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 DAKOTA ELECTRIC ASSOCIATION

I. Introduction

a. Identification/description of our company

Dakota Electric Association (DEA) is an Incorporated Cooperative Association which distributes electricity to more than 100,000 members in Dakota County and surrounding areas. DEA is the second largest electric cooperative in the state of Minnesota, and is a member cooperative of Great River Energy (GRE).

II. Executive Summary

DEA has deployed a fully integrated IP network to 26 substation sites. An IP based network transports data information for Supervisory Control and Data Acquisition (SCADA) and Load Management systems. A private Wide Area Network (WAN) was implemented by DEA in 2001 due to lack of comprehensive coverage by major carriers.

In addition to the WAN, DEA relies on commercial services to communicate with load management receivers via paging technology and smart meters via phone lines.

The rural environment, which covers a significant portion of our service area, and substations in particular present challenges. Carriers and telephone companies build to mass markets not the more rural area Even in mass market areas, no carrier provides 100% coverage. Substations are hazardous electrical environments and thus require expensive and complex protection systems for wire line communications. This has lead DEA to rely heavily on wireless systems.

Public carrier systems and sharing of spectrum on public frequencies with others has proved unreliable in the past. Public wireless network performance degrades over time as public adoption increases. Public wireless networks are also susceptible to failure or overload during catastrophic events. This is the time utilities need them the most.

III. Overview of communications networks

DEA's private WAN links the central office systems to substations and other critical electric distribution sites via unlicensed 900Mhz spread spectrum radio. DEA also communicates to over 100 member owned distributed generation sites via low-speed licensed 900Mhz polled radio system. In addition, DEA's Load Management system is also dependant on private

one-way power-line carrier (PLC) and public one-way paging services.

IV. Why private networks?

DEA's decision to install a private WAN was based on needs for high reliability, security, control and traffic priority.

a. In the past, DEA depended on public carriers for copper leased lines. The majority of DEA's service territory is rural and covers approximately 500 sq. miles. It was common for communication lines to be served by multiple public carriers.
b. In the past, in the event of a public carrier failure, DEA found that it was uncommon for multiple carriers to work together to provide same-day service restoration, despite serving critical infrastructure sites.
c. Owning and controlling the private WAN allows DEA to dispatch for corrective action 24/7, and greatly reduce communication down time to critical infrastructure.

V. What technologies are used?

a. Unlicensed Microwave (private)
    i. DEA's IP based WAN backbone uses unlicensed 900Mhz spread spectrum point to point radios. The WAN backbone connects DEA headquarters with all substation and other critical infrastructure sites. Throughput for this system ranges nominally between 500 Kbps and 1Mbps
b. Licensed Microwave (private)
    i. DEA's licensed MAS radio system is used to communicate to distributed generation sites. The MAS radio system leverages the WAN, but the mid-mile licensed portion of the link communicates at low-speed serial rates.
c. Power Line Carrier (private); one-way
    i. Used to pass load control messaging from DEA's WAN, to point-of-service load control devices via electric distribution lines.
d. Paging (public); one-way
    i. Used to pass load control messaging to point-of-service load control devices.
e. Fiber
    i. DEA has started to implement fiber for DEA's IP based WAN backbone, in partnership with DEA's Generation &Transmission provider, GRE.

f. Overview smart grid deployment plans

i. Types of applications and number of devices

1. SCADA
    a. Fully Deployed, partially integrated
    b. 100% private
    c. 150 devices using private WAN
2. Load Management
    a. Fully Deployed, fully integrated
    b. 58% public (paging carrier) 30,000 devices
    c. 42% private Power Line Carrier (PLC) 22,000 devices
3. Automatic Vehicle Location AVL / Mobile Data
    a. Fully Deployed, partially integrated
    b. 100% public
    c. 100 devices
4. Automatic Meter Information AMI/Smart Grid
    a. Currently communicate with approximately 1,000 meters on a

monthly basis. DEA is anticipating implementing smart metering to all of its members within the next 10 years but a specific timing (or technology) has not been determined.

ii. Timeframe for deployment

1. N/A

g. Overview of communications requirements

i. Current

1. WAN backbone links to any substation site are designed to achieve 99.9% availability, as measured by the SCADA system.
2. Extended serial communication links are designed to achieve 99.5% availability, as measured by the SCADA system.
3. DEA is required by regulatory agencies to serve all membership equally. Any cooperative member who elects to participate in DEA's Load Management program (distributed generation) is entitled to the same services, regardless of the technical challenges required to extend communications to the service point.
4. All SCADA based devices are polled within 10 seconds.
5. 98% of Load Management point-of-service devices (Load Control Receivers) should maintain reliable communications, such that load control commands are executed as transmitted.

ii. Future

1. DEA has no defined plans to implement AMI at this time, which would be the main driver propelling change to DEA's communications system. DEA has investigated AMI systems in the past and fully expects to eventually implement an AMI system. One of the principal hurdles in implementing an AMI system (in DEA's geography) is in implementing a two-way communications infrastructure that can support AMI and other systems. DEA does not feel its existing communications system can be extended to support AMI. A new private network would be needed to run parallel to, or replace DEA's existing WAN.

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

i. What are the communications gaps?

1. There is no dedicated, licensed, broadband spectrum for utilities.
2. There is no cost effective, comprehensive, 2-way, last-mile communications offering (either public or private), given DEA's membership density, and geographic duality between suburban and rural regions.

ii. What do you need to fill those 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. Low-cost IP based wireless radio technology specifically targeted to last-mile, metering and down-line devices.

i. Commercial services

i. Do they currently meet utility needs?

1. **Mission critical applications**
    a. Commercial services do not provide service level agreements that can scale between multiple carriers to meet the needs of electric utility mission critical infrastructure.
2. **Non-mission critical applications**
    a. Non-critical applications such as AVL and mobile data are currently using commercial networks where there is coverage.

ii. How can they be improved?

1. DEA does not want public carrier dependencies for some critical systems, such as SCADA. DEA is unaware of a public carrier who can ensure reliability and life safety needs associated with that system.

VI. Smart grid and communications requirements today

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

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

1. DEA's SCADA system has been deployed throughout our distribution system for many years. This is a very critical system that needs to have high security, high priority, and high reliability. There are life-safety dependencies on this system as well. The SCADA system is considered mission critical.
2. DEA's Load Management (DR) system is used to curtail demand when DEA's G&T GRE calls for load control. Working in conjunction with the SCADA system, the Load Management system allows DEA to control up to 100 MW of load depending on the time of year. This system needs to be able to successfully send control commands to the receivers to control load during times of peak energy use. The Load Control system carries a significant financial liability. DEA's demand component of electric delivery costs are determined by measuring reduced demand during load control execution. SCADA and Load Control systems combine to reduce demand costs in excess of $1,000,000 during periods of high demand. The Load Management system is considered mission critical.

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

i. 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. Life safety and security are the most important components in our communication system.
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.
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. And 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

i. 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. Use of down-line devices will likely increase. DEA has had interest in expanding down-line device usage for years. Solutions that are both reliable and cost effective have not been apparent.
3. AVL and mobile data communication systems for applications such as switching orders, Graphical Information System (GIS) and mapping applications, e-mail, and field personnel network connectivity have been deployed. These systems are important for day-to-day workflow, but are not mission critical.
4. DEA anticipates implementing AMI in the future, after the cost/benefit analysis balances better or is mandated by the government.

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

i. 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. Functional requirements for the items listed above are not anticipated to be different in the future than they are today. However, capacity requirements will increase dramatically in the future, potentially up to 100 times the capacity requirements we have today.

VIII. Technology Options and Other Considerations

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

i. Wireless

1. Licensed

a. Microwave for backhaul
b. 700 Mhz (Arcadian Networks)
c. 900 Mhz

2. Unlicensed

a. 900 Mhz Spread Spectrum
b. 2.4 Ghz (This frequency has become worthless to utilities, and is an example of how overused public frequency degrades reliability).

ii. Wireline

1. Fiber

a. For DEA there have been limited opportunities to implement fiber. Historically, the costs of implementation or lease are prohibitive. DEA evaluates opportunities as they arise, and strives to incorporate fiber segments into the WAN when possible.

2. PLC or other private wireline

a. Leased copper circuits from telephone companies present a unique challenge in that bringing copper into a substation also brings with it remote ground which can lead to hazardous currents being carried out of the substation during an electrical fault within the substation. In order to protect against this hazard it can cost up to $10,000 to install special isolation equipment at each location.

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

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

1. DEA's service territory covers approximately 500 square miles in and around Dakota County, Minnesota, and serves over 100,000 members.
2. Our service territory is half suburban, and half rural, averaging 27 members per mile of electric line.
3. DEA's terrain includes flat to rolling farmland in the mid to southern half of the county, and medium density commercial/residential, with rolling hills in northern third of Dakota County.
4. DEA's distribution system is approximately 1/3 overhead, and 2/3 underground.
5. Wireless is preferred because it is the only affordable form of communications available to DEA that can be privately owned and operated and provides the required coverage and reliability

ii. Cost

As costs of providing electricity increases, and is only anticipated to increase in the future, electric companies are under increasing pressure to keep costs down. Communications systems that are as low cost as possible that meet the business requirements are required.

IX. Recommendations

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

i. Future

1. Backhaul / Backbone
    a. Fiber
2. Mid-mile / Last Mile
    a. Licensed, utility dedicated RF.
3. Voice
    a. Licensed (158) MHz

X. Commercial systems

a. Do they meet your needs?

1. Commercial systems are meeting our needs for AVL and mobile data where coverage is adequate.
2. DEA does not want public carrier dependencies for critical systems such as SCADA. DEA is unaware of a public carrier who can ensure reliability and life safety needs associated with that system.
3. Commercial paging systems are meeting our needs for the Load Management system, although long-term service contracts are not available, and the life expectancy of one-way paging technology is coming to a close.
4. For DEA, it remains to be seen if two-way commercial systems will meet our

needs should DEA migrate systems and technology to take advantage of those two-way services.

b. What improvements would meet your needs?

N/A

XI. 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) and to keep the cost of electricity low. And yet, we do not have any dedicated spectrum to do this, nor do we have access to broadband spectrum. We 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,

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