Before the
Department of Energy
Washington, D.C. 20585

In the Matter of	)
	)
Implementing the National Broadband	)
Plan by Studying the Communications	)
Requirements of Electric Utilities To	)
Inform Federal Smart Grid Policy	)

NBP RFI: Communications Requirements

COMMENTS OF EAST CENTRAL ENERGY-MINNESOTA

I. Introduction

a. **Identification/description of your company.** East Central Energy is a non-profit electric cooperative serving 57,000 customers and is located in east central Minnesota and northwestern Wisconsin. The cooperative serves an area of approximately 4,300 square miles. The geography varies from flat to large rolling hills with many lakes and wooded areas. For the most part the area is relatively sparsely populated. The average consumer density is about 7 consumers per mile. All power purchases are from our cooperative power supplier Great River Energy (GRE).

II. Executive Summary

Because of the lack of ubiquitous coverage by major carriers or operating telephone companies, East Central Energy has contracted with our G&T, Great River Energy for private wireless services to our substations. No single vendor or combination of several vendors could provide an integrated solution

Great River Energy has deployed a fully integrated IP network to 36 of ECE's remote sites of our electric system. The IP network transports data information for SCADA and AMR; metering information. We also use this network to perform maintenance on substation control equipment.

The rural environment and substation in particular present challenges. Carriers and telephone companies build to mass markets. Substations are hazardous electrical environments and thus require expensive and complex protection systems for wire line communications. This has lead many utilities, East Central Energy included, to rely heavily on wireless systems. Wireless covers large areas of geography and is not susceptible to the hazardous voltages.

The spectrum used today will not be enough in the future. As we continue to add Smart Grid distribution system applications to the wireless segment of the network the amount of data will grow. It is projected by the industry that utilities will go from moving and managing 7 terabytes of data to 800 terabytes.

With greater than 99.95% reliability, our current network meets today's requirements.

III. Overview of communications networks

a. ECE contracts with GRE who operates a communications backhaul network comprised of approximately 2500 miles of fiber linked together in nine synchronous optical network (SONET) rings to provide a highly reliable backbone. Several radial digital microwave extensions extend the reach of this system. There are approximately 65 SONET nodes, which operate at a speed of 2.4 gigabits per second (OC 48), and the digital microwave extensions operate at 45 Megabits per second. Data from the systems described below are aggregated into the backbone system and delivered to the Great River Energy system control center. All nodes, including those that are owned and operated by commercial carriers have a minimum of 72 hour generator capacity.

b. For Supervisory Control and Data Acquisition (SCADA) communications, GRE partnered with Arcadian Network, Inc. (ANI) who leases spectrum from a company, Access Spectrum, who owns the two 1 MHz channels at 757 – 758 MHz and 787 – 788 MHz. This network was jointly built out between 2006 and 2008 by GRE and ANI, but is owned by ANI. ANI contracts GRE to monitor and maintain the network, so the network is still under the control of GRE and GRE can dispatch crews for repair 24 hours per day, 7 days per week, 365 days per year. All nodes on this network have generator backup for a minimum of 72 hours. Prior to this system deployment, ECE used different communications services in each substation. By using a broadband network, which uses IP for its network layer, these applications were able to use one communication path for all disparate communication circuits. By using Wi-Fi access points at the substations and switch locations, field personnel are able to access the internet or company's intranet in those locations enabling the same network to be used for network access in addition to SCADA applications. Prioritization is used on the network to ensure that SCADA data always gets through. Virtual Private Networks (VPNs) provide network security and isolation between the SCADA network and the corporate network.

c. Power Line Carrier (PLC) is used for relaying meter data throughout our distribution system. The data is collected at the customers' premise and sent via power line to the substation. The receivers at the sub stations are connected to the 700 MHz communication system for backhaul to the main office.

d. ECE contracts with GRE to provide a private trunked mobile radio system for voice communications from dispatch to field crews and for field crew to field crew communications. This communication system being used by ECE, is also used to make the most effective use of radio frequency (RF) spectrum and to make the system more cost effective. This system covers our 4300 square mile service area in Minnesota and Wisconsin. This is a narrowband (12.5 kHz) wide area, analog, trunked radio system which currently cannot support any data applications. This radio system must be available for communications from System Operations to field crews in the event that all other communications systems fail.

e. ECE contracts with GRE to service a VHF private radio system for load control. This load control system is used throughout ECE's service area and controls approximately 14,000 meters. The current system provides one way communication via a paging type system to receivers connected to meters.

f. ECE contracts with Zayo Enterprise Networks to provide private circuits, for voice and data, to 4 service centers in our service area.

IV. Overview of communications networks

Why private networks?

Better reliability

Better coverage than commercial providers

Security

V. What technologies are used?

a. Backhaul
    i. Fiber - Fiber for this network is a combination of optical ground wire (OPGW) and fiber-based capacity leases from local independent telephone companies. The capacity leases are for exclusive use by GRE.
    ii. Licensed microwave - GRE has installed licensed microwave in the 6 GHz band for extension of the backbone.
    iii. Unlicensed microwave – 2.4 GHz and 5.8 GHz are used for shorter, less critical backhaul links.

b. Others
    i. SCADA
        1. Licensed - The joint GRE/ANI network is IP to the substation over a wireless DOCSIS cable modem using licensed 700 MHz spectrum.
        2. Unlicensed - 900 MHz unlicensed spread spectrum broadband, IP radios are used only for short distances (<2 miles) in rural areas that have less likely chance for interference. These radios allow us to expand our broadband SCADA network cost effectively as they are less expensive than the 700 MHz system. These unlicensed radio links are only used in rural areas for short distances where there is less chance of interference.
    ii. Voice Mobile Radio – GRE uses a proprietary Motorola analog, wide area, trunked mobile radio system. This system is nearing end of life and we anticipate that it will be replaced by an open standard wide area, digital radio system capable of operating at 6.25 kHz efficiency and capable of providing some mobile data

capabilities.

iii. Load control - A licensed VHF one way, analog paging type system is used to perform load control.

iv. Power Line Carrier for meter data

Overview smart grid deployment plans

Types of applications and number of devices

AMR meters – 73,200

AMI Meters – 73,200

Load Control/Demand Response switches – 14,000

Home Area Network Devices - 3000

Distribution Automation Devices - 100

Timeframe for deployment

One way AMR meters and Load Control devices are currently installed

Two way AMI meters will be installed within the next 3-5 years

HAN 3-5 years

Distribution Automation Devices 3-10 years

Overview of communications requirements

Current

Two way mobile radio, point to point, point to multipoint, microwave, fiber, Automatic Vehicle Location and mobile data through private carrier,

v. Future

1. broadband, smart meter data gathering. Data requirements will expand dramatically in the future. The number of devices in the field will increase and the amount of data required for them is estimated to increase about 100 times the current amount. If meters are read every 15 minutes as opposed to once per month, as they are now, that is 3000 times the amount of data. Down line distribution automation, which is currently limited in deployment, will be expanded as well, adding to the data requirements.

c. Assessment of existing networks to meet current and future communications needs

i. What are the communications gaps?

1. Much like public safety, utilities, as a part of critical infrastructure, need reliable communications systems that they operate, maintain, and control. In order to continue to do this effectively and provide for future communication requirements, utilities need dedicated RF spectrum.
2. Some non-critical applications, such as AVL and mobile data, could use commercial cellular service if there was adequate coverage in our service area. Currently, commercial, cellular coverage in rural areas is a major gap.

ii. What do you need to fill those gaps?

Dedicated spectrum for critical infrastructure applications

d. Commercial services

i. Do they currently meet utility needs?

1. Mission critical applications

a. ECE is a rural electric distribution company. We provide electricity to 56,000 members from small cities to very rural areas including farmland and extremely low populated areas in east central Minnesota and northwestern Wisconsin. Commercial wireless communication providers only build their networks to populated areas and along highway corridors. Many, many locations in our services area have either no commercial wireless service, or very poor commercial wireless service. ECE requires communication service everywhere that we have distribution lines and substations. Currently, there is no plan to allow utilities to have priority on commercial networks, if we were to use them. There has been a lot of discussion about joint Public Safety and commercial carrier systems which show a model for Public Safety having priority. Utilities, as a part of critical infrastructure also require priority if a commercial network is to be used.

b. Commercial networks fail due to lack of generator back up and high call volume during disasters. This has been the case from large disasters such as 9/11 and hurricane Katrina to smaller disasters such as flooding in the Red River Valley in Minnesota and North Dakota and during many local storms.

c. Commercial networks take maintenance outages during the middle of the night based on low call volumes. ECE requires rigid change control procedures for all maintenance outages which would be difficult to coordinate with commercial carriers. In addition, commercial network providers do not always repair and restore on a 24/7 basis resulting in extended network or circuit outages.

Non-mission critical applications

No, need better build out in rural areas. Any applications need to be competitively priced to promote usability

How can they be improved?

Have emergency backup available at all sites, Need a process so that any mission critical items are given high priority for restoration. In reality coordination of such a process will not work.

VI. Smart grid and communications requirements today

a. Detailed description of smart grid applications (e.g. AMI, DA, and

DR).

Describe the types of applications, the extent of their deployment and whether they are mission critical.

AMR-ECE has nearly 100% deployment of AMR meters that are capturing daily readings.

DA-Except for a few controlled capacitor installations, all our DA is done at the substation level through a SCADA system controlled by our GRE.

DR-We have an extensive demand response system that directly controls end use devices such as water heaters, AC, heat and irrigation. The system is capable of reducing peak demands between 10-15% depending on season of year. DA and DR are mission critical in maintaining system continuity. AMI will be used to determine abnormal system conditions in both normal and emergency operating conditions.

b. Functional requirements needed to support those smart grid applications.

What are your specific requirements with regard to cost, Coverage, Capacity (Bandwidth), Latency, Reliability, Back-up power (AC Independence), and Security for each of these applications?

1. Security is the most important component in all our communications systems.
2. Reliability is extremely important for reasons described above.
3. AC independence for SCADA and mobile voice radio applications is extremely important.
4. Coverage throughout our service area for all applications is very important. Most of our communications systems are designed for 97% - 98% coverage, depending on the system.
5. Low latency is very important for SCADA and mobile voice radio systems.
6. Capacity or bandwidth is currently the least important of these factors.
7. Cost is a very important factor that must be weighed against the functional requirements of communications systems.

VII. Smart grid and communications requirements of tomorrow

a. Detailed description of future smart grid applications

Describe the types of applications, the extent of their deployment, and whether they are mission critical.

1. All current systems will remain requirements in the future. However, it is anticipated that data requirements will increase on existing systems.
2. AVL and mobile data communication systems for applications such as switching orders, GIS and mapping

applications, e-mail, and field personnel network connectivity will be deployed. It is not anticipated that these systems will be mission critical, but as business processes are defined using these systems, they will become more critical.

b. Functional requirements needed to support those smart grid applications.

What are your specific requirements with regard to cost, Coverage, Capacity (Bandwidth), Latency, Reliability, Back-up power (AC Independence), and Security for each of these applications?

The requirements for mobile data will be for reliable wide area coverage, bandwidths carrying considerably more data than is done with the present system. Reliability will be most important during times of system emergencies when commercial systems are most likely to experience problems. The need will be for a reliable self healing network providing redundant communication paths.

VIII. Technology Options and Other Considerations

a. What technology options are available to meet your needs?

i. Wireless

Licensed

GRE provided microwave backhaul and 700 MHz. GRE provided licensed 450 MHz mobile radio.

Unlicensed

a. A few unlicensed microwave radio hops are used for less critical backhaul paths.

ii. Wireline

Fiber

Fiber is primarily used for backhaul applications that are currently being met by GRE. ECE has one privately owned point to point fiber span.

PLC or other private wireline

Use PLC for AMR data gathering. Not suitable for higher speed applications.

What other considerations come into play in terms of choosing a technology option for your utility?

Terrain, Foliage, Customer Density, Size of Service Territory, Overhead/Underground Grid Topology, etc.

1. ECE operates in Minnesota and Wisconsin. Our service territory is over 4,300 square miles
2. Our service territory is mostly rural with an average of seven customers per mile.
3. ECE's terrain varies from flat farmland to heavily wooded areas. Areas in Wisconsin consist of rolling hills.
4. Wireless is preferred due to the large amount of territory that we cover and the large distances between sites that we

serve.

IX. Recommendations

a. Based on your functional requirements and applications, what technology options would you prefer to use for your utility?

Current

1. Backhaul
    a. Fiber
    b. Licensed Microwave
2. Mid-mile/Last mile (for transmission SCADA)
    a. Licensed 700 MHz
3. Voice
    a. Licensed 450 MHz
4. Last mile
    a. License 150 MHz

ii. Future

1. Backhaul
    a. Fiber
    b. Licensed Microwave
2. Mid-mile
    a. Licensed 700 MHz – currently the bandwidth meets our requirements. However, we anticipate that the 2 MHz of bandwidth will not be adequate in the future as data requirements expand.
3. Voice
    a. Licensed 450 MHz – currently this meets our requirements. However, we anticipate that this will not meet our requirements for mobile data applications nor does it allow for the most widely deployed worldwide mobile radio standard, TETRA (which requires 25 kHz contiguous bandwidth that 4 channels operate in, making it 6.25 kHz efficiency), to be used.
4. Last mile
    a. Licensed 150 MHz – this will not be adequate for two way load control.

X. Commercial systems

Do they meet your needs?

No. Too many problems with coverage, response to service issues, and cost

What improvements would meet your needs?

Currently these systems are most prone to failure when needs are greatest (no or short backup capability and/or high traffic volume). We would need much more extensive build out of facilities in rural areas to ensure adequate coverage and at an affordable cost. We need priority for available communication channels given to critical service customers.

Conclusion

Utilities are being asked to provide more information to consumers, have more reliable and secure electric and cyber networks, which in turn means more and faster data, while keep the cost of electricity low. And yet, utilities do not have any dedicated spectrum to do this, nor do we have access to broadband spectrum. Electric utilities are being pushed to operate the electric grid on commercial services which have historically not provided reliable communications when needed nor do they provide coverage in areas where utilities are required to provide service. Utilities need to have dedicated, broadband spectrum in order to maintain reliable and secure electric systems.

Respectfully submitted,

East Central Energy

____

Linda LaTourelle
Information Technology Manager
East Central Energy
412 Main Ave N.
P O Box 39
Braham, MN 55006
(800) 254-7944 ext 7481
(763) 689-7481

July 12, 2010