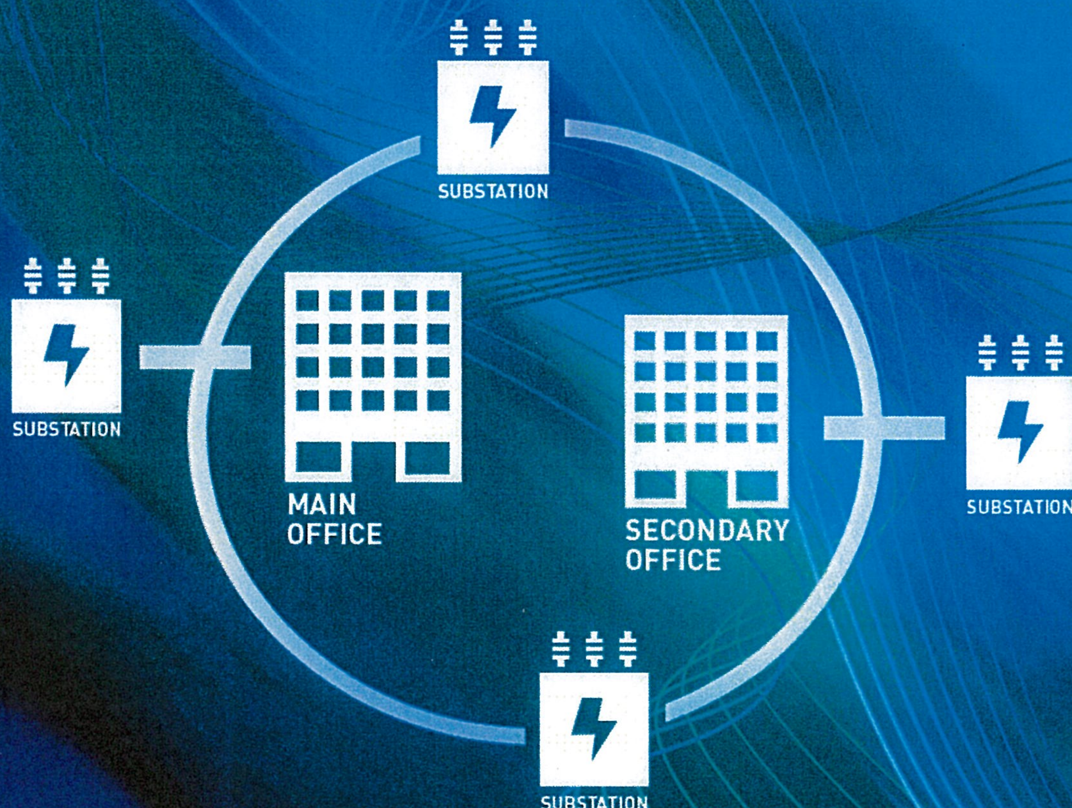
The Value of a Broadband Backbone

for America's Electric Cooperatives

A Benefit Assessment Study



nrtc
Member driven. Technology focused.

NRECA
America's Electric Cooperatives

ERICSSON

1 EXECUTIVE SUMMARY

1.1 Purpose

This paper outlines and quantifies the benefits of a broadband backbone for electric cooperative operations.[1] For the purposes of this paper, a broadband backbone is defined as a high-bandwidth, low-latency data connection, enabled by wired or wireless technology, that connects systemically important infrastructure. Importantly, it provides transport—delivery of data collected by other utility networks—which is critical to managing electric operations. Broadband backbones are necessary to accommodate new data-intensive use cases that optimize operations and adapt to changing consumer behavior.

1.2 Overview

The move to a smarter grid entails more data from more end points on a more frequent basis. Applications such as advanced metering infrastructure (AMI) and distribution automation (DA) enable cooperatives to optimize operations and reduce costs. Meanwhile, as the grid evolves to accommodate more distributed energy resources (DER), system infrastructure must be adapted. At the same time, utilities are moving to take advantage of new technologies, such as drones and video monitoring, to increase grid reliability and security. Many of these use cases can be supported by lower-bandwidth solutions but will continue to advance and require additional bandwidth in the future. Given the fast pace of technological change and the rapid expansion of data, cooperatives should develop and regularly update 10-year plans to address their communication needs, and account for their expected technology and operational use cases over that time.

1.3 Technology Options

A broadband backbone can be comprised of both wired and wireless technologies. To guarantee the performance of all aspects of a network, a fiber backhaul system is typically the best option. Fiber offers the most secure, most reliable, highest-throughput, and lowest-latency wired communications option for cooperative network connections. In addition, fiber provides the opportunity to connect the grid reliably with enough capacity for both current and future use cases. Today, fiber solutions can provide up to 10 Gigabits per second (Gbps) as the wired option. However, fiber has both geographic and cost impediments that limit its use in all situations. In such cases, point-to-point wireless solutions can support the transfer of data with the reliability, bandwidth, latency, and security necessary for cooperative applications. Wireless point-to-point solutions can support all use cases profiled in this white paper. Today, they can provide up to 1 Gbps, with the potential to provide higher speeds in the future. A mix of both wired and wireless solutions will be necessary for most electric cooperatives.

Although it is outside the scope of this paper to analyze the opportunity in depth, cooperatives may be able to leverage this new backbone to provide broadband services to their member-consumers and communitites. The backbone is a major step toward providing those services, either directly or through a third party.

1.4 Use Cases and Quantification

Use cases are technologies that improve the operations or service of a cooperative. The move to a smarter grid is underway, and that smarter grid already has many use cases deployed that collectively require broadband communication. The number of use cases will expand as cooperatives continue to innovate and invest in a smarter grid and the analytics to support it. As described in this study, the value of a broadband backbone depends on the cost avoidance or revenue enhancement associated with use cases on a per-meter basis, collected from publicly accessible data. We evaluated the following use cases: DA, substation automation (SA), AMI, volt/VAR optimization, demand management (DM), outage reduction, asset management (AM), DER, replacement of existing telecommunications carrier costs, and new revenue from leasing dark fiber. This analysis estimates $1.7 million to $2.9 million and $10 million to $16.6 million in economic gain from these cases for a fully implemented 10,000 member and 50,000 member electric cooperative respectively. The value of a broadband backbone is

1 Note that an evaluation of the business case or economic benefits of broadband deployment to member-consumers in electric cooperative territories is beyond the scope of this paper; however, such impacts are "are likely to be substantial." See *The Competitiveness and Innovative Capacity of the United States*, U.S. Department of Commerce (January 2012), pp. 5–8 to 5–10. As each electric cooperative has unique characteristics, the benefits described in this paper are estimates and will vary from system to system.

demonstrated by its essential contribution to achieving these gains. It is a necessary component to enable these benefits, though it is not sufficient to implement these use cases on its own.

1.5 Proposed Actions

Developing a broadband backbone communications solution will provide the reliability, security, speed, and bandwidth necessary to allow electric cooperatives to adopt emerging use cases and new technologies to optimize grid operations. For most co-ops, that solution will likely include a combination of fiber and point-to-point wireless technologies, which will support the transition to a smarter grid that is connected and provides real-time situational awareness and control of grid assets.

2 INTRODUCTION

Rapid changes in technology can allow electric cooperatives to implement innovative solutions that benefit members and their changing consumer preferences. These changes reinforce the cooperative's member focus and align its goals with the interests of its members. Moreover, DER and other edge technologies are changing the grid from a linear, generation-centric system to a flexible two-way grid increasingly dependent on bi-directional communications.

3 TRANSFORMATION OF COMMUNICATION NETWORKS

Communications networks are long-term assets.[2] Thus, utilities need to account for data and communications needs for at least 10 years in the future, and preferably even further. As we move toward a smart grid—one that is two-way, networked, distributed, and intelligent—communications will provide the enabling technology upon which those applications will be built.[3] The U.S. Department of Energy (DOE) outlines four enabling technologies for the smart grid: (1) the communications network; (2) AMI; (3) meter data management (MDM); and (4) supervisory control and data acquisition (SCADA). Although important on their own, communications networks are also necessary to enable the other three technologies.[4] Upgrading telecommunications infrastructure is imperative to facilitate the improvement and advancement of operations and customer service.

3.1 What Is Driving Backbone Demand?

The proliferation of AMI technology has given utilities unprecedented insights into the performance of their systems. Several factors have impacted the current drive toward broadband networks (Table 1).

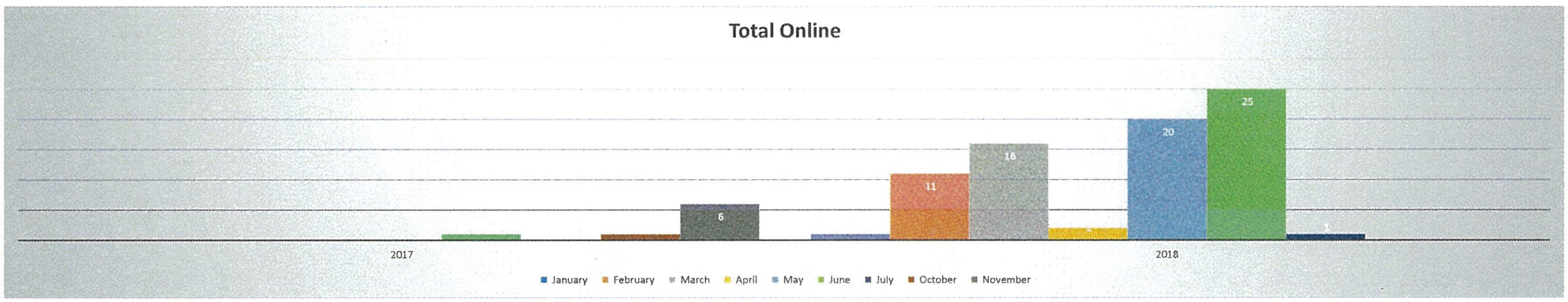
Factor	Description
Proliferation of Smart Grid	Backhaul communications necessary to support the data
Cyber Security Needs	Older technologies do not have the encryptions and firewalls necessary to protect data in transit over lines
Additional Data Usage	New applications, particularly video-enabled monitoring, require high bandwidths to leverage them to their full potential
Latency Requirements	Technologies with automated response systems require low-latency systems to respond to signals quickly enough to make actionable decisions
Improved Distribution Reliability	Real-time monitoring of critical equipment can identify failures before they occur, allowing for replacement and circumventing a potential outage
Availability of Current Telecommunications Services	Third-party carriers and providers are discontinuing older technologies as they transition to digital networks

Table 1: Reasons for the Move to a Broadband Backbone

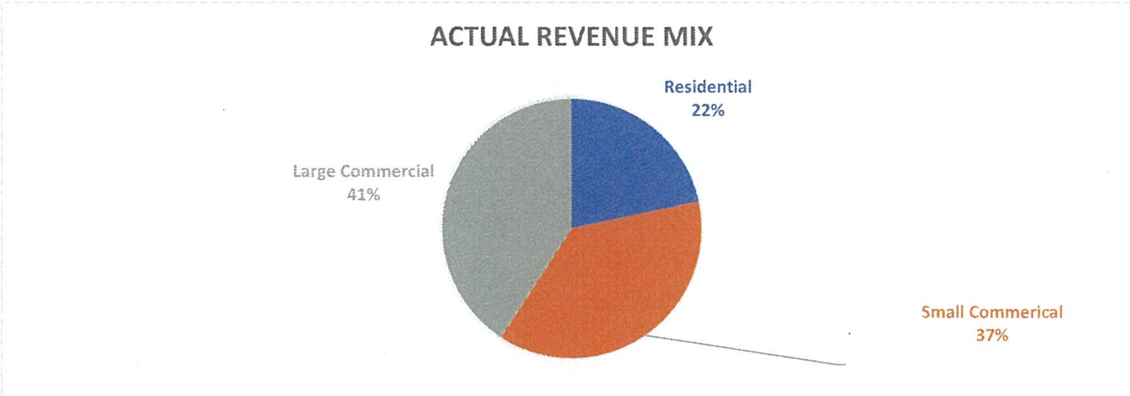
2 NRTC, NRUCFC, NRECA, and CoBank, *Due Diligence of High-Speed Broadband Investment and Business Creation by an Electric Cooperative*, 2017, 5, https://www.cooperative.com/programs-services/bts/documents/reports/broadband-due-diligence.pdf.
3 Navigant Research, *Defining the Digital Future of Utilities*, 2017, 1.
4 National Rural Electric Cooperative Association and the U.S. Department of Energy, *Smart Grid Demonstration Project*, "Communications: The Smart Grid's Enabling Technology," 2014, 1, https://www.smartgrid.gov/files/NRECA_DOE_Communications_1.pdf.

Plant Statistics	Target Passes	Target Online	Target Saturation	Total Passes	Total Online	Current Saturation
Residential	4,000	1,400	35%		62	2%
Small Commerical	100	25	25%		21	21%
Large Commercial	32	11	34%		1	3%
Total Online	4,132	1,436	35%	1,794	84	2%

Total Pending to be put online **39**



Online Customers		January	February	March	April	May	June	July	October	November	Grand Total
	2017						1		1	6	8
	2018	1	11	16	2	20	25	1			76
Grand Total		1	11	16	2	20	26	1	1	6	84



Revenue	Jan - May 2018 Revenue			Jun-18	Jan - May 2018 Revenue	
Residential	$	3,619.00		2857.93	$	6,476.93
Small Commerical	$	6,262.00		1600.31	$	7,862.31
Large Commercial	$	6,806.00		1413.46	$	8,219.46
Total	$	16,687.00	$	5,871.70	$	22,558.70

Current Spending		
52590	$	379,893.67
53647	$	786,649.84
53676	$	1,170,396.11
53763	$	735,913.52
53978	$	2,029,509.44
53979	$	323,507.30
53980	$	138,393.75
53981	$	-
Activity 800 Jan - May 2018	$	124,678.50
Total Cost	$	5,688,942.13

* Does not include Tri-State

Interest Rate 0.67% * 2/3 of 1% Interest rate on WF loan of $2.9 mil