Electric Cooperatives and the Digital Divide

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Michigan State University
EDA University Center for
Regional Economic Innovation

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U.S. ECONOMIC DEVELOPMENT ADMINISTRATION

Electric Cooperatives and the Digital Divide

Helping Connect Rural Americans to 21st Century Opportunity

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INTRODUCTION

The task of bringing high speed Internet to America's rural communities remains a challenging and painfully unfinished one.1 With broadband becoming an essential tool to participate and prosper in the modern economy, this "digital divide" is aggravating existing gaps in rural citizens' access to economic opportunity, education, and healthcare.

Today's rural digital divide is reminiscent of the "electricity divide" our nation experienced during the 1930s. In 1934, less than 11% of U.S. farms had electricity, compared to nearly 90% of farms in Europe. The main reason was the modest profit potential in rural areas compared to cities that were attracting massive investments from profit-focused private utilities. In response to this lack of private investment in essential infrastructure, the Roosevelt Administration created the Rural Electrification Administration (REA) as part of its New Deal initiative. The REA provided loans to rural cooperatives to help them develop locally- and democratically-controlled power systems. Thanks in large part to this combination of national policy and local initiative, by 1942 almost half of US farms had electricity, and by 1952 nearly all were plugged into the nation's electric grid.[2]

Studies have shown that this public investment in rural electrification generated substantial and sustained benefits for rural communities and the nation as a whole.[3] Available evidence suggests that, as electricity did decades ago, broadband Internet access has become essential "prosperity infrastructure" today. In addition to an abundance of anecdotal observations, this evidence includes a growing body of research on broadband's benefits, some of which are depicted in the graphic below.

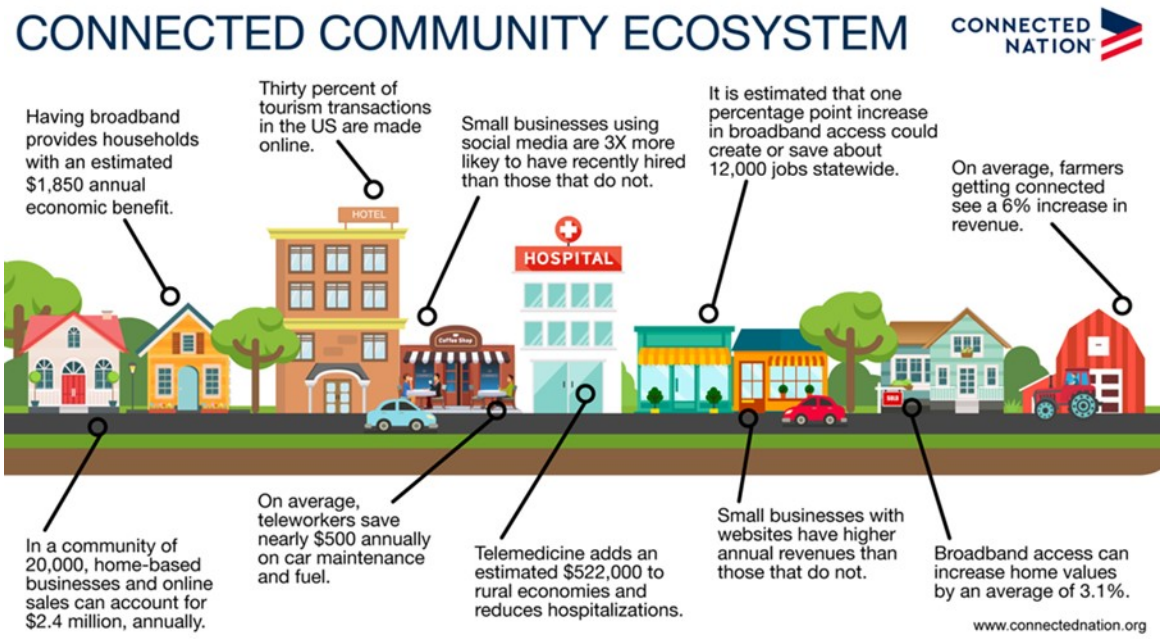


Figure 1: Examples of benefits associated with broadband access and usage
Recent examples of broadband research focused specifically on benefits in rural areas include:

- A 2018 study by the Purdue Center for Regional Development estimating that every dollar invested in rural broadband returns $4 to the economy, including benefits in healthcare, education, economic and workforce development, farm income and consumer savings.[4]
- An April 2019 study by professors at the University of Tennessee and Oklahoma State University finding that faster broadband reduced unemployment, especially in rural areas.[5]
- An April 2019 report by the U.S. Department of Agriculture (USDA) projecting $47 billion in potential annual benefits from nationwide deployment of broadband and precision agriculture technology, with at least $18 billion of that annual benefit dependent on reliable broadband connectivity.[6]

With this historical precedent and the magnitude of potential benefits in mind, this paper examines:

- the evolution and scope of America's rural digital divide;
- the unique capacities that rural electric cooperatives (RECs) can bring to the task of bridging the rural digital divide and restoring the nation's commitment to universal service;
- why and how some co-ops in Michigan and other states are deploying fiber-to-the-home (FTTH) networks that provide their members with world-class Internet connectivity;
- federal and state policies and financial support mechanisms intended to support expanded rural broadband availability and benefits;
- potential strategies for state and local stakeholders to increase broadband access and its benefits in rural Michigan

UNDERSTANDING THE RURAL DIGITAL DIVIDE

In this section we examine: 1) how and why the rural digital divide has developed and; 2) the scope of the divide, and recent evidence suggesting it is much larger than government data suggests.

DEFINING UNIVERSAL SERVICE IN THE DIGITAL AGE

One way to view the rural digital divide is as an indicator that the tools to achieve the longstanding communication policy goal of "universal service" have not been adequately updated for the Internet age. As described in the Communications Act of 1934, this goal was "to make available, so far as possible, to all the people of the United States, a rapid, efficient, nationwide, and world-wide wire and radio communication service with adequate facilities at reasonable charges".[7]

The Telecommunications Act of 1996 aimed to extend that policy to cover "advanced" telecommunication services such as Internet access.[8] But that law also opened the door to massive change in the communication sector that made implementation of the universal service policy more complex and difficult. When that policy was first developed, there was one dominant network technology (twisted pair wires), one category of company (the phone company) and one level of service (Plain Old Telephone Service or POTS). This made decisions about what networks to subsidize in rural areas relatively straightforward. In contrast, today's rural broadband landscape includes a mix of different service providers and technologies, with each technology having its own cost and performance profile. We briefly summarize these below:

Digital Subscriber Line (DSL) technology is commonly used by local telephone companies to deliver broadband service. Adding some level of DSL capacity can be relatively inexpensive compared to other technologies, since it makes use of existing telephone lines, which are fairly ubiquitous, even in rural areas. In terms of speed (and often reliability), DSL tends to be near the low end of the range. DSL speeds also decline fairly sharply with distance, which often translates into very slow speeds in low-density rural areas, sometimes well below the Federal Communication Commission's (FCC) current minimum broadband speed.

Cable-delivered broadband uses technology known as Data Over Cable Service Interface Specification **(DOCSIS)**, which provides much faster speeds than DSL. It is often unavailable in rural areas, especially the more sparsely populated areas outside of town. Unlike phone service, cable's expansion was not subject to a universal service requirement. As a result, cable operators built networks only where financial returns were sufficiently attractive. Though much faster than DSL, DOCSIS cannot match the speed, reliability and upgradability of fiber optic networks, discussed below. Since these two network options cost roughly the same to deploy in unserved areas, fiber is generally the more sensible choice in these situations.

Fiber-to-the-home (FTTH) is the fastest, most reliable, longest-lasting and most upgradable network technology available and, unlike DSL and fixed wireless, it can deliver consistently high speeds across an entire community. Today FTTH networks exist in a minority of rural areas, largely because they cost more to deploy than DSL and fixed wireless (though not significantly more than DOCSIS). Nevertheless, when viewed over the long term, fiber may be more cost-effective than other network technologies, given its performance advantages and longevity, especially so in a world of rapid and relentless growth in demand for network capacity.

Fixed wireless technology is deployed by companies known as Wireless Internet Service Providers (WISPs). The WISP sector emerged in response to the combination of limited availability of DOCSIS and limited speed and reach of DSL in rural areas. The speed, reliability and installation costs of WISP service can vary, often widely, from location to location, due to terrain, foliage and distance from the wireless transmitter. As a result, it is difficult for WISPs to provide comparably high-quality and affordable service across an entire community and in some locations service may not be available at all. Even under favorable conditions, wireless speeds fall far short of those available via fiber optics, especially in rural areas.

Mobile wireless broadband is generally not considered an effective replacement for fixed rural broadband service for multiple reasons, including its relatively high monthly cost, use of restrictive data caps and throttling practices, and its relatively poor coverage in rural areas.

Satellite-delivered broadband is widely available in rural areas, but suffers high latency (delay), and its speeds can degrade, sometimes dramatically, during heavy rains. It is also relatively expensive and comes with restrictive monthly data caps. This mix of characteristics makes it a last-resort option when it comes to broadband service.

As the above suggests, questions about how to define and achieve universal service in the digital age are more complex and challenging than in the days of POTS. For example, what minimal speeds should be required for a location to be considered "served?" And how can we be confident that this speed is actually being delivered, especially when delivered speeds may vary widely across a local service provider's territory?

In an effort to address the first question, the FCC has defined and subsequently updated the minimum speeds it considers adequate to provide "broadband" connectivity. When the 1996 Telecommunications Act[9] was passed, the minimum speed considered as broadband was only 200 kilobits per second (kbps) for both downloading and uploading. In 2010 the FCC increased this to 4 megabits per second (Mbps) for downloads and 1 Mbps for uploads, and in 2015 increased it further to 25 Mbps download and 3 Mbps upload.10 This minimum broadband speed threshold has not been changed since then, even though the typical U.S. household's data usage has grown dramatically, as suggested by a 40% jump in median data usage between 2017 and 2018.[11]

In an attempt to address the second question, the FCC gathers data every six months from Internet Service Providers (ISPs) on the speeds they make available across their service footprint, and the technology they use to deliver that speed. We discuss that data and its shortcomings in the following section.

IS THE DIVIDE EVEN WORSE THAN WE THINK?

The development of U.S. broadband policy depends heavily on broadband availability data compiled by the FCC. This is especially true of decisions regarding the allocation of government financial support for expanding broadband coverage and capacity. However, a growing body of evidence suggests this reliance on FCC data may be slowing our nation's efforts to bridge the rural digital divide. In this section of the paper we consider: 1) problems in how the FCC data is collected and; 2) evidence that it overstates broadband connectivity, especially in rural areas.[12]

FCC DATA EXAGGERATES AVAILABILITY, ESPECIALLY IN RURAL AREAS

A fundamental weakness of the FCC data is its reliance on self-reporting by ISPs and its lack of independent verification of this self-reported data. Another is its definition of "available." According to the FCC, broadband is considered available if "the provider does—or could, within a typical service interval or without an extraordinary commitment of resources—provide service to at least one end-user premises in a census block."[13] With only a single qualifying premise needed for a full block to qualify as "served," this methodology is especially problematic in rural areas, where homes in the same census block can be located miles from one another. For example, nationally, there are more than 3,200 census blocks that are larger than the entire District of Columbia (68 square miles in area) and 5 blocks that are larger than the entire state of Connecticut (5,567 square miles in area). Making matters worse is the FCC's lack of a clear and consistent definition of "extraordinary commitment of resources."[14] By leaving the interpretation of this vague phrase to individual ISPs, the FCC leaves the door open to exaggerated coverage claims to achieve competitive advantage or for other reasons.

The FCC's determination of available broadband speeds is also prone to exaggeration, since it is based on advertised rather than delivered speeds. This is a problem because some technologies face technical constraints that limit their ability to deliver advertised speeds to all homes in a given area. For example, companies using Digital Subscriber Line (DSL) or wireless technology may advertise speeds in excess of the FCC's current minimum to qualify as "broadband" (25 Mbps download combined with 3 Mbps upload), but actually be able to deliver those speeds to only a portion of homes in the areas covered by their advertising.

The FCC data's lack of timeliness is another factor limiting its ability to accurately inform policy and investment decisions. The most current version of the data tends to be at least a year old, sometimes closer to two.15 Another policy-relevant shortcoming of the data is its lack of pricing information since, along with availability, affordability is a key factor driving broadband adoption.

Connected Nation, a national 501(c)3 organization with a mission to expand broadband access, adoption, and use, has extensively studied the FCC coverage data. Using a mixture of variables including census block size, household density, number of reported providers, and technology type, Connected Nation has assigned a confidence rating to each census block in which the FCC's data shows broadband being available.

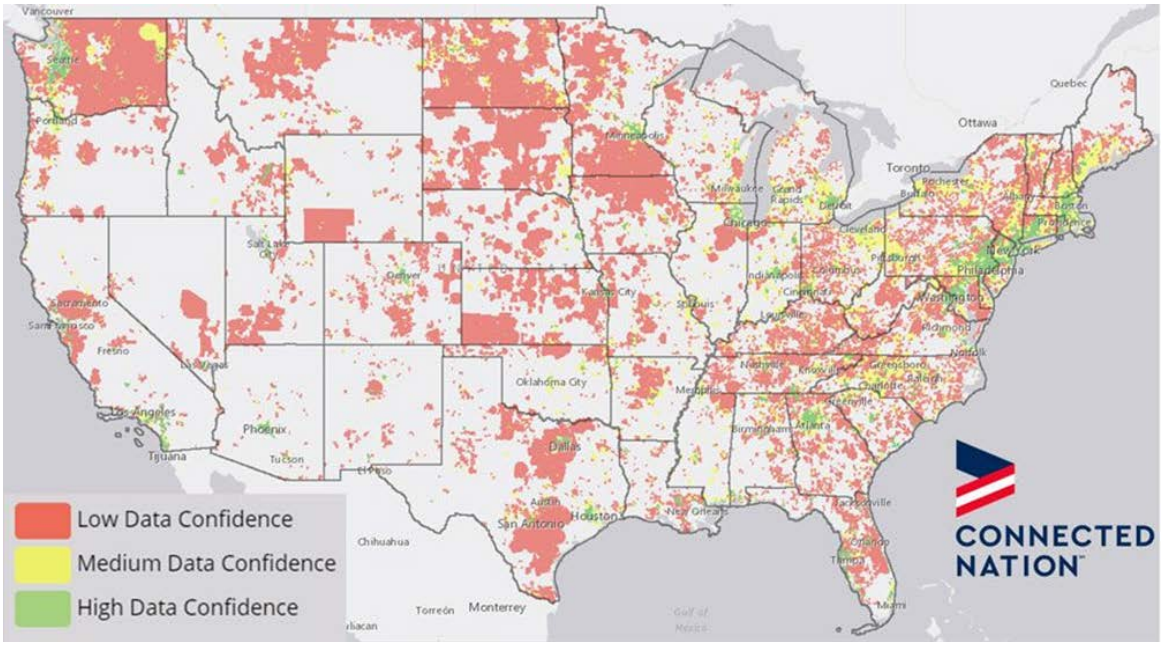


Figure 2: Connected Nation confidence rating of FCC broadband coverage data by census block.

The above map shows census blocks in which the FCC has determined that broadband is available at speeds of 25 Mbps download/3 Mbps upload. The blocks are colored to reflect each one's confidence rating. The red on the map shows areas where broadband is reported as being available, but Connected Nation has low confidence that all or most households in that area have broadband available. A low data confidence rating does not mean broadband is not available or that the data is incorrect, only that it warrants investigation to confirm the level of broadband availability within the census block. Areas not shaded in any color are reported by the FCC as not having broadband service with a speed of at least 25/3 Mbps.

MEASURED USAGE MUCH LOWER THAN ISP-REPORTED AVAILABILITY

Data released by Microsoft in late 2018 provides additional support for claims that FCC data provides an exaggerated picture of broadband availability and adoption.[16] Because it is measuring actual network speeds, Microsoft's usage data is arguably a more accurate reflection of the state of broadband connectivity than FCC availability data, especially given the latter's shortcomings, as discussed above.

To the extent this is the case, the Microsoft data paints a depressing picture of Internet access in America. For example, whereas, FCC data shows 24.7 million Americans lacking access to the agency's 25/3 Mbps minimum broadband speed, the Microsoft data indicates that 6.6 times that many Americans (162.8 million) do not access the Internet at these speeds. The difference in Michigan is less extreme but still substantial. According to the FCC, broadband is available to nearly 90% of the state's residents, but Microsoft's data shows little more than 40% of Michigan users actually accessing the Internet at FCC-defined broadband speeds. A recent study sponsored by the Center for Rural Pennsylvania showed similarly large gaps between FCC availability data and measured speeds. Though the latest FCC data shows 25/3 Mbps broadband speeds available in 100% of the Pennsylvania's census blocks, the study, based on 11 million speed tests, found no county in which more than 50% of tests measured actual speeds of at least 25/3 Mbps.[17]

To provide a more geographically granular picture of how the FCC/Microsoft data comparison applies to Michigan, we analyzed the data at the county level, assigning each county to a category based on its 2013 Rural-Urban Continuum Code (RUCC). RUCCs are based on: 1) whether a county is part of a metro or non-metro area; 2) the population of that area and; 3) for non-metro counties, whether it is adjacent to a metro area. The analysis also considered whether a county is at least partly served by an REC, as well as its average housing density, household income, and unemployment rate.

We found that, in general, as counties become more rural and distant from metro areas:

- broadband availability and usage both decline
- the gap between the FCC's availability percentage and Microsoft's usage percentage increases
- household income declines and unemployment increases
- a larger share of counties are served at least partly by one or more electric co-op

Our analysis (see Appendix 1 for more details) shows that, in general, Michigan counties served at least in part by an electric cooperative are characterized by: 1) the state's most severe lack of broadband connectivity; 2) the greatest exaggeration of that connectivity by FCC availability data and; 3) economic challenges that can create barriers to broadband connectivity, even as that connectivity could help rural communities overcome these challenges.

This, in turn, presents both a challenge and opportunity for policymakers, planners, funding sources and local communities. The challenge is how to transform this self-reinforcing cycle of lack into a healthy dynamic that supports increasing levels of connectivity, opportunity, prosperity and health. The opportunity is to leverage the resources of electric co-ops to help bring 21st century connectivity to Michigan's rural communities.

RURAL ELECTRIC CO-OPS ARE WELL POSITIONED TO HELP

The nation's rural electric cooperatives bring a unique and potentially potent mix of assets to the rural broadband challenge. By virtue of their history and core mission—providing electric power in rural areas unable to attract investments from private profit-focused power companies—RECs tend to serve areas that are similarly less attractive to private ISPs. This means they already have in place key assets that can strengthen the rural ISP business case in these areas, including utility poles, internal monitoring networks, service trucks, access to the right-of-way and utility easements, billing systems, and staff experienced in managing these assets.

And, as user-owned cooperatives, RECs tend to have relatively high levels of customer satisfaction[18,] especially when compared with the consistently dismal ratings for the large cable and telephone companies that provide broadband service to most Americans.[19] And because RECs are owned by their customers and have a history of supporting local community development,[20] they are more likely than profit-focused private companies (especially large national operators with publicly-traded stock) to work with local stakeholders to maximize the benefits of a community owned high-speed network. The experience of co-ops entering the broadband market (discussed in more detail later in this document) suggests that these positive community relations can help achieve the levels of service penetration and customer loyalty needed to support financially sustainable business models in rural areas. Another key factor supporting the REC broadband business case is the fact that co-ops typically consider a much longer investment payback horizon than privately-owned ISPs (again, especially the large national players that dominate the broadband network sector and whose stocks are publicly traded).

Another driver of REC fiber investments is tied to operational and financial benefits in their core electricity distribution business, which is evolving to support an array of "smart grid" applications. For example, according to a 2018 study, the annual benefits to an electric utility of deploying a broadband backbone range from $185 to $317 per meter, including a mix of cost avoidance and revenue enhancement in nine different operational categories.[21]

All of the above notwithstanding, building a high-speed network is a very capital-intensive undertaking and managing a telecommunications network, while similar in some ways to managing an electric grid, is different in key respects. So, while RECs have unique advantages for bringing high-speed connectivity to underserved rural areas, the decision to deploy a broadband network is not one to be taken lightly. As discussed later in this document, an investment of this magnitude merits careful due diligence related to cost, demand, feasibility and risk. For some co-ops, this will point clearly to a financially viable business case. For others, including those with service areas relatively well served by incumbent ISPs, extremely low housing density and/or low income levels, the business case will be less clear and carry more risk.

But even for some of these co-ops, the long-term benefits may justify the risk, especially if government regulation and subsidies help reduce that risk, as occurred when RECs brought electricity to rural America in the 1930s and 1940s. According to Bob Hance, president and CEO of Midwest Energy & Communications (MEC)--a successful REC fiber pioneer discussed later in this document--the risk of a co-op NOT deploying high-speed networks may in some cases be greater than that associated with doing

so. Without sufficient access to broadband, says Hance, continued declines in rural populations and economic conditions could threaten the health of an REC's core electric business, further feeding the cycles of decline plaguing many rural communities.

This growing appreciation for broadband as both a necessity and opportunity is reflected in an increased focus on broadband in the research and advocacy work of the National Rural Electric Cooperative Association (NRECA).[22] It can also be seen in the expanding number of RECs investing in fiber networks. According to the Institute of Local Self Reliance (ILSR), 84 of the nation's RECs were deploying or planning fiber optic networks as of November 2018,[23] including three of Michigan's nine electric co-ops.[24] In 2014 MEC became Michigan's first REC—and among the first in the nation--to take this step. It was joined in 2018 by two other Michigan RECs, Homeworks Tri-County Electric and Great Lakes Energy. We profile these three co-ops and their FTTH ventures later in this document.

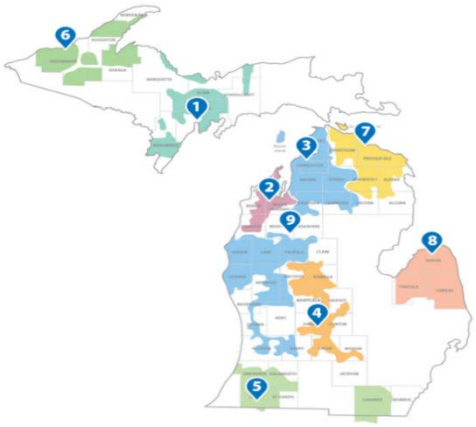
THE ROLE OF ELECTRIC CO-OPS IN THE U.S AND MICHIGAN

According to a 2017 Fact Sheet25 published by NRECA, "[m]ore than 900 cooperatives in 47 states provide electric service to 56 percent of the nation's landmass and 13% of the nation's electric meters." The Fact Sheet also compares RECs to investor and municipally owned utilities on several key metrics that highlight the rural nature of their service areas:

> *Co-ops serve an average of 7.4 consumers per mile of line and collect annual revenue of approximately $16,000 per mile of line as compared to investor-owned utilities, which have on average 34 customers per mile of line and collect $75,500 per mile, and publicly-owned utilities, or municipals, which average 48 consumers and collect $113,000 per mile.*

The table and map below show the size and location of Michigan's RECs.26 [Note that Great Lakes Energy (in blue) and Midwest Energy & Communications (in green) serve two non-contiguous areas and that Cloverland, which serves the eastern U.P., is not depicted on the map].

As the table shows, Michigan's electric co-ops serve a total of nearly 325,000 consumers. The state's largest REC, by a wide margin, is Great Lakes Energy (profiled later in this document), with nearly 125,000 customers, while its smallest is Ontonagon County REA, which serves less than 5,000. The majority of Michigan's RECs serve between 25,000 and 43,000 members.



	Michigan Electric Cooperatives	
1	Alger-Delta Co-op Electric Assn.	9,982
2	Cherryland Electric Cooperative	35,144
-	Cloverland Electric Cooperative	42,591
3	Great Lakes Energy Cooperative	124,622
4	HomeWorks Tri-County Electric Cooperative	25,879
5	Midwest Energy & Communications	35,960
6	Ontonagon County REA	4,873
7	Presque Isle Electric & Gas Co-op	33,389
8	Thumb Electric Co-op	12,212
	Total	324,652

** Co-op map excludes Cloverland Electric Cooperative, which serves large portions of the eastern U.P*

MICHIGAN'S REC FIBER PIONEERS

This section will examine the experience of the three Michigan electric co-ops that are currently at some stage in the process of deploying a FTTH network. The three companies, in chronological order of their project launch, are Midwest Energy & Communications, Homeworks Tri-County Electric and Great Lakes Energy. All three are offering both high-speed Internet and voice service on their network.

MIDWEST ENERGY & COMMUNICATIONS

Midwest Energy & Communications (MEC) serves roughly 36,000 electric members in eight counties in southwestern and southeastern Michigan and adjacent areas in Indiana and Ohio. Its electric lines span roughly 2,000 miles, 80 percent of which is overhead cable, the remaining 20 percent installed underground. On average, it serves approximately eight members per mile of electric line, slightly above the national average of 7.4 members per mile.

MEC's interest in broadband dates back to 2010 and was spurred by two main drivers: 1) unmet demand for broadband among its members, which includes employees of several large businesses and universities located near its service area that wanted at-home connectivity comparable to what they enjoyed at work and; 2) a desire to upgrade its internal communication network to support a range of smart grid applications.

Following a feasibility study, MEC began the project with a 243-mile fiber ring connecting its electric substations and other key facilities and providing a high-speed backbone to support future network extensions to homes and businesses. This expansion began with a small pilot in 2014 and focused initially on MEC's southwest district, which had fewer and slower existing broadband options than were available in its southeast district.

MEC uses the CrowdFiber online platform[27] to help plan network construction.[28] This platform: 1) divides MEC's service area into zones based largely on the areas served by its electric substations and; 2) enables members in each zone to express interest in subscribing to the fiber network. Along with other factors (e.g., construction-related issues), the level of demand expressed by members via the CrowdFiber platform helps MEC prioritize areas for each phase of construction.

MEC plans to complete construction in its southwest district in 2019 with its southeast district targeted for completion in 2021. The project is funded mainly by $73 million in loans provided by USDA's Rural Utility Service (RUS). On a weighted average basis, MEC's interest rate is 2.60%, with an average term of 27 years. MEC has also been awarded $5.18 million in grant support through the FCC's 2018 Connect America Fund reverse auction, a funding mechanism discussed later in this document.

As of mid-April 2019, MEC's fiber project was roughly nine months ahead of schedule in terms of construction, subscription rates and financial performance. According to company officials, net income turned positive in December 2018 vs. their original target of third quarter 2019. This, they say, was driven largely by lower than expected construction costs and higher than expected take rates. The latter had been projected to reach 45%. Instead, after starting around 30% in the first wave of sign-ups following construction, take rates have been building gradually to the 50-60% range and, in some areas are now exceeding 65%.

MEC management avoids the steep but short-term promotional discounts typical of broadband services provided by cable and telephone companies. Instead, the co-op has chosen to build on the foundation of trust it has developed with members and offer a stable price structure that works for members as both customers and owners of the co-op's broadband business.

Though it's too early to quantify impacts of the fiber network, MEC management reports that it has: 1) helped members work from home and avoid moving after a job change; 2) enabled at least one potentially life-saving medical intervention and; 3) helped bridge the "homework gap" by providing students with in-home broadband and complementing MEC's existing support for local education via grants "to support classroom needs, technology, or academic projects/clubs/organizations."[29]

In addition to its pioneering success as an REC broadband operator and RUS Smart Grid borrower, MEC is also emerging as a leader in extending the benefits of fiber beyond its electric service area. In one case it is working with the nearby city of Niles to extend MEC's fiber network to a Niles-based industrial park where some businesses had threatened to relocate if connectivity was not upgraded to meet their needs. Similar network extension projects are in the works to serve other industrial parks and municipal buildings in the area, with Niles contributing free access to its utility poles as part of the cooperative arrangement.

In another case, further from its service area, MEC is operating the fiber network being built in Washtenaw County's Lyndon Township. That network is being funded by a property tax increase approved by the township's voters in 2017. According to MEC officials, early indications of interest in subscribing to the Lyndon Township network are in the 60% range.

HOMEWORKS TRI-COUNTY ELECTRIC COOPERATIVE

HomeWorks Tri-County Electric Cooperative serves roughly 22,000 members in 13 central Michigan counties. It operates approximately 3,300 miles of electric lines, about 90% of which is installed on poles, the remainder underground. That translates into roughly 6.7 members per mile of line.

Like MEC, HomeWorks' decision to invest in a fiber optic network reflects the combination of two key drivers: the need to evolve its electric business in the direction of a "smart grid" and the lack of adequate broadband service in much of its very rural service area, as reflected in mounting demands among its members to remedy this situation.

With these factors in mind, but also cognizant of the investment's magnitude (roughly $75 mil. or $3,400 per member over five years), HomeWorks management undertook two years of due diligence before committing to make the investment. This included; 1) two separate feasibility studies; 2) a statistically valid survey of its members and; 3) a competitive analysis that benefited from its experience dealing with local telecom providers when it was developing its Advanced Metering Infrastructure (AMI) network.

The survey found that: 1) 90% of co-op members feel high-speed internet is important or necessary for a high quality of life in mid-Michigan; 2) 67% support the co-op providing high-speed internet service and; 3) 47% lacked the 25/3 Mbps service that FCC defines as the minimum speeds to qualify as broadband service.[30]

Encouraged by the results of its due diligence, HomeWorks began building its fiber network in 2018. According to Fiber Outside Plant Manager Chris O'Neil, the project is expected to reach the net income breakeven point after five years, with simple payback of the investment (excluding interest expense) achieved in 14 years. Though it is depreciating the network's electronics, which comprise a relatively small percentage of total investment costs, over 5-7 years, it views view fiber cable as an investment with a lifespan in the 30-50 year range.

The first two years of construction are being funded through a loan provided by National Rural Utilities Cooperative Finance Corporation (CFC), which is owned by nearly 1,000 member cooperatives around the country. Noting that savings from the lower interest rates associated with government funding need to be weighed against delays, restrictions and higher compliance costs that often accompany these loans, O'Neil says HomeWorks continues to evaluate both government and private sources for future funding.

Staffing for the FTTH network, which operates as a wholly-owned unit of the co-op, has required an additional 10-11 dedicated employees, plus some part-time allocations of staff shared with other units, with allocations made in compliance with relevant MPSC rules.

To reduce financial risk and increase efficiency during network construction, HomeWorks (like MEC) is using the CrowdFiber online tool to manage a multi-stage process that prioritizes areas where members express the strongest interest in signing up for service. As a FAQ page on its web site explains[31], this process involves five steps. The first is for members to express interest in the service in the form of non-binding pre-registrations. The level of interest expressed at this stage is used to prioritize network design and construction. Once construction of the mainline fiber is complete in a particular zone, the co-op invites members living in that zone to commit to subscribing to one or more network-delivered service. To cost-effectively manage the home installation process, it is not started until customer commitments reach a minimum threshold.

According to O'Neil, this multi-stage process has worked well, with roughly 90% of pre-registrations converting to service contracts within a week once the commitment stage is reached. He adds that achieving this level of conversion is helped by keeping members informed as different milestones are achieved, and waiving installation fees for members connected in the first "bulk" wave of installations. He also cites word-of-mouth advertising as very helpful, especially when combined with the co-op's high customer satisfaction ratings. He says the latter is 86% for electricity and 90% for propane, providing a key competitive advantage compared to the nation's large cable and telephone companies, which are among the lowest rated companies on customer satisfaction.[32]

O'Neil says subscription rates are tracking pretty closely to projections, roughly 35% at the initial commitment stage and increasing over time toward the 45% target developed based on the co-op's two feasibility studies. He says that, rather than marketing and sales, the bigger challenge to adding customers has been the supply of qualified splicing technicians to support construction and installation. While O'Neil says co-op management is getting a better handle on this with experience, his comments suggest that: 1) other co-ops might want to study the relevant local labor markets as part of pre-project due diligence and; 2) an expansion of relevant technical training programs in Michigan might help address this issue more broadly.

Though it's too early to reliably measure the economic benefits from the fiber network's faster, more reliable and lower cost connections, O'Neil points to an increased ability for local residents to work remotely, citing an architect and a GM design engineer as specific examples.

In addition to providing utility services, HomeWorks supports its members in other ways. These include grants "to help teachers provide Science, Technology, Engineering, Arts, and Math-related education in their classrooms"33 and; 2) a Tri-County People Fund34 that since 1993 that provided more than $2 million to local families and organizations with special needs.35 The People Fund grants are paid for by co-op members who agree to have their bills rounded up to the next dollar, with the program's operating costs paid for by HomeWorks.

GREAT LAKES ENERGY

Founded more than 80 years ago, Great Lakes Energy (GLE) became Michigan's largest electric cooperative in 1999, following a merger with two other RECs: Top O' Michigan Electric Cooperative and Western Michigan Electric Cooperative. It currently serves more than 125,000 members in rural portions of 26 counties in western and northern parts of Michigan's lower peninsula. Its network includes roughly 14,000 miles of electric cable, 11,000 overhead and 3,000 underground. On average it serves 9 members per mile of electric line.

Having identified fiber as a strategic initiative in 2016, GLE began a two-year process of due diligence that included three separate feasibility studies and a survey of its members. The survey indicated that roughly 75% of members supported the project. It also found that 45% of members lacked access to broadband service, with others expressing dissatisfaction with the speed and price of the service they do have.

Further encouragement for moving forward came from observing the success of FTTH projects undertaken by sister Michigan co-op, MEC (also profiled in this document), and other co-ops around the country. GLE also brought to the project some experience providing dial-up Internet and long distance phone service.

The apparent enthusiasm of its members and the success of earlier pioneers notwithstanding, GLE has taken a relatively cautious approach to network development, with its initial fiber deployment limited to: 1) connecting all of its substations with a fiber backbone and; 2) a pilot FTTH project in its Petoskey service district, which includes rural areas around Petoskey, but not the city itself. The district includes 10 substations, approximately 17,000 utility poles and 15,553 electric meters, making it larger than the state's three smallest RECs. As an online FAQ page explains, it was selected for a number of reasons:

> *[W]e believe this area should give us a clear understanding of the challenges, costs and benefits involved with this project. It contains a diverse membership with both permanent and seasonal residents, and different types of terrain that would be encountered in the fiber optic cable installation. Members also have access to a wide selection of competing internet service providers, giving us a more realistic idea of potential number of members who would take fiber internet service from GLE.*[36]

Though GLE's decisions about further fiber investment will probably not be made until late 2019, co-op staff has begun preliminary planning for possible network extension into a second district roughly the same size as the Petoskey pilot area.

After considering several proposals, GLE decided to use All-Dielectric Self-Supporting (ADSS) fiber cable for the project. ADSS cable is installed in the upper space on utility poles that GLE already uses to deliver electricity, rather than in the communication space lower on the poles. By taking this approach, the co-op has significantly reduced the "make-ready" work required to prepare poles for network construction.

GLE management stresses the importance of managing initial expectations and educating members about the difference between an all-fiber network and the technology and service offerings of incumbent ISPs, which often have a reputation for overpromising and under-delivering. Once enough people are connected and actually experiencing this difference, word-of-mouth marketing becomes a powerful driver of growth, especially when it leverages the co-ops positive reputation and longstanding community ties.

In terms of financing, GLE is initially using a USDA smart grid loan. It was also a part of the Rural Electric Cooperatives Consortium (RECC) that was successful in securing funding through the Connect America Fund II (CAF-II) auction.[37]

In addition to its utility services, GLE operates several programs designed to support the economic health of its members and their local communities. These include an Economic Development Loan Program that offers two types of loans,[38] and a People Fund[39] similar to the one operated by HomeWorks, as referenced above.

Other Michigan electric co-ops

In the previous section we examined the motivations and strategies of the three Michigan electric co-ops deploying FTTH networks, and the potential lessons they offer to other co-ops also facing a lack of broadband availability in their service area. Together, these three co-ops account for more than 57% of the total population served by the state's RECs.

In this section we consider the three other Michigan co-ops with memberships greater than 15,000, which account for another 34% of the state's REC-served population (combined, the six co-ops' share of that population is nearly 92%). Though none of these three co-ops is currently moving in the direction of deploying FTTH networks, our brief review of their broadband-related perspectives and activities sheds some additional and helpful light on the issues considered in this paper.

Cloverland Electric Cooperative

The largest of these three is Cloverland Electric Cooperative, which serves roughly 42,000 customers in the eastern U.P. While some of its Michigan peers were entering the FTTH business, Cloverland decided in 2017 to sell Lighthouse.net, [40] an ISP it had owned since 1997. Lighthouse had had been providing Internet access via a mix of technologies, including fixed wireless, DSL, resale of satellite-based service, and cable-delivered broadband in several communities in Mackinac County.

Lighthouse.net was acquired by Iron Mountain, MI-based CCI Systems, Inc. and will be managed by CCI's cable TV and Internet subsidiary, Packerland Broadband. Packerland provides a range of telecom services using a mix of network technologies to over 7,000 subscribers in nearly 60 rural communities in northern Wisconsin and southwestern portions of Michigan's U.P.[41] Packerland has launched gigabit-speed Internet service in parts of its service area using the latest generation of cable DOCSIS technology, and appears to be expanding that footprint.[42]

Though we were not able to interview the management of Cloverland or Packerland for this project, the sale of Lighthouse may reflect some combination of: 1) a desire on Cloverland's part to focus on its core electricity business and exit from an ISP business requiring it to manage multiple network technologies and; 2) Packerland's desire to expand its business in other parts of the U.P., while spreading its overhead expenses over a larger subscriber base. It's worth noting that Google reviews of Packerland's service show a mix of very high and very low ratings, with very few in the mid-range.[43] This may reflect the mix of technologies used by Packerland, some of which (e.g., those delivered via cable networks) can deliver relatively fast and reliable service, while others (DSL, fixed wireless and satellite) are more likely to face the kind of performance challenges and frustrated expectations that trigger the kind of strongly negative reviews posted on Google.

CHERRYLAND ELECTRIC COOPERATIVE

Cherryland Electric Cooperative, which serves 35,000 members in the region surrounding Traverse City, has focused on developing partnerships rather than pursuing its own fiber network. According to a February 28, 2017 blog post44 by the co-op's general manager, Tony Anderson, a feasibility study showed that only 19% of Cherryland members are either unserved or underserved. Anderson's post suggests that this figure, which is much lower than the 45-47% figures found in the HomeWorks and GLE member surveys discussed earlier, was a key factor in Cherryland's decision to focus on other ways to bring better broadband to its members rather than invest the more than $80 million the feasibility study indicated a FTTH network would cost.

In his post Anderson highlighted multiple elements of Cherryland's strategy for addressing the Internet access needs of its members and the management of its electric grid. A first step, he said, is "exploring a partnership with Traverse City Light and Power in the Traverse City area" to see if this can enable the co-op to "reduce our risk, learn valuable lessons and then expand into the more rural areas." Another was to work with a company experienced in providing wireless broadband in rural areas. While noting that wireless can't match the speed and reliability of fiber, Anderson cited benefits for Cherryland from this partnership, including modest investment and financial risk. In addition, he said, it will provide Cherryland management with "a real-life survey as to how many people in rural areas are willing to sign up for faster service."

Anderson also explained that Cherryland would be partnering with its wholesale power supplier, Wolverine Power Cooperative, to share the cost of a fiber backbone linking its electric substations to improve internal communications and system reliability. Once that fiber is installed, he says, Cherryland "will seek a vendor or multiple vendors willing to "light up" the fiber…to serve homes and businesses of Cherryland members," with the co-op's revenues coming from leasing excess fiber capacity to these service providers. And whenever Cherryland extends its underground electric grid to reach new subdivisions or housing projects, he adds, it will install conduit to enable easy installation of fiber.

PRESQUE ISLE ELECTRIC & GAS CO-OP

The experience of Presque Isle Electric & Gas Co-op (PIE&G), which serves more than 30,000 members in the northeast corner of Michigan's lower peninsula, provides yet another perspective on issues addressed in this paper. In a May 8, 2019 interview, President & CEO Tom Sobeck explained that, while there is significant unmet demand for faster Internet access in PIE&G's service area, the co-op is not currently in a position to invest in a FTTH network.

The main reason for this is that PIE&G has already committed to two major investment projects: 1) deploying an Advanced Metering Infrastructure (AMI) and; 2) building a new headquarters facility. With these two projects on its plate, it's not realistic, Sobeck explains, for the co-op to focus on a FTTH project that, according a pre-feasibility study, would cost $120 million.

Sobeck did note, however, that the study projected positive income for the project in six to eight years, with payback in 15 years. That study assumed penetration would reach 42% penetration, slightly lower than the 45% targeted by some of the FTTH projects profiled earlier and well below levels achieved in parts of MEC's service area after 4-5 years of service. Sobeck also noted that roughly 13,000 (more than 40%) of his co-op's members are seasonal customers likely to welcome and be able to afford Internet service comparable to what they enjoy at their primary residence, typically located in more densely populated and better-served communities.

Sobeck cited a problem facing RECs seeking government funding. As he explains, much of PIE&G's service area already has access to Internet service at speeds of more than 10 Mbps downstream and 1 Mbps upstream, but often lower than the 25Mbps/3Mbps speed threshold the FCC now uses to define broadband. This means these areas are not eligible for funding through key government programs, which limit eligibility to areas with less than 10/1 Mbps speeds. Sobeck expressed concern that continued use of the 10/Mbps standard to determine eligibility for government subsidies could condemn some rural communities to poor Internet service for many years to come, feeding the negative cycles already draining their economic vitality (Appendix 2 discusses this and related eligibility issues in more detail).

MODELS BEING DEVELOPED IN OTHER STATES

As the previous sections indicate, Michigan's electric co-ops are pursuing and considering a range of strategies to address the need for improved connectivity to support their internal operations and the communication needs of their members. This section broadens the discussion to include models being developed by rural co-ops in other states.

ELECTRIC CO-OPS WORKING WITH TELEPHONE CO-OPS

One such approach involves cooperation between electric and telephone cooperatives. An emerging and potentially large scale example of this is the partnership between North Carolina's state association of electric co-ops--whose 26 members provide electricity to 2.5 million people in 93 of the state's 100 counties--and RiverStreet Networks, the for-profit subsidiary of Wilkes Communications, a 67 year old telephone cooperative.[45]

In a May 3, 2019 interview, Wilkes/RiverStreet CEO Eric Cramer indicated that four pilot projects were currently in development through this partnership, and that RiverStreet was targeting roughly a dozen potential projects over the next three years. He said the company takes a flexible approach to developing projects to reflect the specific resources, goals, strategy and service area of each of its electric co-op partners.

In addition to this ambitious but still nascent statewide effort in North Carolina, other states are seeing electric and telephone co-ops working together. For example, in Illinois, Pineland Telephone and Jefferson Energy Cooperative are working together to expand broadband availability for businesses in Jefferson County, with each being responsible for deploying sections of a fiber optic network.[46] In another part of the state, Sand Prairie Broadband, the broadband division of Jo-Carroll Energy (JCE), has partnered with Adams Telephone Cooperative[47] to leverage the latter's telecom marketing expertise to support Sand Prairie's online marketing and sales platform.[48]

In Indiana, a telecom co-op, Hancock Telecom and an energy co-op, Central Indiana Power, have taken the idea of aligning their resources even further, via a merger consummated in 2011. In the wake of the merger, the expanded co-op, renamed NineStar Connect, became the nation's only rural co-op offering broadband, electricity, water and sewer services.[49]

CO-OPS WORKING WITH COUNTIES & MUNICIPALITIES

As noted earlier, Michigan's MEC is working with the city of Niles and Lyndon township to expand broadband within their jurisdictions. In North Carolina, RiverStreet Networks (a telecom co-op's subsidiary discussed above and below), is working with multiple counties and cities to extend fiber networks to unserved rural homes and businesses in these jurisdictions.

Minnesota also has seen broadband partnerships between local governments and co-ops. Among the earliest was an alliance formed in 2008 between Arrowhead Electric Cooperative (AEC) and Cook County, which at the time suffered one of the state's lowest levels of broadband connectivity. As explained in a post on the Community Broadband Networks (CBN) web site:

> *In 2010, Arrowhead was awarded a $16.1 million combined [federal] grant and loan…to build a fiber network in Cook County. The county government offered Arrowhead a $4 million grant for the project, funded by the voters' reauthorization of a 1 percent sales tax that was due to expire. In return, Arrowhead agreed to provide services such as Internet access to county buildings at no cost.*[50]

In addition to its partnership with Cook County, AEC's fiber venture also leverages the expertise of a local telephone cooperative. As explained in a 2018 NRECA case study:

> *AEC recognized its lack of expertise in broadband service early in the rollout of its fiber network and formed a…partnership with Consolidated Telecommunications Company (CTC)… to address the deficiency. Currently, CTC handles technical service calls from broadband subscribers that AEC staff are unable to resolve. CTC also provides the telephone switch and Internet gateway, which AEC resells to its subscribers.*[51]

Another Minnesota example cited by CBN is the partnership between the Lac qui Parle County Economic Development Authority and Farmers Mutual Telephone Company:

> *In 2010, the partners were awarded a $9.6 million combined [federal] loan and grant to construct a [FTTH] network in Lac qui Parle County. The network would be owned and operated by Farmers, but both the county and the co-op would be jointly responsible to repay the loan. To finance the remaining costs of the fiber project, Lac qui Parle County… loaned Farmers $1.5 million at zero percent interest for the first ten years.*[52]

The article also discusses an arrangement in which Big Stone County and Swift County issued bonds to finance loans to Federated Telephone Cooperative to help the co-op raise matching funds for a Minnesota state grant that financed construction of fiber networks in both counties.53

BOLSTERING BACKHAUL

An important piece of the broadband puzzle is obtaining a sufficiently affordable and high-speed "backhaul" connection from the local network to the broader Internet. In some areas, rural cooperatives have joined together to develop their own regional backhaul networks. For example, LS Networks, which operates a high-speed fiber backhaul network in Oregon, Washington and Northern California[54] is owned by by five rural Oregon electric cooperatives and the Coquille Tribe, a Native American tribal nation.[55] It has also begun working with local communities and other partners to extend this fiber to local residents and businesses, starting with Maupin, a small central Oregon town with a population of 430.[56]

Also in the Northwest, the Skagit Public Utility District (PUD) has entered into an agreement with the Port of Skagit to form a joint company called SkagitNet that will oversee the construction of a fiber optic network connecting small towns in the region.[57] And in Indiana, NineStar Connect, a multi-utility co-op discussed earlier, owns a 10% share of the Indiana Fiber Network, which includes more than 4,500 miles of long-haul fiber cable in the state.[58]

WIRELESS AS PART OF THE SOLUTION

Though fiber optics is the most reliable, high-capacity and future-proof network technology available today, some electric co-ops have launched broadband with fixed wireless, then added fiber to improve performance where demand can economically justify the investment.

This is the case for Jo-Carroll Energy (JCE), which serves more than 26,000 accounts in the northwestern Illinois. After launching fixed wireless service, JCE began a shift to fiber optics in response to growing demand from internal business operations and co-op members, as well as concerns about the life span and long-term economic returns of wireless technology.[59] As with Michigan's RECs profiled earlier, JCE is using crowdsourcing technology to help prioritize its fiber deployments which, according to a NRECA case study are "generally contingent upon a discounted payback period of ten years or better."[60]

Valley Electric Association (VEA), which provides electricity to a population of 45,000 in southern Nevada and a small area in California, is also in the process of transitioning from wireless to fiber. According to a NRECA case study, VEA subsidiary Valley Communications Association (VCA) started building a wireless network in 2015 and began serving members in July 2016. A key motivation for launching with wireless was the speed with which it could be brought online to deliver the 25 Mbps service

management felt would address growing demand among its members. With the wireless network confirming the presence of strong demand and generating healthy cash flow, and a fiber backbone linking the co-op's substations already in place, VCA began deploying FTTH, with payback on the combined wireless/fiber investment expected in seven years.[61]

A SHARED FOCUS ON "SERVING THE UNSERVED"

As suggested above, Wilkes Communications and its RiverStreet Networks subsidiary are among the most ambitious and successful FTTH providers targeting very rural areas (e.g., some parts of Wilkes' FTTH network serve only 3 homes per mile). In this section we explore Wilkes' collaborative approach to "serving the unserved" with state of the art fiber networks.

By 2014 Wilkes had invested $44 million (including $21.5 mil. in a 70/30 mix of grants and loans through the 2009 American Recovery and Reinvestment Act) to upgrade its copper network to FTTH. Having successfully connected its own co-op members with a gigabit-capable network, it set its sights on other areas lacking adequate connectivity. As a first enabling step, it created RiverStreet Networks, a subsidiary designed to serve as a vehicle for expanding beyond its existing co-op service area. Its goal, according to a 2018 presentation by Greg Coltrain, VP of Business Development,[62] was "regionalized network expansion and growth through edge outs, acquisitions, mergers and public-private partnerships." Or, as President and CEO Eric Cramer puts it more simply, "to serve the unserved."

One of Wilkes' first forays outside its co-op service area was extending fiber to business and government facilities in two towns adjacent to its rural service area that were not being well served by incumbent providers. It has also acquired or merged with eight telecom companies in North Carolina and southern Virginia, including both co-ops and for-profit operations.63 And, as noted earlier, its RiverStreet subsidiary has partnered with multiple counties and municipalities and North Carolina's electric co-op association to develop FTTH networks.64

Interviewed for this project, Cramer sketched out elements of the approach his co-op has developed to bring fiber connectivity and its benefits to underserved rural areas. These include:

- a laser focus on "serving the unserved" and channeling revenue back into investments in the local community, rather than maximizing profits;
- bringing together key stakeholders in ways that develop trust, transparency, cooperation, creativity and a win-win approach to planning and partnerships;
- leveraging that foundation of trust to develop shared goals and align stakeholder resources, expertise, access to low-cost capital, potential revenue streams (e.g., from network use by schools, government agencies) and political skills and connections;
- a persistent yet flexible and patient approach to developing alliances and projects;
- once a local fiber network has been funded and deployed, using it as a beachhead from which to expand the scope of partnerships, funding and network buildout;

- developing sufficient scale to support the necessary expertise and systems to efficiently build and manage networks and multi-stakeholder alliances (Cramer suggests the required scale is in the neighborhood of 30,000 customers);
- leveraging the political potency of multi-stakeholder alliances and compelling examples of both successful projects and still-unmet needs to apply political pressure in support of helpful changes in state and federal policies.

Cramer says RiverStreet is flexible regarding the structure of partnerships, but prefers one in which the county, city or co-op owns and is responsible for financing a backbone network, which it can use for internal purposes and as a foundation for network extensions to local homes and businesses. RiverStreet then pays for these network extensions, which Cramer says typically account for 80% of total costs. RiverStreet also acts as the service provider, leveraging its expertise in that role, and shares a portion of network revenue with the county, city and/or co-op.

STATE LAWS THAT HELP, NOT HURT

State laws can restrict the types of partnerships a co-op can create with cities, counties and townships. The most common form of these restrictions concerns the role of local governments.[65] For example, one reason RiverStreet acts as the service provider in its broadband partnerships with cities and counties is that a North Carolina law severely restricts the ability of local governments to play that role.[66]

Though Michigan law is less restrictive than North Carolina's, it does place extra burdens on the development of successful municipal networks as compared to privately owned networks.[67] As a result, relatively few municipal networks exist in the state, though several more are in early stages of deployment or under consideration.[68] Municipal networks are also not eligible to receive grants through a $20 million broadband grant program created by the Michigan legislature in 2018. The law creating the program prohibits grants going "directly or indirectly" not only to a "governmental entity," but also to an "educational institution or an affiliate."[69]

In North Carolina, a bill has been introduced (but not passed as of mid-August 2019) [70] to ease the state's restrictions on municipal broadband. [71] The FIBER NC Act (House Bill 431) would allow cities and counties to build broadband infrastructure and lease it to private internet providers like RiverStreet, and to use tax revenue and grants to help finance these projects.[72] Passage of the bill would provide more flexibility in designing the kind of public-private partnerships being developed by RiverStreet. It could also provide a model for Michigan and other states to consider as they seek to more effectively encourage successful broadband partnerships and projects in underserved rural communities.

North Carolina is also among the growing number of states removing obstacles to the development of electric co-op fiber optic projects. One such obstacle is potential liability risks related to using electricity easements to deploy fiber. Several years ago this issue led to a prolonged battle over easement use rights in Missouri that at one point threatened the financial health of the electric co-op involved.[73] Though the legal fight was eventually resolved without undue harm, it led a number of states, including Missouri,[74] Indiana,[75] Texas,[76] Georgia, Maryland, Alabama[77] and North Carolina[78] to pass laws that minimize ambiguity and legal risk related to deploying fiber within existing electricity easements. In February 2019, a similar bill was introduced in the Michigan legislature.[79] Aside from the easement issue, Michigan (unlike some other states,[80]) does not restrict fiber deployments by electric cooperatives. But, as noted

above, it does impose restrictions on the role municipalities (and most recently educational institutions) can play in partnerships aimed at expanding rural broadband.

FCC AUCTION SUGGESTS RECS CAN DELIVER MORE BANG FOR THE BUCK

In 2018, the FCC conducted the Connect America Fund (CAF-II) reverse auction, which marked the agency's latest attempt to update its universal service policy tools for the Internet age (See earlier section for historical perspective on universal service policy and Appendix 2 for fuller discussion of government policies related to subsidizing broadband networks).

To appreciate the progress represented by the CAF II auction, it helps to first consider the FCC's prior approach to subsidies. In 2015 the agency awarded nearly $9 billion to large local exchange carriers (LECs) in exchange for a commitment to upgrade their networks to deliver speeds of at least 10 Mbps download and 1 Mbps upload. This low standard was used even though the minimum speed the FCC considered as broadband in 2015 was 25 Mbps download and 3 Mbps upload. According to a 2018 study of the network investments made by LECs receiving the subsidies, they tended to invest only enough on network upgrades to satisfy the 10/1 standard, not the 25/3 standard that qualified as broadband when the grants were awarded.[81]

The 2018 reverse auction made several changes, including: 1) opening subsidy eligibility to entities other than incumbent LECs; 2) increasing the minimum targeted speed from 10/1 to 25/3 Mbps and; 3) awarding subsidies to bidders requesting the lowest amount of support, subject to a weighting formula that favored networks providing superior technical performance. [82]

The auction results show RECs--either individually or as part of a 21-cooperative Rural Electric Cooperative Consortium (RECC)[83]--accounting for more than 60% of total winning bids for networks with the highest performance level--low latency plus gigabit-level speeds.[84]

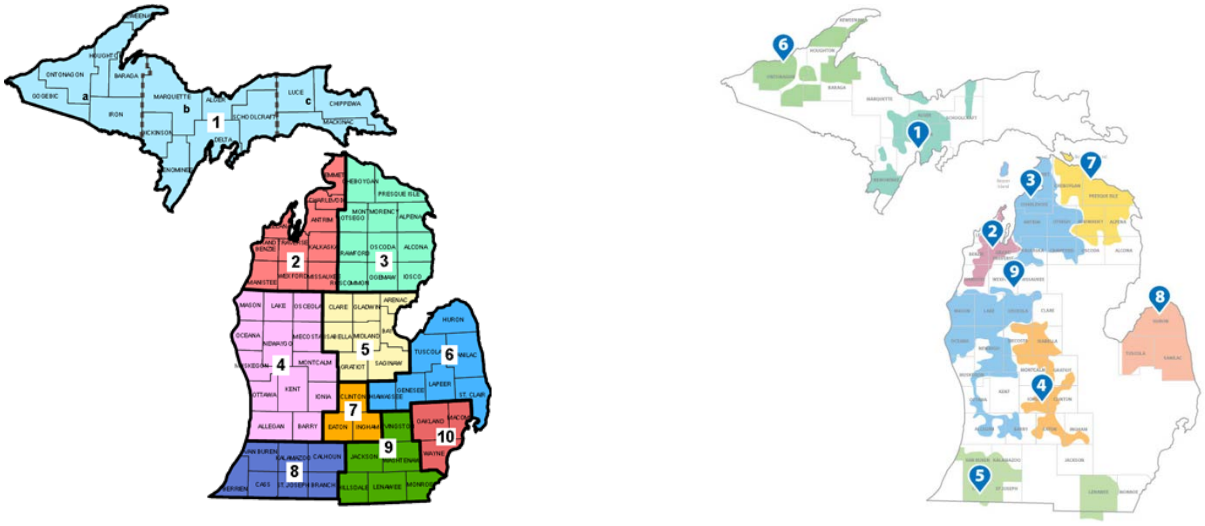
The results also demonstrate that some RECs are able and willing to deliver fiber-grade performance at subsidy levels comparable to those awarded to less capable networks. For example, the RECC, the third largest auction winner by dollar amount, committed to deploy gigabit-speed fiber networks in exchange for federal support of $280 per location served. That was only slightly higher than the $279 and $275 per-location awards to the two largest winners, both of which planned to deploy fixed wireless networks. In contrast to the gigabit speeds reliably delivered by RECC fiber networks, these fixed wireless operators plan to deliver only 100/20 Mbps and 25/3 Mbps speeds, and with less certainty about the extent to which these promised speeds will be reliably delivered. *These auction results underscore the potential contribution RECs can make in maximizing the public value generated by public subsidies.*

In this final section we offer a set of recommendations based on the analysis presented in earlier sections and several appendices. We begin with a discussion of how RECs can contribute to regional broadband planning and development in Michigan. This is followed by a brief review of broadband-related best practices we believe are relevant to local, regional and state planning, and which are discussed further in Appendix 3. The section ends by considering steps that can be taken at the state level, including creation of a state office designed to catalyze and help manage efforts to more effectively expand broadband access and its benefits.

Broadband, RECs and Michigan's Prosperity Regions

In its Fiscal Year 2014 budget Michigan launched the Regional Prosperity Initiative (RPI), which divided the state into ten multi-county Prosperity Regions.[85] A key goal of the RPI was to simplify and make more efficient the process of developing policies and partnerships to improve economic growth and delivery of public services. It was driven by a sense that Michigan had too many regional and local planning and service delivery entities whose work was not well coordinated, driven by different visions and priorities, and yielded unhelpful redundancies and gaps.[86] Though the program was voluntary, it provided a funding mechanism designed to encourage cross-entity and cross-community collaborative planning within regions defined by local and regional economic and social dynamics.

Figure 3: Michigan's Prosperity Regions and Rural Electric Cooperatives*



** Co-op map excludes Cloverland Electric Cooperative, which serves large portions of the eastern U.P.*

The above maps show the geographic boundaries of Michigan's Prosperity Regions (PRs) and eight of its nine RECs (as noted earlier, Cloverland Electric, which serves eastern portions of the U.P. is missing from the latter map). A comparison of the two maps highlights the fact that the purpose of both PRs and RECs is to facilitate the efficient delivery of core services across multi-county regions. It also suggests that, for a good part of the state, RECs cover much of the most rural areas within each PR.

A review of documents generated by the state's PRs indicates that broadband is a topic considered in their plans and goals and the metrics used to monitor progress toward those goals. But this review also suggests that more could be done to recognize, monitor and address the need for and value of broadband connectivity and adoption.

This leads to a recommendation that PR planning efforts feature a more robust broadband-related component to reflect the fact that, like electricity, roads and other infrastructure services, broadband connectivity and its effective utilization have become necessary to achieve prosperity in the digital age. **A related recommendation is that RECs be active participants in this planning process**, to reflect their presence and strong roots in rural areas suffering the largest gaps in broadband availability and usage, and their growing involvement in efforts to bridge those gaps, as discussed in this CLP. As noted in our earlier discussion of MEC's partnerships with Lyndon Township and the city of Niles, these efforts can extend beyond an REC's existing service area.

Incorporating a stronger broadband component in the RPI and individual PR planning efforts could also facilitate broader adoption by local communities and regions of key **broadband-related best practices**, including those listed below and described in more detail in Appendix 3.

- "Dig Once" policies that facilitate cost savings from joint trenching and ensure that broadband goals are coordinated with other infrastructure and public works projects;
- Inventories of vertical assets, community anchor institutions and backhaul capacity to facilitate expansion of broadband coverage and benefits;
- Reducing public and private barriers to utility poles, towers, rights-of-way and other enabling resources to expedite and reduce the costs of broadband deployment;
- As discussed in this CLP, developing partnerships to aggregate the resources necessary to deploy, maintain, manage and derive maximum benefits from broadband networks;
- Understanding the range of options for obtaining financial support for broadband network deployment and the monthly cost of service for low-income households;
- Developing digital literacy training programs and awareness campaigns to promote adoption and effective use of broadband services.

A STATE-LEVEL OFFICE OF DIGITAL EMPOWERMENT

A number of states[87], including Colorado,[88] Maine,[89] Massachusetts,[90] Minnesota,[91] North Carolina,[92] Pennsylvania,[93] Virginia,[94] Washington[95] and Wisconsin[96] have established a state-level office to promote broadband and its benefits. While we are not aware of any study analyzing the impacts of these state offices, we did discover preliminary evidence in a Purdue University study suggesting such an office can help a state more effectively address its rural digital divide.

The Purdue study analyzed FCC data on the availability of broadband speeds (25/3 Mbps) within rural census block groups in six Upper Midwest states as of 2014 and 2017.[97]

Two of the six states considered in the Purdue study have a broadband office, Minnesota and Wisconsin. The experience of Minnesota is most notable here. In 2013 its legislature created an Office of Broadband Development within the state's Department of Employment and Economic Development.[98] Between 2014 (the office's first year of existence) and 2017 Minnesota achieved the largest increase in rural availability (30.9 percentage points) among the six states, as its rural availability climbed from 47.7 to 78.6 percent, the highest level among the group. Wisconsin, whose broadband office is a unit of the state's Public Service Commission, achieved the second largest increase, a 24.8 point gain. In contrast, Michigan's rural availability measure increased by only 12.1 points, to 63.7 percent, during that period.

This leads to our final recommendation, that the state of Michigan undertake a study of the structure, operation and impacts of existing state broadband offices to identify a set of best practices and apply them to the design of a Michigan Office of Digital Empowerment. The term "digital empowerment" is suggested here rather than the more commonly used term "broadband" to emphasize that the goals of the office would include expanding not only broadband availability, but also adoption, usage and benefits. Recognizing broadband as essential "prosperity infrastructure" in the 21st century, the office's goals and work would be approached as an integral component of the state's broader efforts to support broad access to economic development and the health, education, safety and prosperity of its citizens. Toward that end, the office would work with a broad range of stakeholders, not only in the broadband sector, but also those focused on this broader range of social goals.

Though the design and functions of this office would be informed by the proposed study of other state offices, we offer below some suggestions regarding its goals and roles. While these would encompass urban broadband issues (e.g., related to affordability, adoption and digital literacy), the discussion here will focus on potential goals and responsibilities related to the rural broadband issues discussed in this CLP. These include:

Develop a better understanding of broadband gaps and ways to fill them. As discussed earlier, the FCC data relied on for targeting broadband network subsidies tends to exaggerate broadband availability, speeds and adoption, especially in rural areas. The state Digital Empowerment office would oversee an effort to correct these distortions in Michigan data and augment broadband availability data with other helpful datasets.

This effort could build on the data compiled by Connect Michigan, which integrates more data sources than the FCC and tends to be more flexible and in-depth in its data collection and analysis. This could be supplemented by crowdsourcing methods to help verify data provided by ISPs, including an approach being developed by Michigan State University's Quello Center in cooperation with Merit Network.[99] If possible, it could also include the Microsoft and/or Measurement Lab datasets discussed earlier, which are based on measured rather than advertised speeds. Another helpful addition would be trend data related to economic development, which could be analyzed in relation to trends in broadband availability and adoption. Including the geographic boundaries of electric cooperative service areas would also be helpful in analyzing gaps in broadband availability and usage that RECs are well positioned to help address. In addition to the resources provided by Connect Michigan, expertise and data helpful in this effort could

come from the state's universities and other sources,[100] as well as the FCC's proposed Digital Opportunity Data Collection system as it develops.[101] It might also benefit from collaboration with other states wanting to improve the quality of their broadband-related databases.[102]

Develop a better understanding of how broadband can support economic and community development. Though there is an expanding body of research on the impacts of broadband,[103] the reality is that the extent to which these impacts manifest depends on interactions among multiple factors and that these dynamics are still not very well understood. As part of its responsibilities, the state Office of Digital Empowerment would work with development experts, academics and affected stakeholders to examine existing research on broadband adoption, usage and impacts, and develop a Michigan-focused program to build on that base of knowledge.

Key goals of this research program would be to: 1) inform the ongoing evolution of Michigan's digital empowerment-related policies and; 2) maximize the benefits of public and private investments in broadband and digital technology in terms of economic development and the delivery of high-quality education, healthcare and government services. Related to this would be ongoing study of cyber-security and privacy issues related to what will likely be an ongoing expansion of digital connectivity. Timely and worthwhile topics of study could include the impacts of fiber deployments by Michigan RECs and other Michigan networks funded by pending state and federal subsidy programs. As with the effort to improve broadband-related datasets, this research could benefit from collaboration with Michigan's universities[104] and other states.

Encourage partnerships that help expand broadband availability, speeds and benefits and remove legislative obstacles to such collaborative efforts. As discussed in this CLP, RECs are emerging as key participants in the rural broadband sector, and have demonstrated motivation and ability to partner successfully with local governments and telecom cooperatives to cost-effectively expand the scope, speed and benefits of rural broadband. Given its goals and resources, the Office of Digital Empowerment should encourage such collaborative efforts.

A key obstacle in developing such partnerships in Michigan and some other states is the existence of state laws that restrict participation in broadband ventures by local governments and other public entities. As noted earlier, the North Carolina legislature is considering a bill that would loosen such restrictions in that state in order to encourage the kind of collaborative projects co-ops and local governments are successfully developing there. The Office of Digital Empowerment could help Michigan move in a similar direction, by helping political leaders craft legislation that encourages successful partnership models and eliminates barriers to their development.

Learn from and build on the state's new broadband grant program. In the lame duck session following the 2018 election, Michigan's legislature allocated $20 million in grants to be awarded in 2020 through a newly created Connecting Michigan Communities (CMIC) program. The CMIC's process (e.g., eligibility standards and weighting factors) and impacts are worthy topics of study for the research programs referenced above. The same is true of potential strategies that can help the state attract federal grants that boost the potency of its own subsidies and the realization of its broadband goals. These topics are discussed further in Appendix 2.

Advocate for helpful changes in federal policies and subsidy programs. In conjunction with all of the above, the state's rural broadband and development communities, led by and channeled through the Office of Digital Empowerment, should seek to influence federal broadband-related policies and subsidy programs, which are discussed in Appendix 2. This effort would likely have the most impact if undertaken in cooperation with broadband planning entities in other states, as well as national organizations advocating for expanded broadband access and digital literacy.

CONCLUSION

Just as electricity did in the 1930s and 1940s, broadband has in the past two decades emerged as a powerful new component of "prosperity infrastructure," increasingly necessary to support healthy economic growth, well-paying jobs, and high quality education, healthcare and governmental services. Yet, as was the case with electricity in the 1930s, the economics of deploying broadband networks in rural areas is very challenging, a dynamic that has led to a stubbornly persistent rural digital divide. This problem is aggravated by reliance on inaccurate government data as a basis for targeting public subsidies of broadband network construction.

This paper presents data and analysis to argue that, as with electricity in the 1930s, efforts to bridge today's rural digital divide can benefit greatly from the participation of non-profit member-owned cooperatives, especially when coupled with well-designed and accurately targeted public subsidy programs.

Recognizing the unmet needs for connectivity among their members, a small but growing number of rural electric cooperatives (RECs) around the country have begun to deploy fiber optic networks, which are considered the gold standard in terms of broadband speed, reliability, upgradability and future-readiness. These include three Michigan RECs which together account for more than half of the roughly 325,000 rural homes and businesses served by the state's nine RECs. While some co-ops are pursuing these projects on their own, others are partnering with cities, townships and counties, including some outside the co-op's service area but in need of better connectivity. Others are working with telephone cooperatives or making resources available to encourage private companies to better serve co-op members.

The quantitative data and qualitative case examples discussed in this paper support the notion that RECs are well positioned to help bridge the rural digital divide. Since they already provide electric service to much of the nation's least connected rural communities, they already have in place utility poles, easements, skills, trucks, billing systems and customer relationships. These existing assets can help make the rural broadband business case less challenging. As customer-owned service providers, RECs are also focused more on maximizing community benefits than profits. They also have an additional incentive to deploy fiber, since it enables them to improve the quality, reliability and cost-effectiveness of their electric service. As such, they view fiber networks as long-term infrastructure investments and are willing to accept much longer payback horizons than is typical of a privately owned network operator.

The paper, including its appendices, also discusses the shortcomings of current rural broadband policy, most notably related to the allocation of public subsidies for network construction. It also points to progress that has been and can be made on that front, including key changes that can better leverage REC resources and their motivation to better serve their members.

The paper concludes with a number of recommendations intended to encourage and leverage REC participation in efforts to more fully and efficiently bridge Michigan's rural digital divide. Some of these are intended to better integrate the perspectives, goals and resources of RECs in the state's Regional Prosperity Initiative. Others focus on creating a state-level Office of Digital Empowerment to help lead, mobilize and integrate efforts among RECs and others to more effectively expand broadband and its benefits throughout the state. Another set of recommendations outlines a set of broadband-related best practices that are applicable at the local, regional and state level of planning and project development.

These recommendations are presented to the REI community, state policymakers, and other stakeholders in the hope they will spur further discussion and action aimed at extending broadband and its benefits throughout the state of Michigan.

APPENDIX 1: BROADBAND AVAILABILITY AND USAGE IN MICHIGAN'S RURAL COUNTIES

To provide a more geographically granular picture of broadband availability and usage in Michigan, we analyzed FCC and Microsoft county-level data using 2013 Rural-Urban Continuum Codes (RUCCs) to assign each county to a category reflecting its relative rurality. The RUCC classification system is used by the USDA to distinguish different categories of metro and non-metro counties, as summarized in Table 1 below.

Table 1: Rural-Urban Continuum County Codes105

Type	Description
1	Metro - Counties in metro areas of 1 million population or more
2	Metro - Counties in metro areas of 250,000 to 1 million population
3	Metro - Counties in metro areas of fewer than 250,000 population
4	Nonmetro - Urban population of 20,000 or more, adjacent to a metro area
5	Nonmetro - Urban population of 20,000 or more, not adjacent to a metro area
6	Nonmetro - Urban population of 2,500 to 19,999, adjacent to a metro area
7	Nonmetro - Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Nonmetro - Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Nonmetro - Completely rural or less than 2,500 urban population, not adjacent to a metro area

Table 2 examines each RUCC category's percentage of Michigan's total housing units and land area, as well as each category's average per-county housing units, square miles and housing density.

Notably but not surprisingly, the six counties in Category 1 account for 41% of the state's housing units but just 7% of its geographic area. Together, the 26 counties in the three categories of "metro" counties

account for 78% of Michigan's housing units but only 28% of its area, while the 57 "non-metro" counties encompass 72% of the state's land area but only 22% of its housing units. This trend is also reflected in the average housing density per square mile, which declines from a high of 490 in Category 1 to a low of 18 in Category 9.

Table 2: Mix of Michigan Counties by Rural-Urban Category

County Type	**# of Counties**	**Total 2017 Housing Units**	*% of State*	**Total Sq. Miles**	*% of State*	**HU per County**	**HU per Sq. Mi.**
1	6	1,905,942	41%	3,889	7%	317,657	490
2	12	1,141,634	25%	7,370	13%	95,136	155
3	8	519,220	11%	4,784	8%	64,903	109
4	6	207,244	5%	3,750	7%	34,541	55
5	4	117,929	3%	4,453	8%	29,482	26
6	10	211,090	5%	6,388	11%	21,109	33
7	23	338,105	7%	17,607	31%	14,700	19
8	1	9,847	0%	363	1%	9,847	27
9	13	144,147	3%	7,941	14%	11,088	18
State	83	4,595,158	100%	56,547	100%	55,363	81

Table 3 provides a comparison of FCC and Microsoft data for different categories of Michigan counties. The categories are based on each county's RUCC classification and whether it is served at least partly by an electric co-op. The table also includes average household income and unemployment rates for each category, plus a field ("Use % of Avail") that compares Microsoft's usage percentage to the FCC's availability percentage.

Table 3: Broadband Availability & Use by County Type & Presence of REC

Presence of REC	County Type	Housing Density	# of Counties	Housing Units	Broadband % Avail	Broadband % Use	Use % of Avail	UR*	Average HH Income*	Inc. % of State Avg.
	1	490	6	1,905,942	97%	48%	49%	5.4	$ 56,838	108%
	2	255	2	342,744	95%	51%	53%	4.8	$ 53,769	103%
	3	88	3	146,154	90%	41%	46%	5.0	$ 49,257	94%
	4	57	1	30,242	80%	43%	54%	5.3	$ 52,716	101%
	5	17	1	20,376	83%	36%	43%	6.5	$ 43,835	84%
	6	38	3	60,770	63%	22%	35%	5.6	$ 46,498	89%
	7	16	6	91,042	72%	40%	55%	7.5	$ 39,772	76%
	8	27	1	9,847	53%	19%	36%	8.3	$ 43,339	83%
	9	33	2	34,249	70%	15%	22%	7.4	$ 44,442	85%
Y	2	133	10	798,890	92%	45%	49%	4.0	$ 56,866	108%
Y	3	120	5	373,066	91%	38%	41%	5.0	$ 49,540	94%
Y	4	55	5	177,002	75%	29%	39%	4.3	$ 51,693	99%
Y	5	30	3	97,553	92%	35%	38%	5.1	$ 51,370	98%
Y	6	31	7	150,320	58%	16%	27%	6.1	$ 43,339	83%
Y	7	21	17	247,063	64%	24%	37%	6.7	$ 45,463	87%
Y	9	16	11	109,898	40%	10%	24%	7.0	$ 42,976	82%

** UR is average unemployment rate for each category weighted by housing units. Average HH Income is the average of county median household incomes per category weighted by housing units.*

As the table shows, both broadband availability and usage tend to decline as county types become more rural and distant from metro areas. The same is true of the "Use % of Avail" metric, suggesting that the gap between ISP-reported availability and measured connectivity is greater in more rural areas.

The table also shows that more rural and remote counties tend to have relatively low household incomes and high unemployment rates. These weak economic indicators can constrain broadband adoption, especially if—as is often the case in very rural areas--speeds and service quality are low, prices are high and competitive options are few or nonexistent. This dynamic, together with flaws in the FCC's availability data, may help explain the steep decline not only in "% Usage" as we move toward the most rural end of the RUCC scale, but also in "Use % of Avail". Put another way, broadband is not only less available in rural communities and probably less available than FCC data suggests, in areas where it is available, its perceived benefit-to-cost ratio may make it unattractive to a significant percentage of residents in low income rural areas.

Table 3 also shows that 58 (70%) of Michigan's counties are at least partly served by a REC. These include most of the state's low-income, high unemployment rural counties. As noted above, these counties have relatively low levels of broadband availability and usage, and large gaps between reported availability and measured usage.

A logical conclusion from this analysis is that Michigan counties served at least partly by RECs suffer: 1) the state's most severe lack of broadband connectivity; 2) the greatest exaggeration of that connectivity by FCC availability data and; 3) the economic weakness that expanded access to broadband has potential to help address. This, in turn, raises questions about: 1) how RECs can help extend broadband and its benefits to these underserved rural areas, much as they did with electricity decades ago, and; 2) what policymakers and stakeholders can do to help generate the most social value from REC's ability to help bridge the rural digital divide.

APPENDIX 2: MANAGING UNIVERSAL SERVICE SUBSIDIES IN THE INTERNET AGE

Perhaps the most significant public policy issues facing electric co-ops or any other entity wanting to deploy a rural broadband network are those related to government financial support for such investments. Since networks built in rural areas have relatively high per-premise costs, access to government grants and/or low-cost long-term loans can be very helpful--and in some cases necessary--for a network investment to be financially feasible.

Unfortunately, the methods that have been used to determine areas eligible for public support have not evolved as fast as user demand, technology and industry structure, especially when it comes to bringing 21st century connectivity to rural America.

Earlier in this CLP we discussed one key component of this problem, the questionable accuracy of FCC data on broadband availability--especially in rural areas--and the fact that this flawed data is relied on to determine areas eligible for public subsidy of network investments.

A second and related component is the use of outdated speed standards to identify areas sufficiently underserved to justify public subsidy. As noted earlier, the FCC has, since early 2015, defined 25 Mbps downstream and 3 Mbps upstream as the minimum speeds considered "broadband." Nevertheless, the largest federal subsidy programs, which are overseen by the FCC and USDA,[106] and a pending grant program funded by the state of Michigan[107], all restrict financial support to areas lacking only 10 Mbps downstream and 1 Mbps upstream. By excluding from eligibility those with 10/1 Mbps but not 25/3 Mbps speeds, this policy has left some rural areas lacking access not only to broadband speeds, but also to government support that can help remedy this situation.

Following the CAF II auction discussed in this CLP, the next important next step in the evolution of FCC universal service subsidy policy will be an additional round of $20.4 billion in network subsidies, which FCC chairman Ajit Pai has dubbed the Rural Digital Opportunity Fund (RDOF). Pai announced the new funding program on April 12, 2019[108] and in early August the Commission released a Notice of Proposed Rulemaking seeking comment on it.[109]

Among the proposed changes was an increase in the speed required to qualify as "already served" from 10/1 Mbps to 25/3 Mbps. Though this would mark an improvement from the prior 10/1 Mbps eligibility threshold, it's worth noting that: 1) the FCC's 25/3 Mbps broadband standard is more than four years old and; 2) since the standard was adopted, the typical U.S. household's data usage has grown dramatically, as suggested by a 40% jump in median data usage between 2017 and 2018.[110] This suggests that, even with Pai's suggested eligibility change, the RDOF auction may leave a painfully large portion of rural Americans without the connectivity they will need to prosper in our increasingly connection-dependent world.

SUBSIDIZING FUTURE-READY VS. BACKWARD-LOOKING NETWORKS

Additional changes with potential to further shift the balance of FCC grants toward higher-performing and more future-ready networks include increasing: 1) the minimum required speed beyond 25/3 Mbps and; 2) the weighting factor for networks delivering fiber-level performance.

Eric Cramer, CEO of Wilkes Communication, one of the top CAF II gigabit-speed winners (and whose strategy is discussed earlier in this document) suggests that the RDOF go even further, by adopting a two stage auction. In the first stage only networks able to deliver 100 Mbps symmetrical speeds would be eligible to bid. If any bidder in that phase meets the auction's reserve price, it would be awarded funding at that level unless more than one bidder does so. In the latter case, a winner would be decided via a competitive reverse auction process limited to those bidders. If no qualifying bidder meets the reserve price in this first phase, the geography in question would move on to a performance-weighted auction model that includes lower-performing network technologies.

In addition to a stronger focus on technical performance, weighting factors can also prioritize specific public benefits from government subsidies. Examples of pending programs taking this approach are: 1) the Rural eConnectivity Pilot (ReConnect) Program, through which RUS is providing $600 million in loans and grants and; 2) Michigan's recently launched $20 million Connecting Michigan Communities (CMIC) grant program.[111]

The Reconnect program's weighting system includes not only technical performance, but also housing density and the number of farms, businesses, schools, healthcare centers, critical community facilities and tribal lands the proposed network will reach. It also provides extra weighting points for projects in states that: have a recently updated broadband plan; allow "any utilities service provider" to deliver broadband service and; commit to expediting right-of-way environmental permitting.[112]

In Michigan, CMIC's selection criteria give weight to a broad range of factors including: evidence of community support; benefits to community anchor institutions; economic development impacts; affordability and service limitations; service to distressed communities and; inclusion of training and public awareness efforts as part of a broadband adoption strategy.[113] Unfortunately, the law authorizing CMIC also includes a provision that seems to run counter to these public benefit-focused criteria, by prohibiting direct or indirect participation in the grant process by government or educational entities.[114]

THE NEED FOR MORE COORDINATION AND LESS COMPLEXITY

In an early 2019 New York Times op-ed piece, University of Virginia professor Christopher Ali called for increased coordination between the FCC, RUS and states in making broadband subsidy decisions. He went on to propose that RUS be designated as the primary coordinator for rural broadband policy, citing its "century-long relationship with rural communities and offices in every state."[115]

As Ali notes, this approach to coordination would be most effective if combined with reform of the complicated web of RUS restrictions and requirements. He quotes one small provider telling him that '"the hardest thing I've ever tried to do is to navigate" how to get funding from [RUS]." A similar sentiment is expressed by Trevor Jones, VP of Marketing for independent telephone company OTELCO, writing in the May/June 2019 issue of Broadband Communities magazine. In his article Jones explains

how the ReConnect program's complicated and sometimes conflicting rules and restrictions led OTELCO to decide not to apply for funding through the program.[116]

Doug Dawson, president of CCG Consulting, a telecom consultancy active in rural communities, offers a similarly strong critique of existing federal funding programs. He suggests that, instead of relying on flawed FCC data and speed-based restrictions, eligibility decisions should be based on a simple technology-based test: "any place where there is telco copper and no cable company networks should be grant-eligible for fiber overbuilders."[117] This change, he contends, would not only simplify the process of determining eligibility, it would also accelerate rural America's shift from increasingly obsolete copper networks to 21st century fiber-based connectivity.

Dawson also has advice for states, encouraging them to develop strategies that can most effectively leverage federal funding, including the planned $20.4 billion RDOF reverse auction.[118] He points out that, since the auction will favor bidders willing to accept the least amount of federal subsidy (with some weighting for technical performance), those that enter the auction with state grant money in hand will have an advantage over competing bidders with similar business plans using similar technology.

This pre-auction targeting of their state subsidies could provide state broadband planners and policymakers with leverage in directing federal subsidies to projects supportive of their state's connectivity goals. For example, if Michigan adopted broadband deployment goals more ambitious than the FCC's, the state could employ selection criteria for its grants that favor entities whose network plans are most consistent with the state's own broadband goals. The receipt of these state grants would then improve the RDOF auction prospects of these entities. Having already been awarded a state grant, they would need less federal subsidy to make their project financially feasible, and would therefore be better positioned to be a winning bidder in the RDOF reverse auction.

APPENDIX 3: RECOMMENDATIONS FOR BROADBAND BEST PRACTICES

This appendix describes a range of strategies to improve rural broadband availability and benefits. It was developed by Connected Nation, which offer programs and initiatives in Michigan and nationwide to help bridge the digital divide.[119] A more detailed version of it can be found on the Connected Nation web site.

DIG ONCE

According to the Federal Highway Administration (FHA), "ninety percent of the cost of deploying broadband is when the work requires significant excavation of the roadway."[120] "Dig Once" policies aim to increase coordination between government agencies and utility companies to minimize the frequency of roadway excavation and achieve cost savings from joint trenching. The FHA provides guidance and federal policies in relation to Dig Once.[121]

To encourage adoption of Dig Once practices, it is recommended that local governments:

- Draft and adopt Dig Once policies.
- Create a centralized database of planned ROW projects to facilitate coordinated planning. Coordinate departments such as Public Works to manage the installation of empty conduit in trenching projects where additional broadband infrastructure is needed.
- Identify abandoned utility infrastructure and notify ISPs of its existence.

TOWER PERMITTING, CO-LOCATION, AND POLE ATTACHMENT

Some zoning ordinances restrict ISPs' ability to install new towers or wireless transmission equipment on existing towers. Since fixed wireless is often helpful in extending communication services to extremely remote areas, the ability to erect towers and co-locate wireless equipment is helpful for expanding coverage. Pole attachment regulations can also make it more difficult or expensive to install both wired and wireless equipment on utility poles. To address these challenges, it is recommended that:

- Local townships undertake or utilize existing vertical asset inventories to identify public and private vertical assets that could be leveraged to reduce deployment costs.
- Local governments assemble a working group of ISPs, pole owners, and community leaders to discuss ways in which they can expedite the pole attachment process while preserving property values and landscapes.

RIGHTS-OF-WAY (ROW) PERMITTING

In 2002, the State of Michigan enacted the Metropolitan Extension Telecommunication Rights-of-Way Oversight (METRO) Act[122] to streamline ROW access for telecommunications providers. The METRO Act is intended to help these providers obtain permits faster and more easily, improve competition for telecommunications services, encourage the development of new technologies, provide for a standardized ROW permitting process, and ensure reasonable management for public ROW by municipalities within the state. As written, the METRO Act currently only applies to ROW in cities, townships and villages, not unincorporated county areas.

In addition to the Metro Act, Public Act 97 of 2018[123] limits bonding requirements that can be imposed on providers and caps ROW permit fees charged by county road commissions to $300 each, or $1,000 in total for multiple permits per project. In large counties (those with populations greater than 250,000), these caps are doubled.

To continue streamlining access to the ROW, the following is recommended:

- Local governments should alert companies that own infrastructure in areas being excavated so they can perform maintenance or enhancements during excavation.
- Local road commissions should work with ISPs to explore ways to strike a healthy balance between enabling private access to the ROW and protecting public health and safety, in terms of fees, permits, approval timelines, etc.

PARTNERSHIPS

Expanding broadband into sparsely populated areas is economically challenging. Partnerships can help address this challenge by bringing multiple entities together to share costs and enhance revenue potential (e.g., finding anchor tenants, aggregating community and regional demand, and removing regulatory barriers to expedite deployment). The following recommendations are made to facilitate the creation of successful partnerships to support broadband expansion:

- Community and regional planning efforts should facilitate meetings where ISPs meet with local leaders and stakeholders to discuss broadband challenges, solutions, and paths forward.
- Develop templates and model language to facilitate innovative partnership models for broadband expansion. Helpful resources in this area include partnership guidebooks published by the US Department of Commerce124 and the Benton Foundation.125
- Develop recommendations to mitigate tax policies that may discourage broadband partnerships (e.g. personal property taxes, etc.).
- Develop a guide of potential broadband funding opportunities and seek out multiple entities to serve as co-applicants and to strengthen the application for funding.
- Identify economic impacts and returns on investment across various sectors of the entire community from the expansion and adoption of broadband.126
- Develop a best-practice guide to assist in creating effective partnerships to promote adoption of Internet-enabled services, and encourage anchor institutions, non-profits, public agencies and private businesses to create partnerships to build awareness and use of these services.
- Conduct a study to determine the extent of the home connectivity gap among households with K-12 students by working with schools to collect information from students and their families about their current state of home broadband access and adoption.
- Develop a consistent and coordinated messaging and marketing campaign to reinforce the benefits and importance of broadband availability and Internet-enabled services.

INVENTORY OF COMMUNITY ANCHOR INSTITUTIONS

Community anchor institutions (CAIs) include entities such as government offices, schools, libraries, healthcare facilities, higher education institutions, public safety agencies, and others. The following are recommendations to spur investment in communities and ensure CAIs have the connectivity they need:

- Create an inventory of the location and current connectivity of CAIs and use it to help develop solutions to connectivity gaps among CAIs and surrounding communities. The Benton Foundation and the Schools, Health & Libraries Broadband (SHLB) Coalition have published a guide to improving CAI connectivity.127
- Develop information to assist poorly connected CAIs understand the value of connectivity and potential opportunities to create partnerships that improve it.

BACKHAUL INVENTORY

Backhaul (sometimes referred to as "middle-mile") connectivity, carries communication traffic between the global Internet and local networks. It can take several forms, including fiber-optic cables and point-to-point wireless. The private sector has invested heavily in backhaul capacity in Michigan, but ISPs in some rural areas still lack sufficient and affordable middle-mile connectivity.

The following are recommended to address backhaul challenges:

- Identify public and private backhaul capacity and accessibility in the region.
- Create incentives for backhaul providers to install fiber and maximize the number of fiber strands deployed during construction to increase capacity. These could include tax incentives and improving right-of-way access along roads.

GOVERNMENT FUNDING

A number of government subsidy programs are available to support rural broadband construction costs. Reports published by the US Departments of Commerce128and Agriculture129 can help local communities, regional planners and ISPs understand how to access federal sources of financial support, which include the following:

- **FCC Connect America Fund (CAF)**[130] is comprised of several programs including Phase II, Mobility Fund, and Rural Broadband Experiments which offer subsidies to broadband providers to build out networks in rural and/or hard-to-serve locations.
- **FCC E-Rate Program**[131] helps schools and libraries obtain affordable broadband. Eligible schools, school districts and libraries may apply individually or as part of a consortium. Discounts range from 20% to 90%, depending on the level of poverty in the community and whether the school or library is located in an urban or rural area.
- **FCC Rural Health Care Program**[132] provides funding to eligible health care providers for telecommunication services needed to provide rural healthcare.
- **USDA ReConnect Program**.[133] USDA operates multiple loan and grant programs to support rural America. In 2018 it launched the ReConnect Program to help expand rural broadband. The initial program provides up to $200 million in grants, $200 million in loan and grant combinations, and $200 million in low-interest loans.

- **Connecting Michigan Communities Grant program (CMIC)** is a one-time $20 million fund created by the state legislature in 2018 to expand broadband access in remote areas. CMIC began accepting applications in mid-2019 with awards expected in spring 2020.[134]

REDUCING COST BARRIERS TO ADOPTION

Affordability barriers to broadband adoption include both the cost of service and the cost of the devices needed to use that service. In terms of service costs, the FCC's Lifeline Program[135] provides a $9.25 per month subsidy for the purchase of voice telephone service, including mobile, and broadband by low-income households. In addition, some ISPs offer low-cost subscription programs for qualifying low-income households. In Michigan, these programs include Comcast Internet Essentials, [136] Access from AT&T,[137] and Spectrum Internet Assist (Charter).[138]

To address cost barriers to broadband adoption, the following steps can be helpful:

- Develop a grassroots strategy to disseminate information on low-cost broadband subscription programs. This should target households experiencing broadband affordability issues and coordinate with the state 2-1-1 information system and other organizations serving vulnerable populations.
- Encourage and support local libraries in developing and funding hotspot and device-lending programs that enable patrons to access broadband connectivity at home.
- Encourage and support schools in developing solutions to support at-home broadband access for students who lack it.
- Explore and, as needed, develop surplus equipment policies to ensure discarded access devices can be donated to non-profits that refurbish and provide computers to families with low income and/or K-12 students. Encourage public and private organizations to donate computers to such organizations to maximize affordably available devices for vulnerable populations.

DIGITAL LITERACY TRAINING

Digital literacy is the ability to use digital technologies to find, evaluate, create, use and communicate information.[139] Digital literacy initiatives such as those described below can help consumers overcome barriers to broadband adoption, usage and benefits.

- Support digital literacy and technology training by creating a regional clearinghouse of existing digital literacy and technology training programs and curriculum.
- Leverage the International Society for Technology in Education Student Standards that have been adopted by the Michigan Department of Education as a standard set of skills needed to succeed in a digital world. Labeled the Michigan Integrated Technology Competencies for Students, the program offers openly licensed educational resources.140
- Establish partnerships with colleges, universities and libraries to develop mentoring programs to provide digital skills training, particularly for skills sought by employers.
- Support, through schools, the use of technology to foster increased technology competencies in support of learning and preparation for career and college. Technology skills gained by students often extend to parents and others in the home.

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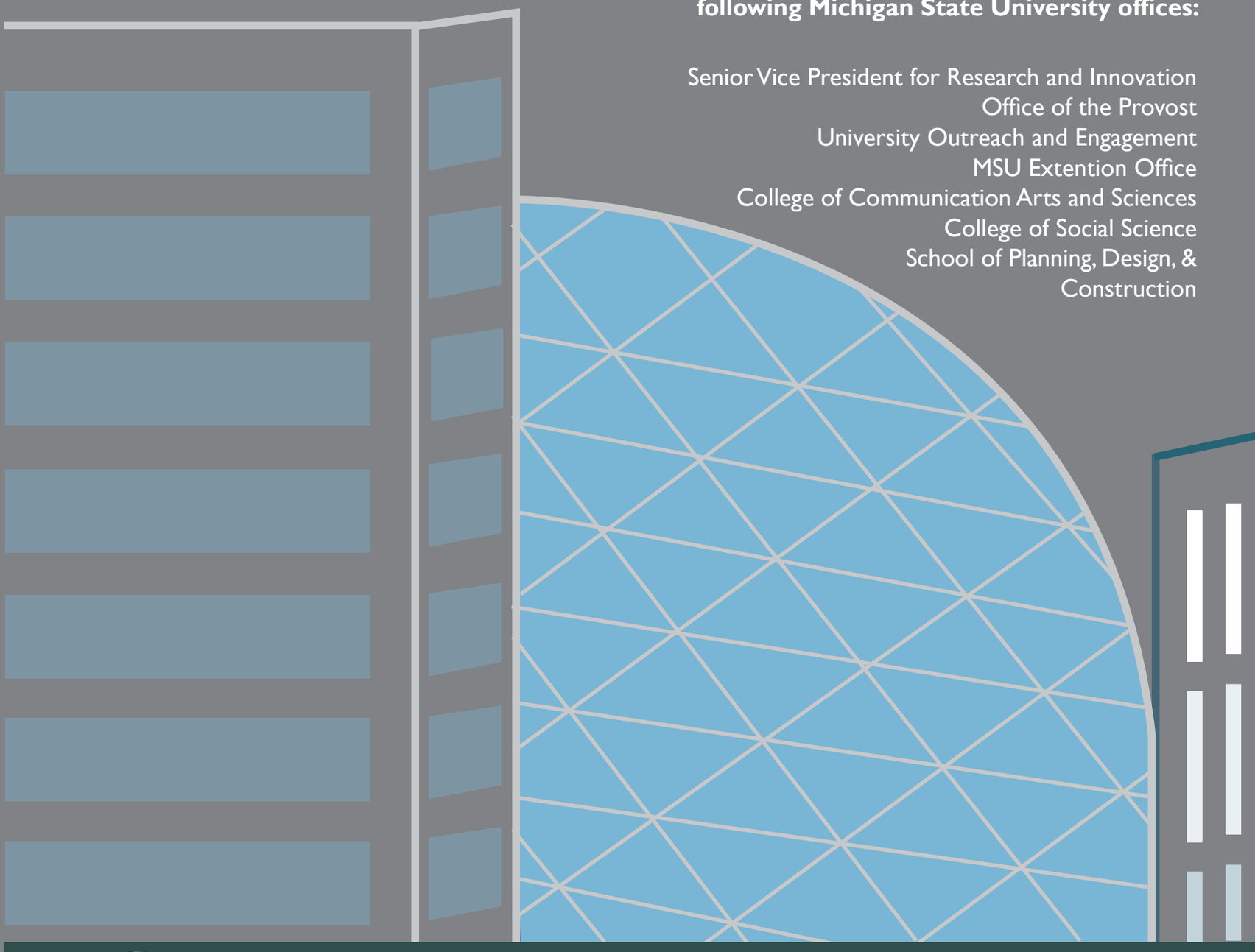

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