

An ADTRAN White Paper



# Lighting up the 21st Century

Electric Utility Providers Powering Their  
Communities Through Fiber Broadband

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## Introduction

Gigabit broadband, fiber-optic cable, and economic development go hand in hand today for a growing number of rural electric utility providers and their communities. Over 100 electrical cooperatives in the United States are now actively engaging in the deployment of fiber to their communities this year alone, according to the National Rural Electric Cooperative Association (NRECA), which represents more than 900 members. There are many different models for deployment, reflecting the diverse resources and needs of the local towns and counties they serve.

This white paper examines the fiber access journey that many communities have taken and concludes that rural America sees gigabit broadband as necessary today as electricity was in the 20th Century. Executives from electric utilities across the United States were interviewed to discuss their decision process for fiber deployment, infrastructure considerations in the physical build, initial services offered, near- and long-term economic benefits, and future expectations of what fiber investment will provide for their communities.

## It All Begins with the Fiber

Fiber-optic cable provides the most secure communications solution for monitoring and controlling electrical systems. Electric utility use of fiber is perhaps best known for supervisory control and data acquisition (SCADA) for existing infrastructure, with the ability to upgrade to a true Smart Grid for reducing power outage frequency and generating less overall customer downtime. Fiber also provides a future-proofed infrastructure to incorporate renewables and power storage.

A Smart Grid delivers significant benefits to businesses and residences by mitigating downtime and shortening the length of power outages. Over a 10-year period, EPB, formerly the Electric Power Board of Chattanooga, in Tennessee, reduced the number of outages in its service area by 50 percent through its Smart Grid. "The cost of power outages to a community the size of Chattanooga is \$100 million per year," said Katie Espeseth, vice president of new products, EPB. "That's lost productivity. If you are keeping business up and going, you are still ringing credit cards."

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But utilities are not simply pulling fiber for electrical grid enhancement. Rural communities want the same high-speed gigabit broadband as big cities, recognizing it as an economic necessity to attract and retain businesses and return children back to the towns in which they grew up. For electric co-ops, they benefit from diversifying their revenue stream outside of a sole-source dependence on electric rates, while also being assured that fiber will provide a path for other revenue and value-added services in the future.

The economic benefits of fiber are real and documented with studies by the University of Tennessee and Purdue University. These studies show a four-to-one ratio of return on investment in rural areas deploying fiber to their communities. Findings by the NRECA and others bear out the beneficial economic, and social impact fiber broadband provides to communities as well as the detrimental effects if broadband isn't available. NRECA estimates more than \$68 billion of lost consumer-membership value across electric co-ops due to lack of broadband. Moreover, businesses of all sizes are naturally going to stay in or move to areas based on high-speed broadband availability and reliable grid management with infrequent power outages.

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## Deciding to Deploy Broadband: Grid Needs + Subscriber Demands

Deployment of fiber into rural communities is an economic investment for today and the future. Electric utilities are aware of the numerous benefits fiber brings to the table for Smart Grid implementations, including a high level of physical network security, high reliability, low latency, enough bandwidth to support current and future applications, and the ability to upgrade the network through electronics replacement. Existing copper facilities are not a viable option due to the lack of investment in what is considered by many local service providers as “legacy” infrastructure, while wireless solutions, although possible as an alternative option, are best reserved for limited, circumstances that prohibit fiber deployment.

Electric utility provider needs alone aren’t enough to justify the cost of even a limited fiber deployment for monitoring equipment. Rolling trucks, digging trenches, and putting cable on poles are expensive, with the labor being the single largest cost for fiber deployment. Implementation of a true Smart Grid complete with real-time monitoring of all key elements down to customer metering only increases labor costs and capital further without an immediate return on investment.

Every utility interviewed said customers wanted high-speed broadband with the same capabilities and speeds available in urban areas—and therein lies the compelling reason why fiber is needed. Utility customers may not have strong feelings about Smart Grid technology, but gigabit broadband speeds are a concrete desire for nearly all. Having high-bandwidth service keeps existing businesses from leaving and attracts new businesses, bringing in more investment and generating more taxes for local governments.

An equally sound economic — yet arguably sentimental — reason for launching high-speed fiber among interviewees was to build an environment whereby college students can return to the communities in which they grew up rather than staying in the metro areas where they went to college. “Instead of moving on, they can come back home,” said Luke Johnson, operations and broadband manager of Meeker Cooperative Light & Power Association in Litchfield, MN.

Across the country, existing rural broadband options, such as satellite, cable, and incumbent telco copper DSL, oftentimes face deficiencies in speed and quality of experience. Incumbent broadband service providers in rural areas have no incentive to improve the quality of service since they are the only option available. Each utility provider interviewed noted that despite complaints by customers to their incumbent communications providers, there was a lack of responsiveness in resolving service problems. Incumbents provided no improvements in broadband speeds, or worse, regularly increased prices without improving service quality. In every case examined, utility customers wanted broadband alternatives and competition rather than to be left at the mercy of a monopoly.

The decision for a fiber deployment is not made lightly or spontaneously, given the expense and necessary commitment for financing a project and the long-term commitment an organization will make to own and operate it. Electric utilities considering fiber projects conduct customer surveys and marketing surveys followed by studies on costs and financial viability. Issues examined include what services customers might want other than broadband, such as voice and video, customers satisfaction with existing broadband options, potential take rates for new broadband service offerings, and the action taken by existing service providers when challenged by a utility-based broadband offering.

“Instead of college students moving on, they can come back home and have the same job opportunities.”

Luke Johnson, operations and broadband manager  
Meeker Cooperative Light & Power Association;  
Litchfield, MN

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Staff from ConnectAnza, the Internet Service Provider division of Anza Electric Cooperative. Photo courtesy of Anza Electric Cooperative

Next, more detailed feasibility studies are undertaken to examine where fiber will be initially deployed and how rapidly the build will be conducted. Equally important is the identification of anchor customers in the community, including business, local government, hospitals, libraries, and schools. Deployment schedules are forecasted in terms of months, if not years, depending on the size of the territory to be served, the aggressiveness of the deployment schedule, and the financial resources available to facilitate the project.

Once all the facts are gathered and reviewed, it is time for a formal vote to approve the capital for fiber deployment, a process that depends on the management structure. For example, within the electric co-op model, approval to move forward may be as “simple” as a board of directors’ vote to move forward, or it may require approval from the entire membership. “We had to do a special vote,” said Debbie Winger, telecommunications manager with Anza Electric Cooperative in Anza, CA. “It was over a 93 percent ‘Yes’ vote, the biggest turnout for any election on our history. It made it very clear what people wanted out here.”

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## To Overbuild or Not to Overbuild? More is Always Better

One of the most surprising findings was the decision by electric utilities to deploy the largest number of fibers strands the capital budget would reasonably allow.

“The incremental cost to go from 24 strands to 288 strands is small compared to the cost for construction,” John Lester, general manager, Clarksville Connected Utilities in Clarksville, AR stated. “It made sense to overbuild when we were at it. We ended up with a 17-mile core with 288 strands.”

Overbuilding fiber provides immediate operational flexibility in network implementation and “future-proofing” for new applications and revenue generation. Deploying 288 strands of fiber in a rural fiber project appears to be overkill, but there are numerous reasons to overbuild. As noted earlier, the most significant cost of deploying fiber is the labor to put it in place on poles and in trenches. Having to go back later and add additional capacity along the same routes means repeating the most expensive part of the deployment – the labor involved in placing the fiber. This is also accompanied by disruptive activities such as temporarily blocking off streets to place fiber on poles and/or digging up roads to place conduit.

Once in the ground, unlit “dark” fiber has zero overhead cost beyond inventory housekeeping to keep track of where it is and how many strands are available for use. Bringing dark fiber into service requires attaching the appropriate electronics on the ends, so utilities can light it as needed based upon customer demand. With fiber electronics capabilities constantly improving while costs continue to decline, dark fiber is a flexible insurance policy for the future.

Multiple strands and bundles of fiber within a fiber cable provide the electric utility flexibility that can be tailored to the needs of the local community. For example, Clarksville is running eight different networks on separate fiber bundles within the same physical cable. The utility’s SCADA network runs on its fiber bundle, which is physically and electronically separated from other users for a high level of security. Other dedicated fiber bundles are allocated for business users, the school system, city, county, libraries, and the local university.

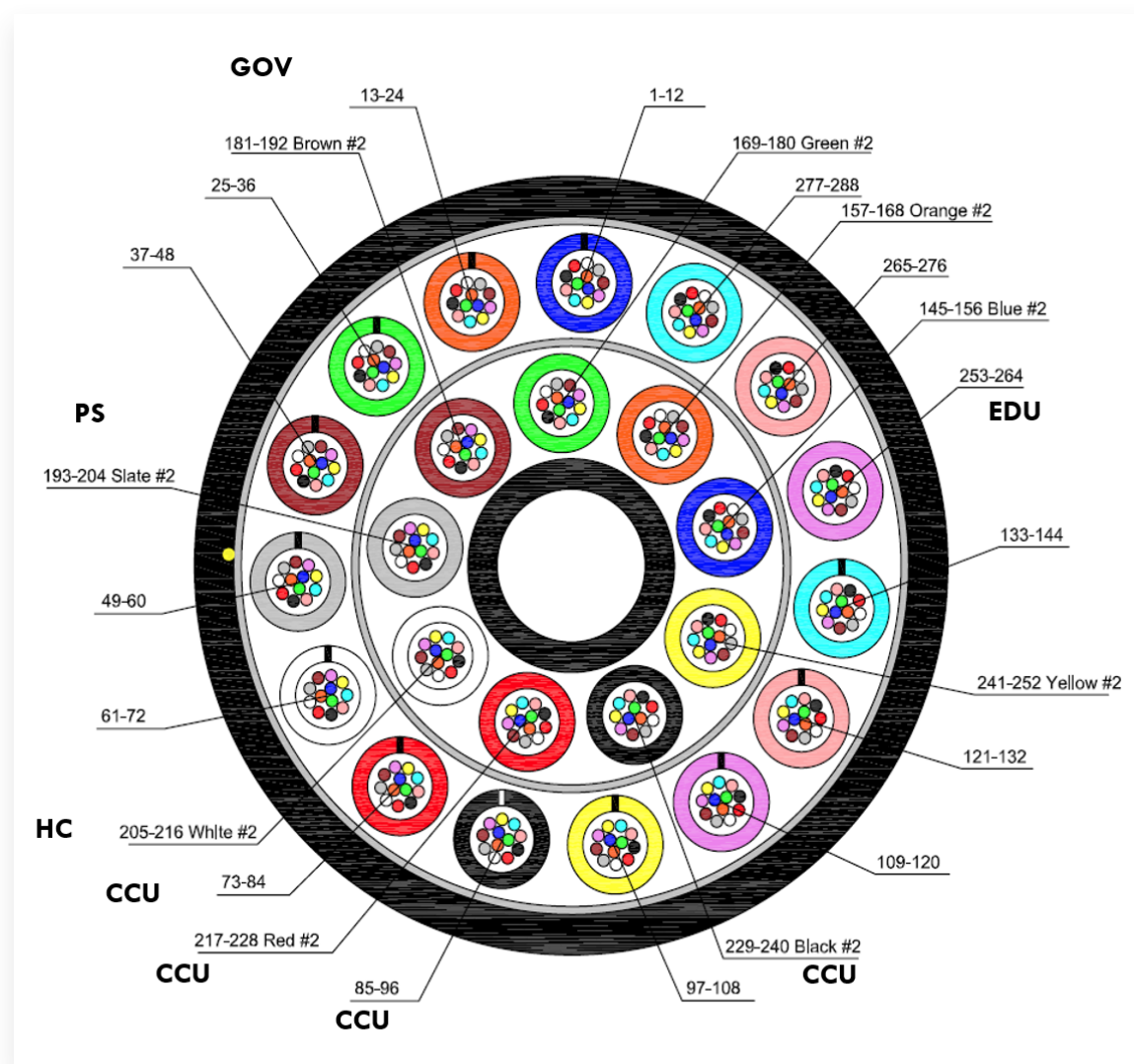
Dark fiber also provides an opportunity for additional revenues from telecommunications and enterprise customers. Cable- or copper-based incumbent broadband providers wishing to improve facilities within their franchise territory to remain competitive have chosen to lease fiber from electric utilities because it is both cheaper than having to lay it themselves and is immediately available. Fixed wireless and cellular carriers are also potential customers for leasing dark fiber to incorporate into their networks.

Enterprise customers also lease dark fiber for various applications. Businesses may need something as simple as connecting a remote site to a larger corporate Wide Area Network (WAN) or something more complex such as monitoring remote facilities. Guadalupe Valley Electric Cooperative (GVEC), based in Cuero, TX, leases its dark fiber to oil companies for Internet of Things (IoT) monitoring. “Oil fields use a lot of radio towers to collect SCADA information from pumps and need to bring it back to the main aggregation point,” said Robert Russell, executive engineer for communications technology for GVEC. “It’s very helpful to get fibers from [the co-op], it lets them run the radios themselves rather than having to send that data via VPN over an internet connection.”

“The incremental cost to go from deploying 24 strands of fiber to 288 strand is small compared to the cost for construction.”

John Lester, general manager  
Clarksville Connected Utilities; Clarksville, AR

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A cross-section view of Clarksville's fiber core utilization demonstrates the tremendous value and capacity of 288-count cable (24 tubes each with 12 fibers). The eight tubes being utilized for education (EDU), government (GOV), public safety (PS), healthcare (HC), and Clarksville's (CCU) own operations comprise a total of 96 fibers, still leaving 16 tubes, or 192 fibers, for future use.

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## Keeping it Simple

Deciding and detailing what products and services will be available for customers in a fiber build is part and parcel of the initial decision process. Providers interviewed, for the most part, stuck to simple strategies of pricing and service options. With experience through operations and customer feedback, additional services and pricing options can be rolled out to meet changing expectations and new opportunities.

An electric utility provider using its fiber for internal needs also seems obvious. Fiber provides the necessary infrastructure for Smart Grid applications and delivers operational cost savings by enabling utilities to migrate internal telephone and data network functions onto utility-owned fiber instead of paying for third-party Local Area Network/WAN and voice services. Other savings can be generated by more accurate and efficient customer billing through better metering technology.

High-speed broadband offerings for residential members tend to be simple in nature, with a single price for 100 Mbps symmetrical service and a higher cost for 1 Gbps service. Like any other provider, utilities adjust pricing and speed packages based upon offerings from competitors, with incumbents typically providing triple-play bundles of data, voice, and video.

Among rural electric co-ops, voice services still appear to be a necessary component of most offerings. While mobile services are always improving and getting faster, actual cellular coverage in rural environments is never as good or widespread as it is in urban areas. Fixed-line voice services delivered via Voice over IP (VoIP) riding over a broadband connection remain a necessary part of what co-ops must provide for their member communities.

Video service is where many electric utilities draw a line between themselves and incumbents, citing two reasons not to offer it. There are significant costs associated with deploying dedicated video services on top of a broadband network, including the purchase and installation of set-top boxes, maintenance of a video head-end, annual and always increasing content distribution rights, and updates of television guide services, just to name a few. Such initial capital costs and constant operational expenses are daunting for any electric utility, regardless of size or geography.

Over-the-Top or simply “streaming” video is a no-cost solution many utilities are embracing since it is already available and effectively turnkey for customers. Customers are encouraged to use existing streaming services because they can get access to the content they want on-demand and may opt to purchase a faster broadband plan to support higher-resolution content and multiple screens within the household.

Businesses represent another clear-cut customer segment for broadband service offerings. Broadband business services, while more demanding than residential offerings are also more lucrative. Companies expect dependable services and pay more in return. Service guarantees of uptime and quality, or Service Level Agreements, will be required. Firms need assured access to everything from basic web services for advertising products and taking orders to cloud-based tools such as call center services with integrated Customer Relationship Management tools.

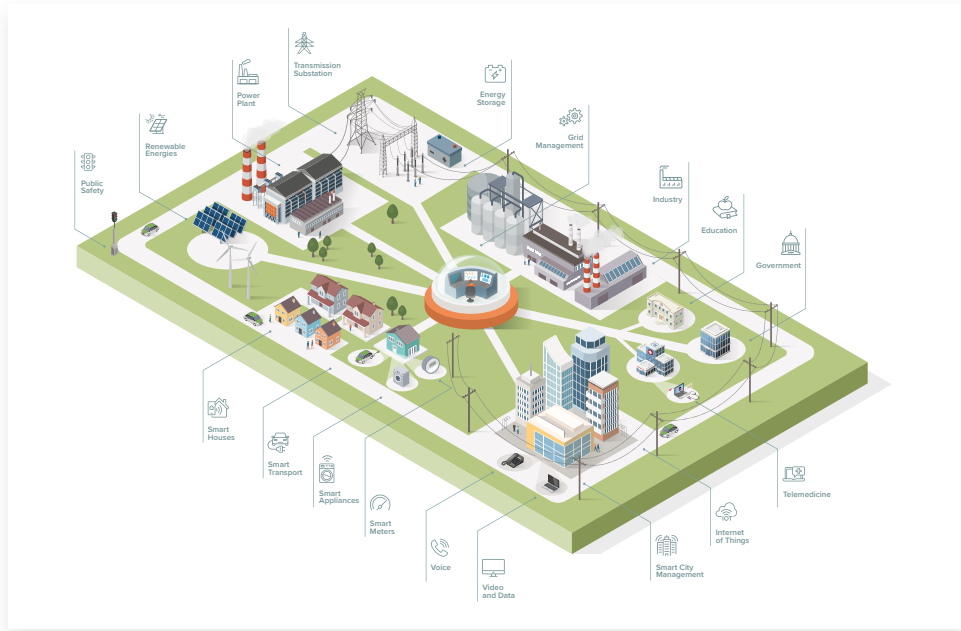
## Gigabit Broadband’s First Wave of Benefits

High-speed broadband connectivity delivers immediate economic benefits to electric utilities and the communities they serve. Offering broadband services provides a diversified revenue stream separate from the fixed-rate business of power generation and delivery. Demand for electricity is typically fixed or declining as members buy newer energy-efficient appliances. Margins are low while the cost of producing power is always inching upward due to inflation, rising labor costs, servicing, and replacing aging physical infrastructure. In comparison, broadband services have much higher margins and offer the opportunity to introduce other value-added services in the future based upon customer needs.

Providing fiber broadband to schools, hospitals, and libraries is a considerable economic and social benefit, especially in rural areas with little or no high-speed internet access. The Schools, Health and Libraries Broadband Coalition (SHLB) believes broadband for community anchor institutions is a win-win.



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A World of Applications for Utility Fiber Broadband

“Anchor institutions provide essential services to the community,” said SHLB Executive Director John Windhausen, Jr. “Access to information, online education, and telehealth services over broadband are one order of benefits. Ancillary benefits extend to the community around it, including the residential and business communities.”

Providers interviewed noted that high-speed broadband access also is now a part of the equation for both school quality and home selection. Educational access to online resources for everything from homework assignments and basic research tools to interactive lectures for K-12 and college courses taught in virtual classrooms is vital today. Families choose where they live based upon the quality of public schools available and on the availability of fiber, access to take advantage of resources for richer K-12 experiences, and more diverse homeschooling curriculums.

Fiber broadband opens new avenues for providing quality health care while lowering costs for insurers and patients. Patients don’t have to travel hours to “the big city” to get tests done. Instead, X-rays and

other scans can be conducted locally with imagery examined by a specialist hundreds of miles away from his home. Minor ailments can be diagnosed through a video telemedicine consultation with a doctor either from home or at a local clinic, saving time and the expense of traveling to an emergency room, especially outside of regular office hours. Fiber broadband also provides the underpinnings for new medical facilities to be built in underserved areas, improving the quality and availability of care.

Electric utility fiber deployments, as noted earlier, provide competition for incumbent cable and telecom providers. In the short term, incumbents adjust pricing, provide competitive bundles, and offer specials to keep customers from leaving. Longer-term, they will selectively invest in upgrading infrastructure to provide more reliable and faster services, with cable companies more likely to spend money on improvements. Copper-based providers have, in select instances, deployed fiber to stay competitive with electric co-op fiber, usually selectively “cherry picking” more economically lucrative areas based on housing density and property values.

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## “We Can’t Build It Fast Enough”

The one major disappointment electricians share once they start deploying fiber is customer demand to get gigabit broadband installed in their neighborhoods and homes as soon as possible. “We found people want their internet more than they want power,” said Russell. “They don’t realize they go hand-in-hand. We had such a high demand for our services that we had to become an internet cooperative as well as an electrical cooperative.”

“The angriest customers we get right now are the ones we couldn’t quite get fiber to at this time.”

Robert Russell, executive engineer for communications technology  
Guadalupe Valley Electric Cooperative; Cuero, TX

GVEC started its broadband effort as a for-profit subsidiary owned by the co-op to generate extra cash flow that could be used for different purposes and to maintain a retail presence with its customers. Moving the internet business into a co-op structure enabled GVEC to commit maximum investment in growing its fiber network, enabling it to put more financial resources into expansion. As a for-profit entity, the internet subsidiary needed to deliver fiber services to 11 to 13 homes per mile to meet financial objectives. Switching to a co-op changed tax and investment needs for deployment to as little as three to four homes per mile.

“The angriest customers we get right now are the ones we couldn’t quite get fiber to at this time,” said Russell. “It’s very, very rewarding when we get internet deployed. It takes us back to the old days when we first brought telephone service out, first brought power out.”

Anza Electric also found its membership clamoring for fiber broadband. “We needed a 40 percent take rate among our membership,” said Winger. “We are at over 53 percent, and we are still building. As soon as we go into an area, as soon as they see our technicians, they flood the [online] signup list, with new signups every day. There is a backlog where we are already connecting people; we will go into a new area, that is when we get more signups, it is on-going. We do not know our eventual take rate. We are increasing our membership with broadband, adding new members.”

## High-speed Broadband, Higher Property Values

Access to fiber provides significant value for both residential and commercial real estate. Residents in bedroom communities outside of cities, seasonal renters, and year-round businesses all want access to the highest speeds possible, and they are willing to pay for it.

“It is hard to quantify the property value increase,” said Russell. “Several studies add up to \$5,000 per lot. Broadband is becoming one of those mandatory questions being asked by residential property developers who know we can provide fiber along with power. They will move those residential neighborhood projects into our territory. We have several subdivisions split between other power providers and us, with 100 percent of our lots built and occupied while less than 10 to 15 percent of the rest of the neighborhood is occupied. It is like a school district line.”

“Broadband is becoming one of those mandatory questions being asked by residential property developers.”

Robert Russell, executive engineer for communications technology  
Guadalupe Valley Electric Cooperative; Cuero, TX

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## A Brightly Lit Future

University of Tennessee studies assessing the impact of EPB's fiber build in Chattanooga cite up to a four-to-one return on investment after five years, with the initial project costing \$300 million and economic benefits up to \$1.2 billion occurring. Similarly, Purdue University examined what it would take to extend broadband to the entire state. Using a model based on installations within the service territory of seven electrical co-ops with 93,000 members, Purdue also arrived at a 4:1 return on fiber project investment.

Chattanooga has over a decade of experience in operating a fiber network. As such, it is a model for electric utilities everywhere as to the true long-term benefits of fiber deployment. EPB's take rate for broadband after a decade is around 60 percent, with many customers also buying phone and video services. Improved power reliability and gigabit speeds opened the doors for hundreds of entrepreneurial startups to move into town, along with two venture capital investment firms.

Electric co-ops should embrace what they do best, said Espeseth, and move forward accordingly.

“It's the local brand that matters to your customers, they know you.”

Katie Espeseth, vice president of new products  
EPB; Chattanooga, TN

“If I am a small rural co-op, it is a heavy lift to do it all,” Espeseth said. “You do not have to do it all. You do not have to build 24 x 7 monitoring or a video head-end, you can build partnerships. It is the local brand that matters to your customers, they know you. Big guys are not going to build in the middle of Mississippi, Alabama, and Tennessee.”

A utility's ties to the local community are the most important asset for a fiber project. “Our people live here,” said Espeseth. “This is a secret weapon that every one of those municipalities and co-ops has. You can buy services from anyone. The way you treat them, the trust that you have, only your local brand has that trust.”

According to an analysis conducted by NRECA last year, electric co-ops can bring high-speed internet to an additional 6.3 million households in areas where there is no existing service. Electric utility providers are uniquely positioned as the engine for deploying high-speed broadband to underserved and unserved rural communities. They achieved an historic mission in household electrification and now have a similar calling in terms of gigabit broadband service. Electric utilities have a civic involvement and duty to their customers as the only organizations possessing the local knowledge and resources to bring high-speed broadband to rural America.

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Luke Johnson, Operations & Broadband Manager, Meeker Cooperative Light & Power Association Litchfield, MN

Tracy Warren, Senior Communications Officer, National Rural Electric Cooperative Association (NRECA), Washington, DC

John Windhausen Jr., Executive Director, Schools, Hospitals & Libraries Broadband Coalition (SHLB), Washington, DC

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