21 percent. In contrast, a study as to the cost-effectiveness of fixed-wireless networks by Zhang and Wolff in Montana concluded that, with "reasonable assumptions" for equipment costs, customer adoption rates, services prices, and market share, a WiFi-based

[28] Analysys Mason (2008). "The Costs of Deploying Fiber-based Next-generation Broadband Infrastructure." *Analysys Mason report for the Broadband Stakeholder Group*. Available at http://www.analysysmason.com/PageFiles/5766/Analysys-Mason-final-report-for-BSG-(Sept2008).pdf

[29] Long-Term Evolution (LTE) is a standard for wireless broadband communication for mobile devices and data terminals that uses cellular network data services.

[30] Frias, Z., Gonzales-Valderrama, C. & Perez Martinez, J. (2015). Keys and challenges to close the broadband rural gap: the role of LTE networks in Spain. In *Proceedings of the 26th European regional ITS conference*. Madrid, Spain.

[31] M. Tahon, J. Van Ooteghem, K. Caiser, S. Verbrugge, D. Colle, M. Pickavet, P. Demeester. Improving the FTTH business case – a joint telco-utility network rollout model. *Telecommunications Policy*, 38 (5–6) (2014), pp. 426-437.

broadband Internet access network is financially viable in a rural area.[32] Similarly a techno-economic feasibility study developed by Simo-Regedias et al. tested, in the Peruvian Amazon, a wireless infrastructure sharing solution through a Capital Expenditure versus Operating Expenditure (CAPEX/OPEX) analysis.[33] Their study showed that a multi-hop rural community network in a developing region based on WiFi-based Long Distance (WiLD) or Worldwide Interoperability for Microwave Access (WiMAX) links can successfully share excess bandwidth with another provider for 3G backhaul. They also proved that, in their studies context, terrestrial backhaul sharing was not only technically feasible, but also economically advantageous for operators and community networks. A 2009 study by Ellershaw et al. examined the deployment costs of three broadband access technologies: passive optical network (PON), fiber-to-the-node, digital subscriber line (FTTN DSL) and broadband wireless (WiMAX).[34] They calculated the deployment cost of enhanced networks for each of these technologies for a range of rural areas in Victoria, Australia. Deployment of optical fiber was the largest single cost component for both PON and FTTN DSL because these broadband access networks needed multiple nodes to span the required distances in rural areas. They also showed that the cost differences between alternative technologies were not as great as expected. For broadband services with access rates around 20 Mbps without contention, FTTN DSL offered the lowest deployment cost for most

[32] Mingliu Zhang, & Wolff. (2004). Crossing the digital divide: Cost-effective broadband wireless access for rural and remote areas. *Communications Magazine*, IEEE, 42(2), 99-105.
[33] Simo-Reigadas, Municio, Morgado, Castro, Martinez, Solorzano, & Prieto-Egido. (2015). Sharing low-cost wireless infrastructures with telecommunications operators to bring 3G services to rural communities. *Computer Networks*, 93, 245-259.
[34] Ellershaw, John & Riding, Jennifer & Lee, Alan & Tran, An & Jie Guan, Lin & Tucker, Rod & Smith, Timothy & Stumpf, Erich. (2009). Deployment costs of rural broadband technologies. *Telecommunications Journal of Australia*. 59. 10.2104/tja09029.

rural households and for 50 Mbps and above, PON offered the lowest deployment costs per rural household.

2.3.1.2 Demand Analysis

Analysis of rural demand of broadband technology raises an apparent paradox; despite the relative advantages broadband brings to rural communities, when compared to urban ones, rural adoption of broadband service has progressed at a slower rate.[35] After accounting for access and demographic variables, studies have shown that the adoption rate of service (using the FCCs standard for broadband set as 10Mbps/l Mbps) in rural areas is around 10 to 20 percent less than in urban areas.

This slower adoption rate is surprising given the benefits afforded to rural communities. A study of rural benefits of high-speed internet showed that rural areas realize higher economic, education, and lifestyle related benefits than urban areas.[36] High-speed internet also has been shown to increase the rate and ease of new business creation by affording rural residents the ability to establish cottage-industry or "work-from-home" solutions to geographic issues.[37] Rural citizens are more likely to sign up for internet education classes than urban counterparts and also state that their primary reason for adopting high-speed internet is to take advantage of distance-learning opportunities.[38] High-speed internet service has also been shown to increase health and

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[35] Bell, P., Reddy, P., & Rainie, L. (2004). Rural Americans' Internet use has grown but they continue to lag behind others. *Pew Internet & American Life*. Available at http://www.pewinternet.org/pdfs/PIP_Rural_Report.pdf/S and Gregg, J. L., LaRose, R., Strover, S., & Straubhaar, J. (2006). Understanding the broadband gap in rural America. Paper presented to the International Communication Association, Dresden, Germany.
[36] Parker, E. B. (2000). Closing the digital divide in rural America, *Telecommunications Policy*, 24(4), 281—290
[37] DeLong, M., Gahring, S., Bye, E., Johnson, K. K. P., & Anderson, J. (2002). Using the internet to enhance business opportunities in rural areas. *Journal of Family and Consumer Sciences*, 94(3), 33—38.
[38] Hollifield, C. A., & Donnermeyer, J. F. (2003). Creating demand: Influencing information technology diffusion in rural communities. *Government Information Quarterly*, 20, 135—150.

safety and reduce health costs in rural areas more than in urban areas due to availability of online health service functions.[39] Yet demand side analysts are left with the question of why, given these apparent benefits, do rural areas fall behind urban in terms of broadband adoption rates?

First, there is the issue of access and affordability. While federal and state governments have attempted to bridge the digital divide through funding mechanisms, such as the USDA's broadband loan and loan guarantee program and the FCC's Connect America Fund, or by attempting to incentivize the rural broadband market through regulatory or de-regulatory mechanisms, rural areas still suffer from access to fewer broadband services than urban areas. A study of the FCC's mechanism for gathering rural access rates (forms providers complete to demonstrate areas of coverage) showed that, despite industry claims that 95% of the U.S. population has access to high-speed internet service, these surveys may heavily weight business access compared to household access and also do not account for a lack of multiple providers.[40] Because many rural areas may only have access to one provider, that provider may choose to set unreasonably high-rates for service or maintain unreliable service due to lack of competition.

A 2004 study showed that rural residents are less likely than urban counterparts to believe broadband service exists in their area even if it does.[41] This can be due to either a breakdown in communication channels or a disconnect of rural residents from the communication channels that would inform them of service availability.

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[39] Pigg, K., & Crank, L. (2005). Do information and communication technologies promote rural economic development? *Journal of the Community Development Society*, 36, 65—76.
[40] Government Accounting Office (GAO) (2006). "Broadband deployment is extensive throughout the United States, but it is difficult to assess the extent of deployment gaps in rural areas." (GAO-06-426).
[41] Kwak, N., Skoric, M. Me, Williams, A. E., & Poorj N. D. (2004). To broadband or not to broadband: The relationship between high-speed internet and knowledge and participation. *Journal of Broadcasting & Electronic Media*, 48(3), 421-445.

One of the main demand side characteristics used to explain the "digital divide" is that of "unfavorable demographics."[42] This argument suggests that the increased age, lack of access to education, and reduced income levels of rural citizens makes them less likely to adopt high-speed internet service.

The demand side of rural broadband analysis has been examined through the lens of "diffusion of innovation." The seminal work on diffusion of innovation theory was conducted by Everett Rogers.[43] Rogers stated that the process of adoption of innovative technology was formed through the time taken to adapt to the characteristics of new technology based on access to communication channels and the societal norms associated with communication. He went on to explain that this process is affected by demographics. Specifically, age, income and education levels influence the speed at which a person will flow through this adoption process. Those adults with higher age and lower income/education are at the low end of Roger's adoption scale, categorized by Rogers as "laggards," and those with lower age and higher income/education are at the high end of the scale, referred to as "early adopters."

Since Rogers introduced the characteristics of the diffusion process the impact of these factors on adoption has been confirmed by meta-analysis of studies regarding corroboration of factors with adoption processes.[44] Others have gone on to further expand on the diffusion characteristics.[45]

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[42] Parker, E. B. (2000). Closing the digital divide in rural America, *Telecommunications Policy*, 24(4), 281—290
[43] Rogers, E. M. (1986). *Communication technology*. New York: Free Press; Rogers, E. M. (1995). *Diffusion of innovations* (4th Ed.). New York: Free Press; Rogers, E. M. (2003). *Diffusion of innovations* (5th Ed.). New York: Free Press.
[44] Tournatzky, L. G., & Klein, K. J. (1982), Innovation characteristics and innovation adoption—implementation: A meta analysis of findings. *IEEE Transactions of Engineering Management*, 29(1), 28—45.
[45] Hall, B.H., & Khan, B. (2002). "Adoption of new technologies." Available at http://www.nber.org/papers/w9730

Despite the success of diffusion of innovation in providing a model that explains the traditional adoption process, critics have claimed that it has certain flaws relative to individual characteristics; or differences in adoption patterns between similar demographic groups.

Rosenberg (1972) in one of the early works on the diffusion process stated that it is apparent that, despite diffusion having explanatory purpose, researchers witness unexplainable variation in adoption rates within similar demographic variables.[46]

Work in the field of psychology and communication has pointed out that diffusion research focuses too much attention on the characteristics of the innovation rather than the psychological and communicative traits of individuals involved in the process.[47] Given the apparent stability of high-speed internet as an innovation (its characteristics are relatively stable give or take reductions or improvements in speed) it is necessary to move beyond innovation characteristics and towards an interaction based model. Another challenge with using diffusion of innovation as a model for explaining rural broadband adoption is that diffusion theory mainly focuses on initial adoption.

High-speed internet, much like electricity or running water, is a service individuals adopt to become part of their standard way of life. Thus, in order to understand broadband network demand, analysts have extended the initial use to an acceptance of being included in an individual's future way of living. While diffusion of innovation is a relevant starting point for

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[46] Rosenberg N. (1972). *Technology and American economic growth*. New York: Harper and Row.

[47] Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall; Ajzen, I. (1985). "From intentions to actions: A theory of planned behavior." In J, Kuhl, & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11—39). Heidelberg: Springer; LaRose, Re, & Eastin, M, (2004). A social cognitive explanation of Internet uses and gratifications: Toward a new theory of media attendance. *Journal of Broadcasting and Electronic Media*, 48(3), 358—378.

addressing factors that influence adoption, another model, Social Cognitive Theory (SCT), expands on the nature of adoption and continued use.

SCT provides us with a glimpse into the psychological and communicative processes involved in adopting and adapting to innovations, Specifically, SCT adapts the characteristics of diffusion and places individual perception as the central focus. As such relevant advantage becomes "expected outcomes," trialability becomes "enactive learning," observability becomes "observational learning," compatibility becomes "life on the screen" or "lived experience," and complexity becomes "self-efficacy."

In SCT research, demographic variables fade in comparison to socially constructed factors. For example, demand side analysis from a diffusion perspective argues that income levels are determinants of broadband network adoption. SCT scholars, however, point to the reversal of causal effect in relation to income levels as an argument against this position. Researchers have shown that people with higher income have lower self-efficacy than those of lower income.[48] The reason suggested for this is that those with higher income have the resources to pay other people to fix issues that arise with their service, whereby those of lower income must resort to their own means to fix any problems. Thus, lower income individuals are more likely to have experience with solving their own technical issues than those of higher income. This results in higher perceptions of ability to overcome technical difficulties.

An interesting finding in relation to age and internet adoption is that there are two social mechanisms at play in rural communities compared to urban. SCT researchers have found that,

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[48] Kwak, N., Skoric, M. Me, Williams, A. E., & Poorj N. D. (2004). To broadband or not to broadband: The relationship between high-speed internet and knowledge and participation. *Journal of Broadcasting & Electronic Media,* 48(3), 421-445.

due to access to internet service reducing out-migration and the retention of youth within rural communities, older members of local communities are more likely to engage with technology to retain youth.[49] Thus, within rural communities SCT researchers witness an equal desire from various age groups to adopt high-speed internet based on a mutually beneficial relationships; younger community members stay because they have access to modern digital infrastructure services and are able to pass knowledge of technological benefits onto older community members who in turn encourage digital participation to retain their community's youth.

In terms of education, SCT research, like diffusion theory, associates a causal effect on a lack of access to education as an inhibiting factor in adoption of high-speed internet. However, whereby diffusion characterizes education levels as a fixed determinant, SCT researchers believe that the social mechanisms of observational and enactive learning create a more fluid process in terms of adoption. Whereas the diffusion view of education as a limiting or beneficial factor creates a circular reasoning flaw in terms of rural broadband adoption, SCT provides a socially cognitive solution. As adoption or interaction in a community grows so does the ability of community members to interact with observational or enactive learning. Therefore, increasing the availability of high-speed services, through library technology programs or community technology outreach and training, increases community members access to education processes and, in turn, increases communities' overall self-efficacy in relation to high-speed internet.[50]

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[49] LaRose, Re, & Eastin, M, (2004). A social cognitive explanation of Internet uses and gratifications: Toward a new theory of media attendance. *Journal of Broadcasting and Electronic Media*, 48(3), 358—378.
[50] Kwak, N., Skoric, M. Me, Williams, A. E., & Poorj N. D. (2004). To broadband or not to broadband: The relationship between high-speed internet and knowledge and participation. *Journal of Broadcasting & Electronic Media,* 48(3), 421-445.

2.3.2 Universal Service

Universal service is a federal policy that describes a scenario where every consumer has access to communications services despite income or geography. [51] The policy was developed around two principles: that society would benefit from universal access and that communication networks would flourish under that vision.[52] The latter principle was based on the idea of network effects-- as the number of users increase so does the value of the communication network to each individual user. These benefits include expansion of education opportunities, access to healthcare, economic development, and freedom of information.[53]

The policy does, however, come with a cost, requiring that the cost of universal service be balanced against the benefits accrued by the policy.[54] In terms of Universal Service costs, researchers have analyzed two categories:

-Cost to society: Increases in consumption results in increased consumer costs or consumer taxation to fund the policy.[55]

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[51] Michael H. Riordan, "Universal Residential Telephone Service," in *The handbook of telecommunications economics: structure, regulation and competition,* 423, 424 (Martin E. Cave, Sumit K. Majumdar & Ingo Vogelsang eds., 2002).
[52] The Progress & Freedom Foundation, "Digital Age Communications Act: Proposal of the universal service working group", 6 (2005). Available at http://www.pff.org/issuespubs/books/051207daca-usf-2.0.pdf.
[53] *Id* at 6-7.
[54] 12 F.C.C.R. 8776, T 55 (May 7, 1997) stating that the universal service principles established by Congress in the 1996 Act inherently include the concept of "economic efficiency."
[55] The Congressional Budget office, "financing universal telephone service", 19 (2005). Available at http://www.cbo.gov/ftpdocs/61xx/doc6191/03-28-Telephone.pdf

-Cost to providers: Requirements that telecommunications providers contribute to the Universal Service Fund (USF). This cost can also be passed to consumers through line items on bills.[56]

Prior to enactment of the Telecommunications Act of 1996, as amended, Universal Service was funded primarily though implicit subsidies. These were funded through telecommunication provider revenues and were generally achieved by averaging geographic rates as well as higher business and interstate service pricing.[57] Prior to the 1990s, when the U.S. telecommunications systems were primarily serviced by monopoly providers, this funding mechanism was relatively successful. The expansion of smaller providers throughout the 90s, however, required reform of funding mechanisms.[58]

The 1996 Act mandated that Universal Service funding should move from being "implicit" to "explicit."[59] As such, the Federal Communications Commission (FCC) moved to create new funding mechanisms based on pro-competitive principles. The growth of the "Universal Service Fund," in particular the "High Cost Fund" and the percentage of interstate revenue that telecommunications providers were required to contribute to USF and that is passed onto consumers,[60] resulted in calls for reform of these funding mechanisms. There has been,

[56] 47 U.S.C. § 254(d).
[57] Federal-State Joint Board on Universal Service, Report and Order, 12 F.C.C.R. 8776, T 55 (May 7, 1997)
[58] Qwest Commc'ns Int'l Inc., 398 F.3d 1222, 1226 (10th Cir. 2005)
[59] 47 U.S.C. § 254(e)
[60] FCC, "Universal Service Fund Contribution Factor & Quarterly Filings." Available at http://www.fcc.gov/omd/contribution-factor.html

however, concern from researchers that the political motive to sustain this policy has outweighed a desire to adequately address these funding issues.[61]

In the 1996 Act, U.S. policymakers committed to universal service policies and established a universal service fund (USF or Fund) to meet these objectives and principles.[62] The 1996 Act specified certain universal service principles, including that "access to advanced telecommunications and information services should be provided to all regions of the Nation"[63] and "consumers in all regions of the Nation, including low-income consumers and those in rural, insular, and high cost areas, should have access to telecommunications and information services, including interexchange services and advanced telecommunications and information services, that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas."[64]

The concept of universal service also was updated to include bringing advanced telecommunication services at discounted rates to elementary and secondary school classrooms, libraries, and rural health care providers.[65] The existence of the USF fund has been seen as an acceptance by the federal government that it intended to play a part in funding universal service as a policy. However, except for funding for schools and libraries and rural health care providers, the USF was not designed to support residential broadband service. The American Recovery and Reinvestment Act of 2009 (ARRA) required the FCC to develop, and submit to Congress, a

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[61] Barbara A. Cherry. "Addressing political feasibility as well as economic viability constraints to achieve sustainable telecommunications policies in the U.S." (2003). Available at Http://www.intel.si.umich.edu/tprc/papers/2003/198/cherrytprc2003.pdf.
[62] CRS Report RL30346, "Federal Credit Reform: Implementation of the Changed Budgetary Treatment of Direct Loans and Loan Guarantees."
[63] §254 [b] [2]
[64] §254 [b] [3]
[65] (§254[b][6] and 254[h]

national broadband plan (NBP) to ensure that every American has "access to broadband capability." This plan, Connecting America: The National Broadband Plan, submitted to Congress on March 16, 2010, called for the USF to play a major role in achieving this goal.

Complementing its desire to reform the USF, the FCC also has reformed the fund to address the lack of broadband services in rural areas. Since 2011, the FCC has undertaken significant reforms of the USF to expand the concept of universal service to broadband.

In 2011 the FCC adopted an order (USF Order) that called for the USF to be updated over a multi-year period from the support of voice telephone service to a policy that could also support the expansion of both fixed and mobile broadband networks into unserved areas.[66] The FCC set out to replace the High Cost Program with the Connect America Fund (CAF). In addition to this new CAF, the Low Income, Schools and Libraries, and Rural Health Care programs were also updated and expanded.[22]

2.3.2.1 Connect America Fund

The USF Order created the Connect America Fund (CAF) to support the expansion of affordable voice and broadband services, both fixed and mobile, of at least 4 Mbps actual download speed and 1 Mbps actual upload speed (later updated to 10Mbps down and 1 Mbps up).

2.3.2.1.1 Price Cap Carriers

Price cap incumbent local exchange carriers, which tend to be the large and mid-sized carriers, were transitioned to the CAF in two phases. Under Phase I, which commenced on

[66] Report and Order, FCC-11-161, November 18, 2011.

January 1, 2012, legacy high-cost funding was frozen at 2011 levels of no more than 1.8 billion annually.[67] The FCC additionally created a $300 million one-time "incremental support" fund to stimulate broadband deployment in unserved areas. This support was made available to price-cap carriers that choose to deploy fixed broadband to areas not currently served, or targeted to be served, by a fixed broadband provider within their service territory. Any price-cap carrier electing to receive Phase I incremental support received $775 in incremental support for each unserved location to which it provided broadband at the speeds established through the order. After acceptance of funds, carriers were expected to deploy service to no fewer than two-thirds of the required locations within two years and complete all deployments within three years.

Under CAF Phase II Price Cap, annual funds were distributed through a competitive bidding process (e.g., reverse auctions) for a five-year period ending year-end 2017.[68] The funds were only available for areas currently unserved by other providers. By the end of the third year, carriers that accepted support had to offer broadband speeds of at least 10 Mbps download speed and 1Mbps of upload speed. If no incumbent provider accepted funds in a given area after 5-years the offered funds were made available via a further competitive bidding process.[69]

2.3.2.1.2 Rate-of-Return Carriers.

Through 2017, smaller carriers that serve only isolated geographic areas, known as rate-of-return carriers, continued to receive support frozen at December 31, 2011 levels. Unlike in the case of price-cap carriers, no additional "incremental support" was provided to specifically target broadband deployment in unserved areas.

[67] Report and Order, FCC-11-161, November 18, 2011 at 11.
[68] USF Order at para. 502.
[69] USF Order at para. 23.

Rate-of-return carriers that continued to receive support or began accepting CAF support were only required to offer services of 4 Mbps download speed and 1 Mbps of upload speed. Additionally, they were not subject to specific build-out requirements and were not required to offer service to the most expensive locations within their service territories.[70]

The impact of replacing the High Cost Fund with the Connect America Fund has yet to be determined properly. A study by the Blandin Foundation, using Minnesota as a data set, found that a lack of transparency and accountability in the program means that impact is hard to measure based on available data.[71] Fund recipients are not required to submit network plans or maps that show where funds were used or successfully implemented. Instead the FCC relies on the results of form 477 data, where Internet Service Providers (ISPs) must report covered census areas, which has been criticized due to its broad definition of coverage attached to single locations within a larger census area.[72] In its most recent Broadband Progress Report, the FCC admits that it is yet to see from Form 477 results (the most recent being 2016) the impact of its Universal Service Reforms. However, the FCC does state that 2017 announcements of network expansions by various ISPs (ATT, Verizon. Frontier, and Alaska Communications) are assumed to have occurred because of the changes implemented by the Commission.[73]

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[70] *Ibid.*
[71] Blandin Foundation, "Impact of CAF II funded networks," (June, 2018). Available at https://blandinfoundation.org/learn/research-rural/broadband-resources/broadband-initiative/impact-of-caf-ii-funded-networks/
[72] Lennard G. Kruger, "Broadband and Data Mapping," (July 3, 2018). Available at https://fas.org/sgp/crs/misc/IN10925.pdf
[73] The Federal Communications Commission, "2018 broadband deployment report," 18-10A1, February 2, 2018.

2.3.2.2 Low Income Program

A broadband consumer survey conducted by the FCC found that 36 percent of non-adopters of broadband cited finances as the main reason they do not have broadband service at home.[74] To address this barrier, the FCC adopted an order[75] on January 31, 2012, to update its Low-Income Program. The Commission eliminated the Link Up on non-Tribal Lands and expanded the role of the Lifeline Program. It created a $9.25 flat per-line monthly reimbursement rate; and established safeguards to combat waste, fraud, and abuse. To address the adoption of broadband service the FCC allowed bundled service plans that combine voice and broadband to be included in Lifeline reimbursements and established a Broadband Adoption Pilot Program to explore how to best use the Lifeline Program to increase broadband adoption among Lifeline eligible subscribers.[76] Funding for the Pilot Program, estimated at up to $25 million, came from savings resulting from Low Income Program reforms.

2.3.2.3 Rural Health Care Program

Section 254(h) of the 1996 Act required that public and non-profit rural health care providers should have access to advanced telecommunications services necessary for the provision of health care services at rates comparable to those paid for similar services in urban areas. Subsection 254(h)(1) further specifies that "to the extent technically feasible and

[74] National Broadband Plan, Adoption and Utilization, 9.1, Understanding Broadband Adoption.
[75] Lifeline and Link Up Reform and Modernization, Advancing Broadband Availability Through Digital Literacy Training (Final rule). Federal Register, Vol. 77, No. 42. March 2, 2012, p. 12952. Also see Lifeline and Link Up Reform and Modernization, Advancing Broadband Availability Through Digital Literacy Training (Proposed rule). Federal Register, Vol. 77, No. 42. March 2, 2012, p. 12784.
[76] Public Notice DA 12-683 Wireline Competition Bureau Announces Application Procedures and Deadline for Applications to Participate in the BroadbandAdoption Lifeline Pilot Program, released April 30, 2012. Available at http://transition.fcc.gov/Daily_Releases/ Daily_Business/2012/db0430/DA-12-683A1.pdf.

economically reasonable," health care providers should "have access to advanced telecommunications and information services."

2.3.3 The Digital Divide

Within the United States, as defined by the National Telecommunication and Information Administration (NTIA), the term "digital divide" has been used to explain the socio-economic differences between US populations with our without access to advanced telecommunications services (broadband internet).[77] In its most basic form, "digital divide" research attempts to analyze where discrepancies lie in expansion and adoption of these services based on distinct socio-economic segments of the United States.[78] On a secondary level this research examines how and to what extent various socio-economic factors (education, income, health etc.) are affected by access, or lack of access, to these services.[79]

In terms of adoption discrepancies, various studies have taken an aggregate level approach to determine differences in internet penetration rates across subsets of socio-economic segments.[80] These studies vary in their conclusions based on their research methods and

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[77]National Telecommunications and Information Administration. (1999). Falling through the net: Defining the digital divide. Retrieved from https://www.ntia.doc.gov/legacy/ntiahome/fttn99/FTTN.pdf.TIA; National Telecommunications and Information Administration, Falling Through the Net: Toward Digital Inclusion. (http://www.ntia.doc.gov/ntiahome/fttn00/contents00.html); NTIA and ESA, 2002. National Telecommunications and Information Administration and Economics and Statistics Administration, A Nation Online: How Americans Are Expanding Their Use of the Internet. Washington, DC: NTIA. http://www.ntia.doc.gov/ntiahome/dn/html/anationonline2.htm and http://www.ntia.gov/ntiahome/dn/nationonline_020502.pdf; Buente, W. and A. Robbin (2008) ―Trends in Internet Information Behavior, 2000–2004‖, Journal of the American Society for Information Science and Technology (59)11, pp.1743–1760; Robinson, J.P., P. DiMaggio, and E. Hargittai (2003) ―New Social Survey Perspectives on the Digital Divide‖, IT & Society (1)5, pp. 1–22.

[78] Compaine, B.M. (ed.) (2001) *The Digital Divide: Facing a Crisis or Creating a Myth*, Cambridge, MA: MIT Press.

[79] *Id.*

[80] T.A. Downes, S. Greenstein. Do commercial ISPs provide universal access? S.E. Gillett, I. Vogelsang (Eds.), Competition, Regulation, and Convergence: *Current Trends in Telecommunications Policy Research*, Lawrence

definitions. Some researchers, for example, are content to suggest that availability of service is the most significant measure,[81] whereas for others adoption of service is more important.[82] Despite a dispute as to the measures used to examine availability and adoption there is a general consensus that a digital divide does exist at a socio-economic level in the United States.[83] Following on from this acceptance that the divide exists, researchers have attempted to understand what, and how, various socio-economic factors influence access and adoption patterns.

Table 1 provides a summary of research into the factors that influence access and adoption of advanced telecommunications network services.

One of the main characteristics used to explain the "digital divide" is "unfavorable demographics".[84] This argument suggests that the increased age, lack of access to education, and reduced income levels of rural citizens make them less likely to adopt high-speed internet service. Yet this argument presents a circular reasoning flaw. Based on secondary level digital

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Erlbaum Associates, Mahwah, NJ (1999), pp. 195-212; S. Strover. Rural internet connectivity.Telecommunications Policy, 25 (2001), pp. 331-347;

[81] *Ibid.*

[82] S. Strover. Rural internet connectivity. *Telecommunications Policy*, 25 (2001), pp. 331-347;

[83] National Telecommunications and Information Administration. (1999). "Falling through the net: Defining the digital divide." Available at https://www.ntia.doc.gov/legacy/ntiahome/fttn99/FTTN.pdf.TIA; National Telecommunications and Information Administration, Falling Through the Net: Toward Digital Inclusion. (http://www.ntia.doc.gov/ntiahome/fttn00/contents00.html); NTIA and ESA, 2002. National Telecommunications and Information Administration and Economics and Statistics Administration, A Nation Online: How Americans Are Expanding Their Use of the Internet. Washington, DC: NTIA. http://www.ntia.doc.gov/ntiahome/dn/html/anationonline2.html; Buente, W. and A. Robbin (2008) ―Trends in Internet Information Behavior, 2000–2004‖, Journal of the American Society for Information Science and Technology (59)11, pp.1743–1760; Robinson, J.P., P. DiMaggio, and E. Hargittai (2003) ―New Social Survey Perspectives on the Digital Divide‖, IT & Society (1)5, pp. 1–22.

[84] Parker, E. B. (2000). Closing the digital divide in rural America, *Telecommunications Policy*, 24(4), 281—290

Table 1. Digital Divide Research Overview: Access and Adoption Factors

Topics/ Papers	**Scope**		**Methodology**	**Key Access and Adoption Findings**
	Years	**Subjects**		
NTIA (1995 to 2016)[85]	1994 - 2016	Random individuals	CPS	Income, location, race, age, and education.
Pew Internet (2003-2018)[86]	1997 - present	Random individuals	Mass adoption and usage questionnaire	Income, race, education, age, location, and gender.
Eamon (2004)[87]	2000	Youths, aged 10 to 14	Adoption and usage survey	Family income for PC home ownership, but not for predicting usage.
Rice and Katz (2003)[88]	2000	Individuals	Random telephone survey	Income and age linked to internet use.
Kraut et al. (1996;1999)[89]	1995 - 1997	Households	Observation and surveys	E-mail more important adoption factor than web surfing.
Selwyn et al. (2005)[90]	2002	Random individuals	Survey and interviews	Interest, relevance, household dynamics.
Katz and Rice (2002)[91]	1995 - 2000	Households	Telephone survey	Adoption based on prior interests.

[85] NTIA (1995) *Falling Through the Net: A Survey of the 'Have Nots' in Rural and Urban America*, National Telecommunication Information Administration, United States Department of Commerce, Washington, DC; NTIA (1998) *Falling Through the Net II: New Data on the Digital Divide*, National Telecommunication Information Administration, United States Department of Commerce, Washington, DC; NTIA (1999) *Falling Through the Net: Defining the Digital Divide*, National Telecommunication Information Administration, United States Department of Commerce, Washington, DC; NTIA (2000) *Falling Through the Net: Toward Digital Inclusion*, National Telecommunication Information Administration, United States Department of Commerce, Washington, DC; NTIA (2002) *A Nation Online: How Americans are Expanding their Use of the Internet*, National Telecommunication Information Administration, United States Department of Commerce, Washington, DC; NTIA (2004) *A Nation Online: Entering the Broadband Age*, National Telecommunication Information Administration, United States Department of Commerce, Washington, DC; NTIA, *The state of the Urban/Rural digital divide*, August 10, 2016.
[86] PEW, "Internet core trends surveys," 2003-2018. Available at http://www.pewinternet.org/datasets/.
[87] Eamon, M. K. (2004) "Digital Divide in Computer Access and Use Between Poor and Non-Poor Youth," *Journal of Sociology & Social Welfare*, (31)2, pp. 91-112.
[88] Katz, J.E. and R. E. Rice (2002) *Social Consequences of Internet Use: Access, Involvement, and Interaction*, Cambridge, MA: The MIT Press.
[89] Kraut, R., T. Mukhopadhyay, J. Szczypula, S. Kiesler, and W. Scherlis (1999) "Information and Communication: Alternative Uses of the Internet in Households," *Information Systems Research*, (10)4, pp. 287-303; Kraut, R., W. Scherlis, T. Mukhopadhyay, J. Manning, and S. Kiesler (1996) "The HomeNet Field Trial of Residential Internet Services," *Communications of the ACM* (39)12, pp. 55-63.
[90] Selwyn, N, S. Gorard, and J. Furlong (2005) "Whose Internet is it Anyway? Exploring Adults' (Non)Use of the Internet in Everyday Life," *European Journal of Communication*, (20)1, pp. 5-26.
[91] Katz, J.E. and R. E. Rice (2002) *Social Consequences of Internet Use: Access, Involvement, and Interaction*, Cambridge, MA: The MIT Press.

Table 1. Continued

Topics/ Papers	Scope		Methodology	Key Access and Adoption Findings
	Years	Subjects		
Mehra et al. (2004)[92]	2000 - 2001	Individuals in demographic segments	Focus groups, community, email analysis	Marginalization, relationships, and online communities.
Mossberger et al. (2003)[93]	2001	Individuals	Telephone survey	Employment
Venkatesh and Brown (2001)[94]; B&V (2003;2005)[95]	1997 and 1999	Households	Theory building, surveys	Household life cycle.

[92] Mehra, B., C. Merkel, and A. P. Bishop (2004) "The Internet for Empowerment of Minority and Marginalized Users," *New Media & Society*, (6)6, pp. 781-802.
[93] Mossberger, K., C. J. Tolbert and M. Stansbury (2003) *Virtual Inequality: Beyond the Digital Divide*, Washington, DC: Georgetown University Press.
[94] Venkatesh, V. and S. A. Brown (2001) "A Longitudinal Investigation of Personal Computers in Homes: Adoption Determinants and Emerging Challenges," *MIS Quarterly*, (25)1, pp. 71-102; Venkatesh, V., M. G. Morris, G. B. Davis, and F. D. Davis (2003) "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly*, (27)3, pp. 425478.
[95] Brown, S.A. and V. Venkatesh (2003) "Bringing Non-Adopters Along: The Challenge Facing the PC Industry," *Communications of the ACM*, (46)4, pp. 76-80; Brown, S.A. and V. Venkatesh (2005) "Model of Adoption of Technology in Households: A Baseline Model Test and Extension Incorporating Household Life Cycle, *MIS Quarterly*, (29)3, pp. 399-426.

divide effects research, broadband has increased access to education,[96] reduced out-migration,[97] and increased income[98] in rural areas. All these benefits increase the likelihood of adopting high-speed internet, yet without access to high-speed internet rural areas cannot establish these benefits.

2.3.4 Funding Mechanisms[99]

Apart from internal financing and external loans procedures, a major source of income for broadband projects in the U.S. is found through federal or state funding initiatives. These funding sources, either through grants or government backed loans, are provided by various federal and state agencies. Table 2 provides a summary of the federal or state funding mechanisms available to broadband network providers in the United States. It shows the funding programs, supporting agencies, and current funding amounts.

[96] Hollifield, C. A., & Donnermeyer, J. F. (2003). Creating demand: Influencing information technology diffusion in rural communities. *Government Information Quarterly*,, 20, 135—150.
[97] Jenkins, T. (2003), Community-based, community pride: Telcos enrich rural way of life. Rural Telecommunications, 22(6), 14.
[98] DeLong, M., Gahring, S., Bye, E., Johnson, K. K. P., & Anderson, J. (2002). Using the internet to enhance business opportunities in rural areas. *Journal of Family and Consumer Sciences*, 94(3), 33—38.
[99] The following section provides and answer to RQ3. What is the current funding process for potential broadband providers in the United States?

Table 2. Overview of State and Federal Broadband Funding Initiatives

Program	**Agency**	**Funding Amount (est. FY2018 unless otherwise noted)**
Broadband Technology Opportunities Program (BTOP)	National Telecommunications and Information Administration, Dept. of Commerce	$4 billion
Broadband Initiatives Program (BIP)	Rural Utilities Service, U.S. Dept. of Agriculture	$2.5 billion
Rural Broadband Access Loan and Loan Guarantee Program	Rural Utilities Service, U.S. Dept. of Agriculture	$169 million
Community Connect Broadband Grants	Rural Utilities Service, U.S. Dept. of Agriculture	$100 million
Telecommunications Infrastructure Loan Program	Rural Utilities Service, U.S. Dept. of Agriculture	$700 million
Distance Learning and Telemedicine Loans and Grants	Rural Utilities Service, U.S. Dept. of Agriculture	$21 million
Universal Service Schools and Libraries Program (i.e., E-rate)	Federal Communications Commission	$2.25 billion
Universal Service Rural Health Care Pilot Program	Federal Communications Commission	$418 million
Connect America Fund	Federal Communications Commission	$4.5 billion
Appalachian Area Development Program	Appalachian Regional Commission	$56 million
States‘ Economic Development Assistance Program	Delta Regional Authority	$11 million

Table 2. Continued

Program	**Agency**	**Funding Amount (est. FY2018 unless otherwise noted)**
Investments for Public Works and Economic Development Facilities	Economic Development Administration, Dept. of Commerce	$112 million
Library Services and Technology Act Grants to States	Institute of Museum and Library Services, National Foundation on the Arts and the Humanities	$156 million
Native American Library Services	Institute of Museum and Library Services, National Foundation on the Arts and the Humanities	$4 million
Choice Neighborhood Implementation Grants	Office of the Assistant Secretary for Public and Indian Housing and Office of Multifamily Housing Programs, Dept. of Housing and Urban Development	$110 million
Special Education—Technology and Media Services for Individuals with Disabilities	Office of Special Education and Rehabilitative Services, Dept. of Education	$30 million
Telehealth Network Grants	Health Resources and Services Administration, Department of Health and Human Services	$6 million
Telehealth Resource Center Grant Program	Health Resources and Services Administration, Department of Health and Human Services	$4 million
National Environmental Information Exchange Network Grant Program	Environmental Protection Agency	$10 million

3 HISTORY OF ELECTRIC COOPERATIVE UTILITY DEVELOPMENT

3.1 Pre-Rural Electrification Administration (REA)

Prior to World War II, hands and animals powered life in rural America. While the automobile and the tractor had brought with them some advantages, the most important 20th century technological advancement, electricity, eluded most rural residents.

A report by the United States Department of Agriculture in 1919 stated that most rural families spent more than 10 hours a week pumping water and carrying it from the pump into their kitchens.[100] Washing became a daily chore given that heating water and cast irons meant the use of wood-burning stoves. The soot and heat generated by the constant lighting of the stove made the task of keeping clothes clean extremely difficult and living conditions, especially in already hot environments, almost unbearable. According to one report, women in rural areas spent 20 days more per year washing clothes than women in places with access to an electric washer.[101]

Without access to lightbulbs, the rural home was lit mainly by oil lamp. Descriptions of using oil-burning lamps differ distinctly from the picture drawn by modern day television shows and movies. The radius of light cast by a kerosene lamp was relatively small, meaning that families would have to gather closely around the few lamps available in impoverished homes. The temperamental flickering and dimming of the wick also diminished the reach of the light.

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[100] A.M Daniels, "Electric Light and Power in the Farm House," *Yearbook of the United States Department of Agriculture 1919* (Washington DC, 1920).
[101] REA, Interbureau Co-ordinating Committee on Rural Electrification, "Present Uses of Electricity in Rural Areas," Typescript 1941, Library of Congress Manuscript Division.

Later studies would report that literacy rates improved dramatically in children with access to electric lighting.[102]

Nebraska Senator George W. Norris, a major proponent of rural electrification, described the emerging gap between rural life and that of cities and towns prior to access to electricity.[103]

> I had seen firsthand the grim drudgery and grind which had been the common lot of eight generations of American farm women. I had seen the tallow candle in my own home, followed by the coal-oil lamp. I knew what it was to take care of the farm chores by the flickering, undependable light of the lantern in the mud and cold rains of the fall, and the snow and icy winds of winter.
>
> I had seen the cities gradually acquire a night as light as day. I could close my eyes and recall the innumerable scenes of the harvest and the unending punishing tasks performed by hundreds of thousands of women, growing old prematurely; dying before their time; conscious of the great gap between their lives and the lives of those whom the accident of birth or choice placed in the towns and cities.

By 1920, the increased disparity between rural and urban life had resulted in migration from rural areas to towns and cities. The federal census in 1920 showed that of the 6 million farms in the United States, just under 500 thousand had access to electric lighting and only 600 thousand had some form of running water. Of those farms with access to electricity, most were in New England and California, with an electrification rate of 15 to 45 percent respectively. The Midwest and the South had the lowest rates of rural electrification with rates as low as one percent. By 1930, the rate of rural electrification had risen to around 60 percent in California; however no significant gains had been made elsewhere.[104]

Prior to the creation of the Rural Electrification Administration in 1935, the responsibility for expanding electricity into rural areas had rested almost entirely with private power

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[102]the United Nations Department of Economic and Social Affairs, " Electricity and education: The benefits, barriers, and recommendations for achieving the electrification of primary and secondary Schools," (December 2014). Available at https://sustainabledevelopment.un.org/content/documents/1608Electricity%20and%20Education.pdf

[103] George W. Norris, *Fighting Liberal: The Autobiography of George W. Norris*, Bison Books, February 1, 1992.

[104] Bureau of the Census, "Fourteenth Census of the United States, Agriculture," 5 (1922); 23, 512-14 & Fifteenth Census of the United States, Agriculture, 4 (1932); 10.

companies. Yet due to the high cost of rural implementation, many had been reluctant to do so. An initial attempt to "co-operate" rural electric expansion occurred in 1923 when the power companies attempted to partner with state agricultural colleges and the American Farm Bureau Federation (AFBF). This initiative tested whether access to electricity led to farm consumption at a level suitable for revenue generation by the power companies. Two projects launched in Minnesota and Alabama; however, neither yielded results deemed suitable by the power companies. The program, known as the Committee on the Relation of Electricity to Agriculture (CREA) lasted less than a decade before being abandoned due to a lack of progress.[105]

3.2 The Creation of the REA

Due to the market's inability to expand affordable electricity into rural locales, more than thirty state rural power initiatives were created during the 1920s and early 1930s. President Hoover's administration believed that rural electrification could be aided by the efforts of state governments.[106] Governor of New York, Franklin Delano Roosevelt, pursued the goal of rural electrification and played a key role in the creation of the New York Power Authority. Created in 1930, its goal was to harness the hydroelectric generating capacity of the St. Lawrence River.[107] The Depression, however, resulted in many of the state electric authorities failing and further discouraged private investment in rural electrification. As a result, when President Roosevelt was inaugurated on March 4, 1933, there was a lack of confidence in rural electric investment.

[105] Douglas F. Barnes, *The Challenge of Rural Electrification: Strategies for Developing Countries*, Routledge, July 13, 2007.
[106] D. Clayton Brown, *Electricity for Rural America*, Greenwood Press, 1980, p6.
[107] Ibid, p 32.

While the Roosevelt Administration can be credited with much of the success of New Deal policies and understanding the potential of rural electrification for economic stimulation, the vision and leadership for rural electrification came from Morris L. Cooke. Cooke had experience with rural electrification as head of Pennsylvania's Giant Power Survey.[108] Through his work on the survey, the aim of which was to gather information on how to best harness Pennsylvania's natural resources for the generation of power, Cooke had come to realize that private industry had no real interest in investing in rural communities. Without some form of state intervention there would be little progress. After appointment as Chairman of the Mississippi Valley Committee of the Public Works by the Roosevelt Administration,[109] Cooke authored an eleven-page report in 1934 using data supplied by the utility industry, electrical engineers, Giant Power, and the U. S. Census of 1930. This report laid the foundation for the creation of a federally-funded rural electrification program.[110] In his report, Cooke refuted the claims of private industry that stated the cost per mile of rural electrification was too high to recoup investment by including detailed cost estimates gathered during his research in Pennsylvania:

"This cost of the line with transformers and meters included for one to three customers will range from $500 to $800 the mile. To amortize this cost in twenty years at four percent involves a cost to each of the three customers on a mile of line of about one dollar a month."[111]

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[108] Morris L. Cooke, "Report of the Giant Survey Board." Available at https://babel.hathitrust.org/cgi/pt?id=uc1.$b113619;view=1up;seq=5
[109] "The Papers of Morris L. Cook." Available at https://fdrlibrary.org/documents/356632/390886/findingaid_cooke.pdf/10837c86-580e-4ef8-bbe8-055ab9b99fbe
[110] Morris L. Cooke, "National Plan for the Advancement of Rural Electrification Under Federal Leadership and Control with State and Local Co-operation as a Wholly Public Enterprise" typescript, Library of Congress, 1934.
[111] *Ibid p6.*

Cooke included in his report a detailed cost estimate of national rural electrification. Cooke's commissioned studies identified that household payments for electricity would be a minimum of one dollar per month for the first ten kilowatts of electricity, three cents per kilowatt for the next forty kilowatts, and two cents per kilowatt for the remaining balance.[112] Cooke estimated the cost to provide electricity to 500,000 farms, at an average of three farms per mile of rural road, would total $112 million, or $225 per farm. He calculated that even if new generating facilities were needed for all 500,000 farms, the creation of 333 power plants would cost an additional $87 million. Therefore, Cooke's high-end estimate for the complete electrical infrastructure needed to bring electrical service to 500,000 rural American farms was $200 million, or $400 per farm.[113] Cooke concluded his report by stating that a new "rural electrification agency" should be tasked with constructing necessary infrastructure since private industry had deemed many rural locations to be not worthy of investment.[114]

The Rural Electrification Administration (REA) was created by Presidential Executive Order 7037[115] on May 11, 1935. This was followed by the Norris-Rayburn Act in 1936, which authorized a ten-year program supported by $410 million in appropriations for the purpose of electrifying American farms.

The REA would finance the expansion of rural electricity through federally-subsidized loans to private companies, public agencies, or co-operatives. These federally-guaranteed loans had a relatively low interest rate and a repayment schedule of twenty-five years. The interest rate

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[112] *Ibid p8.*
[113] *Ibid p9.*
[114] *Ibid p11.*
[115] "The American Presidency Project. Available at http://www.presidency.ucsb.edu/ws/?pid=15057

initially matched the federal funds rate when the loan was executed, but after 1944 the rate was fixed at two percent.[116]

Under Cooke's direction, the REA adopted the rural co-operative model.[117] Co-operatives were not-for-profit consumer-owned firms organized to provide electric service to member-customers.[118] Most co-operative were governed by a board of directors elected from the ranks of its residential customers. The board established rates and policies for the co-operative and hired a general manager to conduct the ordinary business of providing electricity to customers within the service region. Only two restrictions were placed on the formation of co-operatives: they could not compete directly with utility companies, and co-op members could not live in areas served by utilities or within a municipality with a population of 1500 or more.[119]

In terms of the adoption of the co-operative model for rural electrification, one of the major initiatives that came from the first one hundred days of the Roosevelt Administration was the establishment of the Tennessee Valley Authority (TVA). The agency was created to harness the natural power of the Tennessee River for the creation of energy. The TVA Act[120] included, significantly, a clause stating that preference for sale of surplus power should be given to "States, counties, municipalities and co-operative organizations of citizens or farmers, not organized or doing business for profit, but primarily for the purpose of supplying electricity to its own citizens or members. "[121]

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[116] Joskow and Schmalensee, "Markets for power: an analysis of electrical. Utility deregulation," 1983, p.17
[117] D. Clayton Brown, *Electricity for Rural America*, Greenwood Press, 1980, p8.
[118] For more detail on the co-operative model and structure please see Appendix.
[119] *Ibid p69.*
[120] The Tennessee Valley Authority Act. Available at https://www.tva.com/file_source/TVA/Site%20Content/About%20TVA/TVA_Act.pdf
[121] 16 USC 831i: Sale of surplus power; preferences; experimental work; acquisition of existing electric facilities

3.3 Electric Co-operatives After the Creation of the REA

The first significant milestone for rural electric co-operatives after the creation of REA was the formation of the National Rural Electric Co-operative Association (NRECA) in 1942. Initially, this organization was formed to fight claims that electric co-operatives were hoarding wire during WWII,[122] but the organization would go on to represent all electric co-operatives in Washington, DC.

The efforts of the REA to kickstart a rural electrification program were hindered by World War II. In 1944, however, the REA Postwar Planning Committee had drawn up a plan to extend electricity to almost 4 million farms and homes. Owing to the low interest rate of loans and longer than market average payback schedules, rural electrification picked up pace through the 1950s.[123]

By 1953, 2,544,000 farms had been connected to REA-supplied lines. Nine hundred and thirty-eight electric co-operatives existed and had been supplied with almost $3 million in federal loans.[124] One of the key successes of the REA program was its low rate of loan defaults, with only one percent of all loans defaulting before repayment.

Through the 1950s and 1960s, electric co-operatives grew in strength. Changes to REA lending rules in the 1960s enabled electric co-operatives to move into the energy generation and transmission market. In 1969, the National Rural Utilities Co-operative Finance Corporation (CFC) was incorporated. By the mid-1980s, CFC had loaned more than $3 billion in long-term

[122] America's Electric Cooperatives, "Our cooperative history." Available at https://www.electric.coop/our-organization/history/
[123] D. Clayton Brown, "America Achieves Rural Electrification", 1980.
[124] *Moody's Public Utility Manual*. New York: 1954, p A-13

capital to its member rural electric co-operatives and provided co-ops with ready access to $2.5 billion in short-term credit.[125]

The rapid growth of electric co-ops through the latter half of the 20th century led to them becoming the prominent electric provider in rural areas. Today they cover fifty three percent of the nation's land mass and provide electricity to over forty million members.[126]

3.4 Current Operating Environment

Despite their beginnings as providers of electric services to rural areas, electric co-ops are now making the case that they are ready and able to branch-out into broadband network communications. These co-operatives generally have made large investments into advanced telecommunications infrastructure as part of their energy distribution systems. Electric co-operatives, as part of this endeavor, have invested in mobile radio systems, private dispatch, microwave, and tracking systems. In terms of infrastructure deployment, they are already equipped with the machines, equipment, poles and towers that are used in the deployment of retail fiber broadband.

In 1994, fewer than five percent of rural electric co-operatives were involved in, or planned to enter, the provision of digital telecommunications. By 1998, this number had risen to around 24 percent.[127] Today there are 66 active electric co-operative broadband projects in 24 states.[128]

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[125] *The Next Greatest Thing*, NRECA, 1984.
[126] *Ibid.*
[127] Dunn, Warren. "Electrifying rural economies: electric co-operatives will connect rural America to the information superhighway." *Forum for Applied Research and Public Policy*, vol. 13, no. 4, 1998
[128] See Chapter III methodology for identifying broadband projects.

4 OPPORTUNITIES FOR ELECTRIC CO-OPERATIVES TO DEVELOP RURAL BROADBAND NETWORKS

Figure 1 below shows the current service territories of all electric co-operatives in the United States. Figure 2 displays their current broadband network service areas. As can be seen from comparing these two figures there is a disparity between the current electric co-operative broadband network service areas and their electric service territory capacity. As such, there is the potential opportunity for electric co-operatives to expand broadband network service into a much larger footprint than has currently been achieved.

4.1 Marketplace Business Models

One of the primary motivators for electric utilities to enter the telecommunications marketplace is the existence of in-place infrastructure. As previously noted, many electric utilities have invested in fiber infrastructure to support and enhance their electric systems. Currently more than 3,200 electric utilities in the United States serve an estimated 145 million customers.[129]

• Public Power Utilities (also known as "Municipals" or "Munis"): Are established as not-for-profit utilities under the authority of cities and counties. City-owned utilities are referred to as municipal utilities companies (Munis). Universities and military bases may own and operate their own utilities. Regulation of these entities is performed, in most cases, by a local government.

[129]U.S. Department of Energy Office of Electricity Delivery and Energy Reliability, "United States Electricity Industry Primer," (July 2015). Available at https://www.energy.gov/sites/prod/files/2015/12/f28/united-states-electricity-industry-primer.pdf

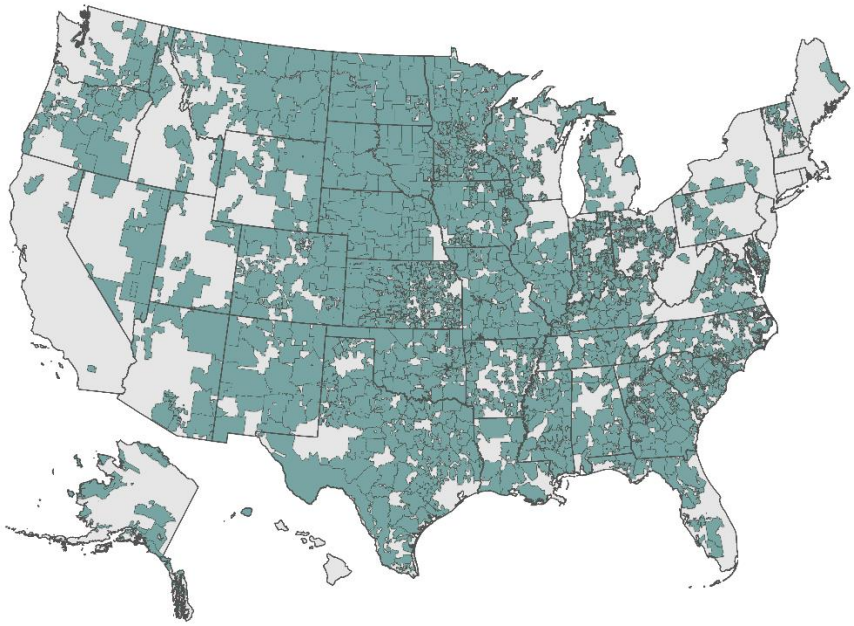

Figure 1. Electric Co-Operative National Service Territory Map[130]

[130] 2019 U.S electric cooperative service territories. Data supplied by the National Rural Electric Cooperative Association (NRECA.)

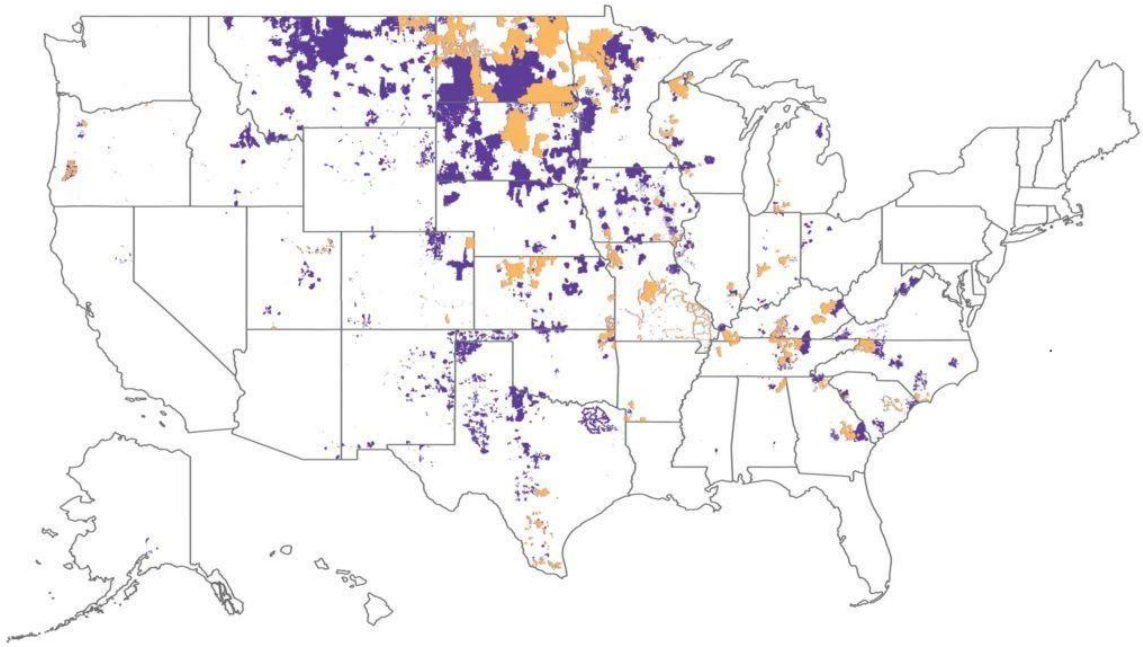

Figure 2. Electric Co-Operative Current Broadband Service Territory Map[131]

[131] 2018 FCC form 477 data compiled using QGIS by the Institute for Local Self-Reliance. Orange shows electric co-operatives offering over 25Mbps upload and 5 Mbps download, purple shows electric co-operative's who offer "any broadband" service.

Distribution of electricity to the home is performed by three forms of electric utilities:

• Investor-Owned Utilities (IOUs): These are for-profit companies that are owned by their shareholders and often have service territories in one or multiple states. IOUs are granted licenses to operate in specific areas of each state by state commissions and under certain terms and conditions. Any interstate generation, transmission, and power sale is regulated by the Federal Energy Regulatory Commission (FERC), and any distribution system and retail sale is regulated by the State energy commission.

• Co-operatives (Co-Ops): As described in more detail throughout this study, these are not-for-profit entities owned by their members and regulated under both state code as well as by either federal or state energy contracts.

Despite being fewer in number, Investor Owned Utilities have the largest share of customers in the United States (68.3 percent).

Table 3. U.S. Electric Utility Providers[132]

Category of Utility	**No. of Providers in United States**
Investor Owned Utility	187
Public Power Utility	2012
Electric Co-operative	876

[132] American Public Power Association, "2016–2017 Annual Directory & Statistical Report," Available at https://ebiz.publicpower.org/APPAEbiz/ProductCatalog/Product.aspx?ID=7553

Table 4. Number of Customers Served by U.S. Electric Utility Providers[133]

Category of Utility	**No. of Customers Served**
Investor Owned Utility	88,268,193
Public Power Utility	21,497,486
Electric Co-operative	19,095,159

4.1.1 Retail Services

Retail Internet service involves building a fiber to the premise network that connects services to businesses and residences with the utility acting as the sole provider. In some cases, this can be bundled with phone service (a "double-play" bundle) as well as with video (a "triple-play").

Douglas Electric Co-operative, which has a 2,200 square mile service area in southern Oregon, offers an internet and voice bundle through Douglas Fast Net (DFN).[134] DFN was founded 12 years ago with the goal of delivering "high-speed broadband to everyone in Douglas County—even those in outlying areas that might not have gotten service before."[135] DFN provides connections to the medical and education sectors as well as homes and businesses.

The biggest financial factor influencing the decision to enter the retail Fiber to the Home (FTTH) market was the cost of network build out and maintenance. The co-operative is required

[133] *Id.*
[134] Douglas Fast Net, "Bundles." Available at http://www.douglasfast.net/bundles.
[135] Douglas Fast Net, ""About DFN." Available at http://www.douglasfast.net/about/ (accessed March 13, 2015).

not only to maintain the fiber backbone (usually through its electric smart-grid) but also the lines and equipment entering homes, businesses, and facilities.

In certain circumstances, co-operatives also will enter into competition with other providers and become *overbuilders* navigating the provider's infrastructure. Despite in some instances not being federally defined as a broadband service (in the case of "dark fiber"), this incumbent infrastructure can pose competition issues. Electric co-operatives entering the retail market could face competitive maneuvers, such as lowered prices or competitive marketing practices. An ability to gain significant market share to overcome the initial investment will be necessary to make a "retail play" financially viable.

Financing of these networks can be done "in house" via loans, internal loan procedure or via funding sources, such as grants or secured loan programs.

4.1.1.1 Open Access

Under this model a utility owns the fiber infrastructure that forms the backbone of a residential or business broadband network. The utility installs the equipment necessary to connect and light[136] broadband service from an access point to the end-user-address. Instead of offering service, however, the utility leases its backbone network to another provider who operates the residential or business service. The fiber and the transport electronics can be owned and operated by the utility or they can be contracted out to a 3rd party operator.

In this "wholesale" or "open access" model, the backbone infrastructure is separated from retail or business services. The highest cost of market entry for providers can often be the large-scale infrastructure needed to construct a broadband network. By allowing providers to lease

[136] The process of sending bandwidth from one end of a network cable to the other.

access to this infrastructure, this model allows smaller providers easier access to the market and often can support multiple providers and therefor create greater competition.,

One risk associated, with the open access model, is recovering the investment made in the network backbone buildout. Recovering these costs requires gathering enough interest from providers in leasing the network as well as the ability of these providers to maintain success through the length of a lease contact. The UTOPIA network (Utah Telecommunications Open Infrastructure Agency, a joint project of 14 communities in suburban and rural Utah), faced some of these problems. UTOPIA had difficulty finding enough providers as well as the inability of providers to maintain sound marketing efforts to maximize their business opportunities.[137]

4.1.1.2 Alternative Model: Institutional/Middle Mile

In this model, the utility seeks to offer dark fiber[138] connections, through a lease, to institutions and businesses. The utility installs and operates the cables and pole attachments that form the wired infrastructure of the network but do not provide or operate the equipment that "lights" the network service. Excess fiber constructed to support an electric smart grid can be used to recover incremental costs so long as the leased fiber contract is structured not to violate internal, state, and federal safety requirements. There is less risk associated with this model as the utility is only required to install and maintain fiber cabling and not the other network equipment. At the same time, the model utilizes a utility's cabling right-of-way knowledge and maintenance capabilities.

[137] Columbia Telecommunications Corporation, *Utility Broadband Guide*, November, 2014.
[138] Dark fiber refers to the lease of point-to-point fiber strands. The lessee of dark fiber is responsible for adding electronics to "light" the fiber.

This model has the highest possibility of financial success with the lowest risk for the utility due to the lowest investment cost. A utility is taking its excess fiber, constructed to support electric operations, and allowing another provider to pay for access. It does, however, provide the least opportunity for revenue generation as compared with a full retail or business service operations or an open access model.

The "dark fiber" model is problematic for businesses and residential customers as without another provider the fiber will sit unused and unlit. The model does offer some incentives for a private provider to construct FTTP infrastructure, but it does not significantly lower the costs of market entry as the provider is required to install broadband network equipment and secure a bandwidth contract to supply the network with adequate service. In this model, the utility serves as a "middle man" between an access point operator and a last-mile broadband provider.[139]

4.1.2 Fixed vs Fixed Wireless

To identify which type of deployment electric co-operatives favored, an analysis was conducted that examined reported broadband buildouts by electric co-operatives nationally. Electric co-operatives make available to their members updates of business operations via newsletters. To identify data for this examination, the newsletters of each active electric co-operative broadband project in the United States were reviewed. To identify active broadband projects, the websites of each electric co-operative member of the National Electric Co-operative Association (NRECA) were examined to identify information regarding active broadband projects (either existing or in buildout stage). This study identified 66 active projects out of the

[139] *Ibid.*

897 NRECA member co-operatives nationally. The newsletters of these 66 electric co-operatives were examined to identify the following sets of data:

- (sub) Contracted technology vendor name.

- Date project began (first announcement of project via newsletter).

- Technology being used.

- Services offered.

This examination produced the dataset presented in Tables 5 and 6.

Of the 66 active electric co-operative broadband projects in the United States 35 reported, via their member newsletter, the vendor who had been contracted to help with the broadband buildout. Of these 35 the majority (n=21) had contracted with Calix. According to Reuters, Calix is[140]:

> …a global provider of cloud and software platforms, systems and services, which is required to deliver the unified access network and smart home and business services. The Company's platforms and services help its customers to build next generation networks by developing a DevOps operating model. The Company's cloud and software platforms, systems and services enable communication service providers (CSPs) to provide a wide range of revenue-generating services, from basic voice and data to advanced broadband services, over legacy and next-generation access networks. The Company focuses on CSP access networks, the portion of the network that governs available bandwidth and determines the range and quality of services that can be offered to subscribers. The Company's platform includes Calix Cloud, Experience eXtensible Operating System (EXOS) and Access eXtensible Operating System (AXOS)…

[140] Reuters, "Calix Profile." Available at https://www.reuters.com/finance/stocks/companyProfile/CALX.N

Table 5. Electric Co-operative Broadband Buildout Types

Provider	States	Vendors	Date	Technology	Services
ARIS (Arkansas Rural Internet Service)	AR	N/A	2016	N/A	Data,Video, Voice
Arrowhead Electric Co-operative	MN	Pulse Broadband, Calix	2010	GPON	Data, Voice
BARC Electric Co-operative	VA	N/A	2014	N/A	Data
Barry Electric Co-operative	MO	Calix	2015	N/A	Data
BEC Fiber (Bandera Electric Co-operative)	TX	Calix	2017	N/A	Data
Blue Ridge Mountain Electric Membership Co-operative	GA NC	Allied Telesis, OFS	2006	Active Ethernet	Data
Bolt Fiber Optic Services (Northeast Oklahoma Electric Co-operative)	OK	Alcatel-Lucent, ETI Software Solutions	2014	GPON	Data, Video, Voice
Callaway Electric Co-operative (Callabyte Technology)	MO	Calix	2017	N/A	Voice, Data, Video
Carolina Connect (Mid-Carolina Electric Co-operative)	SC	Calix	2016	GPON	Data
Central Virginia Electric Co-operative	VA	N/A	2018	N/A	Data
Ciello (San Luis Valley Rural Electric Co-op)	CO	Calix	2016	GPON	Data, Voice
Co-Mo Electric Co-operative	MO	Calix, Pulse Broadband	2011	GPON	Data, Voice, Video
Communications Access Co-operative (CACHE, Hood River Electric Co-operative)	OR	N/A	N/A	Carrier Ethernet	Data

Table 5. Continued

Provider	States	Vendors	Date	Technology	Services
ConnectAnza (Anza Electrical Co-operative)	CA	ADTRAN	N/A	N/A	Voice, Data, Video
Consolidated Co-operative	OH	N/A	2018	N/A	Data
Continental Divide Electric Co-operative	NM	Pulse Broadband	2017	N/A	Data
Craighead Electric Co-operative	AR	N/A	2018	N/A	Data
Delaware County Broadband Initiative (DCBI)	DE	N/A	N/A	N/A	Data
Douglas Fast Net	OR	ADTRAN, Ciena	2002	Active Ethernet	Data
Elevate Fiber (Delta-Montrose Electric Association, DMEA)	CO	Calix	N/A	GPON	Data, Voice
Enlite Fiber Optic Network (Consolidated Electric Co-operative)	OH	ADTRAN	2012	Active Ethernet	Video, Data, Voice
French Broad Electric Membership Corporation	NC	N/A	N/A	N/A	Data
GCEC Telecom (Grayson-Collin Electric Co-operative)	TX	ADTRAN	2013	Active Ethernet	Video, Voice
Gibson Connect (Gibson Electric Membership Corporation)	TN	Calix	2017	N/A	Data
Great Lakes Energy	MI	Calix	2018	N/A	Data, Voice
Guadalupe Valley Electric Co-op (GVEC.net)	TX	ADTRAN	2013	Active Ethernet, GPON	Data, Video, Voice
Habersham Electric Membership Co-operative (partner of Internet EMC)	GA	Allied Telesis	2010	Active Ethernet	Data
Holston Electric Co-operative	TN	ADTRAN	2018	N/A	Data, Video, Voice

Table 5. Continued

Provider	States	Vendors	Date	Technology	Services
IllinoisNet.com (Illinois Electric Co-operative)	IL	Calix	N/A	N/A	Voice, Data, Video
Jackson County REMC / Jackson Connect	IN	Calix	11/1/2017	GPON	Data
Kit Carson Electric Co-operative	NM CO	Pulse Broadband, Fujitsu, Zhone Technologies	2010	GPON	Data, Voice
Lake Region Electric Co-operative	OK	CommScope, Pulse Broadband	2012	EPON	Data, Voice
Lumbee River Electric Membership Corp.	NC	Allied Telesis, Calix	2010	GPON	Data, Video, Voice
Maquoketa Valley Electric Co-operative	IA	Calix	2017	GPON	Voice, Data, Video
Mecklenburg Electric Co-operative	VA	N/A	2017	N/A	Data
Mescalero Apache Telephone	NM	N/A	N/A	N/A	Data
Middle Tennessee Electric Membership Corporation	TN	N/A	2018	N/A	Data, Video, Voice
Midwest Connections (Midwest Energy Co-operative)	MI	Calix	2013	GPON	Data
Mille Lacs Energy Co-operative	MN	N/A	2017	N/A	Data
NEXT (North Alabama Electric Co-operative)	AL	ADTRAN	2010	GPON, Active Ethernet	Voice, Data, Video
NEXT (North Arkansas Electric Co-operative)	AR	N/A	2017	N/A	Data, Video, Voice
NineStar Connect (formerly Hancock Telecom)	IN	Enablence, OFS, Calix, Zhone Technologies	2002	EPON, GPON	Voice, Data, Video
Ntera	WI	N/A	2017	Fiber to the Building	Data

Table 5. Continued

Provider	States	Vendors	Date	Technology	Services
OEC Fiber (Oklahoma Electric Co-operative)	OK	Calix	2018	N/A	Data, Voice
OEConnect (Otsego Electric Co-operative)	NY	N/A	2018	N/A	Data, Voice
OPALCO (Rock Island Communications)	WA	N/A	2014	Active Ethernet	Voice, Data
Orange County Fiber (Orange County Rural Electric Membership Co-operative)	IN	N/A	2018	N/A	Data, Voice
OzarksGo	AR OK	Calix	N/A	GPON	Voice, Data, Video
Pemiscot-Dunklin Electric Co-operative	MO	N/A	2017	N/A	Data, Video, Voice
Plumas-Sierra Telecommunications	CA	Calix	2010	N/A	Data
Prince George Enterprises (Prince George Electric Co-operative)	VA	N/A	2017	N/A	Data
Ralls County Electric Co-operative	MO	Pulse Broadband	2010	N/A	Data
Roanoke Electric Co-operative	VA	N/A	2017	N/A	Data
SCI Fiber (South Central Indiana Rural Electric Membership Corp.)	IN	N/A	2018	N/A	Data, Voice
SEMO Electric Co-operative	MO	N/A	2017	N/A	Data, Voice, Video
Sho-Me Technologies	MO	N/A	2016	Carrier Ethernet	Data
South Central Connect (South Central Arkansas Electric Coooperative)	AR	N/A	2018	N/A	Data, Video, Voice

Table 5. Continued

Provider	States	Vendors	Date	Technology	Services
Southeast Colorado Power Association (SECOM)	CO	Calix	2009	GPON, Active Ethernet	Data
Taylor Electric Co-operative	TX	N/A	2018	N/A	Data
Tipmont Rural Electric Membership Corporation	IN	N/A	2018	N/A	Data, Video, Voice
Tombigbee Communications (Tombigbee Electric Co-operative)	GA	N/A	2017	N/A	Data
Tri-County Electric	TN	N/A	2017	N/A	Data
United Electric Co-operative	MO	Pulse Broadband, Calix	2010	GPON, Active Ethernet	Data, Video, Voice
Valley Electric Association, Inc. (VEA)	NV	N/A	2015	N/A	Voice, Data, Video
Volunteer Electric Co-operative	TN	N/A	2017	N/A	Data

Table 6. Buildout Type Summary

Vendors (35 Reported)	**N=**	**Buildout Technology (27 Reported)**	**N=**	**Services Offered (66 Reported)**	**N=**
ADTRAN	7	Active Ethernet	9	Data Only	31
Alcatel-Lucent	1	Carrier Ethernet	2	Data + Voice	11
Allied Telesis	3	Ethernet Passive Optical Network (EPON)	2	Data + Voice + Video	24
Calix	21	Gigabit Passive Optical Networks (GPON)	15		
Ciena	1				
Enablence	1				
ETI Software Solutions	1				
Fujitsu	1				
OFS	2				
Pulse Broadband	7				
Zhone Technologies	1				

Twenty-seven electric co-operatives informed their members via newsletter the kind of technology that is being used in their broadband buildout. These technologies were categorized under the following descriptions:

- Active Ethernet (AE): An AE network provides each subscriber with their own fiber link to the network node switch, which links the local network to the Internet.[141]

- Carrier Ethernet (CE): CE is a ubiquitous, standardized service network delivered globally & locally. These standardized service networks include Ethernet Private Line (E-Line), Ethernet Private LAN (E-LAN services), Ethernet Virtual Private Line and Ethernet Virtual Private LAN services.[142]

[141] OTELCO, "What is Active Ethernet?" Available at https://www.otelco.com/faq/what-is-active-ethernet/
[142] Omnitron Systems, "Carrier ethernet fundamentals." Available at https://www.omnitron-systems.com/carrier-ethernet-learning-center/carrier-ethernet-fundamentals.php

- Ethernet Passive Optical Network (EPON): EPON is a "short haul" network that uses fiber optic cables, Ethernet packets (instead of ATM cells), and a single Layer 2 network with a single protocol to deliver internet access, voice over internet protocol (VoIP), and digital TV services.[143]

- Gigabit Passive Optical Networks (GPON): GPON is a point-to-multi point access mechanism network. Its main characteristic is the use of passive splitters in the fiber distribution network, enabling one single feeding fiber from the provider's central office to serve multiple homes and small businesses.[144]

Of the 27 co-ops who reported their deployment technology, the majority (n=15) had deployed or were deploying GPON.

Of the services offered by electric co-operatives nationally, almost half (n=31) reported that they were offering "data only" services. Of bundled services, eleven co-ops reported that they offered "data + voice" bundles and 24 reported that they offered "data + voice + video" services. Table 7 presents data regarding the optimal environments for various broadband network technologies.

[143] New Wave Design & Verification, "What is EPON?" Available at https://newwavedv.com/markets/telecommunications/what-is-epon/
[144]GPON, "What is GPON." Available at http://www.gpon.com/how-gpon-works

Table 7. Opportunities for Fixed Wireless Access

	mmWave (Cellular FW)	**< 6 GHz (WISP)**	**FTTH**	**FTTdp/ G.Fast**	**Situations Where Wireless Solution Preferable**
Dense Urban	Optimal	Good	Good	Good	Where fiber cost/home passed >$1,000 and one good FBB provider
Urban	Good	Optimal	Ok	Good	mmWave viable to HH w/in 0.5 km or < 6 GHz. Need 30%+ penetration
Suburban	Possible	Good	Possible	Good	Sub- 6 GHz viable where ~ 500 hh/mi^2 & only 1 good FBB provider
Ex-Urban	Challenging	Ok	Challenging	Ok	Possible using mix of sub-6 GHz/LTE and where FBB underserved
Rural	Sub-Optimal	Ok	Sub-Optimal	Possible	Generally unlicensed and perhaps LTE where there are 'clusters'

4.1.2.1 Cellular Fixed Wireless (mmWave)

In terms of solutions, mmWave generally does not apply in rural contexts. The new mid-band spectrum envisioned for LTE/5G, such as the 3.5 GHz band cannot deliver broadband signal across the distances or through the required geography/typography in areas with density well under 100 homes per square mile or where there is the presence of natural disruptive artifacts (such as trees or hills etc).

Cellular fixed wireless technology operates on the following "spectrum"[145]:

o *mmWave.* mmWave is any spectrum above 24 GHz and is the high frequency spectrum being considered for 5G in some countries. The range is typically less than 500m, but channel bandwidths of 200 MHz or more deliver the type of speed and capacity that support a competitive, if not a superior, broadband offering. Table 8 shows the optimal environments for the use of mmWave (5G) networking technology.

Table 8. Use of Cellular Wireless Based on Density

	Density (hh/*mi*^{2})	**mmWave (45/5G)**
Dense Urban	1,500	Optimal
Urban	1,000	Good
Suburban	500	Possible
Ex-Urban	Under 200	Challenging
Rural	Under 100	Sub-Optimal

[145] The signal bands either licensed or unlicensed that are used to distribute radio signals from point to point.

5G, or high-frequency/low distance, technology could be used in places where there are a cluster of homes. But, given that its function is to provide high speeds across low distances, it is not an appropriate solution for low density rural locations.

4.1.2.2 Fixed Wireless Internet Service Providers (WISP)

Fixed Wireless Internet Service Providers deliver broadband service to consumers in fixed locations, primarily via wireless technology. Different from cellular service providers, WISP providers use wireless technology to serve customers in fixed locations such as residences, businesses, and community anchor institutions by delivering broadband from a fixed (fiber point) over wireless spectrum to a receiver on a premise. Services delivered by WISP providers include data as well as voice over IP, and video. WISP providers deliver their services over a combination of licensed spectrum, lightly licensed spectrum (or "shared access" spectrum), and unlicensed spectrum. Most WISP networks also include fiber infrastructure or "backbone." Indeed, this fiber backbone provides a WISP's "backhaul" (the connection that provides the WISP with bandwidth). Typical download speeds are in the range of 5 to 50 Megabits per second (Mbps), dependent on technology. In recent years companies such as Ubiquity have begun to offer more efficient technology at more cost-effective prices.[146] Fixed wireless technology is now able to support Gigabit download speeds.[147]

In a typical WISP network a providers connects a wireless distribution network via wired or wireless connections to a fixed fiber access point. From there, signals are delivered to customers via wireless transmitters on towers. WISP providers operate their networks over

[146] Lee Hutchison, "What I've learned…three years of enterprise WIFI", ARS Technica, July, 2018.
[147] *Id.*

licensed or unlicensed. Customers receive the signals via antennas that are attached to their premises. Within the subscribers' premises, the signal is delivered via a Wi-Fi router or ethernet cable to their various devices.

For last-mile, point-to-multipoint connections, unlicensed spectrum bands such as 900 MHz and 2.4 GHz were commonly used in the early years of the industry. However, these bands have given way to 5 GHz, 3.65 GHz, and 2.5 GHz to accommodate increased speed, coverage, and capacity needs. Unlicensed 5 GHz and licensed 6-24 GHz point-to-point connections are most commonly used to connect towers and serve high-volume enterprise customers. The 5Ghz unlicensed spectrum band is most commonly used in rural areas due to the cost of access (it does not require a spectrum license purchase from the FCC) as well as its efficiency for sending data over large distances and through wooded terrain. It does present, however, the highest chance of interference due to multiple competing operators. It is often the case, therefore, that there will be single dominant WISP operators in any given geographic area.[148]

For co-operatives, exploring cost-effective options for low-density broadband deployment fixed wireless could be an option to consider. From an economic perspective, fixed wireless has benefits over fixed fiber deployments, or as a part of a hybrid network.

Table 9 compares relative capital expenditures per residential subscriber, as well as speed, upgrade costs, average revenue per unit (ARPU), and payback times for the five most popular U.S. broadband technologies. In this dataset the values of each variable for WISPs are set to an index value of 10. According to analysis by the National Rural Telecommunications Co-operative and The Carmel Group, fiber deployment is seven times WISP costs. As household

[148] "BWA Industry Report" (2017). Available at https://carmelgroup.com/wp-content/uploads/2017/12/TCG_2017_BWA_Full_Report.pdf

density drops, capex for fixed fiber rises but remains relatively constant for wireless. This analysis suggests that with a payback period of just under one year, WISP offers the most attractive economics of the top U.S. broadband technologies.[149]

4.2 Electric Co-operative Case Studies

The following case studies show examples of electric co-operatives throughout the nation that have taken on broadband projects. These case studies were selected based on their unique or innovative approach to engaging in a broadband offering. OPALCO for its partnership with T-Mobile to provide LTE fixed wireless and use of neighborhood funding mechanisms, CO-MO for being one of the first co-ops to enter the market and develop a four-phased approach, and NRS a subsidiary of NEOEC which operates three divisions: full service right-of-way management, a technology and communications division, and Bolt, its fiber-optic division. The data used to construct these case studies were identified by exploring the websites and newsletters of the selected electric co-operatives.

Table 9. Economic Comparison Between Deployment Types[150]

	Fiber	**Cable**	**Satellite**	**Mobile**	**WISP**
Capex per customer relative to WISP	70	45	10.5	21	10
Average download speed per customer	1 Gbps	150 Mbps	12-35 Mbps	10-12 Mbps	100 Mbps
Upgrade Costs	Modest	High	High	High	Modest
Av. Rev. Per User	$69	$42	$61	$59	$51
Payback Period on Investment	60 Months	38 Months	12 Months	21 Months	11.5 Months

[149] *Ibid.*
[150] *Id.* Combined data from National Rural Telecommunications Co-operative and The Carmel Group

4.2.1 Orcas Power & Light Co-operative (OPALCO)

This member-owned, nonprofit co-operative utility has provided energy services to San Juan County in far northwest Washington State since 1937. Delivered to 20 islands in an archipelago by way of submarine cables, most of its power is hydro-electric energy generated by Bonneville Power Administration (BPA).

The idea to deliver broadband came from OPALCO's need to better communicate with key grid infrastructure (substations and submarine terminals). Starting in 2000, OPALCO began sharing surplus fiber with larger institutions (public safety, government, schools, libraries) in San Juan county. Due to the failure of an undersea cable for 10 days in November 2013, disconnecting the community from its sole provider, the co-op saw an immediate impact on emergency management systems, the economy and normal daily life and initiated the plan to bring broadband to the community.

San Juan county is an older, seasonally driven economy and demographic. OPALCO's service territory has an average age of 52, compared to a Washington State average age of 38. Additionally, 35 percent of the home ownership is part-time/seasonal residents.

Prior to its broadband rollout the primary offering was DSL internet delivered over copper infrastructure, mixed with minimal cable and satellite. DSL was either provided by an incumbent carrier or resold via local ISPs. Prior to engaging in this project OPALCO conducted both internal and external feasibility studies.

OPALCO's core network is an active Ethernet FTTH/P supplemented with an LTE fixed wireless network. It has entered into a long-term partnership with T-Mobile US, whereby the co-op shares investment and capability allowing it to offer a private wireless solution using multiple LTE spectrum bands (2, 4 and 12). They also deliver some services via public spectrum WiFi as

well as reselling DSL connectivity. The co-op only offers broadband and voice having decided that online streaming services would replace cable television over time.

OPALCO's broadband staff has grown to 30 full-time employees since its inception in 2014. Its employees have been hired to bring in skills including technology, finance, marketing and retail experience. The co-op is a 100 percent equity owner of Island Network LLC, doing business as Rock Island. OPALCO maintains ownership of its backbone infrastructure, while Rock Island owns all distribution assets installed.

OPALCO financed its broadband operation using a combination of operating revenue, loan/line of credit from CoBank and direct investment for construction from property owners. To help finance infrastructure buildout the co-op received an average upfront payment of $3,500 to $4,000 per residential subscriber location. Each subscriber location has helped to fund buildout through its neighborhood and to its homes. The Rock Island team has actively worked with organized groups of homeowners in HOAs, road or water associations, or simply groups of neighbors who have come together to share costs.

To help offset the cost of construction the co-op has offered two types of incentives. The first is a construction incentive of $1,500 toward the last-mile construction. The second is a discount incentive for those willing to cover its entire construction cost. Rock Island provides a $20 per month discount on fiber subscriptions for as long as customers lives at their service address. OPALCO's partnership with T-mobile has allowed the co-op to expand network coverage into areas where fiber financing is not possible through the creation of an LTE fixed wireless network.

4.2.2 Co-Mo Electric

Co-Mo was one of the first electric co-operatives in the nation to build out a fiber to the home network to its entire service territory. Starting with a pilot project in 2010, Co-Mo has now extended the option of fiber to each of its 15,000 members.

The co-op's energy service serves around 32,000 meters in central Missouri. It has 4,000 miles of electric line and has built out its entire electrical system with fiber where possible. The co-op has around 3,000 miles of mainline fiber supporting its smart metering system.

Co-Mo's broadband, video, and phone service has around 15,000 subscribers with a monthly growth of about 100 to 120 subscriptions. It has a take rate of around 50 percent.

The broadband initiative started out with a pilot. After this successful pilot the co-op developed a four-phased approach to the full roll-out. The first phase targeted Co-Mo's most densely populated areas to get as many members connected as quickly as possible. Each phase thereafter was tiered based on territory density. The co-op wanted to attempt to recoup its initial investment using its most densely populated member base. The four-phased approach also gave the co-op a way out at the end of each phase if the economy changed and if take rates didn't produce what was required. During the process some service territory was moved out of phase three to put into phase two. Phase three and four were also merged together

Co-Mo is governed by a nine-member board of directors for the electric co-op. The electric co-op owns the subsidiary that operates under the name of Co-Mo Connect. The co-op owns the fiber assets on the poles, and leases dark fiber to its subsidiary. The subsidiary then "lights" that fiber. The subsidiary owns all the electronics in the shared headquarters, the TV headend, and all the electronics in the home. Through a lease agreement between the subsidiary

and its parent company, the owning co-op is repaid so that it has principal and interest in order to operate the subsidiary.

The broadband subsidiary was initially funded almost entirely through debt capital accessed via two electric co-operative member banks. Members were required to put down $100 to secure a connection and that deposit then went toward the installation of the equipment in their home. The majority of fiber buildout and hardware installation was contracted out to 3rd party contractors. Initially co-op staff were allocated roles within the broadband subsidiary and now 25 full time broadband dedicated staff perform the subsidiary operations.

4.2.3 Northeast Rural Services (NRS) a wholly owned subsidiary of Northeast Oklahoma Electric Co-op (NEOEC)

Northeast Oklahoma Electric Co-op (NEOEC), is a member-owned electric distribution co-operative headquartered in Vinita, Oklahoma, that provides power to 38,631 customers through 5,293 energized miles across five counties in northeast Oklahoma. NRS operates three divisions: a full-service right-of-way management, a technology and communications division, and Bolt, its fiber-optic division. Bolt manages the broadband deployment to over 30,000 homes and businesses. Bolt's available services include internet connectivity up to 1 gigabit, as well as high-definition television services, Voice over internet Protocol (VoIP) telephone services, and home security services.

The decision to pursue a broadband subsidiary involved a four-year decision-making process. Surveys were conducted with several thousand members to determine demand. One survey utilized a telecommunications engineering firm to establish questions and determine member take rate. The co-op then went through several financial forecasts to see if it could construct a financially feasible project.

NRS is in the process of completing its GPON network. The subsidiary owns its own media room headend for television services and has a soft switch. Recently it received permission from the state of Oklahoma to offer phone services. NRS is now an independent telephone company and does not have to utilize a third-party service. It also offers home security through its fiber network.

NEOEC hired 30 new personnel to staff its subsidiary. These included installers, engineers, the manager of customer service, director of engineering, and director of operations. Several other co-op employees were given new roles within the subsidiary. The general manager of the electric co-operative is also the general manager of the subsidiary. NRS has a director of operations, director of engineering, director of IT and account representatives that report to the NRS general manager. The subsidiary owns all the broadband assets and is a wholly owned subsidiary of the co-op.

The co-op's broadband initiative has been funded partially through an RUS broadband loan through the Farm Bill. The loan process with RUS took around two and a half years. The co-op has also utilized bank loans for bridge financing during the interim construction periods and delays in RUS reimbursements. NRS has also been awarded around $4 million from the FCC's Rural Broadband Experiment program. The co-op requires a $100 deposit to secure a member connection.

NRS is currently installing 12 to 15 drops (member connections) per day. It has around 4,600 customers receiving services and another 2,500 signed up who are awaiting service. NRS has a goal of delivering 20 drops a day, or 100 per week, and will push for that going forward once its main backbone is built out. The subsidiary believes that once it has 10,000 members connected it will have enough cash-flow to deliver service to its entire territory.

5 CHALLENGES ELECTRIC CO-OPERATIVES FACE WHEN DEVELOPING RURAL BROADBAND NETWORKS

5.1 Defining "rural" in Terms of Electric Co-Operative Service Territories

There is much dispute in terms of how and why to define the term "rural." There are both qualitative and quantitative factors that can be applied to its definition. According to the USDA:[151]

The use of different definitions of rural by Federal agencies reflects the multidimensional qualities of rural America…The choice of a rural definition should be based on the purpose of the activity.

According to The General Accounting Office there are three commonly used federal definitions of rural:[152]

- The Department of Commerce's definition based on the 2010 census criteria.
- The White House's Office of Management and Budget (OMB) definition.
- The United States Department of Agriculture's Economic Research Service definition.

[151] Amber Waves, "Defining the "Rural" in Rural America: The use of different definitions of rural by Federal agencies reflects the multidimensional qualities of rural America." USDA, Economic Research Service, (June 2008). Available at http://ers.usda.gov/amber-waves/2008-june/defining-the-%E2%80%9Crural%E2%80%9D-in-rural-america.aspx

[152] GAO, "Rural Development: Profile of Rural Areas," pp. 26-31

5.1.1 The U. S. Census Bureau Urban and Rural Classification

The Census Bureau's urban-rural classification is defined by the creation of delineated urban and rural geographical areas. The Census Bureau's urban areas contain densely developed territory, and encompass residential, commercial, and other non-residential urban land uses. The data that contribute to this definition are gathered through the decennial census by applying specified criteria. "Rural" encompasses all population, housing, and territory not included within an urban area The Census Bureau identifies two types of urban areas:

- Urbanized Areas (UAs) of 50,000 or more people
- Urban Clusters (UCs) of at least 2,500 and less than 50,000 people.

5.1.2 Office of Management and Budget (OMB)

OMB designates areas based on the "Standards for Delineating Metropolitan and Micropolitan Statistical Areas."[153] According to the February 28, 2013, revised standards, "Metropolitan and Micropolitan Statistical Areas are delineated in terms of whole counties (or equivalent entities), including in the six New England States. If specified criteria are met, a Metropolitan Statistical Area containing a single core with a population of 2.5 million or more may be subdivided to form smaller groupings of counties referred to as Metropolitan Divisions."[154] In general, "OMB establishes and maintains the delineations of Metropolitan Statistical Areas, Metropolitan Divisions, Micropolitan Statistical Areas, Combined Statistical Areas, and New England City and Town Areas solely for statistical purposes. This classification

[153] Office of Management and Budget 2010 Standards for Delineating Metropolitan and Micropolitan Statistical Areas (Revised 2013).
[154] *Id.*

is intended to provide nationally consistent delineations for collecting, tabulating, and publishing federal statistics for a set of geographic areas. The Metropolitan and Micropolitan Statistical Area Standards do not equate to an urban-rural classification; many counties included in Metropolitan and Micropolitan Statistical Areas, and many other counties, contain both urban and rural territory and populations."[155]

- Metropolitan Statistical Areas contain at least one urbanized area with a population of 50,000 or more, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.
- Micropolitan Statistical Areas have at least one urban cluster with a population of at least 10,000 but less than 50,000, plus adjacent territory as defined above.

5.1.3 U.S. Department of Agriculture Economic Research Services (ERS) Rural Classification

ERS defines rural areas as "nonmetro" areas based on counties. Nonmetro counties, that are not part of larger labor market areas or "metropolitan areas," include some combination of open countryside, towns with fewer than 2,500 people, and other areas with populations not exceeding 49,999.

Electric co-operatives are member created entities that emerged in areas unserved by private power companies. They grew from agriculture co-operatives into retail co-operatives throughout the 20th century. As their scale grew, so did their service territories. These service territories, alongside other regulated monopoly utilities such as Municipal Power Companies, eventually were controlled by each state's utility commission. These Commissions are tasked

[155] *Id.*

with regulating and amending the boundaries of these service territories to ensure there is no overlap as well as to maintain customer service. Co-operatives can apply to have boundaries changed if they can identify residents who are not being served by another co-operative in whose territory the residents reside.

These territories cover 56 percent of the nation's landmass. [156] This encompasses both urban and rural areas. Given the coverage area of electric co-operatives, each of the above definitions of "rural" would include a service territory served by an electric co-operative. The New Deal ensured that these co-operatives would fill the gaps in coverage that had been neglected by private companies' focus on urban areas. When this study discusses "rural" it does so with an acceptance that, regardless of the definition of "rural," each definition points to a geographic area covered by an electric co-operative service territory by the nature of how these entities emerged to supply energy to all rural areas.

5.2 Legislative Mandates

In 1914, section 6 of the Clayton Act[157] mandated that anti-trust laws cannot be construed to prohibit the existence and operation of agricultural organizations created for the purpose of mutual help, so long as these organizations exist not-for-profit and do not retain capital stock

The Capper-Volstead Act of 1922[158] granted agricultural co-operatives limited immunity from antitrust laws and permitted co-operatives to retain capital-stock and be incorporated as for-profit institutions.

[156] Energy Information Administration (EIA), "Electric Sales, Revenue, and Price," (2014). Available at http://www.eia.gov/electricity/data.cfm#sales
[157] 15 U.S.C. § 17
[158] 7 U.S.C. §§ 291–292

In 1926 the Co-operative Marketing Act[159] established the Division of Co-operative Marketing within USDA, to provide research, technical assistance, and education support to rural co-operatives. It also authorized co-operatives to acquire and exchange "past, present, and prospective crop, market, statistical, economic, and other similar information."

The Rural Electrification Act of 1936[160] established the Rural Electrification Administration and authorized the distribution of federally subsidized low-cost loans to telephone and electric co-operatives. It established a federal management system for the creation and support of rural electric co-operative organizations.

In 1967 the Agricultural Fair Practices Act made illegal the act of coercing any agricultural producer into joining a co-operative.[161]

5.3 Statutory Status[162]

Due to the incorporation of electric co-operatives via state code prior to the invention of advanced telecommunications or data services, these organizations are now branching into a market area that differs from their original intents. Owing to this, there exists statutory ambiguity as to the status of electric co-operatives as advanced telecommunications providers

Despite receiving a form of tax exemption as 501(c)(12) organizations by the IRS the existence and purpose of electric co-operatives is generally provided by state code or statute. In order to identify what the purpose of electric co-operatives is, as defined through state code or statute, all 50 state codes or acts were analyzed to locate references to electric co-operatives and

[159] 7 U. 7 U.S.C. ch. 31 § 901 et seqS.C. § 455
[160] 7 U.S.C. ch. 31 § 901 et seq
[161] 7 U.S.C. §§ 2301–2306
[162] The data collected in this section and the subsequent analysis provide an answer to RQ1. What is the legislative status of electric co-operatives and how can it be updated to reflect the changing status of electric co-operatives?

"powers" or "purpose." After identifying state codes and statutes that reference electric co-operatives and "powers" or "purpose" all acts were then further examined for reference to the purpose, or services to be offered, and whether states gave reference to telecommunications or data services.

These statutes all had the following general attributes:

- "Existence:"
  - – Articles of Incorporation (Contents, Amendment, etc.)
  - – Disposition of Property (Member Approval, Appraisal, etc.)
  - – Dissolution (Member Approval, Lookback Period, etc.)
- "Operation:"
  - – Purpose (Electric Energy Only, Any Lawful Purpose, Serve Members Only, etc.)
  - – Powers (Own Interest in Other Entities, etc.)
  - – Bylaws (Contents, Board and/or Member Amendment, Proposing Amendments, Reasonableness, etc.)
  - – Nonprofit Operation (No Dividends, etc.)
- "Members:"
  - – Qualifications (Bylaws, Purchase Electric Energy, etc.)
  - – Meetings (Annual, Special, Calling, Vote, etc.)
  - – Refunds (Rates, Capital Credits, etc.)
- "Directors:"
  - – Qualifications (Bylaws, etc.)

– Elections (In Person Vote, Mail Vote, Electronic Vote, Staggered Terms, Length of Terms, etc.)

– Removal (Board and/or Members, Disqualification, etc.)

– Districts (Nominate and/or Elect, etc.)

– Meetings (Notice, Telephone Participation, etc.)

– Officers (President, Vice President, Secretary-Treasurer, etc.)

The results of state statutes and code analysis is presented in Table 10.

This analysis shows that for most states (n=34), the primary purpose of electric co-operatives, under state statute, is to provide electricity/electric energy to their members. Of the states that provide a statutory purpose/definition of an electric co-operative other than the provision of electricity/electric energy, less than 20 percent (n=8) have statutory definitions that include additional services such as water, sewer, natural gas and "other lawful purposes," and seven states have statutory provisions that explicitly list telecommunications as a service to be offered by electric co-operatives. While no states expressly forbid electric co-operatives from providing advanced telecommunications, two states (New Mexico and North Carolina) suggest that for an electric co-operative to provide that service, it would need to establish a separate telecommunications entity.

Table 10. Electric Co-operative Purpose: As Defined by State Code/Statute

State	State code/statute	Purpose/authorized services	Mention of data/telecommunications
Alabama	AL CODE § 37-6-1 THROUGH 37-6-49	Electricity, water, sanitary sewer systems and television programming through decryption equipment and satellite dish, and telephone service	Television supply equipment shall not be used for bi-directional transmission of voice, data or other signal. Can supply telephone service.
Alaska	AS 10.25.020	Electric energy, waste heat distribution, heating systems, sewer, water, gas, direct satellite television	None
Arizona	ARS 10-2057	Electric energy	None
Arkansas	AR Code § 23-18-306 (2016)	Electricity	None
California	CLI PUC 1.2.5 2776-2778	Electricity	None
Colorado*	C.R.S. 40-9.5-107 (2017)	Electric Energy	None
Connecticut	CGS 33.597 33-219 (2015)	Electric Energy	None
Delaware	59 Del. Laws, c. 397, § 1.	Electric Energy	None
Florida	Florida Statute 452.04 (2013)	Electric Energy	None
Georgia	GA Code § 46-3-200 (2016)	Electrical energy, energy conservation	None
Hawaii	HI Rev Stat § 421C-1 (2016)	Electric Utility Service	None
Idaho	ID Code § 63-3501 (2016)	Electric Power	None
Illinois	220 ILCS 30/3.4	Electricity	None
Indiana	IC 8-1-13-2	Electric energy	None
Iowa	IA Code § 390.1 (2016)	Electric Power & Energy	None
Kansas	Kansas statute 17-4602	Electric energy	None
Kentucky	KRS 279.110	Electric Energy	None

Table 10. Continued

State	State code/statute	Purpose/authorized services	Mention of data/telecommunications
Louisiana	LA Rev Stat § 45:121 (2016)	Electric service	None
Maine	MRS 35-A §4137	Electricity	None
Maryland	Md. Code Ann. § 5-607	Electricity	None
Massachusetts	MGL Part 1, Title II, s. 136	Energy/energy-related service	None
Michigan*	MCL 460.32	Electricity	None
Minnesota	MS 216B.1691 & 308A.210	Electric Service	"A telecommunication services purchasing co-operative may be formed under this chapter for the sole purpose of purchasing advanced telecommunications services by aggregating demand and negotiating reduced rates for its members." & "A purchasing co-operative is not a telephone or electric co-operative."
Mississippi	MS Code § 77-5-231 (2016)	Electric Energy	None
Missouri	RSMo 394.080.	Electric Energy	None
Montana	MCO 35-18-106	Electric, telephone, cable television, broadband	Allows: Telephone, cable television & broadband services. Does not allow: telegraph & radio broadcasting
Nebraska	NRS 70-703	Electrical Energy	None
Nevada	NRS 81.500	No specific reference (general powers of a private entity)	No specific reference (general powers of a private entity)
New Hampshire	NH Rev Stat § 301:53 (2016)	Electric Energy	None
New Jersey	NJ Rev Stat § 48:3-88 (2016)	Electric Power	None

Table 10. Continued

State	State code/statute	Purpose/authorized services	Mention of data/telecommunications
New Mexico	NMS 62-15-2	Electric Power/Energy	"Co-operatives may form, organize, acquire, hold, dispose of and operate any interest up to and including full controlling interest in separate business entities that provide energy services and products and telecommunications and communications services and products, including cable and satellite television." 62-15-3.1
New York	N.Y. R.E.L. Law § 10 (Consol.)	Electric Energy	None
North Carolina	NCGS 117.2.1.2	Electric Energy	"Electric membership corporations may form, organize, acquire, hold, dispose of, and operate any interest up to and including full controlling interest in separate business entities that provide energy services and products, telecommunications services and products"
North Dakota	NDCC 10-13-01	Electric Energy	None
Oklahoma	OS §18-437.1.	Electric Energy	None
Oregon	2015 ORS 261.010	Electric Distribution	None
Pennsylvania	SPCS 15.73.7304	Electric Energy	None
Rhode Island**	N/A	N/A	N/A
South Carolina	SCCLU 33-49-210	Electric Energy	None

Table 10. Continued

State	State code/statute	Purpose/authorized services	Mention of data/telecommunications
South Dakota	SDCL 47-21-2	Any lawful purpose (except banking, securities, and insurance)	"Co-operatives proposing to provide local exchange telephone service in a rural telephone company's service area may do so only in compliance with the procedures contained in section 251(f) of the Communication Act of 1934, as amended by the Telecommunications Act of 1996."
Tennessee	TN Code § 65-25-104 (2016)	Electric power and energy, water, sewer, and natural gas	"Every co-operative has the power and is authorized, acting through its board of directors, to acquire, construct, own, improve, operate, lease, maintain, sell, mortgage, pledge or otherwise dispose of any system, plant or equipment for the provision of telephone, telegraph, telecommunications services, or any other like system, plant, or equipment within and/or without the service area of such co-operative in compliance with title 65, chapters 4 and 5, and all other applicable state and federal laws, rules and regulations." 65-25-134
Texas	TXUC 161.001	Electric Energy	None
Utah	UC 54-2-1	Electricity	None

Table 10. Continued

State	State code/statute	Purpose/authorized services	Mention of data/telecommunications
Vermont	30 V.S.A. § 3001a	Energy, Cable Television, Telecommunications, Interactive media, and Internet access	"A co-operative shall have power…to distribute, sell, supply, and dispose of energy, cable television, telecommunications, interactive media, and Internet access to its members, to governmental agencies and political subdivisions" 30 V.S.A. § 3002
Virginia	COV 56-231.16	Energy, Energy Services and "other" utility services	"Utility services" means any products, services and equipment related to energy, telecommunications, water and sewerage."
Washington	RCW 23.86.035	"Any lawful purpose"	"Any lawful purpose"
West Virginia	N/A	N/A	N/A
Wisconsin	2015−16 Wis. Stats. 185.995	Electric Energy	None
Wyoming	WY Stat § 17-20-140 (2016)	Electric, Telephone and Television Distribution Systems	"Co-operative utility" means a corporation organized under any law of this state or under the law of any other jurisdiction, for a purpose other than the conduct of business for profit and includes, but is not limited to, corporations organized to own, operate and maintain electric, telephone and television distribution systems primarily to its members"

**Colorado and Michigan statutes include provisions for co-operatives to opt-out of certain state regulations based on a vote of membership. The bylaws and regulations put in place by the co-operatives replace these opted-out of state regulations.*

***Rhode Island statutes made no specific reference to the purpose or powers of electric co-operatives, electric membership associations or electric co-operative corporations. Instead the statutes had general co-operative provisions with no specific provisions or referenced "purchasing co-operatives."*

This analysis shows that electric co-operatives entering the advanced telecommunications marketplace exist in a state of statutory ambiguity. For the most part, states define these entities as having the primary purpose of providing electric energy to their members. A minority of states have adapted their statutes to reflect the emergence of electric co-operatives as advanced telecommunications providers. While not expressly forbidden by statute from providing this service, these entities are beginning to challenge their statutory purpose and intent and move into an area for which state legislators, for the most part, appear not to have accounted. As such, it may be necessary for guidance as to the suitability of electric co-operatives as advanced telecommunications providers.

5.4 Regulation[163]

Whether a utility provider is regulated or unregulated if it constructs an FTTH network is dependent upon the actual provision of advanced telecommunications services delivered over a network. Network construction alone generally will not be subject to federal or state regulation. The Federal Communications Commission (FCC) only regulates the use of fiber that is activated with optical and electrical equipment attached to a network being used to deliver service by that provider or if capacity in a broadband network is leased or sold or made available to any user on a "common-carrier basis."[164] A "common-carrier basis" means making a fiber network

[163] This section provides an answer to RQ2. How are mixed utility (energy/telecommunication) providers regulated and how can this be applied to electric co-operatives?
[164] 47 U.S. Code Part I - Common Carrier Regulation

available indiscriminately to any person or entity. In each of these instances a provider would be deemed a "telecommunications carrier" providing a "telecommunications service" under the Communications Act and will be regulated by the FCC.

State public utility laws have common carrier provisions.[165] Thus, if a provider offers capacity on a common carrier basis the provider will be regulated by the state where the network is situated.

5.4.1 Electric Utility Provider's Offering Telecommunications Services

5.4.1.1 Federal Regulation

An electric utility provider offering local exchange or long-distance telecommunications services over an advanced telecommunication (or broadband) network, under federal law has a duty to provide interconnection to other telecommunications carriers under Sections 201 and 251 of the Communications Act. It also must apply “just and reasonable” practices to the provision of telecommunications services. These include:

- Avoiding unjust and unreasonable practices and discrimination under Sections 201 and 251 of the Communications Act, and;
- Not imposing unreasonable and discriminatory conditions on the resale of telecommunications services through the FTTP under Section 251 of the Communications Act.

[165] Jacob Geffs, *Statutory Definitions of Public Utilities and Carriers*, 12 Notre Dame L. Rev. 246 (1937). Available at: http://scholarship.law.nd.edu/ndlr/vol12/iss3/3

Providers also must provide access to its rights-of-way under Sections 251 and 224 of the Communications Act. These provisions are avoided if a utility does not not render any local exchange or long-distance telecommunications service over its network.

Section 224 of the Communications Act provides that a utility shall provide a cable television system or any telecommunications carrier with “non-discriminatory” access to any pole, duct, conduit, or right-of-way owned or controlled by it.

The term *utility* as used in §224(f)(1) means "any person who is a local exchange carrier or an electric, gas, water, steam, or other public utility, and who owns, or controls poles, ducts, conduits, or rights-of-way used, in whole or in part, for any wire communications.”

The term *pole attachment* as used in §224(a)(4) is defined as, “any attachment by a cable television system or provider of telecommunications service to a pole, duct, conduit, or right-of-way owned or controlled by a utility.*”* Unless regulated by a state, or a state authorized entity (such as TVA) the FCC regulates the rates and terms or conditions of pole attachments.

A utility's "ownership or control" of rights-of-way or other such facilities, as defined by state law, depends on whether the utility can voluntarily provide access to a third party. The utility also would be entitled to “reasonable” compensation for doing so. These compensation amounts vary by state. Significantly then, state law plays an important role in determining whether, and the extent to which, utility ownership or control of a right-of-way exists in relation to Section 224 and the related compensation pole attachment rates.

5.4.1.2 State Regulation

If a utility company provides local exchange or long-distance service over an FTTH network, it will have substantially the same obligations described above under the public utilities laws of the state where an FTTH network is located. A related question, however, is whether a

provider's pure management of an FTTH network without actually providing telecommunications services implicates state regulation.

In some states, Kansas e.g., a "telecommunications infrastructure provider" is classified as a regulated utility for certain purposes. These purposes may include, but are not necessarily limited to:

- Filing reports and making rights-of-way available to traditional video and telecommunications providers.

In other states (e.g., Illinois), if a utility "manages" telecommunications facilities or a plant but does not provide service, it may be classified as a "telecommunications corporation" subject to public utility regulation. The Illinois Commerce Commission has yet to regulate a provider that only "manages" an telecommunications network.

In states such as California if a provider merely "manages" a telecommunications network and does not provide telecommunications services to the public, the developer will not be regulated as a public utility.

5.4.2 Utility Company Provision of Video and Internet Services Over a Broadband Network

5.4.2.1 Internet Protocol Television (IPTV)

A slightly different set of circumstances is presented when an entity provides internet television over a broadband network. IPTV[166] is the “distribution of video signals using Internet Protocol (IP).” IPTV is a relatively new method of delivering and viewing television

[166] IEEE Explore Digital Library, “IPTV.” Available at https://ieeexplore.ieee.org/document/4084875/

programming. Among other things, IPTV allows a subscriber to obtain television programming independent of a traditional cable or satellite television provider. Not only is IPTV a new distribution or playback method for television or other video programming, but it also eliminates the need for a fixed video programming schedule and operates as an “on demand” model.

When a co-operative offers IPTV, it is providing an "information service" under the Communications Act, and therefore is not subject to federal or local franchising authority regulation. In National Cable & Telecommunications Assn., Inc., et al. v. Brand X, et al., ("Brand X"), the U.S. Supreme Court held that the FCC had lawfully concluded in its 2002 Declaratory Ruling[167] that cable companies selling broadband internet service are not "telecommunications service" providers as defined under the Communications Act. Thus, such services are exempt from mandatory common-carrier regulation under Title II of the Act.

Due to the ruling in Brand X it has been assumed that operators offering IPTV service (such as Netflix) are not deemed to be cable operators. Cable operators would be subject to federal and state specific cable legislation. Incumbent local exchange telecommunications carriers such as Verizon, which is deploying its FIOS system, and AT&T which is offering IPTV have, however, either obtained statewide franchises from those states that have enacted legislation allowing statewide cable franchises. Alternatively, they have obtained cable franchises from local franchising authorities before deploying their IPTV systems. This is to satisfy local government’s demand for a grant of authority for the use of their rights-of-way. These incumbent local exchange carriers have elected to pay fees in the form of percentage of

[167] Declaratory Ruling and Notice of Proposed Rulemaking (FCC 02-77)

revenues to local governments where their IPTV networks are located, rather than litigate the issue of whether they must obtain a franchise for IPTV.[168]

In 2007, the FCC attempted to reform cable franchise rules regarding local authority over franchising through its 621 order.[169] In 2015, however, the FCC, clarified that the franchising rules and findings it extended to incumbent cable operators in the "621 order*"* do not apply to any state laws governing cable television operators, or to any state-level cable franchising process. Thus, "cable operators" are still subject to local franchising arrangements and cannot ask for FCC pre-emption under current rules.

It could therefore reasonably be concluded that electric co-operatives do not need to obtain such franchises if they provide IPTV but may want to obtain a statewide franchise if possible or offer a percentage of revenue from IPTV to the local government in lieu of securing a local franchise.

[168] Amy Harris, "Enabling IPTV: What Carriers Need to Know to Succeed," (May 2005). Available at https://www.emc.com/collateral/analyst-reports/idc-iptv-whitepaper-jun-9-05.pdf
[169] FCC 18-148

6 LEGISLATIVE, REGULATORY, AND INDUSTRY PERSPECTIVES[170]

6.1 Research Methods

To gather and analyze perspectives from legislators, regulators, and industry members the following procedures were followed.

6.1.1 Secondary Data

To gather data that gave perspectives from these three stakeholders regarding this topic, public comments made by representatives of each group were gathered. These data came from federal and state documents through the database HEIN. The following keyword terms were used to search for each perspective:

- Industry: “Electric Co-operative” AND “Broadband” AND “Testimony”
- Legislative: “Legislative” OR “Legislation” AND “Broadband” AND “Electric Co-operative” AND “Testimony”
- Regulatory: “Regulation” or “Regulatory” AND “Broadband” AND “Electric Co-operative” AND “Testimony”

These data were then analyzed for relevancy to the stated research purpose and question. The secondary sources used for this analysis are presented in Tables 11, 12, and 13.

[170] The following section, and the recommendations presented in Chapter 7, provide and answer to RQ5. How can the experience of legislators, regulators, and industry members inform new policy and funding initiatives?

Table 11. Industry Perspectives Secondary Source List

Data Type	Individual Submitting Data	Data Captured By	Date Captured
Oral Testimony	Craig Eccher President and CEO of Tri-County Rural Electric Co-operative	The Center for Rural Pennsylvania	April 5, 2018
Written Testimony	Christopher Allendorf V.P. of External Relations and General Counsel Jo-Carroll Energy, Inc.	The Committee on Agriculture, House of Representatives, One Hundred Fifteenth Congress, First Session	October 24, 2017
Written Statement	Curtis Wynn, President and Chief Executive Officer, Roanoke Electric Co-operative; Vice President, Board of Directors, National Rural Electric Co-operative Association, Ahoskie, NC	The Committee on Agriculture, House of Representatives, One Hundred Fifteenth Congress, First Session	June 9, 2017
Written Statement	Hon. Glenn English, Chief Executive Officer, National Rural Electric Co-operative Association, Arlington, Virginia	The Committee on Agriculture, Nutrition, and Forestry, United States Senate, One Hundred Ninth Congress, second session	June 20, 2006

Table 11. Continued

Data Type	Individual Submitting Data	Data Captured By	Date Captured
Written Statement	Robert L. Hance, President and Chief Executive Officer, Midwest Energy Co-operative, Cassopolis, MI; On behalf of National Rural Electric Co-operative Association	The Subcommittee on Livestock, Rural Development, and Credit of the Committee on Agriculture, House of Representatives, One Hundred Thirteenth Congress, Second Session	July 29, 2014
Written Statement	Duane Highley, President and CEO, Arkansas Electric Co-operative Corporation, on Behalf of the National Rural Electric Co-operative Association	The Committee on Energy and Commerce, House of Representatives, One Hundred Thirteenth Congress, First Session	May 21, 2013

Table 12. Legislative Perspectives Secondary Source List

Data Type	**Individual Submitting Data**	**Data Captured By**	**Date Captured**
Hearing	Various Legislators	The Subcommittee on Communications and Technology of the Committee on Energy and Commerce, House of Representatives, One Hundred Fourteenth Congress, First Session.	October 28, 2015
Hearing	Various Legislators	The Committee on Small Business, United States House of Representatives, One Hundred Thirteenth Congress, Second Session.	February 11, 2014
Hearing	Various Legislators	The Committee on Energy and Commerce, House of Representatives, One Hundred Tenth Congress, Second Session.	June 24, 2008

Table 12. Continued

Data Type	Individual Submitting Data	Data Captured By	Date Captured
Hearing	Various Legislators	The Committee on Agriculture, Nutrition, and Forestry, United States Senate and the Subcommittee on Jobs, Rural Economic Growth and Energy Innovation, One Hundred Thirteenth Congress, Second Session.	May 1, 2014
Hearing	Various Legislators	The Committee on Agriculture, House of Representatives, One Hundred Fourteenth Congress, First Session.	March 17, 2016
Hearing	Various Legislators	The Subcommittee on Telecommunications and the Internet of the Committee on Energy and Commerce, House of Representatives, One Hundred Ninth Congress, first session	April 27, 2005

Table 12. Continued

Data Type	**Individual Submitting Data**	**Data Captured By**	**Date Captured**
Hearing	Various Legislators	The Committee on Commerce, Science, and Transportation, United States Senate, One Hundred Eleventh Congress, second session	September 23, 2010
Hearing	Various Legislators	The Subcommittee on Communications and Technology of the Committee on Energy and Commerce, House of Representatives, One Hundred Twelfth Congress, First Session	February 16, 2011
Hearing	Various Legislators	The Subcommittee on Communications and Technology of the Committee on Energy and Commerce, House of Representatives, One Hundred Twelfth Congress, First Session	June 1, 2011

Table 12. Continued

Data Type	Individual Submitting Data	Data Captured By	Date Captured
Hearing	Various Legislators	The Subcommittee on Communications of the Committee on Commerce, Science, and Technology, United States Senate, One Hundred Sixth Congress, second session	June 14, 2000

Table 13. Regulatory Perspectives Secondary Source List

Data Type	Data Given By	Data Captured By	Date Captured
Written Statements	Various Representatives of The Tennessee Valley Authority	The Federal Communications Commission	February 17, 2015 - March 20, 2015
Hearings	Various Representatives of The Tennessee Valley	The Subcommittee on Energy and Power of the Committee on Commerce, House of Representatives, One Hundred Sixth Congress, first session. 3.	September 13, 1999
Meeting Notes	Various Representatives of The Tennessee Valley Authority	The regional resource stewardship council	September 23, 2011

6.1.2 Supplemental Primary Data

Primary data collection also was pursued to explore the specific areas of inquiry laid out in the study's research questions in greater depth. The aim of this process was to add "rich data" to the secondary dataset. Initially, surveys were distributed to members of each of the three stakeholder groups. This involved distributing a survey via email to:

- The seven legislative members of the Tennessee Advisory Committee on Intergovernmental Relations (TACIR: The body tasked by the state of Tennessee with researching and developing the plan for rural broadband development that resulted in The Broadband Accessibility Act of 2018)
- The General Council's Office of the Tennessee Valley Authority (The regulatory body that oversees regulation of electric co-operative electric distribution and re-sale in Tennessee and 6 other states).[171]
- Twenty-three electric co-operative presidents or CEOs.

After feedback and analysis of initial returned data, it was concluded that, in order to gain more valuable data, in-depth interviews would provide a more effective mode of data capture.[172]

The in depth-interviews were conducted via telephone with participants. These participants agreed to be involved in the study on the condition that no named or personal identifiers would be published. Accordingly, data were aggregated and anonymized after collection and prior to data analysis. Participants in this study, via the in-depth interview procedure, were:

-Five members of the legislative body TACIR.

-Two members of TVA's General Counsel's office.

-Five Presidents or CEOs of Tennessee's electric co-operatives.

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[171] Alabama, Mississippi, Kentucky, Virginia, North Carolina, and Georgia.
[172] For interviewing techniques in depth see Herbert H. Hyman, *Interviewing in Social Research*, Chicago: University of Chicago Press, 1975.

For these interviews, the research questions that formed the basis of this study were used to guide the interviews; however, participant responses led to follow-up questions to explore areas in-depth as they arose. For example, when discussing the topic of "cross-subsidy" with regulators it was necessary to explore in-depth the legal ramifications and alternatives available to electric co-operatives when approaching this regulated topic. Additionally, when discussing selection of broadband partners with a CEO of an electric co-operative, questions were used to gather more data on the method of that partner selection process.

6.1.3 Data analysis

A thematic analysis was conducted to identify themes across the secondary and primary data, with each data source serving as a unit of analysis. An initial active reading of the data was conducted to view overall context and provide an immersive data interaction.[173] After an initial reading, specific steps were taken to derive the themes that would help to answer each research question. First words or phrases were highlighted that related to each research question. Those words or phrases were considered initial codes that could become the basis of themes. Codes are elements that constitute a theme. For example, in an in-depth interview conducted with a CEO of an electric co-operative, the CEO stated that, "In our experience, dealing with telephone co-operatives as a partner corresponds more closely with our values." This descriptor was considered an important characterization of an experience that could "inform regulation and funding" and thus was highlighted as a code that could potentially later serve as an indicator of a theme.

[173] Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. Qualitative Research in Psychology, 3 (2). pp. 77-101. ISSN
1478-0887, pp. 77-101.

Second, these initial codes and their meanings and patterns, were examined in order to decipher existing themes. Third, the themes were honed to ensure that enough data or codes existed to support the derived themes. For example, one of the themes that was unearthed from a regulatory perspective was that it is not TVAs current mission to assist in rural broadband development. The codes that connoted this theme were revisited and the number codes that conveyed this theme were noted. Fourth, all themes were then analyzed to see if any interrelated themes could be combined to form over-arching themes. The final process involved defining and labelling the themes in order to pinpoint the essence or core of each theme.

The specified steps were worked through before comparing the findings and considering the themes in relation to the research questions.

Similarities and variances that existed in the found themes were analyzed to better hone the themes and their relation to each research question. Moreover, theme labels were assessed to see whether they were concise and could immediately inform the reader about the identified themes. During the entire process of analysis, every effort was made to ensure the type of methodological rigor outlined for qualitative research,[174] with special attention paid to reflexivity and subjectivity in order to assure consistency and validity.

Through data analysis the thematic perspectives presented in Table 14 were identified.

[174] Lincoln & Guba, *Naturalistic* Inquiry, SAGE Publications; 1st edition (April 1985) pp. 73-84

Table 14. Summary of Legislative/Regulatory/Industry Perspectives by Theme

Perspective	Theme
Legislative	*Update Legislation to reflect the current electric co-operative industry*
	Electric ratepayer revenue should not be used to subsidize the cost of service
	Formal partnerships in the form of joint ventures are encouraged but structure is not legislatively proscribed
	Legislative and regulatory barriers could be minimized using "streamlined permitting" and the "broadband ready community" model
Regulatory	*TVAs mandate is to protect the electric rate payer*
	TVA does not proscribe how co-ops establish funding protocols but does approve them
	TVAs mission, as defined by legislation, is focused on electricity and not broadband service
	TVA has the potential to provide broadband infrastructure but currently its obligation is electricity
Industry	*One entity, two "businesses"*
	DIY vs Partnership model
	Funding Issues

6.2 Legislative Perspectives

6.2.1 Update Legislation

One of the primary motivators for legislators in Tennessee to enact the 2017 Broadband Accessibility Act was to update state law to allow electric co-operatives to provide broadband network service. Prior to this legislation, state law restricted electric co-operatives only to providing "Electric Service." As was seen by analysis of state legislation nationally, only seven states explicitly account for broadband or internet service as a service offered by electric co-operatives via statutory definition. Legislators regarded this as one of the primary factors influencing electric co-operatives' decision to enter the broadband market. A lack of clarity on how electric co-operatives operate meant legislators were unaware of the potential for these entities to enter the broadband market. Updating legislation to reflect electric co-operatives ability to provide that service would, according to legislators, aid in clarifying the co-operatives statutory status and enable other regulatory or policy hurdles to be confronted.

6.2.2 Electric Ratepayer Revenue Should Not Be Used to Subsidize the Cost of Service

One item many experts spoke of regarding electric co-operatives was the issue of protecting electric ratepayers from any failed entry into the broadband marketplace. This means ensuring that any funds allocated to the cost of building out and supplying these networks must be separate from the operating costs of the electric business.

Legislators giving testimony to Congress brought up failed municipal broadband projects in Pennsylvania, Florida, Washington, California, Vermont, and Minnesota as examples where

high levels of debt, low levels of consumer demand, and an inability to compete with existing ISPs had led to these enterprises either being shut down or resulting in higher than expected financial investments.

Similarly, legislators in Tennessee referenced municipal broadband projects in Memphis and Covington that eventually were sold due to revenue generation issues. Covington Electric System's broadband project was funded via a general obligation bond in 2002 and was sold to a private provider in 2007 after the municipal utility decided it could no longer maintain operations. Memphis Light Gas and Water (MLGW) entered into a partnership with a private provider in 2007 establishing the broadband enterprise Memphis Networx. Due to low take rates, it was sold at a loss of $29 million in 2007.

Legislators in Tennessee did however point to successful ventures in Chattanooga, known in the industry as "Gig City," Morristown, Jackson, Erwin, Clarksville, Pulaski, and Bristol as examples of successful ventures.

In the case of legislating against failure of these networks, legislators point to the language of Tennessee's Broadband Accessibility Act as a way of protecting electric ratepayers. Section 7 (B) (1) of the act states that:

"*A co-operative providing any of the services authorized by subsection (a) shall not provide subsidies for such services. A co-operative shall administer, operate, and maintain the electric system as a separate department in all respects, shall establish and maintain a separate fund for the revenues from electric operations, and shall not directly or indirectly mingle electric system funds or accounts, or otherwise consolidate or combine the financing of the electric system, with those of any other of its operations."*

6.2.3 Formal Partnerships in the Form of Joint Ventures are Encouraged But Structure is Not Legislatively Proscribed

Legislators in Tennessee spoke of their desire to see entities, such as electric co-operatives, partner with more experienced telecommunications providers when considering broadband network ventures. The existence of fiber infrastructure within a co-operative's electric system could be combined with both the backbone of private or telephone co-operative providers and the existing skills, knowledge, and resources could be leveraged. Legislators felt it was not necessary to legislatively proscribe how these partnerships were formed, other than pointing out that these ventures should abide by any codes or regulations designed to protect their existing business or ratepayers. Legislators in Tennessee mentioned Middle Tennessee Electric's (MTE) partnership with United Communications as a successful example of an electric co-operative private business partnership. In this arrangement, United Communications will provide its existing fiber backbone as well as technical expertise and funds to support MTE's fiber broadband rollout.

Nationally, legislators from Missouri and Massachusetts described how co-operative/private and government/private projects had resulted in successful broadband ventures. In Missouri, Sho-Me Power Electric Co-operative formed a private enterprise called Sho-Me Technologies. This enterprise leveraged NTIA's Broadband Technology Opportunities Program (BTOP) funding as well as the co-operatives 954 miles of existing fiber infrastructure to create a middle-mile network that was then leased to private last-mile providers. In Massachusetts, the state formed an economic development agency, Massachusetts Technology Park Corporation (MTPC), which built an "open access" backbone network that connected 123 towns and over 1,100 community anchor institutions. Axia, a private firm, then contracted out this backbone

network. Axia operates the networks and provides wholesale service and backhaul capacity to any entity looking to provide FTTH to the surrounding communities.

6.2.4 Legislative and Regulatory Barriers Could Be Minimized Using "Streamlined Permitting" and the "Broadband Ready Community" Model

Both national and Tennessee legislators spoke of the need to amend existing legislation to allow for "streamlined permitting" of broadband network deployment. Electric co-operatives, due to the nature of their service areas, according to legislators, would benefit most from an ability to avoid unnecessary permitting processes. Often electric co-operative service territories span multiple counties and jurisdictions. Thus, having a statewide framework for permitting would help to ease the process of permitting across county lines. At the national level, this topic is brought up regarding the permitting process for broadband projects along federal lands, such as highway rights-of-way. Currently the permitting process involves an environmental review process that critics claim is redundant. Proposed legislation (H.R. 4842/S.1988), introduced in 2017, aims to streamline this process by allowing states to assume federal environmental permitting responsibilities for broadband projects along highway rights of way. The legislation also would establish a Categorical Exclusion under the National Environment Policy Act for such projects, which means they would not be subject to environmental review.

At a local level, legislators spoke of the need to focus on four areas that would help streamline permitting processes and reduce broadband deployment costs for entities, such as electric co-operatives, expanding into high cost areas:

- Expectedness – Utilize existing knowledge from providers to create processes that consider "what is already known" regarding the build-out process. This could come in the

form of template documents or "examples" that show providers what is expected from applications.

- Reducing Regulatory Barriers – Examining historic regulations and removing either redundant or out-of-date requirements.
- Permit Database – Create a database of prior applications so that applicants can see examples of success.
- Collaboration – Create communication and other processes that allow entities, such as the Office of the City Planner, Economic Development, Utilities Commission, and the Department of Transportation, to cross-collaborate on the permitting process.

The topic of "streamlining" in Tennessee already has been expanded through the creation of a "broadband ready community" (BRC) process. Public Chapter 228, S 4-3-709 of the state code allows for a "political subdivision" (or county) to apply to the state to be designated as a BRC. This means that the county has adopted an efficient and streamlined policy for reviewing broadband applications and issuing permits; appointed a single point of contact for all matters related to a broadband project; and has established procedures to allow all forms, applications and documentation related to a project to be reviewed and approved or denied within 30 business days. Broadband Ready Community projects are also allowed to be filed or submitted and signed electronically, where possible.

6.3 Regulatory Perspectives

6.3.1 TVA's Mandate is to Protect the Electric Rate Payer

TVA is the electric contract regulator for electric cooperatives in Tennessee, Alabama, Mississippi, Kentucky, Georgia, North Carolina, and Virginia. When discussing electric co-

operatives, TVA emphasized that its role is to protect the electric ratepayer. TVA derives its authority in this regard from the Tennessee Valley Authority (TVA) Act signed into law in 1993. Section 11 of that Act states that it is the policy of the federal government that TVA should be "considered primarily as for the benefit of the people of the section as a whole and particularly the domestic and rural consumers to whom the power can economically be made available, and accordingly that sale to and use by industry shall be a secondary purpose, to be utilized principally to secure a sufficiently high load factor and revenue returns, which will permit domestic and rural use at the lowest possible rates and in such manner as to encourage increased domestic and rural use of electricity."

In accordance with the TVA Act, and established by five-year rolling electric contracts, TVA is the exclusive retail rate regulator of Tennessee's 23 electric co-operatives. This means that TVA sets and approves the rates that electric co-operatives charge for power to its customers. TVA also sets the wholesale power rates of the co-operatives. The primary mode of regulating electric co-operatives is via the financial obligations set out in the power contracts signed by electric co-operatives with TVA. The terms of these contracts establish how they can use their electric system revenues in accordance with TVA's obligation that its revenues are being used for electric system purposes so as to protect the electric ratepayers.

6.3.2 TVA Does Not Proscribe How Co-Ops Establish Funding Protocols but Does Approve Them

Within the contracts established between TVA and the electric co-operatives there are terms, or provisions, that list the permitted revenue uses. There also are internal TVA policies regarding how these contractual terms are enforced. These policies and processes implement the particular provisions of how electric co-operatives can use electric system revenues.

These contractual provisions generally state that electric co-operatives may only use revenue for electric system operating expenses, payment on debts, regional reserves and tax payments. These contracts also state that any unallocated reserves generated through electric revenue must be used to lower electric rates. In terms of using electric revenue for other services, TVA regulates this via a "schedule of terms" contained within the power contracts. These terms state that all other service operations must be kept financially separate from the electric system finances.

TVA, as the electric co-operative power contract regulator, stated that if electric co-operatives are fulfilling the obligations of the terms of their power contracts, it does not hold a regulatory position regarding electric co-operatives offering broadband service. It also stated that if electric co-operatives maintain separate finances, there is no obligation to separate their businesses further. An electric co-operative does not necessarily have to create a "subsidiary" company to provide broadband service. Electric co-operatives could instead create two separate business divisions within the same entity.

These regulators did state that their staff can help to establish electric co-operative financial operations. If, for example, an electric co-operative wanted to "loan" finances from its electric operation to its broadband operation via an interfund transfer, TVA's staff can explain to electric co-operatives how to do that while maintaining the obligations set forth in their power contracts.

6.3.3 TVA's Mission, as Defined by Legislation, is Focused on Electricity and Not Broadband Service

TVA accepts that the financial rules established by these power contracts could be seen by some to be an obstacle to electric co-operatives entering the broadband business. As a power

contract regulator, however, it has a federal obligation to protect the electric ratepayer and the protection set forth by "cross subsidy" terms of contract are designed for that purpose.

TVA, as power regulators, has a primary mission to maintain electric rates as low as possible and to make sure that electricity is available to the rural population. This means that availability of broadband or internet infrastructure in rural areas is not established as a statutory goal. It would take congressional action or a change of federal policy in relation to TVA's purpose for the issue of broadband accessibility to be one that TVA accounts for in its regulatory mission.

6.3.4 TVA Has the Potential to Provide Broadband Infrastructure but Currently Their Obligation is Electricity

TVA officials have stated that over the next few years they will be upgrading and expanding 3,500 miles of fiber optics across seven states. The purpose of this fiber network is to support and modernize the telecommunications system that supports its electric generation operations. This includes infrastructure supporting TVA power plants, its smart grid network, data-driven power supply management, and solar entities.

There has been some discussion by TVA officials regarding plans to offer excess "dark fiber" via interconnections with telecommunications providers, such as electric co-operatives. However, at present, there has been no congressional mandate or policy decision that would compel TVA to offer this service.

6.4 Industry Perspectives

6.4.1 One Entity, Two "Businesses"

In terms of separating finances to comply with power contract terms of service, electric co-operatives in Tennessee are exploring multiple options. For some this has involved creating a separate entity, either a for-profit or a non-profit enterprise that handles the broadband network business. For others, this has meant establishing two internal departments with separate finances. One handles the electric operation and one handles the broadband operation.

Practically, this can lead to some complications. For example, if an electric co-operative has fiber optic cable supporting it's SMART-metering that is connected to a member's property and then deploys FTTH to a member's property, the cost of the fiber and equipment supporting the SMART meter is allocated to the electric business and the cost of the FTTH connection is allocated the broadband business.

This cost allocation can be avoided if the electric co-operative chooses to go into a partnership arrangement with another provider.

6.4.2 DIY vs Partnership Model

Electric co-operative industry members stated that there are two models for them to enter the broadband market-- to do it themselves (DIY) or to partner with another entity.

In the DIY model, the electric co-operative would purchase access through a tier 1 provider to a backhaul connection. In Tennessee, this could be through the iRiS network. It then would build out and distribute broadband service to members using existing fiber lines and last-mile FTTH connections.

The largest benefit to a co-operative of the DIY model is long-term financial gain. It would recoup one hundred percent of any revenue generated through subscription fees. This model does, however, come with the largest amount of financial risk. In order to maintain the DIY model, electric co-operatives would first have to build out to high-density areas. The hope from that point is that the take rate from these areas is enough to return a high portion of the initial investment to then build-out in lower density areas.

The second model is to partner with a third party for backhaul connection to an internet exchange point, use existing fiber lines as a "middle-mile" connection, and allow the partner to connect the last-mile FTTH. In order to obtain a potential partner, or to identify broadband plan options, electric co-operatives would send out "Requests for Proposals" and then filter these proposals based on who they deemed to be suitable partner entities.

Electric co-operatives evaluated potential partners based on experience and business philosophy. Most proposals had similar price structures. The electric co-operatives identified in this study stated that they saw the best fit with telephone co-operatives. Telephone co-operatives have a proven track record of success in rural areas and have member-owner models that mesh well with an electric co-operative's structure and norms. They also saw in telephone co-operatives a similar principle of being a non-profit economic developer. A larger share of revenue is invested in this arrangement in the network than in the case of a private partner model. A huge potential in Tennessee, in the eyes of electric co-operatives, is the existence of a telephone co-operative owned backhaul network that can connect to internet exchange points.[175]

[175] In Tennessee, eight telephone co-operatives and two telephone companies have partnered to form a backhaul fiber network that connects FTTH providers to internet exchange points in Atlanta, GA, Ashburn, VA, and Chicago, IL.

Industry members stated that the benefits of the partnership model were that the partner entities already had backhaul infrastructure in place as well as the technology to connect into video service, along with customer service staff and billing software in place. In this arrangement, a partner would be responsible for customer service and technical issues, going to properties, and installing equipment. The electric co-operative would be responsible for building the line and handing the connection over to the partner entity.

In terms of staffing, industry members spoke of the necessity to add roughly 20 to 30 people to the broadband network operations. Partner entities already have those employees on staff. One or two people might be brought on by the electric co-operative to manage the relationship and increase fiber build out, but most people operating the FTTH service would come from the partner entity.

A negative of this arrangement is that the electric co-operative will gain less revenue in the long-term compared to the DIY model. A partner FTTH entity would receive all the money from the subscriptions and pay the co-operative a portion of this in return for leasing the co-operative's fiber lines.

As far as cost allocation, described above, in a partnership arrangement the electric co-operative avoids having to deal with two business funds as the partner pays the electric co-operative to "lease" lines and deals with the FTTH financing themselves.

Ultimately, the decision for electric co-operatives as to whether to follow the DIY model or enter into a partnership comes down to overall finances, build-out time, and risk. There is increased risk by bringing in a third party as the co-operative must trust that the third party has sound business practices. If the third party was to act in an improper manner, this could affect the image of the electric co-operative, as the two are "co-branded." Private third-party providers, in

the experience of electric co-operatives examined in this study, typically have a “fast-to-market” model. To return the initial investment, third party providers typically want to gain relatively rapid take rates in high-density areas. If an electric co-operative chooses the DIY approach, it can choose to build out “where they want, when they want,” and only invest in areas that are deemed sound investments before pursuing a long-term strategy for the rest of its service territory.

In terms of finances in a partnership, the electric co-operative is tasked with funding the buildout of the initial fiber network. That fiber is owned by the electric utility co-op as an asset and then parts of it are leased to a third party for retail operations. According to one electric co-operative, the cost of building a fiber “backbone” is about 80 percent of the capital cost (CAPEX). So, the question that prospective electric co-operatives must answer is, if they are going to spend eighty percent of the money (in that scenario), does it make sense to allow someone else to receive the majority of revenue and only get paid for the leased fiber so as not to have to deal with the retail broadband business itself?

6.4.3 Funding Issues

One of the primary topics that electric co-operatives state as an issue to entering the broadband business is financing the upfront cost of building out fiber networks. Funding options can be categorized under the following options:

-Low-cost external loans;

-Inter-entity loan procedures; and

-Grants and other external funding initiatives.

In terms of low-cost external loans, electric co-operatives have an established procedure for access to these kinds of funds. For financing projects that involve generation, transmission, and distribution projects; system improvements; and energy conservation projects in communities with populations of 10,000 or less, electric co-operatives can apply for loans through USDA's Rural Utilities Service (RUS) Electric Infrastructure Loan and Loan Guarantee program. These low-interest, long term loans have been a source for electric co-operatives seeking to use fiber to support their electric system operations. Through its guaranteed loan program, credit is provided by the Federal Financing Bank at interest rates set 12.5 basis points over U.S. Treasury rates and for terms of up to 35 years. Electric co-operatives, however, emphasized that these loans are designated for use by the electric business for that purpose. As such, financing a retail broadband operation would require a different financing model.

Private capital can be borrowed from CoBank, a national co-operative bank and a member of the Farm Credit System. It makes loans to agribusinesses and providers of rural power, water, and communications and serves several hundred rural electric generation, transmission, and distribution co-operatives.

Alternatively, electric co-operatives mentioned that they can navigate the financial rules contained within their power contracts to create an "interfund loan." This procedure involves the transfer of funds from the electric business "reserves" into the broadband business account provided with a requirement for repayment. Interfund loans are reported as interfund receivables in lender (electric) funds and interfund payables in borrower (broadband) funds. The exact details of how these funds should be secured for repayment as well as repayment terms and conditions involve discussion between the electric business and the power contract regulator, such as TVA. Some electric co-operatives expressed confusion regarding their ability to

undertake these loans internally. They were unsure if a fully-fledged subsidiary broadband entity would be required in order to secure the loan guarantee.

One of the biggest challenges stated by electric co-operatives in terms of financing has been their ability to secure funds made available to broadband providers for the provision of infrastructure or FTTH service. Grant initiatives such as the FCC's Connect America Fund and USDA's Community Connect grants provide these funds. Electric co-operatives have stated, however, that their "lack of experience" in the FTTH market has been a barrier to securing these funds when competing with existing providers. Electric co-operatives stated that it is much easier for them to secure funding for fiber networks that support their electric system as they have a proven history in this area. The knowledge and expertise gained through the electric distribution communications venture, while apparent to the co-operatives to be transferable to the retail broadband business, is not accounted for in retail broadband grant initiatives. As such, electric co-operatives have been advised to partner with existing FTTH entities to secure these kinds of funds. This is an issue for electric co-operatives who have chosen to pursue the DIY FTTH model.

7 RECOMMENDATIONS, LIMITATIONS OF STUDY, FUTURE RESEARCH, AND CONCLUSION

7.1 Recommendations

The primary research question that drove this study was "Should the legislative and regulatory framework in which electric co-operatives operate be updated to reflect the many changes in the electricity industry, and the way that co-ops do business, to increase co-ops ability to provide broadband network service to rural communities?" Analysis of the data collected during this study shows that the answer to this question is yes due to the following conclusions:

- There exists statutory ambiguity regarding electric co-operatives status as broadband network providers.
- Electric co-operatives have expressed that they require help in understanding internal financing procedures for non-electric ventures and improved communication with regulators could solve this issue.
- There exists concern among legislators regarding the risk to electric service when revenue is used for a new venture. This could be addressed by policy that insulates electric business from new venture risk.
- Existing funding application evaluations are primarily based on existing or prior retail broadband network experience. This does not consider electric co-operative's related experience.
- Electric regulators and distribution entities, such as TVA, have the potential to aid in broadband expansion but currently are not mandated to do so.
- Federal infrastructure policy does not currently account for electric co-operatives as a potential solution to the lack of broadband network access in rural areas.

The following section provides some recommendations regarding how these issues could be addressed.

7.1.1 Electric and Telecommunications Co-operatives: Enable an Evolving Rural Broadband Model

An interesting topic that emerged through analysis of discussion with electric co-operatives was their belief that partnering with telecommunications co-operatives is likely to be a model that increasing numbers of electric co-operatives follow. The combination of similarity of structure, rural experience, philosophy as well as different infrastructure needs makes these partnerships ideal broadband ventures for electric co-operatives. In Tennessee, electric co-operatives are seeking to partner with telecommunications co-operatives not only for their retail telecommunications experience, but also due to their access to Tier 1 backbone infrastructure. The company "iRis Networks" in Tennessee was formed by eight telephone co-operatives and one telecommunications company to create a backbone infrastructure linking the state to three internet exchange points in Georgia, Virginia, and Illinois.

By partnering with one, or multiple, of these telephone co-operatives, electric co-operatives in Tennessee not only gain the benefits associated with the partnership model but also gain access to this critical infrastructure at a reasonable rate because the partner co-operatives own the iRis network.

A successful example of a partnership between an electric and telephone cooperative can be seen in Minnesota. In 2016 Consolidated Telephone Co. (CTC) in Brainerd, MN, and Mille Lacs Energy Cooperative in Aitkin, MN, began to work together on a partnership to bring broadband to rural Minnesota. This year this partnership completed its first FTTH project. By connecting the two entities headquarters via fiber line the two entities can now work together to

connect residents along the 106 miles of fiber backbone. Millie Lacs CEO has stated that without CTCs knowledge and partnership the venture would not have gone ahead.[176]

Beyond partnerships, a new model may emerge from these relationships. In 2010 Indiana's Central Indiana Power (CIP), an electric co-operative, merged with a rural telecommunications co-operative to form a company now called NineStar Connect. During the process of planning for a smart grid project involving installation of smart meters, CIP discovered that Hancock Telephone had existing fiberoptic networks installed to many of CIP's members residences. Hancock Telephone contacted CIP to expand its fiber network to additional CIP customers and add new subscribers for its broadband services. The decision was eventually made to merge and create one singular entity that now operates with a telecommunications division and an electric division.
It is yet to be seen whether Ninestar Connect is the indicator of an emerging trend or whether it is an anomaly.

In order to facilitate these mergers, or allow for potential partnerships to be successful, states must evaluate their laws regarding electric and telephone co-operative partnerships, acquisitions, and mergers. States should remove unnecessary hurdles or barriers that could be preventing these entities from working together, however, much like the recommendations to insulate electric co-operatives from the risks of an unregulated broadband venture,[177] states should also seek to make sure that these entities have procedures in place that insulate them against the risks associated with any partnership or merger.

[176] National Rural Telephone Cooperatives, "Electric Telco Partnership." Available at https://www.nrtc.coop/rural-connect/upper-midwest-session-spotlights-electric-telco-broadband-partnership
[177] See section 7.3

7.1.2 Clarify Internal Financing Rules

One of the key areas in terms of financing broadband projects is the area of internal financing. Specifically, for co-operatives that are looking to finance the venture without a partnership. This involves securing external funds as well as being able to transfer electric revenue "reserves" from their electric business to the broadband entity. While electric co-operatives can work with their electric power regulator, in Tennessee that would be TVA, currently that is an internal dialogue between the two entities. Just as states and municipalities are seeking to produce open-source permitting procedures it would make sense, for those electric co-operatives struggling with this financing issue, to have access to template documents or industry accessible guides where the procedure for internal loans that comply with power contract Terms and Conditions are explained. At present, the advice given by regulators is for the electric co-operatives to come to them to have that discussion. For electric co-operatives that are not in frequent contact with regulatory staff this may not be an option. A shared resource distributed by the regulators to the electric co-operatives could open this dialogue and solve an issue with which many electric co-operatives struggle.

7.1.3 Create Policy to Insulate Electric Co-operatives Against Broadband Business risk

Unlike the electric utility business, which in Tennessee is regulated by a combination of TVA (as a regulatory body) and the state legislature (as both a legislative body and the base of the state's utility regulatory commission), supply of internet is largely unregulated (see chapter on FCC and "information services" et al.). Thus, a criticism of entities who are dual-investing

(supplying both energy and home internet) is that there are not sufficient policies in place to protect the utility business from the risks associated with a broadband venture.

One way to protect a utility providers energy business from the risks of a secondary broadband venture is by "ring-fencing." Ring fencing has been defined in different ways but generally involves techniques used to insulate the "credit risk of an issuer from the risks of affiliate issuers within a corporate structure."[178] In relation to electric co-operatives engaging in a broadband venture, policy should ideally focus on ring fencing mechanisms that can be employed to insulate the regulated utility (energy) from the business practices and credit risks of sometimes highly speculative, non-regulated affiliates (broadband).

There are several techniques that can be employed separately, or together, to insulate a utility from the risks of a secondary operation within the same company system. These include pro-active regulatory oversight, financial restrictions, structural separations, and operational controls.[179]

According to a report by Standard and Poor[180] there are three internal mechanisms that an entity can use to insulate its regulated utility from the risks associated with an unregulated venture:

> 1. A special "Structure," often including a "special purpose entity." This is a way of financially structuring a business in a way that reduces the risk of a subsidiary being pulled into bankruptcy along with its parent.

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[178] Bonelli, Sharon, Yee, Mona, CFA, and Lapson, Ellen, CFA (2003)." Corporate Finance, Rating Linkage Within U.S. Utility Groups, Utilities, Holding Companies and Affiliates." Fitch Ratings: Global Power/North America Special Report, April 9.
[179] *Ibid.* at 4.
[180] Venkataraman, Swami, Standard and Poor's (2003). Holding Company Diversification and Its Impact on Regulated
Operations. Speech before the *NARUC Staff Subcommittee on Accounting and Finance*, Reno, Nevada, March 26.

2. A tightly drafted set of covenants or rules including dividend tests, negative pledges, non-petition covenants, prohibitions from creating new entities, restrictions on asset transfers, and inter-company advances that serve to protect the financial well-being and autonomy of the ring-fenced subsidiary.

3. Securing collateral debt so that an internal debt is fully secured by a pledge of all or substantially all the assets of the subsidiary. In this arrangement the "parent" or the electric business, in principle, has less obligation to deal with the assets of the subsidiary.

However, according to analysts' internal policies are weaker than those mandated by law, regulation or contract because the corporation may adjust its policies at will. [181]

Outside of internal corporate policy, states and the federal government could impose policies that restrict the risks associated with a utility or electric co-operative's subsidiary broadband venture.

Three states currently operate regulatory insulation mechanisms:

The Wisconsin Commission has explicit statutes governing the energy utility/affiliate relationship. Statute 196.795(5)(g) requires that "no holding company system may be operated in any way which materially impairs the credit...of any public utility affiliate." Statute 196.795(5)(c) and (d) prohibit a utility from lending money to or guaranteeing any obligations of its parent holding company or any nonutility affiliates. Statute 196.795(6m)-Asset Cap, limits non-utility investments to 25 percent of public utility assets with certain exceptions. Statute 196.795(5) also includes provisions limiting subsidies between the utility and nonutility affiliates. Statute 196.52 relates to relations with affiliated interests and Commission control of

[181] Bonelli, Sharon, Yee, Mona, CFA, and Lapson, Ellen, CFA (2003). Corporate Finance, Rating Linkage Within U.S. Utility Groups, Utilities, Holding Companies and Affiliates. Fitch Ratings: Global Power/North America Special Report, April 9.

affiliate contracts. Statute 196.80 requires Commission approval for an energy utility to merge, consolidate, acquire the stock of any other public utility, or sell, acquire, lease, or rent any public utility plant or property constituting an operating unit or system. Statute 196.795(3) regarding "takeovers" requires commission review and approval before allowing anyone to own more than 10 percent of the outstanding voting securities of the holding company. Statute 201.03 requires that utility security issuances be approved by the Commission prior to the issuance of such securities and that the use of proceeds must be related to utility operations. Finally, Statute 196.795(4), for utilities in an energy holding company system, and 201.11 authorize the Commission to order a utility to cease paying dividends on its common stock when there is a finding of "capital impairment."

The Oregon Commission placed certain conditions in its Order approving the Portland General Electric Company (PGE)/Enron merger.[182] Most notable, "PGE must maintain the common equity portion of its capital structure at 48% or higher unless the Commission approves a different level and must notify the Commission of certain dividends and distributions to Enron."[183]

The Virginia Commission also has explicit statutes regarding utility/affiliate relationships. Chapter 3 (§56-58) of Title 56 of the Code of Virginia requires that utility security issuances be approved by the Commission prior to the issuance of such securities. The use of proceeds must be related to utility operations. Additionally, Chapter 3 (§56-59) and Chapter 4 (§56-82) require that utilities, prior to assuming obligations as a guarantor, seek Commission approval for such guarantees. Chapter 4 (§56-82) requires utilities to gain Commission approval

[182] UM 814, Order 16-427, In The Matter Of The Application Of Enron Corp For An Order Authorizing The Exercise Of Influence Over Portland General Electric Company, A Public Utility.
[183] *Ibid.*

for affiliate loans. Chapter 4 (§56-83) authorizes the Commission, under certain circumstances, to prohibit a utility from paying dividends to an affiliate. Chapter 5 requires that prior to the change in ownership or control of: (1) a utility operating in Virginia, (2) any utility asset located in Virginia, or (3) utility securities occurs, Commission approval must be obtained. Under SEC Rule 53(c) of the Public Utility Holding Company Act, the Virginia Commission has been able to get utilities to agree that measures will be taken if bond ratings fall to certain levels. These conditions were based on the above-mentioned statutes.

In summary, of the three states that mentioned, two rely upon state statutes for their regulatory insulation. The third relied on conditions in a merger that indirectly is dependent upon state authority over mergers.

At a federal level the Federal Energy Regulatory Commission (FERC) does have some regulatory oversight regarding internal financing of energy companies. However, at present electric co-operatives are exempt from FERC oversight. If the federal government were to impose legislation regulating electric co-operative operations it could take guidance from FERCs existing ring-fencing mechanisms. Namely that[184]:

1. Utility companies seeking authorization to issue secured debt backed by a utility asset must use the proceeds of the debt for utility purposes only.

2. If any utility assets that secure debt issuances are "spun off," the debt must follow the asset and also be "spun off."

3. If any of the proceeds from unsecured debt are used for nonutility purposes, the debt must follow the nonutility assets. If the nonutility assets are "spun off," then a proportionate share of the debt must follow the "spun-off" nonutility asset.

[184] FERC, "Regulation of Cash Management Practices," Docket No. RM02-14-000.

4. If utility assets financed by unsecured debt are "spun off" to another entity, then a proportionate share of the debt must also be "spun off."

7.1.4 Amend Funding Avenues [185]

One of the key drivers for amending funding avenues is for loan or grant processes to consider electric co-operatives' desire to enter the retail broadband market. Currently, many funding avenues are designed to fund electric system projects. These funding avenues could be amended to consider the experience, skills, and resources electric co-operatives have developed that apply to the retail broadband project and to direct finances towards that purpose. For example, loan or grant applications could be amended so that the purpose of the loan or grant could be for either electric system communication projects or retail broadband projects associated with that infrastructure. Questions contained within these application processes could be amended to account for experience developed by the electric co-operatives that are transferable to the retail broadband project. For example, instead of asking electric co-operatives to "outline their experience, knowledge, and resources regarding retail broadband provision" the application could ask entities to "outline experience, knowledge, and resources that could apply to the provision of a successful retail broadband project." In this way electric co-operatives, and other electric utility entities, can show which of their experiences, knowledge, and resources developed via the electric communications systems are transferable to a retail broadband project.

[185] The following section also provides and answer to RQ4. How can the broadband funding process be revised to reflect electric co-operative's entry into the telecommunications marketplace?

7.1.5 Update State Law

As was shown in the chapter analyzing the statutory status of electric co-operatives in all 50 states, most (n=32) state legislation still refers to electric co-operatives as electric energy providers only. This research has shown that electric co-operatives have evolved from electric utility providers into the telecommunications market. Whether this is through the purchase and resale of telecommunication service through lease arrangement or via the process of offering broadband service to their members. As such, state law should be updated to reflect this change in status. As a template Tennessee's 2017 Broadband Accessibility Act gives other states a source of knowledge with which to implement updates to their own statutes or codes.

7.1.6 Update Federal Law

Two issues regarding federal mandates and the Tennessee Valley Authority are apparent from this research.

Given that the TVA Act mandates the Tennessee Valley Authority to ensure access of availability to electricity at as low rates as possible, it is not in TVA's mandate to account for broadband access. As such the decisions made by TVA about electric co-operatives or other regulatory issues (such as pole attachment rates that could contradict the FCCs broadband deployment mandate) are designed to protect this original mandate. This has the effect of pitting the interest of electric rate payers against the interest of those lacking broadband access in rural areas.

Secondly, it has been stated by TVA that they have close to 4,000 miles of fiber optic cables across seven states that could be made available to aid providers in connecting rural areas. Currently, given TVA's federal mandate, this fiber is allocated to improving and supporting

TVA's electric distribution system. By the very nature of electric system communication networks, as has been experienced by electric co-operatives, this results in the distribution of miles of unused "dark fiber."

A simple fix to align the needs of rural electric customers with those who lack broadband access would be for congress to amend federal legislation with regards to entities such as TVA to expand their mandate to include broadband communications. For example, congress could amend Section 10 of the TVA Act to state that (changes in bold):

> The Board is hereby empowered and authorized to sell **or lease** the surplus power **and fiber optic cable** not used in its operations, and for operation of locks and other works generated by it, to States, counties, municipalities, corporations, partnerships, or individuals, according to the policies hereinafter set forth; and to carry out said authority, the Board is authorized to enter into contracts for such sale **or lease** for a term not exceeding twenty years, and in the sale of such current **or lease of fiber** by the Board it shall give preference to States, counties, municipalities, and co-operative organizations of citizens or farmers, not organized or doing business for profit, but primarily for the purpose of supplying electricity **or broadband service** to its own citizens or members…
>
> …Provided further, That the Board is hereby authorized and directed to make studies, experiments, and determinations to promote the wider and better use of electric power **and broadband internet service** for agricultural and domestic use, or for small or local industries, and it may co-operate with State governments, or their subdivisions or agencies, with educational or research institutions, and with co-operatives or other organizations, in the application of electric power **and broadband internet service** to the fuller and better balanced development of the resources of the region…

These changes would not only reflect the potential of TVA to enable vast improvements to rural broadband access to other states, but it would also mandate TVA to consider broadband service alongside electric service and not as a competing issue. These recommendations also could be mirrored in other federally mandated electric utility systems such as the Bonneville Power Administration, Southeastern Power Administration, Southwestern Power Administration, and the Western Area Power Administration.

7.1.7 Improve Federal Policy

The most recent update to federal policy in relation to rural broadband networks came in the form of the Department of Commerce's NTIA "American Broadband Initiative Milestones Report."[186] Mandated by Congress, this report reflects the key target areas of the current federal government, namely:

1) That government processes should be clear and transparent
2) That government assets should be made available to benefit network expansion.
3) That the federal government should be fiscally accountable to taxpayers when it comes to infrastructure spending.

The report highlights future actions that should be taken to aid in the expansion of broadband networks into rural and underserved areas. This includes:

- Investing in private sector deployment of broadband infrastructure through $600 million dollars in USDA broadband awards targeted at unserved rural areas.
- Making available to broadband providers the over 7000 towers operated by the Department of the Interior to host broadband equipment.
- Streamlining the process for commercial use of federal assets for network deployment.
- Streamlining the permitting process for commercial deployment of broadband equipment on federal assets.
- Agencies such as the National Science Foundation, Census Bureau, and FCC will continue to collect better data on broadband availability and make use of federal funds to support key target areas such as telemedicine, library access, and access for minorities and those of low-income.

Of note in the federal governments policy is its advocacy for the use of federal assets (towers, buildings, land etc.) for the deployment of broadband network equipment. It makes sense to utilize existing infrastructure especially in areas where the federal government has a large presence. For example, in many rural areas, the main landholders and managers are the

[186] NTIA, American Broadband Initiative Milestones Report, February 13, 2019. Available at https://www.ntia.doc.gov/report/2019/american-broadband-initiative-milestones-report

federal government in the form of the national parks service. The ability to host equipment on towers and buildings operated over these large areas, such as the Smoky Mountain National Park would help to bridge gaps currently unavailable to providers who do not currently have access to that land or its assets.

This theme of utilizing existing infrastructure for broadband network expansion ties neatly into the outcomes of this study. In rural areas we have in electric co-operatives and other power operators the same opportunities held by the federal governments across their assets. That is an existing infrastructure that can be built upon to expand broadband network service into rural areas. From this study we can see that electric co-operatives are not building broadband networks from scratch. These networks are additions to their existing power systems. The poles and equipment necessary to construct broadband networks and the backbone necessary to support a home retail broadband system are structures that exist within these power systems that need only to be built onto. The one thing that these electric co-operatives primarily lack is the "risk free" funds necessary to expand their existing networks to support home residential service. The current risk is inherently tied to the use of electric purpose funds in support of a broadband expansion service.

A key recommendation from this study would be for the federal government to support the expansion of broadband networks into rural areas by expanding on the existing assets not only of the federal government but of the electric co-operatives and other power companies that supply electricity to these areas already. The federal government could learn from the New Deal policy of releasing fixed rate, government assured, long-term loans to these entities, for the primary purpose of expanding broadband service into rural areas. A New Deal for the 21st

century, expanding on the successes of the past and bringing a broadband future to rural America.

7.2 Limitations of Study

This study was limited in its scope in that it focused primarily on electric co-operatives potential to expand broadband networks into rural areas and not on broadband service. As such, it is necessary to clarify that this study did not evaluate in depth the ability of electric co-operatives to perform the role of broadband service providers. Analysis of this role would need to consider their actions as service providers as well as a survey of customer/member opinion of this role.

Consumer or member experience was not a focus of this study. It did not identify the opinions, or gather feedback, from electric co-operative members as to the role of electric co-operatives in expanding broadband networks into rural areas or of offering broadband service to members.

Given the size of the electric co-operative industry it was not possible to adequately represent the opinions and experience of the entire industry from the data collected during this study. The data collected and analyzed gives a good approximation of the current opportunities and challenges faced by electric co-operatives entering the broadband market. There does exist, however, a large amount of data that is not represented in this study and that has the potential to be valuable in expanding the body of knowledge in this field.

7.3 Potential for Future Research

The following research questions could inspire future studies in this area:

1. How successfully have electric co-operatives implemented broadband network projects?

2. Have broadband ventures been beneficial or disadvantageous to electric co-operatives?

3. What has been the economic or social impact of electric co-operatives expanding broadband networks into rural areas?

4. Should electric and telephone co-operatives merge or partner to offer broadband service to rural areas?

5. How have changes to federal or state policy regarding electric co-operatives impacted the expansion of broadband into rural areas?

6. How can the experience of mixed utility providers internationally inform potential mixed utility providers in the United States?

7. If all electric providers in the United States were to offer broadband network service what would the potential impact be?

8. How could the experience of electric utility providers in the United States inform federal or state broadband policy?

9. How do electric co-operatives or other electric utilities reflect on their experience of applying for federal or state funding and how could this inform better funding policy or practice?

7.4 Conclusion

Electric Co-operatives due to their existing rural infrastructure, access to a large member base, and experience in delivering service to rural areas present an excellent opportunity to expand broadband networks into rural areas. This study has identified various issues that could be hindering these entities from entering the broadband network market.

By addressing statutory ambiguity regarding electric co-operatives status as broadband network providers, state and federal legislators can clarify this issue as well as highlight publicly their intent to utilize electric co-operatives to address the issue of broadband network availability in rural areas. Electric co-operatives and regulators can work together to solve internal financing issues to ensure broadband ventures account for the preservations of electric service. Existing services can also be protected by legislators and industry members working together to create policy that insulates electric businesses from new venture risk. Access to broadband network funding can be addressed by amending existing funding initiatives to account for electric co-operative's related experience as well as the government providing electric co-operatives access to long-term, low-rate loans. An examination of the history of electric service expansion in rural areas showed that the New Deal was a successful example of government backed infrastructure funding and much can be learned from that experience. Electric regulators and distribution entities, such as TVA, have the potential to aid in broadband expansion but currently are not mandated to do so. Updating these mandates to include broadband would allow these entities to support broadband network expansion in tandem with electric service and not as a competing service.

Addressing these issues would help to support and incentivize electric co-operatives to expand broadband networks into rural areas. The potential for electric co-operatives to help solve the United States' rural broadband network access issues is apparent. If community stakeholders, policy-makers, and regulatory bodies would take the necessary measures to help co-ops transition into the broadband network marketplace, this would enable electric co-operatives to do for rural broadband access today what they did for electricity in the 20th century. Furthermore, this would show a significant investment in rural communities

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APPENDIX

Electric Co-operative Elements

Each customer of an electric co-operative is a "member-owner." Members elect a board of directors from the membership and each member has one vote. They are generally incorporated under state statute or code and are granted federal tax-exempt non-profit status under IRC section 501(c)(12). To comply with this status, 85 percent or more of their annual income must come from member-owners.

Electric co-operatives aim to operate "at cost." To fulfil operations and initiatives costs, they generally accumulate equity capital. When revenues exceed expenses, net earnings are returned to member-owners via patronage returns. Each member-owner is allocated an amount of "capital credit." These are allocated to member accounts but retained by the co-operative until a specified retirement time. In most cases, retired capital credit is returned to members via utility bill deduction.

The IRS has set the following requirements for electric co-operatives:

a) Ditch and irrigation companies, telephone companies, electric companies, and "like organizations" that seek exemption under IRC 501(c)(12) must be organized and operated as mutual or co-operative organizations. The terms "mutual" and "co-operative" have no legal distinction for purposes of section 501(c)(12). The U.S. Tax Court has defined "co-operative" as, "A co-operative is an organization established by individuals to provide themselves with goods and services or to produce and dispose of the products of their labor. The means of production and distribution are those owned in common and the earnings revert to the members, not on the basis of their investment in the enterprise, but in proportion to their patronage or personal

participation in it."[187] Additionally, the court has described the organizational and operational co-operative principles as follows:

> 1. The organization must periodically hold democratically conducted meetings with members. Election of officers must be on a one member, one vote basis. Meetings must have a quorum of members in attendance or voting by proxy.[188]
>
> 2. The organization must allocate all excess operating revenues (excess of revenue over expenses) among the members.[189]
>
> 3. The organization must ensure that those who contribute capital neither control the operations nor receive most of the financial benefits. The organization will meet this requirement by ensuring that the members control and own the savings or monetary benefits rather than the shareholders or equity investors.

The IRS also sets out additional organizational and operational co-operative requirements that an organization must meet for exemption under IRC 501(c)(12) . These requirements are:

> 1.The organization must keep adequate records of each member's rights and interests in its assets.[190]
>
> 2. The organization must distribute any savings to members in proportion to the amount of business done with them based on the "operation at cost" principle.[191]
>
> 3. The organization must not retain more funds than it needs to meet current losses and expenses.[192]

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[187] 7 Ency. Am. 639 (1957)
[188] Puget Sound Plywood, Inc. v. Commissioner , 44 T.C. 305 (1966), acq. 1966-2 C.B. 6.
[189] *Id.*
[190] IRC 501(c)(12)
[191] *Id.*
[192] *Id.*

4. The organization cannot forfeit a member's right and interest in the organization upon termination of membership.[193]

5. Upon dissolution, the organization must distribute the gains from the sale of any appreciated assets to all persons who were members during the period that the organization owned the assets, in proportion to the amount of business done by the members during that period.[194]

A co-operative exempt under IRC 501(c)(12) must obtain 85 percent or more of its income from members. The "85-percent member income test" requires that the income be derived from members and used to pay for services listed in IRC 501(c)(12). The 85-percent member income test is computed each tax year. If in any year the member income falls below 85 percent of the total income received that year, the organization is no longer exempt under IRC 501(c)(12) for that tax year and must file a corporate tax return.

[193] *Id.*
[194] *Id.*

VITA

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