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EDISON ELECTRIC INSTITUTE

July 12, 2010

U.S. Department of Energy
Office of the General Counsel
Attn: NBP RFI: Communications Requirements
1000 Independence Avenue, SW
Room 6A245
Washington, DC 20585

Re: DOE Request for Information – Implementing the National Broadband Plan by Studying the Communications Requirements of Electric Utilities To Inform Federal Smart Grid Policy

The Edison Electric Institute ("EEI"), on behalf of its member companies, hereby submits the following comments in response to the Request for Information ("RFI")[1] by the Department of Energy ("Department" or "DOE") regarding the current and future communications requirements of utilities, including, but not limited to, the requirements of the Smart Grid in an effort to implement certain recommendations of the National Broadband Plan.[2] EEI is the association of the United States investor-owned electric utilities and industry associates worldwide. Its U.S. members serve almost 95 percent of all customers served by the

[1] *Implementing the National Broadband Plan by Studying the Communications Requirements of Electric Utilities to Inform Federal Smart Grid* Policy, Department of Energy, 75 Fed. Reg. 26206 (May 11, 2010).
[2] Fed. Commc'n Comm'n, *The National Broadband Plan: Connecting America*, (March 15, 2010) ("NBP").

shareholder—owned segment of the U.S. industry, about 70 percent of all electricity customers, and generate about 70 percent of the electricity delivered in the United States. EEI frequently represents its U.S. members before Federal agencies, courts, and Congress in matters of common concern.[3]

EEI's member companies are major owners and operators of private communications networks and significant users of commercial and other private communications networks. EEI member companies have made and will continue to make significant investments in communications infrastructure. Recently, investor-owned utilities have begun major deployments of smart grid technology throughout the country. EEI and many of its members actively participated in the Federal Communications Commission's National Broadband Plan proceeding.[4] Accordingly, EEI and its members have an ongoing interest in ensuring that this nation's electric utilities have sufficient communications capabilities in order to meet their ongoing duty to provide safe, reliable and cost-effective services, and fully support and welcome the Department's efforts herein.

Executive Summary

EEI welcomes the decision by the Department to initiate this inquiry. As the Department has noted, the potential promises of the Smart Grid are numerous and will serve to benefit the nation as a whole as well as electric customers and the utilities that serve them.[5] Electric utilities have made major strides in beginning to deploy Smart Grid technology in a majority of the states[6] and will continue to move forward. At the same time, electric utilities are major users of

[3] EEI fully supports the Comments of the Utilities Telecom Council ("UTC") in this proceeding and incorporates them by reference.
[4] *See, e.g., Comments of the Edison Electric Institute*, FCC GN Docket Nos. 09-47, 09-51, 09-137 (filed October 2, 2009) ("*EEI Comments")*.
[5] *RFI* at 26207.
[6] Attachment 1, *Utility-Scale Smart Meter Deployments, Plans & Proposals*, Institute for Electric Efficiency (April 2010).

both private and commercial communications networks. Moreover, as a critical infrastructure industry ("CII"), electric utilities must have high standards for their communications requirements. For example, as noted in the NBP, utilities are particularly limited by their lack of access to suitable wireless broadband spectrum and that lack may hamper the development of an interoperable Smart Grid and slow the nation's progress toward greater energy independence and energy efficiency.[7]

EEI strongly agrees with the Department that no one particular communications technology should be favored to accommodate all reasonable Smart Grid implementations and applications. For electric utilities to provide the level of service required in meeting customer expectations and to maintain safe and reliable operations, electric utilities must be able to utilize various communications technologies—there is no magic solution. This is appropriate given that utilities vary greatly in structure, geography, population/demographics, state/local regulations, and economics. These utilities must have flexibility to plan on how to meet their communications system requirements as they consider a broad array of variables such as functional and performance requirements, network ownership and technology options, and network management approaches. As part of their deployment strategies, utilities must decide on issues such as building, sharing or leasing a network from a telecommunications provider. Electric utilities must also have the flexibility to decide how to manage a network and how to comply with applicable standards. Consequently, electric utilities utilize many different communications technologies for many different reasons. Therefore as indicated in the *RFI* a "one-size-fits" all approach is not appropriate.

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[7] *NBP* at 253.

More specifically, in order to meet their varying communications needs, utilities rely on both private and commercial communications networks including licensed wireless radio, licensed wireless microwave, unlicensed wireless, fiber, other private network, commercial wireless (licensed), commercial wireless (unlicensed) and commercial wireline. Electric utilities face different situations (*e.g.* urban, rural mountains, plains coastline, etc…) and have different requirements. Further, no one communications technology is available everywhere a company might operate.

In meeting their communications requirements electric utilities make extensive use of privately-owned communications networks, including fiber optic networks and will continue to do so. These utility owned networks support critical functions. The same utilities are also significant users of commercial networks Commercial networks however are not typically designed or built to provide the levels of reliability, survivability, availability, and/or coverage that are necessary to meet utility communications needs, particularly in times of emergency. In particular, wireless networks tend not to be able to meet utility reliability requirements. It is important for the Department to understand and make clear in its analysis that electric utilities make their decisions on communications networks based on their obligations to provide safe and reliable service and not solely based on rate of return incentives, as some would erroneously argue.

Finally, one of the primary future communications needs of utilities is and will be the need for more spectrum. It is clear that the deployment of new Smart Grid systems and technologies will add to utilities' need to use wireless communications systems since many utilities will require communications infrastructure that supports dynamic interaction between the utility and its customers. This need for spectrum is not driven solely by the emergence of the Smart Grid. Dedicated spectrum is also needed to meet more traditional but still critical needs for internal communications.

I. Question 1—The Current and Future Communications Needs of Electric Utilities

In this proceeding DOE seeks to collect information about electricity infrastructure's current and projected communications requirements, as well as the types of networks and communications services that may be used for grid modernization. More specifically, the Department seeks, *inter alia*, information on what types of communications capabilities electric utilities think they will need. In line with this basic inquiry, in Question 1 the RFI asks what are the current and future communications needs of electric utilities, including for the deployment of new Smart Grid applications, and how are these needs being met?

The short answer to this question is that electric utilities need the flexibility to utilize the communications networks and technologies that provides their customers with the appropriate level of quality of service, which is economically priced and provides the appropriate level of access, security, reliability and privacy that is needed for that application. In order to do so, utilities must continue to be able to use both private and commercial communications networks as appropriate to meet their needs. However, to fully understand the current and future communications requirements of electric utilities, it is first necessary to understand why they use both private and commercial communications networks, as well as the types of networks and the variety of communications services and applications the utilities use.

The provision to the public of safe, reliable, and affordable electric service is an extremely complex endeavor and essential responsibility. In this task, electric utilities have expansive communications needs because they typically have extensive infrastructure that requires maintenance, remote control and monitoring. Utilities must be prepared to offer safe and reliable ubiquitous electric service at reasonable costs even in the most rugged and remote areas of which many are not adequately served by telecommunications providers, particularly the larger carriers. Furthermore, due to state Public Utility Commission ("PUC") mandates, electric utilities must have 100 percent communications coverage throughout their service territory. In addition, for reasons of reliability, security, and public safety, in many instances utilities are required to have alternative means of communications that circumvent the public switched telecommunications network. As a result, electric utilities must deploy multiple solutions not only because no one communications technology is available everywhere a company might operate,[8] but also because regulations and prudence require that critical portions of their networks be divergent and redundant.

In order to meet their varying communications needs, utilities rely on both private and commercial communications networks including licensed wireless radio, licensed wireless microwave, unlicensed wireless, fiber, other private network, commercial wireless (licensed), commercial wireless (unlicensed) and commercial wireline. In the past, utilities have mainly utilized narrowband and broadband communications equipment for both data and voice communications. Lack of commercial carrier coverage across a utilities service territory and the sustainability/survivability or the reliability of the communication service are the main reasons why utilities invested in communication systems.

Electric utility communications systems must operate at a higher level of reliability than is typical for other networks because these systems must comply with rigorous mandatory and

[8] *See, e.g.* American Electric Power Company, Inc., *Comments-NBP Public Notice #2*, FCC GN Nos. 09-47, 09-51, 09-137 (filed October 2, 2009) 6-7 ("*AEP Comments"*).

enforceable Reliability Standards pursuant to EPAct 2005.[9] Under EPAct 2005, the Federal Energy Regulatory commission ("FERC") and the North American Reliability Council ("NERC") have adopted mandatory and enforceable Reliability Standards for electric utilities, including cyber security standards.[10] Compliance with these standards requires utilities to have reliable, secure communications systems capable of handling large amounts of data and traffic with an extremely low level of latency that broadband can provide. This means that utilities' communications systems must work twenty-four hours a day, seven days a week, and 365 days a year at a very high level of reliability to meet America's everyday needs. This is especially the case during service outages, natural or man-made disasters or other emergency situations.

Such a demanding requirement for reliability means that utility and CII operations have little or no margin for any potential interference, interruption, or diminution of their critical wireless communications services. Keeping the lights on is a core value of every utility—before, during and after major events such as hurricanes and ice storms. It is essential that a utility's communications services utilized for both voice communication with crews and for command and control of equipment and protective devices must remain operational. Use of communications services is essential in utilities being able to evaluate and respond to the major event.

During non-major event situations utilities must have the confidence that their communications services are reliable and will remain operational. By nature the electric utility equipment creates electromagnetic interference that impedes communications, especially

[9] Energy Policy Act of 2005, Pub. L. No.109-58.

[10] See NERC Reliability Standards at http://www.nerc.com/page.php?cid=2%7C20. See also NERC Critical Infrastructure Protection ("CIP") Standards at http://www.nerc.com/page.php?cid=2%7C20. See e.g., Western Electricity Coordinating Council Reliability Standards at http://wecc1.guidance.com/Application/ContentPageView.aspx?ContentId=71.

wireless communications. Electric utilities do everything possible to mitigate the such interference; however, it still exists. In addition, State PUCs evaluate various reliability data and customer satisfaction data in deciding rate requests and allowing utilities to recover costs of implementing performance improvement programs. Types of Reliability data that PUCs evaluate include:

- CAIDI – Customer Average Interruption Duration Index
- CAIFI – Customer Average Interruption Frequency
- CEMI – Customer Experiencing Multiple Interruptions
- CELI – Customer Experiencing Long Interruptions
- MAIFI – Momentary Average Interruption Frequency Index
- SAIFI – System Average Interruption Frequency Index
- SAIDI – System Average Interruption Duration Index

Performance improvement include programs to replace aging infrastructure, asset management, conductor replacement, tree trimming, advanced metering infrastructure ("AMI"), and distribution automation ("DA") among others. Cost is a very important consideration because electric utilities are subject to state PUC regulation that requires that their expenditures be prudent and because utilities take seriously their obligation to keep the costs down for their rate payers. Therefore, utilities always seek to select an optimal mix of products and services to achieve cost effectiveness.[11]

Utilities use a variety of communications services and applications and such usage varies by company and by region. For example, utilities operate an assortment of transmission, distribution and substation facilities which are equipped with fiber optic, microwave or satellite communications. Due to redundancy requirements many of these facilities have diverse links.[12] At the same time, electric utility field crews must have effective communications throughout

[11] *AEP Comments, supra.*
[12] *See, e.g.* Southern California Edison, *Response to Comment Sought on the Implementation of Smart Grid Technology,* FCC GN Docket Nos. 09-47, 09-51, 09-137, 3-4 (filed October 2, 2009).

service territories, and wherever individual customer meters must communicate back to the utility. Accordingly, utilities rely on private land mobile radio systems for crew communications performing maintenance, storm recovery, or other essential work. Utility crews often work in difficult and dangerous conditions, sometimes in remote areas. Therefore, the land mobile systems on which they rely must provide sufficient geographic coverage and available capacity to allow crew communications at anytime, under any conditions, and particularly after severe weather events when other forms of communications are disrupted.

An essential component of the electric utility system's operation is the Supervisory Control and Data Acquisition ("SCADA") system. Just as the name implies the SCADA system is used to monitor and control protective devices and other equipment on the utility system. The coverage and reliability requirements associated with a SCADA system makes it necessary for utilities to own and operate communications networks. As a result most utility SCADA systems are narrow band, point-to-point communications systems that allow for remote monitoring and control of facilities and equipment.

- Electric utilities use broadband communications networks for a variety of internal uses including, but not limited to, mapping for remote locations and for pinpointing outages or other problems, transmitting schematics, blueprints and other necessary data to field crews, such as video surveillance to prevent copper theft and providing overall security throughout the grid.

The following four charts illustrate the variety of communications services and the applications that are utilized by electric utilities.

UTILITY A –

	Application	Leased T1 Lines	DSL Lines	Licensed Point-to-Point Microwave	Unlicensed Point-to-Point Microwave	Private/Leased Fiber Rings	Land Mobile Radio (150 MHz - 956 MHz)	Wifi
Office Buildings	Corporate Office			✓		✓	✓	✓
	Data Centers			✓		✓	✓	✓
	Area Work Centers (AWCs)	✓		✓			✓	✓
	Line Shops	✓			✓		✓	✓
Tower Sites		✓		✓	✓	✓	✓	
Substations	Distribution	✓	✓	✓	✓		✓	
	Transmission	✓	✓	✓	✓	✓	✓	
Generating Stations		✓		✓		✓	✓	

UTILITY B–

Smart Grid Application	Device	Comm Type	Bandwidth	Provider Options
AMI	Substation Communication	Frame Relay	Broadband	private/commercial
	Smart Meter	Power Line	Narrowband	private
	Home Area Network	Power Line	Narrowband	private
Self Healing Network	Line Recloser or Transfer Switch	DS-0	Narrowband	private
	Substation Communication	Frame Relay	Broadband	private/commercial
Synchro-phasor	Phasor Measurement Unit	DS-0	Narrowband	private
	Data Concentrator	DS-1	Broadband	private
Demand Response		Pager, PLC, Cellular	Narrowband	private/commercial
Distribution Capacitor Control		VHF radio, PLC	Narrowband	private/commercial
Outage Detection (Sentry)		Voice Channel	Narrowband	commercial
Power Quality Meter		Voice Channel	Broadband	commercial
Recloser		Voice Channel	Narrowband	private/commercial
Regulator		Voice Channel	Narrowband	private/commercial
Transfer Switch		Voice Channel	Narrowband	private/commercial
Subtransmission Switch		Voice Channel	Narrowband	private/commercial
Remote Fault Indicator		Cellular	Narrowband	private/commercial

UTILITY C–

WAN	**LAN**	**N2N**
Ethernet	Ethernet	Mid-Voltage PLC
Verizon 3g network	Serial Communications	IEEE 802.11 (Wi-Fi)
Sprint 3g network	USB	
AT&T 3g network	IEEE 802.11 (Wi-Fi)	
	LonWorks PLC	
	Other industry standard PLC	

The following definitions apply to the above chart.

- Wide Area Networking ("WAN") –The network connecting the nodes to the enterprise data center and back office.
- Local Area Networking ("LAN") – The network serving end points on the same low voltage network as the node and local end points such as sensors, cap banks, homes, etc. in the same general area as the smart grid node. The size of the LAN may vary depending upon the technology used.
- Node-to-Node Communications ("N2N") – A peer to peer form of communications that could be utilized in lieu of, or in conjunction with a WAN connection in some smart grid nodes. The N2N would allow nodes to communicate to each other and utilize a single WAN connection in one of the nodes for connectivity to the data center. Additionally, the N2N capability can also be utilized for diagnostics and to support other envisioned utility support functions.

UTILITY D–

Application	Device	Communication Type
AMI	Cell Relay to Electric Meters	Unlicensed 900 MHz, Unlicensed 2.4 GHz, WiMax
	Electric Meters to Gas Meters	Unlicensed 900 MHz, Unlicensed 2.4 GHz
	Collection Engine to Cell Relay	Mobile Data Services, Satellite, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, Unlicensed 5.x GHz, WiMax
Distribution Generation		Satellite, FCC Licensed Wide Band PMP, Unlicensed 900 MHz, Unlicensed 5.x GHz, WiMax
Distribution Intelligence		FCC Licensed Wide Band PMP, Unlicensed 900 MHz
Fault Data		Mobile Data Services, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
Field Worker Access		Mobile Data Services, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
IED Monitor & Control		Mobile Data Services, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
Physical Security		Data Service (T1, Frame, Ethernet), Satelite, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
Power Quality Monitoring		Mobile Data Services, Satellite, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
Relay Communication Management		Satellite, FCC Licensed Narrow Band, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
SCADA	Central EMS to Sub Trans Pole	Satellite, FCC Licensed Wide Band PMP, Fiber, Unlicensed 900 MHz, WiMax
	Central EMS to Substation	Data Service (T1, Frame, Ethernet), Satellite, FCC Licensed Wide Band PMP, Fiber, Licensed Microwave, Unlicensed 900 MHz, Unlicensed 5.x GHz, WiMax
	Substation to Dist Device	FCC Licensed Wide Band PMP, Unlicensed 900 MHz, WiMax
Smart Home	Customer Comm to Internet	Mobile Data Services, Data Service (T1, Frame, Ethernet),FCC Licensed Wide Band PMP
	Utility Comm to the Home	Mobile Data Services, FCC Licensed Wide Band PMP, Unlicensed 900 MHz
	Utility Comm within the Home	Unlicensed 2.4 GHz
	Substation to Dist Device	Data Service (T1, Frame, Ethernet), Satellite, FCC Licensed Wide Band PMP, Fiber, Licensed Microwave, Unlicensed 5.x GHz

As illustrated by the charts, Utilities A, B, C, and D have different communications needs and make use of different applications, technologies and networks, The variances demonstrated in these charts are typical. Therefore, the actual configuration of utility networks varies from company to company and region to region. On one hand, in meeting their communications needs electric utilities must make extensive use of privately-owned communications networks, including fiber optic networks. These utility-owned networks support critical transmission and distribution functions. In other instances, utilities rely on commercial networks or may choose to lease network services from a telecommunications carrier or a service provider.

Electric utilities cannot be totally dependent upon commercial networks. Although utilities typically use commercial services for some portion of their communications needs, commercial networks are not typically designed or built to provide the levels of reliability, survivability, availability, and/or coverage that are necessary to meet utility communications needs, particularly in times of emergency. Wireless networks in particular tend not to be able to meet utility reliability requirements and do not have the back-up sufficient for utilities to rely upon. The concern is not that the utilities' private networks never fail, but that they tend to be more robust and can be repaired more quickly than can commercial networks in cases of emergency by the utilities using their own workforce.

In making their network configuration decisions, utilities must examine a number of factors and requirements. The Department has already recognized the importance of such factors as security, bandwidth, reliability, coverage, latency, backup, terrain, customer density and size of territory.[13] However, as demonstrated by the previous discussion, there are a number of additional factors which may also be considered depending upon the circumstances including: availability, route diversity and redundancy, frequency availability, network management ability, priority, standards compliance, distributed generation monitoring, field worker access, power quality monitoring, type of application, type of traffic (*e.g.* telephone versus SCADA), ownership of infrastructure, ease of provision and affordability.

[13] *RFI* at 26208.

The Department should not be distracted by myopic arguments incorrectly asserting that traditional rate of return regulation perversely provides incentives for electric utilities to "build" as opposed to "buy" communications networks. This argument is not only incorrect, but it also reflects a fundamental misunderstanding of how electric utilities make these decisions. As previously demonstrated, the decision of whether to use a private or commercial communications network is based on a host of factors all geared to ensuring the safe and reliable provision of electric service. Today investor-owned electric utilities (IOU) face a daunting set of investment needs - transmission, distribution, coal fleet retrofits, renewable resource mandates - totaling an estimated $1.5 to $2 trillion by 2030.[14] The issue is not finding new opportunities to build rate base. The issue is whether utilities can raise the capital, and at what cost. Average electric IOU credit ratings have declined since the early 1990s, and the industry just passed through a credit contraction in 2008 when utilities with less than strong credit found the price of debt much increased. At times, weaker utilities were shut out of short term capital market altogether. Looking ahead, electric utilities have to be particularly careful in making capital expenditures given the close scrutiny which is paid to such outlays by rating agencies and state commissions. In fact, unnecessary capital expenditures on account of investment by a utility in communications networks might actually lead to a ratings downgrade. Moreover, the potential cost to utilities caused by improper choices far exceeds any additional return that utilities might receive.

In sum, there is no "one-size-fits-all" answer to the question of what are the communications requirements of electric utilities. Instead electric utilities must continue to be

[14] *Transforming America's Power Industry: The Investment Challenge 2010-2030*, The Brattle Group November 2008. Prepared for the Edison Electric Institute.

able to use a variety of communications networks and technologies. Likewise, they must have the option of choosing among a variety of private and commercial options. Moreover, with the advent of the Smart Grid, it has become even more imperative that utilities have access to more spectrum.

II. Question 2—The Basic Communications Requirements of Utilities

In Question 2 the RFI asks 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, and how do these requirements impact the utilities' communications needs?

Security is one of the most critical factors for electric utilities. The following elements of security should be evaluated for incorporation across each layer of the Smart Grid architecture to ensure that consumer data is accessible to only those that are authorized, has data integrity, and it is accessible and available when needed, subject to any technological capabilities or limitations in the utility smart meter/AMI system:

- Encryption of data in transit when using wireless or non private wired networks
- Physical segmentation or one way only connection between the utility meter and the HAN
- Access controls,
- Authentication of devices participating in the HAN and NAN networks
- Authentication of users,
- Security patches and antivirus processes
- Intrusion detection and prevention
- Logging and alerting
- Physical security at the device level

Reliability, in the sense of having reliable communications systems, is another essential component to current electric utility operations as well and to the future operation of the electric utility operation including a Smart Grid. Recently, the National Academy of Engineering cited electrification as the greatest engineering achievement of the 20^{th} century. Although the fundamental concepts of power generation, transmission and distribution are governed by the laws of physics and have not changed, the modern electric grid (which utilizes high speed protective devices, dynamic loading, automatic reclosing/fault isolation) is nothing like the 110 volt direct current ("DC") system that provide service to 59 customers in 1882.[15]

Today's modern electric utility's maintain the highest levels of reliability of any modern service and in order to do so electric utility need communication systems that adhere to the same, if not higher levels of reliability. Electric utilities design both their electric systems and communications systems to ensure 99.999 percent reliability of their electric systems.

With regard to coverage, as previously noted, electric utilities are regulated by PUCs and are required to provide electric service to 100 percent of the customers within their service territory.

Bandwidth is also important. Electric utilities need access to spectrum. Utilities often utilize spectrum between 150 MHz to 512 MHz for voice and data communications; some utilities believe that the sharing of voice channels with data is unsafe and unacceptable; therefore, electric utilities require more exclusive use of data channels below 512 MHz. Furthermore, utilities have utilized 2 GHz point-to-point licensed spectrum and the loss of this spectrum has negatively impacted the reliability of utility communications systems utilizing this spectrum. EEI firmly agrees and supports the UTC recommendation that utilities need access to 30 MHz of dedicated 1.8 GHz spectrum. The implementation of the Smart Grid along with two-way communications between utilities and customers will exponentially increase the data traffic

[15] A Brief History of Con Edison: Electricity (http://www.coned.com/history/electricity.asp).

the utility communications systems will have to be able to handle. It is difficult to estimate the exact amount of data that would be generated without specifying a near real-time interval. However, if X amount of data is generated on an hourly basis then correspondingly:

- 15 Minute Data = 4X Amount of Data
- 5 Minute Data = 12X Amount of Data
- 1 Minute Data = 60X Amount of Data

Likewise, latency is important. The latency requirements of data depend on the actual data, but in general data that directly impacts the operation of the electric utility system, commonly referred to as Command and Control Data must have no latency or extremely low latency; whereas, for information data, such as customer billing information, higher levels of latency are acceptable. Once again, the level of latency is dependent upon the application for which the data is being utilized. It is anticipated that latency requirements for various customer information will get much lower with the advent of Plug-in Electric Vehicles ("PEVs") and other Smart Grid applications.

III. Question 3—Additional Considerations

In Question 3 the RFI seek input on whether there are other additional considerations (e.g. terrain, foliage, customer density and size of service territory) that should be taken into account. As noted in Section I there are a number of factors which utilities take into account when making their decisions regarding the usage of particular communications networks and technologies.

As previously noted broadband communications, especially wireless play an important role in electric utility communication plans the advent of the Smart Grid will only increase the demand of the need for spectrum needed by utilities. The need for spectrum is independent of the utilities terrain, foliage, customer density or size. As illustrated by the Charts A-D utilities currently utilize and will continue to utilize spectrum as part of their communications plans. The advent of the Smart Grid will only place more demands on the spectrum. Regardless of how rural or urban are their service territories, utilities experience problems with spectrum whether it be the lack of coverage in rural areas or the over use of frequency spectrums in urban areas. Therefore, EEI supports UTC's assessment that electric utilities will need access to 30 MHz of licensed spectrum below the 2 GHz frequency to support current and future communication needs along with access to data channels below 512 MHz.

Backup power or resiliency of the communications network must also be considered. In addition, to the electromagnetic interference issues that electric utility communications must be able to withstand, simply having communications on a battery or generator back-up power that lasts several hours may not be sufficient. Back-up power or redundant communications paths and/or systems may be necessary to meet the electric utilities communications reliability needs. Electric utilities apply the same criteria to their communications systems operations as they do their electric system operations.

IV. Question 4—IOU Use Cases

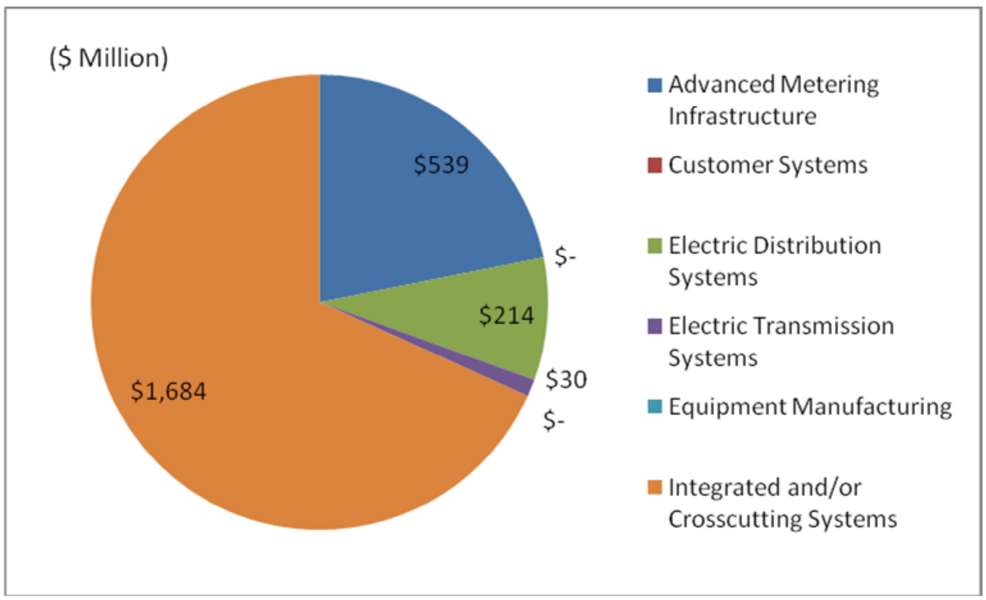
In Question 4 the RFI requests commenting parties to discuss the use cases for various smart gird applications and other communications needs.

As previously noted the modern electric grid is nothing like that first grid of 1882. The advent of electronic controls, computers and microprocessors along with improvements in manufacturing processes and various other technologies have enabled electric utilities to more efficiently generate, transmit and distribute electricity to the end use customers. Of course there is always room for improvement and electric utilities are constantly working with PUCs and their customers to improve the quality of the electric service while providing an affordable product. As a result, PUCs constantly must decide between the value of the benefits and the financial burden that will be imposed on the rate payers. Unlike industries, the electric utility industry cannot simply replace equipment or implement programs because they are the latest, greatest new and improved item on the market. As a result, the utility industry has been perceived to be slow to modernize. In actuality, the utility industry has constantly modernized when the cost benefits to all the rate payers justifies such modernization. For instance, the advent of AMI has been investigated by many utilities and utilities have moved forward where the business case has supported the deployment.

As of April 2010 the Institute for Energy Efficiency[16] has identified 45 electric utility AMI programs. Once completed, these programs would serve approximately 60 million electric customers. Of the 45 programs, 19 that will serve approximately 31 million electric customers, are being implemented without Smart Grid Investment Grant ("SGIG") funds. In most cases these 19 programs were planned prior to the announcement of DOE SGIG fund availability. Electric utilities have embarked on numerous programs such as implementation of Automatic Meter Reading ("AMR"), Outage Management System ("OMS"), Distribution Automation ("DA") Programs, Capacitor Optimization Programs, etc. to improve operation and outage restoration capabilities. In addition, many utilities have implemented Quality Assurance Programs, Asset Optimization/Replacement Programs, etc. to replace aging infrastructure and to install more modern equipment.

[16] See Attachment 1.

Even though there are many grid modernization programs being implemented, EEI would like to commend DOE for implementing the SGIG program. The availability of the SGIG[17] funds has resulted in the increased the deployment of grid modernization or in some cases made such programs economically feasible such that the electric utility was able to obtain PUC approval for implementation of various programs. EEI member companies won 72 percent or $3.4 Billion and, as illustrated in the chart below, are using the money to modernize the grid as well as to implement the Smart Grid.



In a recent Pike Research survey 81percent of the utility respondents indicated that their utility has plans to deploy Smart Grid technologies.[18]

There are several different scenarios that illustrate the utility vision of the Smart Grid and the how AMI, Demand Response ("DR"), Home Area Networks ("HANs"), Plug-In Electric Vehicles ("PEVs"), Photovoltaic ("PV") Solar, Distribution Automation ("DA"), Volt-Var

[17] See Attachment 2 DOE SGIG Awards By Category
[18] PikeResearch, *Smart Grid Industry Survey* (Aviat Networks April 2010) (("*PikeResearch Survey*").

Control, Synchro-phasors, etc. fit into the vision. Several of these technologies are referenced in Charts A-D in Section I and have been discussed previously in this document. The actual implementation of these technologies involve detailed analysis. In most cases, the analysis includes a "Use Case", which describes the functional aspects of the system, identifies the stakeholders, describes the data flow and identifies the requirements of the system. The OpenSG diagram which is attached hereto as Attachment 3 illustrates the flow of information and is helpful in understanding the relationship between requirements and/or stakeholders. For the Smart Grid applications there are many excellent sources of use case information including the Smart Grid Interoperability Panel ("SGIP") National Institute of Science and Technology (NIST) Smart Grid Collaboration Site[19] or the NIST Twiki Site, UCA International Users Group Open SG Users Group Smart Grid Networks System Requirements Specifications[20] Electric Power Research Institute ("EPRI") Use Case Repository,[21] and the numerous uses cases cited in the UTC comments.

V. Question V—Technology Options

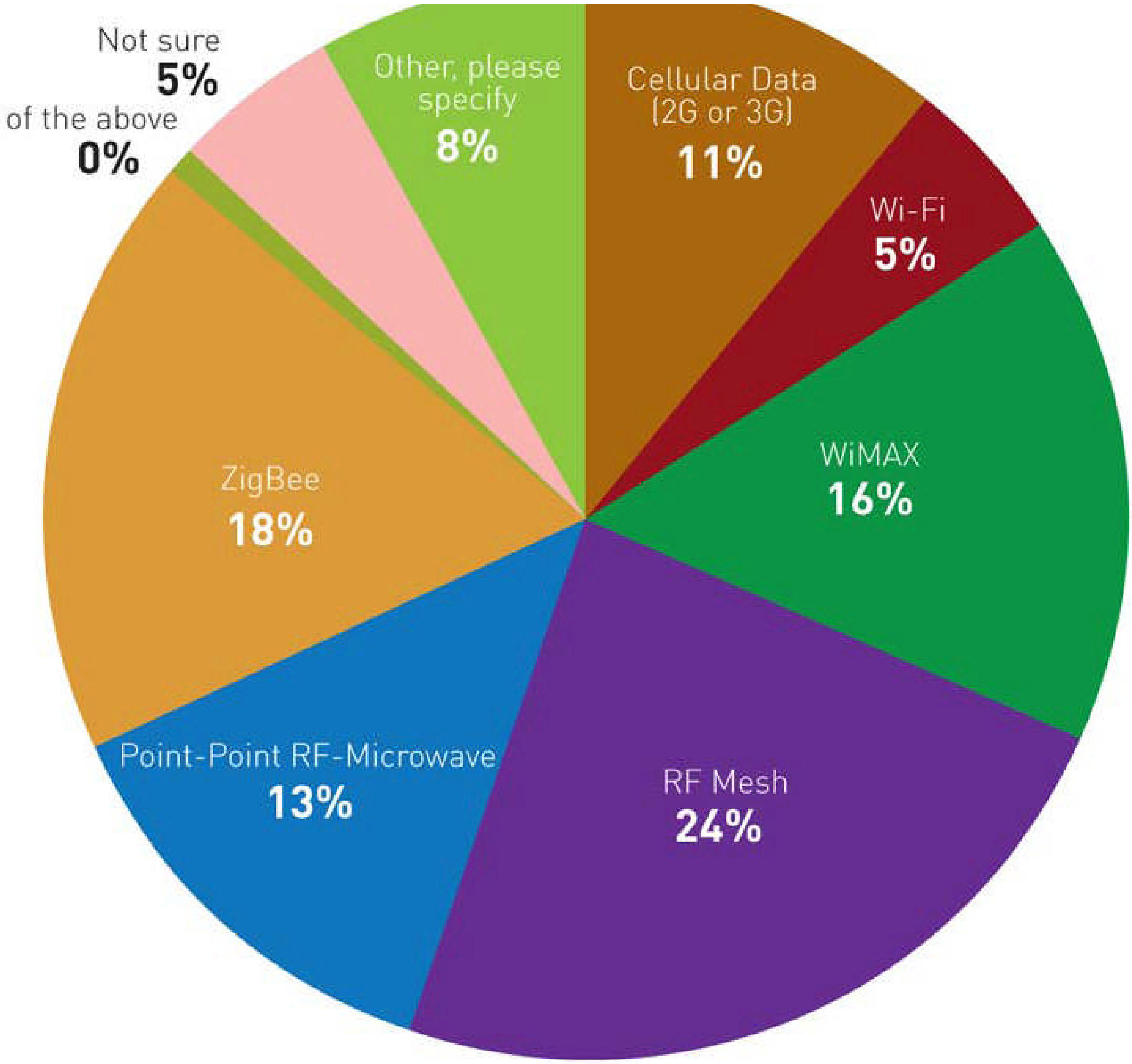
In Question 5 the Department inquires as to what are the technology options for smart grid and other utility communications.

The answer to this question is complicated by the fact that the Smart Grid is in its early developmental stages and many technology options are available. Consequently, it is important

[19] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/IKBUseCases.
[20] Smart Grid Networks System Requirements, (http://osgug.ucaiug.org/UtiliComm/Shared%20Documents/SG-NET%20PAP%20work-in-progress/SG%20Network%20SRS%20Harmonized%20Version%20V3.X.doc). The (http://osgug.ucaiug.org/UtiliComm/Shared%20Documents/Interim_Release_4/SG%20Network%20System%20Requirements%20Specification%20v4.0.xls) and the diagrams (http://osgug.ucaiug.org/UtiliComm/Shared%20Documents/Forms/AllItems.aspx?RootFolder=http%3a%2f%2fosgug%2eucaiug%2eorg%2fUtiliComm%2fShared%20Documents%2fInterim%5fRelease%5f4%2fDiagrams&FolderCTID=0x012000D61E6400383B0E4DA3A3454503972C5A.
[21] http://www.smartgrid.epri.com/Repository/Repository.aspx.

to avoid having technological choices preordained by government mandate and the industry applauds DOE for its apparent desire to avoid such a misstep. For example, in addition to the smart meter, other means by which customers and third-party service providers can access residential energy usage data, price data, and demand response signals include, but are not limited to: the path used by an AMI system to communicate with meters, private VHF or UHF radio (owned by the utility, municipalities, etc.), paging, VHF broadcast radio subcarriers (that is, inaudible channels of broadcast FM radio stations, and digital cellular phone (audio or short-message channels); as well as HANs, radio frequency receivers (such as communications-equipped thermostats), in-home displays, energy management portals, and digital control devices.

Consequently, due to the evolving nature of the Smart Grid, decisions regarding the best technology to employ should be made by each utility based upon the unique characteristics of its service territory and customer base. Among the most important factors affecting such decisions are customer density, the nature of the utility's legacy systems, and the degree to which the utility is integrated. EEI believes that any standards or guidelines which may be adopted or recommended need to be flexible to allow for innovation in technology and market structure. Utilities should be free to choose the communications technologies that will work best for them and their customers. It is clear from Charts A-D that wireless technologies both play an important role in electric utilities current communications plans and proposed communications plans to implement the Smart Grid. In the *PikeResearch Survey* when asked the question of the "importance of wireless technologies in your Smart Grid network" 29 percent indicated critical, 30 percent very important, and 35 percent said important. The following chart illustrates the different wireless technologies that respondents were considering for their Smart Grid communications. These technologies represent the wireless technologies that are currently available to electric utilities and yes, they are predominately in the unlicensed spectrum because these represent the only options presently available to utilities.[22]



As previously stated EEI supports the recommendation by UTC for 30 MHz of dedicated spectrum and member requests for spectrum below 512 MHz. It should also be noted that in the

[22] *PikeResearch Survey* at 11.

PikeResearch Survey that 41 percent of the survey respondents were planning new point-to-point microwave deployments. Electric utilities are utilizing and will continue to utilize all available wireless technologies in the course of their daily operations.

VI. Question 6-Recommendations for Meeting Current and Future Utility Needs

Question 6, DOE asks for recommendations for meeting current and future utility requirements. Earlier in the RFI, after noting that electric utilities had indicated their need for additional dedicated spectrum for a number of important reasons including, but not limited to, providing for faster power restoration in an emergency or natural disaster, more reliable service, and protection from a cyber attack on the electric grid,[23] the Department indicated that it wished to better understand this need for more spectrum. The Department also stated that it wished to learn what compels this need in addition to the fact that as a result of Smart Grid deployment, electric utilities will be required to handle a significant amount of additional data.

In answer to these inquiries EEI submits that one of the primary future communications needs of electric utilities is and will be the need for more spectrum. It is clear that the deployment of new Smart Grid systems and technologies will add to electric utilities' need to use wireless communications systems since many utilities will require communications infrastructure that supports dynamic interaction between the utility and its customers. The need to accommodate the growth of rooftop solar panels and wind turbines as well as other distributed resources will require electric utilities to be able to manage large numbers of such resources. Furthermore, given the array of "Smart" devices that is contemplated to be connected from the customers' premises to the utility, this potentially means generating huge volumes of data and

[23] RFI at 26208.

raising a host of issues with respect to bandwidth and latency as well as costs. Furthermore, Smart Grid will have to support different classes of information that will require it to be managed differently by electric utilities. For example, while operational data may be constant in volume and timing therefore requiring certain bandwidth and latency requirements, other information, such as telemetry-type data is similarly managed but presents greater data volumes. Additionally, data that is generated in reaction to grid events is generally unpredictable in frequency and needs to be processed with very low latency.

Wireless broadband communications will be an essential component of utility Smart Grid systems. In June 2009, the NIST released a report it had commissioned from EPRI on the development of technical standards for Smart Grid interoperability.[24] The report found that "Communications is a key aspect of ensuring interoperability and increased efficiencies." For example, many electric utilities implementing AMI systems have found that they require a separate wireless broadband infrastructure capable of delivering 24/7 high-speed communication to enable a variety of Smart Grid applications and their corresponding benefits. Such a communications system is needed to provide "cost effective" backhaul of AMI data, delivery of sophisticated management/control programs, and real-time connectivity within the utility to help improve service delivery, outage management, and overall productivity.[25] Additional examples include remote monitoring and control (*e.g.*, SCADA, video surveillance, etc.), Wifi hotspots for field-work, demand response services, load management, and 6 GHz under-build network expansion and upgrades.[26]

[24] *See* Electric Power Research Institute Report on NIST Interoperability Standards Roadmap, June 17, 2009 at 94, available at http://nist.gov/smartgrid/InterimSmartGridRoadmapNISTRestructure.pdf.
[25] *See* Comments of Motorola, GN Docket No. 09-51, at 32-33.
[26] *See* id at 33-34.

IEEE-USA has stated that, for "functional areas" of Smart Grid, "broadband is either required as a fundamental enabling technology, or can serve as a highly desirable means of removing bandwidth constraints."[27] IEEE has also explained that the need for broadband to support Smart Grid will fall into three categories. First, there is a basic need for high bandwidth and low latency. Second, IEEE-USA stated that there is a need for communication with a large number of nodes. Third, IEEE said there is a need for broadband related to new communications protocols and related data models and structures that "facilitate the common semantic framework that FERC has identified as priority." Finally, IEEE-USA has stated that these broadband capabilities will be necessary throughout the electric industry including rural and urban areas, pole tops, substation sites, and on customer premises as well as electric grid facilities.[28]

EEI member companies similarly report that requirements for Smart Grid will generally entail the following elements:

- Coverage/Availability: Most utilities have large service areas that include both rural and urban locales. Electric utility infrastructure is often located far from any population centers.
- Bandwidth: available network able to carry the data.
- Latency: sufficient response time of the network.
- Reliability: network or service availability when the utility needs it.
- Affordability: cost-effective system.
- Security: appropriate network security for the application.
- Independence: network independent of end-use controlled subscription service.

All of the Smart Grid applications will need bandwidth to enable them, and every additional application implemented by a utility will require additional bandwidth – some more than others. Consider the following estimates of the bandwidth budget necessary for certain Smart Grid applications as shown below:

[27] *See* Comments of IEEI-USA, GN Docket No. 09-51, at 15.
[28] Id.

Substations 0.2-1.0 Mbps per advanced substation
Meters (advanced) 1.85 -2.0 Mbps per million meters (steady reads)
Smart Sensors 500 Mbps - 4.75 Gbps per 10,000 devices.[29]

While many of these applications can be supported by wireline technologies, many will also require broadband wireless technologies.

Dedicated spectrum will also be needed to meet critical business operations that require the ability to overcome issues of vegetation, distance, climate and topology. Examples include substation communications, SCADA and other critical infrastructure areas.[30] Studies by the UTC clearly demonstrate that at least 30 MHz of spectrum would be necessary to meet utilities and CII needs for voice and data communications to support fixed and mobile applications.[31]

To free up the necessary spectrum, UTC asked policymakers to harmonize the U.S. with Canada, which has allocated the 1800-1830 MHz band to support its electric grid. UTC also called on the FCC to act on a petition (FCC RM-11429) that would give CII secondary access to additional frequencies as a means of easing spectrum pressure. EEI supports this request.

There are several reasons why utilities and other CII need this spectrum in addition to those related to the smart Grid. First, CII have been losing access to spectrum, due to refarming, rebanding, and pure reallocation forcing their removal from several critical allocations. This has resulted in increased congestion and interference to existing radio systems, as well as systems that are more costly to retain the same amount of reliable coverage. Second, utilities and other CII need private internal systems to support their critical infrastructure systems; commercial systems are not suited to utility needs for various reasons. Specifically, the public telephone

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[29] *See* Charlie Arteaga, IBM, "Smart Grid, the Secret Sauce of BPL," a presentation to the United Power Line Council 2007 Annual Conference, Dallas, Texas.
[30] *NBP Public Notice #2 Comments of Florida Power & Light company*, FCC GN Docket No. 09-51 (filed October 2, 2009).
[31] *See EEI Comments* at 20.

networks become overloaded and can be unavailable during and in the aftermath of emergencies and natural disasters. CII need to have a communications system they can count on, and most commercial systems are not designed to withstand hurricanes and do not have the battery back-up CII need to communicate in areas where power has been knocked out. While CII do make some use of commercial systems, these are usually secondary communications, and UTC estimated that commercial systems might only account for 10 percent of utilities' spectrum needs. Utilities must not be forced to use commercial communications services for their private internal communications, because commercial systems generally do not meet the reliability and security standards of utilities.

In addition to the 1800-1830 MHz band, some utilities are examining the need for more dedicated, primary use spectrum in the 150 MHz to 512 MHz range, available to utilities in 5 kHz to 50 kHz channels for digital radio use for system automation and in the 1.8 GHz spectrum for point-to-point long haul microwave paths.

VII. Question 7—Utilization of Existing Communications Networks

In Question 7, the Department asks the much-debated question of to what extent existing commercial networks can satisfy the utilities' communications needs.

It is clear that Smart Grid applications will continue to be deployed by utilities using a variety of public and private communications networks, as well as using both licensed and unlicensed spectrum. The suitability of private or commercial networks will vary by application and by company. Therefore, multiple options should continue to be available to meet the broadband communications needs of electric utilities, which include both licensed and unlicensed private wireless, as well as commercial solutions. As explained above, although electric utilities do continue to rely on telecommunications companies to meet some of their needs, utilities cannot rely on commercial networks to meet all of their needs. Moreover, utilities should not be required to rely on commercial networks to meet critical needs simply because of some misguided policy theory that forcing utilities to use underutilized commercial networks is in the public interest because it has the effect of subsidizing the build-out of national broadband networks and promoting the wider utilization of broadband.

As has been previously indicated, while utilities typically use commercial services for their secondary communications needs, these commercial networks are not designed to provide levels of reliability, survivability and coverage necessary to meet all utility communications needs, particularly in times of emergency. Notably, both wireline and wireless networks may become overloaded or unavailable during and in the aftermath of emergencies and natural disasters. Utilities and CII need reliable communications systems, and most commercial systems are not designed to withstand major weather events and may not have the battery back-up needed to communicate in areas where power has been knocked out.

Utilities have great concern regarding the ability of commercial carriers to restore communications after major events. Often commercial carriers often cannot restore their own networks until after electric power is restored. Therefore, electric utilities must be able to rely on private networks to aid in restoring their own grids. According to the "Long Term Outage Study" of the National Communications System of Principals the "vulnerability of communications is revealed during power outages that extend beyond 48 hours or are especially widespread." The study went on to indicate:

> For power outages lasting from 24 to 96 hours over a wide geographic area, the possibility of service disruption increases substantially for the following reasons: (i) the

> communications provider may exhaust its capacity to provide mobile generators and replacement batteries to all the RT sites, and (ii) fuel supplies will become scarce. For power outages lasting longer than 96 hours, the ability to implement emergency plans to (i) deploy portable generators for extra power, (ii) provide mobile cell sites for auxiliary communications, and (iii) obtain regular fuel supply will determine the continuity of communications services.[32]

Also, since communications service providers often rely on electric utility infrastructure to co-locate their facilities, in some instances they are unable to rebuild their facilities until after the electric utility has repaired the infrastructure. Electric utilities own more than 70 percent of the distribution poles that are utilized to provide customers with electric and telecommunications services.

In the *PikeResearch Survey* 82percent of the respondents indicated that they preferred private networks to public networks and cited the following factors in justification: security, service reliability lack of control, coverage, cost and other. More than half of the respondents listed security and service reliability as the primary reasons why they preferred private networks.

Connecting an electric utility to a public carrier shared with public subscribers raises significant additional concerns about lack of control and potential security vulnerabilities.

Further, in many instances commercial networks do not prioritize data traffic, which is a requirement for many utility use cases. Notably, while wireline networks may prioritize data traffic, wireless networks do not offer similar capabilities. Utilities will also need assurance of reliability and quality of communications services, which carriers are typically reluctant to guarantee. Electric utilities are held accountable by their state regulators for loss of power events and as a result it is not uncommon for an electric utility to have a 99.99 or greater percentage of reliability. Communication service providers are not held to the same level of accountability.

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[32] *Long Term Outage Study*, Communications Dependency Electric Power Working Group Report, National Communications System of Principals 26-27 (February 17, 2009).

In addition to operating safely and reliably, utilities require priority restoration of their communications networks, which they often do not receive from commercial carriers. While wireline networks may provide priority restoration, wireless networks do not. Some utilities may therefore prefer to rely on their own crews to restore private communications systems expeditiously.

Another issue of concern is that electric utilities are increasingly confronting service difficulties created by telecom carriers' copper replacement policies. Many electric utilities rely on copper loop facilities which are now being retired with little notice to the companies. As the NBP recognized, "[r]etirement of these copper facilities affects…existing broadband services."[33] The refusal of telecom carriers to continue to support these facilities has made electric utilities even more leery of over-reliance on commercial networks,

In a recent Smart Sync webinar on "Why Cellular Networks Will Win The Smart Grid War"[34] it was stated that historically, electric utilities do not use cellular networks because of concerns about cost, coverage, bandwidth and security. As previously stated this is incorrect. Reliability of the communications network is the primary concern.

Electric utilities in limited cases are using cellular service as part of their overall Smart Grid deployments as indicated by Utility C in Chart C. However, the lack of reliable service and less than 100 percent coverage prohibits utilities from utilizing cellular technology as the only communications technology they use to implement the Smart Grid. As indicated in the Chart, Utility C also is utilizing additional communications technologies to implement the Smart Grid. Therefore, because commercial systems generally do not meet the reliability and security

[33] *NBP* at 48.
[34] Smart Sync June 6, 2010 webinar.

standards of utilities, as well as the other issues which have been raised, private internal broadband networks will continue to be essential in some areas.

CONCLUSION

The deployment of the Smart Grid will require electric utilities to utilize more wireless and wireline communications options. The implementation of the Smart Grid will require electric utilities to collect more information from end use customers, and field devices than ever before. In order to collect the large amounts of data that will be generated, electric utilities will need to utilize all the commercial and private communications network options at their disposal including both wireless and wireline options. Accordingly, EEI respectfully requests that the Department consider these comments and ensure that any DOE action recommended regarding the communications requirements of electric utilities is consistent with them. If the Department has any questions about these comments, please contact Greg Obenchain, Manager of Distribution Operations and Standards, at gobenchain@eei.org or 202-508-5138.

Respectfully submitted,

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