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 BALTIMORE GAS & ELECTRIC COMPANY

I. Introduction

BGE is the nation's oldest and most experienced utility company. It has met the energy needs of central Maryland for nearly 200 years. Today, it serves more than 1.2 million business and residential electric customers, and approximately 650,000 gas customers in an economically diverse, 2,300-square-mile area encompassing Baltimore City and all or part of ten central Maryland counties.

BGE already has many systems that it considers to be "smart." For example:

- One hundred percent of BGE's substations are remotely monitored and controlled and real-time data is supplied to PJM to support markets and grid reliability.
- Approximately 40% of BGE's distribution circuits are remotely monitored and controlled with automatic restoration functionality on many of those circuits.
- Using a 1-way VHF paging system, most line capacitors are automatically controlled in order to better manage system voltage and VAR reduction.
- BGE's demand response program (PeakRewards^{SM}) is underway and has installed over 260,000 thermostats and AC load control switches with a target of 450,000 through 2011 (including replacement of legacy devices).
- Sixty percent of BGE's customers' meters are read via drive-by vans (Automatic Meter Reading technology).
- Large commercial and industrial customers currently have access to interval consumption data.

Overview of Smart Grid Deployment Plans

BGE submitted a Smart Grid proposal to the Maryland Public Service Commission (PSC) on July 13, 2009. The proposal outlined BGE's plan to install or upgrade 2.1M

gas and electric AMI meters by 2014. BGE also submitted a DOE grant application for up to $200M to offset the costs of the Smart Grid Initiative. BGE was one of six utilities to receive the full $200M grant; however, on June 21, 2010 the Maryland PSC rejected BGE's proposal to proceed with the initiative. BGE is currently evaluating its options.

II. Response to Questions

1. What are the current and future communications needs of utilities, including for the deployment of new Smart Grid applications, and how are these needs being met?

Current: BGE uses internal fiber, copper, microwave and RF networks and limited wireless spectrum (800-900Mhz) for point-to-point, point to multi-point, mobile, and other field applications. In most cases, only general business communication needs are met by for-profit commercial public carrier facilities. BGE's network requirements include dedicated system control and protection, real-time 2-way data telemetry, low latency and guaranteed capacity, and dedicated spectrum on private use systems. Limited satellite communications are also used today for emergency work.

Future: For energy management and automation devices, BGE does not need or prefer a common communication network. The use of redundant networks provides for resiliency and back-up in case of failure. Non-critical data can be managed on a common network; however, for critical data, BGE prefers the risk reduction and reliability that redundant systems provide.

AMI radio-based communications (2-way communication between the utility and the meter) will enable remote meter reading capabilities but would also be capable of supporting a wide variety of other smart grid applications including:

- Transmission of customer energy consumption data in 15-min intervals across the AMI network and backhaul to utility back office
- On-demand meter reading
- Near real-time outage and restoration notification, improved SAIDI/CAIDI
- Proactive load data analysis to improve SAIFI
- Detection of energy theft and consumption on inactive meters
- Remote connect/disconnect of power
- Line loss reduction (enhanced utilization of load and voltage data to reconfigure the electric grid and adjust capacitor settings based on network conditions monitored via the AMI communications system)
- Expanded use of distribution automation (for fault detection and power restoration)
- Remote fault indicators (AMI network would greatly increase communication network coverage and allow utility to quickly identify location of faults and reduce outage restoration time)

- Improved voltage control/VAR control (AMI network could support 2-way communication with capacitor banks to inform utility when capacitors fail and confirm when capacitors operate successfully)
- Conservation voltage reduction (AMI enables utility to measure voltage at the meter and precisely set voltages to ensure customers receive sufficient service without wasting energy)
- Demand-response signals, pricing signals

AMI also provides for 2-way communication between the meter and the home (via ZigBee-compliant radios in the smart meters) and supports future applications including:

- Consumer energy management products (e.g., in-home displays, programmable thermostats, load control devices, etc.)
- Distributed generation (wind, solar, fuel cells)
- PHEV charge monitoring and control
- Lighting, appliances and air conditioning unit control and cycling

2. What are the basic requirements, such as security, bandwidth, reliability, coverage, latency, and backup, for smart grid communications and electric utility communications systems in general— today and tomorrow? How do these requirements impact the utilities' communication needs?

In general, utilities need to continue to be forward-looking in terms of the capital expenditures required to build out the communication needs of the future. *Please see the accompanying spreadsheet for a more detailed view of both current and future communication requirements.*

3. What are other additional considerations (e.g. terrain, foliage, customer density and size of service territory)?

The availability and suitability of RF spectrum for utilities will be a significant factor in determining which future applications they deliver and how those applications perform. RF communications systems operating in the presence of excessive foliage and mountainous terrain will present a challenge that may limit the functionality utilities choose to implement. In-building penetration capabilities and limitations will also have to be considered for utilities, such as BGE, with a large installed base of indoor meters.

4. What are the use cases for various smart grid applications and other communications needs?

Please see both the response to question #1 and the accompanying spreadsheet.

5. What are the technology options for smart grid and other utility

communications?

WAN – Wide Area Network
This is the backhaul communications media that connects to the LAN and is used as the bulk communications channel. High-power, longer-range radios or Ethernet IP-based solutions are typical (i.e. Ethernet, fiber networks, T1 lines, 900 MHz radio, microwave, DSL, broadband, WiMAX, digital cellular).

LAN – Local Area Network
The core AMI component, this subsystem provides high-speed, high-bandwidth, two-way communication paths from collection devices directly to the utility's meters or AMI endpoints. Power line carrier (PLC) and radio frequency (RF) are the two predominant technologies in use today.

- **RF AMI Networks:** Use an assortment of frequencies, cover a range of distances and implement a variety of network topologies or methodologies. The two primary RF AMI network topologies include star networks, sometimes called point-to-multipoint systems, and mesh networks. Common frequencies include 900 MHz and 2.4 GHz, and typically, RF solutions are most cost-effective for urban, densely populated service areas.
- **PLC AMI Networks:** Transmit and receive messages via the utility's distribution power lines that are already connected to every meter. PLC solutions are cost-effective particularly in rural, low-density areas.
- **Hybrid AMI Networks:** Combine RF and PLC systems into one solution that is able to serve a diverse territory

LAN communications modules can be used in devices other than meters to facilitate communications, maximizing a utility's return on its AMI investment. Other devices that may communicate through the AMI network include demand response (DR) devices and distribution automation (DA) equipment including smart sensor products.

While AMI LAN modules can be used for DR, non-AMI communications options exist and may be more cost-effective or may better meet latency requirements. This may be the case if the system was configured for all messages have equal priority or if network latency was built in to accommodate meshing capabilities or system redundancies.

HAN – Home Area Network
The Home Area Network (HAN) facilitates communications between an advanced meter and devices inside a consumer's home. These communications include messages to present information via in-home displays (IHDs), as well as messages that DR devices can use to control key appliances. ZigBee, Bluetooth and Wi-Fi network messaging protocols are used to transmit messaging in unlicensed RF spectrum.

A few RF and PLC communications technologies exist for this application. In this scenario, a meter would contain transmitters to communicate to the LAN and devices on the HAN, linking a utility to its customers by leveraging its AMI investment.

For more info: http://www.elp.com/index/display/article-display/5587901893/articles/utility-products/volume-7/issue-10/feature-story/ami-communications.html

6. What are the recommendations for meeting current and future utility requirements, based on each use case, the technology options that are available, and other considerations?

BGE suggests that spectrum be allocated for exclusive use by utilities for smart grid applications. This would help ensure the availability, capacity, reduced latency and security of utility specific, wide-area-network requirements.

7. To what extent can existing commercial networks satisfy the utilities' communications needs?

In general, BGE chooses to use existing commercial networks only for non-critical applications. Use of commercial networks is costly and, over time, commercial networks have, in some case, demonstrated poor reliability that is unacceptable for mission-critical data transfer.

8. What, if any, improvements to the commercial networks can be made to satisfy the utilities' communications needs?

Revenue-driven service level agreements that exist today do not satisfy a utility's need for dedicated, reliable service. The current business model for commercial network providers creates incentives to oversubscribe the network. Because commercial carriers can rely on customers not using the network concurrently most of the time, they often oversubscribed their networks. During emergency and storm-related events, utility communication does not necessarily take priority and, due to this oversubscription, the network may become congested and unreliable just as it is most needed.

Improvements would include cost reductions, options for dedicated service, network redundancy, guaranteed performance levels and limited subscription with priority access for utilities during times of emergency.

9. As the Smart Grid grows and expands, how do the electric utilities foresee their communications requirements as growing and adapting along with the expansion of Smart Grid applications?

BGE expects its communications needs and requirements to grow substantially with

the following:

- Increased customer involvement and engagement in personal energy management
- Increased customer access and control of the meter-to-home network
- Increased level of utility involvement and control over the meter-to-home or gateway-to-home network and devices
- Increased automated controls and telemetry within the utility distribution network
- Increased focus on interoperability standards development for data exchange and at the appliance-to-meter level
- Increased focus on security standards development for data confidentially and control reliability

III. Conclusion

The Department of Energy is in a unique position to provide informed guidance and best practice information for the benefit of energy utilities and their customers, regulators and legislators. The challenges surrounding Smart Grid with respect to utilities' future communications needs are significant and evolving. If BGE can provide additional information or detail with respect to this Request-For-Information, please let us know. Thank you for the opportunity to provide our perspective and input on this most important topic.

Respectfully submitted,

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