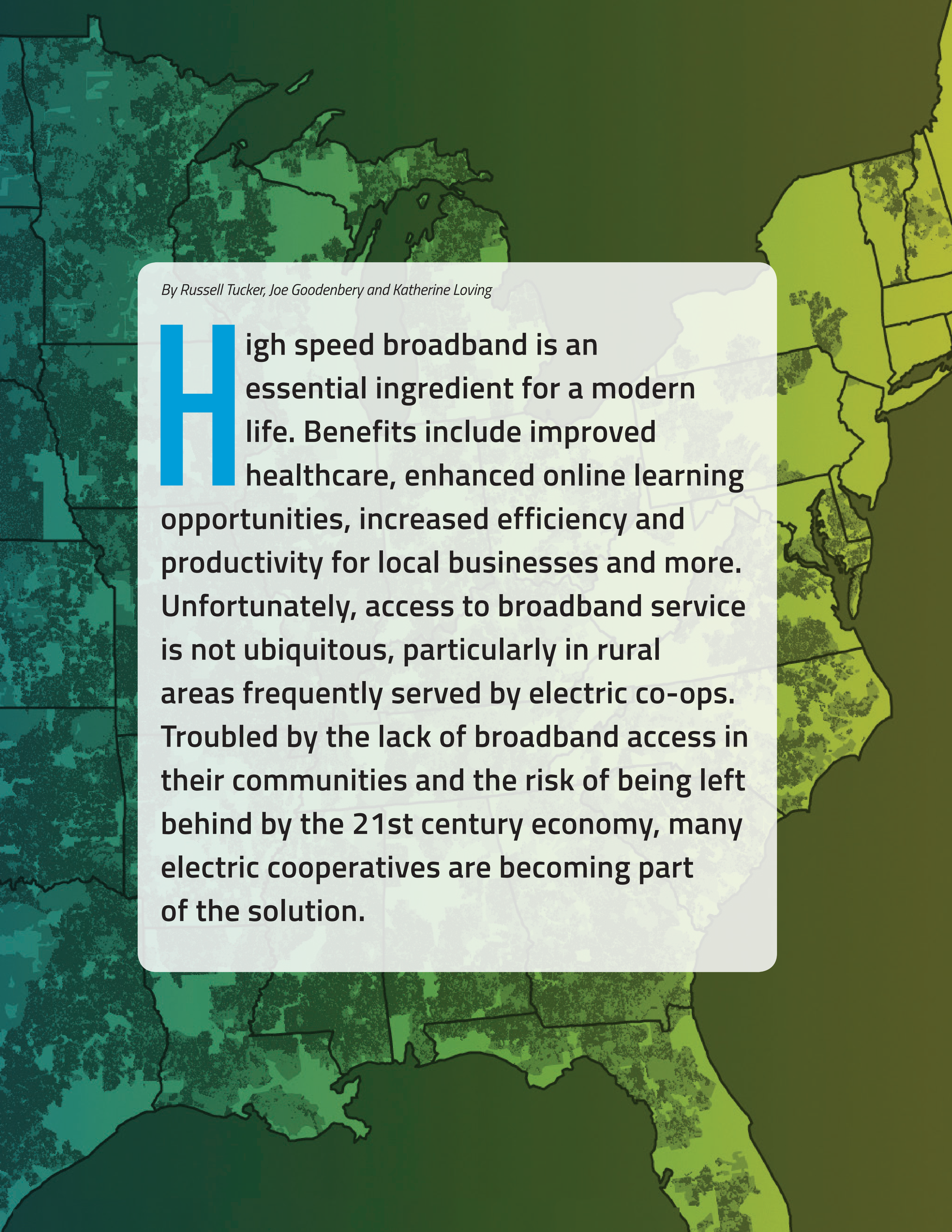
THE DIGITAL DIVIDE

Electric co-ops can provide last-mile broadband to rural American



By Russell Tucker, Joe Goodenbery and Katherine Loving

High speed broadband is an essential ingredient for a modern life. Benefits include improved healthcare, enhanced online learning opportunities, increased efficiency and productivity for local businesses and more. Unfortunately, access to broadband service is not ubiquitous, particularly in rural areas frequently served by electric co-ops. Troubled by the lack of broadband access in their communities and the risk of being left behind by the 21st century economy, many electric cooperatives are becoming part of the solution.

The Digital Divide

The digital divide refers to the economic, educational and social inequities between those with online access and those without.[1] According to the U.S. Federal Communications Commission (FCC), 34 million Americans currently lack broadband internet access.[2] Rural areas, in particular, lag behind, with 39 percent of rural Americans lacking access to broadband service compared to just 4 percent of urban Americans.

This trend is similar for areas served by electric cooperatives. There are approximately 6.3 million households, totaling 13.4 million people, without access to broadband internet service in electric co-op communities. And weaknesses in the FCC's data suggest the actual number of electric co-op consumers without broadband access may be far greater.[3]

Thirty-four million Americans currently lack broadband internet access.

Figure 1 maps the census blocks located within electric co-op service territories that do not have access to broadband service. As shown in the map, electric co-op areas without broadband service exist in all 47 states where electric co-ops operate.[4] This highlights that broadband access is a widespread, multi-state issue. Without adequate, high speed broadband, electric co-op service areas will be left behind, or worse, may not survive.

Broadband benefits outweigh deployment costs

On average, electric cooperatives serve eight consumer-members per mile of electric distribution line. In these low-density areas, the broadband deployment costs per customer are high and private returns alone may not justify the capital investment required for broadband deployment. This is largely due to the significant gap between private carrier returns and consumer benefits from broadband investment.

The absence of broadband service means that electric co-op consumer-members lose out on the benefits associated with broadband access. The total value of these lost benefits can be quantified by estimating the consumer surplus in areas with broadband service. Consumer surplus is the difference between the total amount that consumers are willing and able to pay for a good or service and the total amount that they actually pay. One approach to computing consumer surplus involves estimating demand curves by looking at variations in prices households paid for broadband service at different places and times. From the demand curves, researchers can then determine an implicit household willingness to pay and the resulting consumer surplus.[5]

One recent and widely-cited study published by Econometrica in 2016 employs this approach to calculate the consumer surplus associated with the purchase of broadband service at various speeds and service options.[6] Based on these estimates, an average consumer surplus of $1,950 per household is used to calculate the annual economic value of forgone benefits for underserved households in electric cooperative service areas.[7] Multiplying this estimate by the 6.3 million co-op households currently without access to broadband service, and

1 https://www.merriam-webster.com/dictionary/digital%20divide.

2 Federal Communications Commission, 2016 Broadband Progress Report, GN Docket No. 15-191, January 2016. Service at download speeds of 25 megabits per second and upload speeds of 3 megabits per second (25/3 Mbps) is the current benchmark used by the FCC to define high speed broadband service.

3 According to the National Telecommunications Information Administration, a provider offering service to any homes in a Census block is instructed to report that block as served even though it may not offer broadband services in most of the block. This can lead to overstatements in the level of broadband availability, especially in rural areas where Census blocks are large. Moreover, there is no independent validation or verification process for the self-reported data from providers. Federal Register, Vol. 83, No. 104 (Wednesday, May 30, 2018) at 24748.

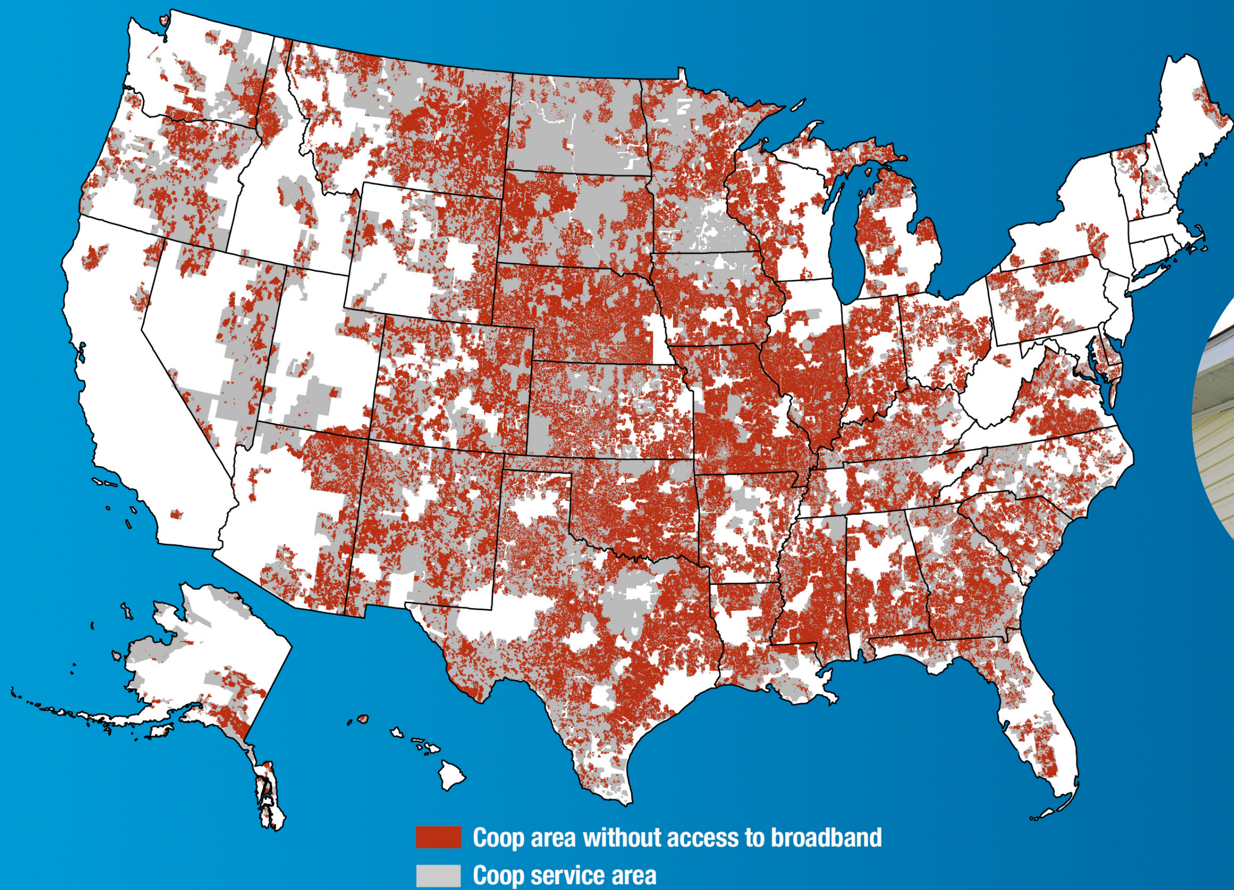
4 Depending on state law, electric cooperatives may or may not have authority to provide retail broadband services.

5 S. Greenstein and R. McDevitt, *Measuring the Broadband Bonus in Thirty OECD Countries*, OECD Digital Economy Papers, No. 197, OECD Publishing, 2012.

6 Aviv Nevo, John L. Turner, and Jonathan W. Williams, "Usage-Based Pricing and Demand for Residential Broadband," *Econometrica, 84*(2), 2016.

7 Our assumption of $1,950 per household is based on the average of two consumer surplus values calculated by Nevo et al. (2016), one for unlimited broadband service at 10 Mbps and one for unlimited broadband at service speeds approaching 1 Gbps. This estimate is similar in magnitude to the value of $1,850 per household assumed in Rembert et al., *Connecting the Dots of Ohio's Broadband Policy*, The Ohio State University Swank Program in Rural-Urban Policy, April 2017.

Figure 1: Electric Co-op Service Areas without Access to 25/3 Mbps Broadband



Millions of electric cooperative consumer-members lack adequate broadband service. Map: NRECA . Photo: Roanoke Electric Cooperative

adjusting for a 49 percent adoption rate,[8] results in an estimated forgone consumer value of $6 billion per year. Moreover, because the advantages of broadband are not simply a one-time benefit, but rather occur continuously over time, the long-term present value of these benefits would total $68 billion over 20 years.[9] These benefits represent the potential value of broadband access not yet available to electric cooperative consumer-members. Importantly, the deployment of broadband to electric co-op service areas will also enable wide-ranging community benefits.

Taking the consumer surplus value into account, rather than just private returns to carriers, the total benefits of broadband service are likely to exceed the costs of deployment. For example, the FCC estimates that it would cost $40 billion to deploy fiber-based broadband to most of the underserved locations in the U.S. and achieve 98 percent coverage nationwide.[10]

Meeting tomorrow's energy needs

America's electric cooperatives are adopting new tools and technologies as they work to meet tomorrow's energy and technology needs. Increasingly, smart grid applications require two-way data flows between meters, substations and supervisory control architecture. Electric co-ops are turning to broadband backbones to transport this data, optimize operations and meet evolving consumer expectations. [11]

8 The adoption rate refers to the percentage of households with access and who take service. The FCC reports that the adoption rate from broadband service in non-metropolitan areas is 49%. *FCC Broadband Deployment Report 2018.*

9 Based on a 7% discount rate as employed in Rembert et al. (2017) and 20-year life-span.

10 Paul de Sa, *Improving the Nation's Digital Infrastructure*, U.S. Federal Communications Commission, January 17, 2017.

11 *The Value of a Broadband Backbone for America's Electric Cooperatives*, NRTC, NRECA, and Ericsson, 2018. See Telecommunications & Broadband Resources at https://www.cooperative.com/topics/telecommunications-broadband/Pages/default.aspx.

A broadband backbone communications system connects critically important smart grid infrastructure. Importantly, it provides backhaul transport—the delivery of data collected by the co-op's other communications networks to a central location to support analysis and decision-making. A broadband backbone communications system unlocks this value and enables improved operational performance while potentially creating opportunities to expand broadband to electric cooperative communities.

The backbone is capital intensive and costly to build. It is often made up of high-count fiber cables. It not only enables the co-op's smart grid operations, it also enables internet connectivity. An electric cooperative that builds a broadband backbone to support its electric operations can potentially leverage this investment in a cost-effective way to support the buildout of a retail broadband network to its consumer-members where permitted by state law.

Economies of scope exist if it is cheaper to produce multiple products within a single firm than it is to produce each product in a separate firm.[12] For example, a co-op leveraging and building a retail network off of its broadband backbone is likely to be less costly than building a retail network independent of the co-op's backbone. Alternatively, the co-op may choose to lease excess capacity from its backbone to a third party retail broadband entrant. In either case, economies stem from the joint use of the backbone to support both electric operations and retail broadband service.

Similarly, electric co-ops own poles, trucks and other equipment, and employ technicians. Allocating the costs of these resources between electric and broadband operations when possible offers additional opportunities to achieve cost reducing economies of scope. These cost sharing dynamics suggest that co-ops can play a vital role in deploying broadband in their communities, and the co-op business model ensures that co-op members in these communities will own and control these resources and benefit from their operations.

In this way, electric cooperatives are becoming part of the solution. For example, Roanoke Electric Cooperative (REC) sought to enhance its backbone communications to support the development of its smart grid operations. Member interest convinced REC to pursue retail broadband access for its unserved communities.

Case Study: Roanoke Electric Cooperative[13]

Roanoke Electric Cooperative (REC) serves 14,500 consumer-members across five counties in northeastern North Carolina, 95 percent of which are residential. The cooperative maintains 2,000 miles of electric distribution lines. All counties served by REC have low population densities and are deemed "distressed counties" by the state of North Carolina.

In 2014, REC began planning to build a smart grid infrastructure that included the deployment of a high-speed communications system necessary to operate the utility of the future. As the first phase of a long-term plan to create a broadband backbone network to facilitate electric operations, REC connected its twelve substations to its offices by deploying 200 miles of fiber-optic lines at a cost of $4 million. One Community Development Block Grant has so far been obtained and REC is actively exploring other potential funding sources to finance its expanded broadband infrastructure.

Nearly 60 percent of REC's cost of service is in its wholesale power supply costs. The co-op adopted a cost avoidance strategy by actively pursuing advanced distribution optimization technologies. As REC's CEO Curtis Wynn puts it, "Broadband communications are a critical part of realizing these wholesale costs saving opportunities. Distribution reliability and resiliency are equally important. Features such as proactive outage identification—which enables the co-op to respond before an outage is even reported by an affected member—

12 W. Kip Viscusi, John M. Bernon, and Joseph E. Harrington, Jr., Economics of Regulation and Antitrust, 2nd Edition, The MIT Press, Cambridge, MA, 1995, p. 356.

13 Taken from Eric P. Cody, "Broadband Case Study: Roanoke Electric Cooperative," NRECA, April 2018. For additional information on this case study and others, see Telecommunications & Broadband Resources at https://www.cooperative.com/topics/telecommunications-broadband/Pages/default.aspx.

and innovative member services such as online billing and new payment options are not possible without a broadband communications infrastructure."

The co-op's initial plan was to leverage its fiber backbone and establish an open access network by creating a fiber ring and leasing dark or unused fiber to Internet Service Providers (ISPs) and other telecom players. REC subsequently decided to explore the possibility of providing last-mile broadband services to members. A pilot test involving 60 consumer-members was undertaken in April 2017 to evaluate fixed wireless networking equipment and member acceptance/satisfaction. Participants received free, high-speed Internet access, water heater demand controls and Ecobee3 smart thermostats.

The value of offering members broadband service, while not the initial driver behind REC's broadband investment, became apparent after the pilot test proved successful and highly popular. REC formed Roanoke Connect, a new wholly-owned for profit subsidiary focused on leveraging REC's network backbone to deliver broadband access to underserved communities. Prior to Roanoke Connect, REC's service territory had very limited broadband access. The fiber-optic network that REC deployed to enhance its own operations became the foundation of a subsequent plan to roll out an all-encompassing, high-speed internet service to homes and businesses in and around the communities REC serves. Roanoke Connect plans to fully deploy broadband service to enable edge-of-grid demand-response devices (water heater controls and smart thermostats initially). Last-mile connections to member premises are wireless.

Overall, the business model is primarily that of a conventional electric utility whose distribution assets are being leveraged by advanced technology, namely high-speed telecommunications. REC owns and operates the broadband backbone network and provides support related to the co-op's demand response and system automation programs. As such, related capital costs are rate-based as with other investments for system improvement. Roanoke Connect's projected take-rate is approximately 30 percent of members, which may be conservative given that as much as 70 percent of its members

An April 2017 pilot helped Roanoke Electric Cooperative in northeastern North Carolina determine the feasibility of providing last-mile broadband service to members.
Photo: Roanoke Electric Cooperative

have no other viable broadband solutions. It is unlikely that incumbent service providers would have viewed expansion of existing telecom services or upgrades as attractive.

The utility of the future

The digital divide has left millions of electric cooperative consumer-members without adequate broadband access, leading to nearly $70 billion in lost value. The communications requirements associated with advancing smart grid applications is steering many electric cooperatives to invest in broadband to support their electric operations. Increasingly, electric cooperatives are seeing opportunities to leverage their broadband investments to support retail broadband deployment and to provide value to their members, thus helping to bridge the digital divide in rural America.

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