**Comments of TIA on NBP Public Notice #2   
Smart Grid Technology  
November 4, 2009**(DRAFT)

1. **SUITABILITY OF COMMUNICATION TECHNOLOGIES**
   1. **Specific network requirements by application (latency, bandwidth, reliability, coverage, others)**

Smart grid network requirements will vary for each application in the grid, and utilities are deploying and will deploy smart grid applications using both public and private communications networks. [The FCC already has a dozen tables providing network requirements by application with varying degrees of specificity, so additional TIA input is not needed here.]

* 1. **Which communication technologies meet requirements and are best suited for smart grid? Relative costs and performance benefits?**

Because of the diversity of applications and the evolving nature of the smart grid, there is no single technology best suited for the entire Smart Grid. Smart Grid deployments may include a combination of Private Wireless, Commercial Wireless, Unlicensed Mesh, Point to Point Microwave, Private Fiber, Leased Wireline, PCL, Land Mobile Radio and Satellite Communications based on application requirements, availability, and cost. These technologies can roughly be divided between those better suited for point-to-point core (e.g. Fiber and Microwave) or point-to-multipoint access (e.g. Unlicensed Mesh, Private/Commercial Wireless (WiMAX, LTE, CDMA 2000 EvDO, HSPA), Fiber, PCL or a customer’s existing broadband connection) applications based on requirements for reliability, security, latency, bandwidth, coverage and cost of deployment. Advances in wireless broadband technology are making it a suitable technology for many core grid applications as well.

**Wireless:**  
Wireless broadband is an essential technology for the future operation of the smart grid. In addition to providing cost-effective backhaul of AMI data, technology advances in wireless broadband enable its use for many critical core grid functions as well such as transmission and distribution monitoring and control. Utilities have stated a preference to transition to wireless broadband smart grid systems where possible, citing low cost of deployment and proven reliability during storm events.  
  
**900 MHz Unlicensed Mesh:**Utilities currently rely on 900 MHz Unlicensed Mesh for basic Advanced Metering Infrastructure (AMI) for last-mile communications to customer premises. Unlicensed Mesh is a cost effective, point-to-multipoint technology in high density urban and suburban deployments because of the short distance between meters. Basic AMI functions like meter reading can currently be accommodated on 900 MHz Unlicensed Mesh as they are delay-insensitive, lower bandwidth and require significantly lower data rates than other smart grid applications. As AMI becomes more advanced, however, increased data rate requirements and potential spectrum interference in unlicensed bands will present challenges for the use of 900 MHz Unlicensed Mesh for future smart grid applications and require migration to other wireless technologies that support broadband communications. For this reason, utilities generally have a preference to use licensed spectrum when it is cost-effective.

**Fiber:**  
Fiber is a critical technology for core smart grid applications as it meets the most stringent utility requirements for latency and capacity. Microwave can be used in areas where it is not feasible to lay fiber.

**Satellite:**[Need member input]

**Internet Protocol:**  
TIA recommends that the FCC promote the use of Internet Protocol (IP) as an end-to-end network layer for Smart Grid communications. IP has many qualities better-suited for the development of the smart grid than other protocols used by utilities:

* IP is secure with a proven and mature system of cybersecurity tools and applications.
* IP is interoperable, which minimizes costs and discourages technology silos.
* IP is reliable and self-healing as the technology will automatically avoid failed transmission links to ensure delivery of communications.
* IP is scalable and flexible allowing for loose coupling between the physical communications network and the applications on the network regardless of the underlying physical infrastructure.
  1. **Network technologies most commonly used in smart grid**

[This question was thoroughly answered by the UTC, which conducted a formal survey of its members as well as individual utilities who provided comments. The conclusion of their survey is that practically all utilities incorporate the use of wireless communications for smart grid deployments, either as an end-to-end or hybrid solution. For wireless solutions, utilities traditionally use licensed spectrum solutions for long-haul and middle-mile backhaul (e.g. microwave) and use unlicensed radio solutions (e.g. wireless mesh) for last-mile communications to the customer premises. At substations, most two-way communications include narrowband wireline, the vast majority of which is commercial. Other commonly used technologies at substations include narrowband wireless and fiber, both of which are predominantly private. UTC states that many utilities “want to transition away from narrowband commercial leased lines toward a broadband wireless alternative, as either a stand-alone or in combination with fiber backhaul.” (UTC, 8-9). ]

* 1. **Adequacy of commercial communication networks**

Current commercial communication networks are adequate for the operation of many but not all smart grid applications. Commercial networks can meet needs for routine monitoring of the distribution system, communications with small, dispersed distributed generation, and meter reading because these applications have less demanding requirements for performance, reliability and latency. Upcoming upgrades by commercial operators will significantly improve latency and performance as major deployments of LTE will begin in 2010. Even with these upgrades, however, utilities remain concerned about operating critical utility communications in a shared environment. Utilities are very comfortable with wireless technology but are not comfortable with commercial wireless networks. As utilities will ultimately decide which communication networks will meet their requirements, commercial carriers will need to adequately address the following issues through Service Level Agreements in addition to those outlined in the section on spectrum below:

**Reliability:**

Commercial communication networks meet reliability requirements for basic AMI such as meter reading. For core smart grid applications, commercial carriers would need to provide utilities with service availability in emergency situations beyond their standard offering to general consumers. Within the last decade, utilities point to specific examples when commercial networks did not demonstrate adequate reliability or survivability during emergency events (September 11th, 2003 Northeast Blackout, 2005 Hurricane Katrina, 2009 Hurricane Ike). In order to make commercial communications networks capable of being used for critical smart grid operations, adequate system power supply backup and congestion management would need to be available. Utilities have great concerns with respect to the ability of commercial carriers to restore communication systems after an emergency event.

Additionally, utilities are subject to reliability and security requirements from FERC and NERC under EPAct 2005. Utilities do not want to hand over the liability for their communications reliability to a third-party—if the networks, subject to other demands and built to a consumer-serving economic model, should not perform as needed (regardless of any service level agreement). The utility must answer to regulators and the communities it serves for the resulting delay in response, longer outage or any other problems caused by defective communications. (EEI, 21).

During emergencies commercial networks can become overloaded. The Telecommunications Service Priority (TSP) program priority restoration criteria only ranks utilities at “Category D” the lowest rank for service restoration priority, so utilities cannot rely on that in an emergency. Commercial wireless systems do not have sufficient backup to remain operational when there is an extended power outage, while internal utility networks generally are built with generators at each site, and a minimum of one to two weeks of fuel for each. Commercial carriers do not provide prompt restoration of service. Service level agreements contain force majeure clauses that utilities cannot accept. (UTC, 11-12). Commercial communications networks are designed for profit from consumer services and wireless networks, especially, are concentrated in higher-density population centers. They simply are built to a different economic model. (UTC, 12).

In many cases, even when available to AEP, commercial network options are not utilized for Smart Grid communications. Risks due to reliability, availability and cost cannot be satisfactorily mitigated. Many carriers do not provide generator backup to base station sites. When sufficient backup power is available, Distribution Automation and SCADA would compete with other users on the commercial system. Utilities would need priority access in order to use them for critical communication needs during emergencies. (AEP, 18).

**Cost:**  
Intuitively commercial networks should be more cost-effective than dedicated private networks for certain Smart Grid applications, but in conducting cost-benefit analyses many utilities continue to argue that it is more cost-effective to build private networks than use already built commercial networks. Unless commercial carriers can competitively price a large number of devices with very low data requirements, utilities will continue to use other alternative.

1. **AVAILABILITY OF COMMUNICATION NETWORKS**

[This topic was adequately covered by utilities and carriers.]

1. **SPECTRUM**

TIA believes that existing licensed spectrum for utilities is inadequate to support core smart grid applications. Existing licensed spectrum for utilities is in short supply. Unlicensed spectrum will be subject to increased interference and latency in the future, which utilities prefer not to use for critical operations. TIA recommends that more study is needed to determine both the amount and specific band of spectrum to be dedicated for utility use. Because wireless broadband will play such a critical role in the development and execution of a smart grid, the FCC needs to allot more time in making this determination. TIA encourages the FCC to take into consideration the following points:

**Interference:**

Utilities currently rely effectively on unlicensed spectral bands for basic AMI and other communications. Advances in technology in unlicensed spectrum including interference mitigation techniques have made unlicensed spectrum a cost-effective technology for basic AMI like meter reading. Increased use of unlicensed spectrum will put pressure on unlicensed bands. It is anticipated that smart grid applications operating on unlicensed spectrum will eventually need to transition to wireless broadband.

**Coverage:**

Utilities will require coverage in rural and remote areas where coverage by commercial systems is incomplete. Coverage in these rural areas for smart grid operations is likely to be increasingly important as the country moves to using alternative power sources, such as wind and solar farms that are located away from population centers.

**Throughput:**

Data volume and rates for current smart grid control applications are not expected to be very high, but needs will increase as the smart grid becomes more advanced.

**Latency:**

[Latency requirements vary significantly between smart grid applications. One question that the FCC is looking to address is whether LTE and other advanced wireless networks will meet utility requirements, particularly when delivered over a commercial network. Member input will be helpful here.]

**Security:**

Commercial network operators are able to meet the security requirements for smart grid applications. Commercial networks have a demonstrated record of incorporating robust cybersecurity capabilities into their networks. There is consensus that security should be built into the solution from the very beginning.

**Harmonization:**

The benefits of harmonizing spectrum with Canada in the 1800-1830 MHz band include creating a larger market allowing vendors to produce equipment in a more cost effective manner, proximity and providing consistency for utility interconnections across borders. The 1800-1830 MHz band would be difficult to relocate from the Federal Government and the Department of Defense in the US.

1. **REAL-TIME DATA**
   1. **Access to real-time consumption and/or pricing data**
   2. **Methods of consumer access**
   3. **Third party use of data—security and privacy**
   4. **Most effective uses to reduce peak load and total consumption**
   5. **Benefits of granularity of consumption data**
   6. **Implications of real-time data to consumers, devices and applications**
2. **HOME AREA NETWORKS**

TIA recommends that that there should be a clear dividing line between customer premises and the reach of the utility network. Rather than connecting a wide variety of devices (air conditioners, electric water heaters, appliances, thermostats, lighting controls, energy displays, plug-in electric vehicles, etc.) directly to the utility’s smart meter, the architecture should include a home energy manager as the demarcation point between the customer premises and the utility. The home energy manager will communicate energy usage, generation and storage data to the utility. The home energy manager can collect consumption data from devices in the home, receive pricing signals from the utility and implement efficiency measures automatically based on a customer’s specified preferences. This architecture presents several advantages over utility-based and internet-based alternatives:

* Maintains privacy of customer usage data keeping it fully under the consumer’s control making smart grid more acceptable to consumers.
* Allows for innovation on both sides of the smart meter without requiring consumers to wait for utilities to upgrade meters, which typically have longer technology refresh cycles.