TENDRIL
Smart Energy For Life

COMMENTS OF TENDRIL NETWORKS, INC.

Comments – NBP Public Notice #2
Implementation of Smart Grid Technology
GN Docket Nos. 09-47, 09-51, 09-137

Introduction.

On September 4, 2009, the Federal Communications Commission released a public notice[1] seeking comment on how advanced infrastructure and services can help achieve efficient implementation of Smart Grid technology. Tendril Networks commends the Commission for recognizing that targeted data is necessary to bring the benefits of smart grid technology to utilities and energy customers alike, and to implement the goal of helping the national to manage and reduce energy consumption by fostering innovation in the smart grid application and device markets.

In addition, smart grid technology is a promising way to use broadband and advanced communications to promote energy efficiency, reduce greenhouse gas emissions and foster innovation in the electric industry. Accurate, targeted data is a critical first step to ensuring that all Americans have access to this technology. Tendril shares the Commission's goal of achieving efficient and wide scale implementation of smart grid technologies.

In the Public Notice the FCC seeks information about barriers to entry and growth – as well as opportunities -- for companies bringing smart grid technology to the wireless ecosystem. A great deal of the information sought , involves highly technical matters, including the type of bandwidth and speed required for smart grid technologies and the suitability of existing communication technologies and networks for deployment and data transmission. The FCC has also requested information about the use of spectrum for transmission of real time pricing and consumption data and is particularly interested in whether smart grid wireless networks can perform better over dedicated, licensed wireless versus spectrum unlicensed, shared spectrum.

About Tendril Networks

Tendril Networks develops solutions that enable smart energy options for today and tomorrow. Tendril's technology, products and services establish a rich, often automatic and invisible dialogue, between consumers their energy providers. The Tendril Residential Energy Ecosystem (TREE) is an open, extensible and standards-based energy management system that connects and manages "smart" consumer devices (such as thermostats and outlets), emerging "smart" appliances (such as refrigerators, washers and dryers) and an exciting new generation of "smart" consumer products including plug-in electric vehicles, smart televisions and smart phones.

[1] *NBP Comment Sought on the Implementation of Smart Grid technology*, GN Docket Nos. 09-47, 09-51, 09-137.

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As a result, the TREE solution enables smart energy options for utility consumers. It enables the possibility to understand and to manage – even automatically, but at consumer discretion and control – the energy within their home. The solution also enables utilities and system operators the ability to manage disparate home energy loads as a dynamic resource that can be deployed to implement smart grid functions such as demand response and peak load reduction.

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General Remarks on National Smart Grid Policy

Development of a "smart grid" has forcefully emerged as a national priority. Tendril offers a standards-based, secure platform that maximizes consumer discretion and consumer choice. The platform directly engages residential consumers. This customer class is described in the June 2009 FERC *National Assessment of Demand Response Potential* as representing "the most untapped potential for demand response." In March 2009, the Federal Energy Regulatory Commission issued a proposed policy statement and action plan that noted, "Ultimately, the Smart Grid will facilitate consumer transactions and allow customers to better manage their energy costs."

These conclusions of key federal agencies build on the principles of the Energy Independence and Security Act of 2007, which established that, "It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth…." Importantly, this national policy includes, "provision to consumers of timely information and control options." This policy of smart grid development was reinforced through funding provisions of the American Recovery and Reinvestment Act of 2009.

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We believe that providing information tools to the consumer is consistent with national policy. Improving system efficiencies, reducing consumer costs and mitigating environmental impacts all depend upon the provision of detailed energy usage information directly to the consumer. Open, non-proprietary consumer access to usage information is a guiding principle for development of policies governing smart grid technologies. We also believe that such access will accelerate technology innovation and help the consumer realize additional benefits. Moreover, providing consumers with greater transparency and control over how their information is used in the smart grid environment will build consumer trust and confidence in this developing technology. Such increased consumer trust will in turn promote public adoption and acceptance of smart grid systems and solutions, which are not ends in themselves but means to achieve policy objectives of clean energy, reliable and secure energy infrastructure, and market-based options for the consumer.

We believe that the funding opportunities presented under the American Recovery and Reinvestment Act of 2009 provide a unique opportunity to coordinate and advance many public policy objectives. In this regard, we believe there are multiple opportunities to leverage and align funding priorities of the ARRA, FCC, DOE and other Federal agencies.

Information and Smart Grid Functionality

Every definition of smart grid technology includes the overlay of communications technology as a core element. Tendril Networks views a robust, open communications platform as a critical component of achieving smart grid functionality. Such a platform allows Tendril to effectively connect the two ends of today's electricity network, linking consumer demand on one end with efficient, clean generation on the other. To this degree, we believe that provision of timely and useful information is critical to achieving smart grid functions. Notably, the Department of Energy has put forward several functions and benefits that can be achieved by smart grid technologies. These include:

1. Enabling Informed Participation by Customers
2. Accommodating All Generation and Storage Options
3. Enabling New Products, Services, and Markets
4. Providing the Power Quality for the Range of Needs in the 21st Century
5. Optimizing Asset Utilization and Operating Efficiently
6. Addressing Disturbances – Automated Prevention, Containment, and Restoration
7. Operating Resiliently Against Physical and Cyber Attacks and Natural Disasters

Each of these benefits requires the delivery of information to consumers, utilities, system operators and regulators. Broadband and other advanced communications systems can be used to support these and other smart grid functions.

Other Relevant Regulatory Proceedings

Several state public utility commissions have addressed issues that we believe are relevant to the questions addresses in this inquiry. Primarily, these proceedings address the rights of consumers to access energy usage information and obligations related to privacy concerns. We highlight these proceedings here for consideration by the FCC.

Public Utilities Commission of Texas Policy
The Public Utilities Commission of Texas established a policy on advanced metering and home area network (HAN) data in 2008. We believe that this policy is a robust model that the FCC should review. In particular, we note that under this policy AMI must be capable of providing consumers with direct, real-time access to electricity usage data, that data must be stored on the meter in a form that complies with nationally-recognized non-proprietary standards, and that AMI must be capable of communicating with other devices on the premises, such as monitoring devices, load control devices, and prepayment systems. Further, the Texas legislature has established that consumers will not have to pay an additional fee or have to obtain special permission to view their data. These recommendations are summarized (with supporting references) in the "Public Utility Commission Report to the Legislature on Advanced Metering (September 2008.)" This report is accessible from:

http://www.puc.state.tx.us/electric/projects/34610/Commission_Report_on_Advanced_Metering_2008.pdf

Pennsylvania Public Utility Commission Policy

The Pennsylvania Public Utility Commission issued a policy in June 2009 establishing the fundamental right of consumers to have direct access to their usage information. This policy was established in an Order issued by the PUC on June 18, 2009 in Smart Meter Procurement and Installation proceedings (Docket No. M-2009-2092655). This proceeding was initiated to implement several provisions of the Pennsylvania's Act 129. Act 129 requires electric distribution companies to make available to third parties, including electric generation suppliers and providers of conservation and load management services, with customer consent, direct access to the meter and electronic meter data. (66 Pa.C.S. § 2807(f)(3)). In their Order, the Commission stated their belief that "the true usefulness of smart meters is to provide information to empower customers to control their electric use, for knowledge itself is power." To further this intent, the Commission ordered that consumers shall have, at a minimum:

1. Non-discriminatory access for retail electric suppliers and third parties…,
2. Open, non proprietary two-way access for electric suppliers and third parties…, and
3. Full electronic access to customers and their representatives to meter data upon customer consent.

Colorado Public Utility Commission
The Colorado Public Utility Commission issued an Order on August 12, 2009 initiating a proceeding to investigate privacy concerns as they relate to smart grid implementation. This investigation is ongoing, but may provide useful information to the FCC. (Docket 09I-593EG, "In The Matter Of The Investigation Of Security And Privacy Concerns Regarding The Deployment Of Smart-Grid Technology."

Data Access Rights and Responsibilities

We believe that providing increasing access to information and energy usage data is a key component of smart grid technology. At the same time, this provision of information raises questions of data privacy. The question of ownership of personal data is common in discussions about privacy and consumer protection. However, this focus on concepts of "ownership" may inadvertently create unnecessary limitations in discourse where either the customer "owns" the information or the utility "owns" it. These rights are then perceived to be mutually exclusive. In practice, it may be more accurate and perhaps more constructive to consider overlapping rights (and accompanying responsibilities and duties) with regard to access to personal information.

For example, the utility requires access to information necessary for billing and systems operation. Accompanying this right of access is the duty to protect the information from theft or unwarranted disclosure. The customer also has the reasonable expectation that this information will be used for the intended primary purposes of utility operations and will not be used for secondary purposes without customer choice.

The consumer also has a right to access information about their individual energy usage. The policy established by the Public Utilities Commission of Texas illustrates a potential model to govern the provision of timely and actionable information directly to the consumer. At their

discretion, consumers may elect to share this information directly with energy service providers or other businesses. Those businesses would be bound by similar responsibilities to protect the information and use it in accordance with the consent granted by the consumer. The Pennsylvania Public Utility Commission issued a similar policy in June 2009 establishing the fundamental right of consumers to have direct access to their usage information.

Several public policy objectives may also require disclosure of information beyond individual energy usage. For example, integration of renewable energy resources and reduction of peak load are accelerated by disclosure of real-time system information to consumers. We encourage the FCC to consider whether smart grid technologies can be leveraged to accomplish other public policy goals. For example, should consumers be provided with real-time access to information about the carbon content of the energy being delivered to them? Might consumers use that information to modify their behavior to reduce their carbon footprint? We believe that such applications are key national objectives in implementing smart grid technologies.

Observations on Information and Technology Innovation

We believe that several overarching questions are raised by the current inquiry, including:

What is gained by unlocking end-user data? Are there risks?

As we have stated above, there are numerous smart grid functions that will be enabled by providing more end-user data, including better consumer engagement, home energy management technologies, acceleration of the smart appliance market and consumer scale generation and storage technologies (especially renewables and electric vehicles).

Specifically, "unlocking" end-user data (i.e. providing a means for consumers to see instantaneous and historical consumption information) is a base enabling step for home energy conservation. When describing increased mpg figures achieved by drivers of the Toyota Prius, Alex Steffen, Executive editor and co-founder of *Worldchanging*, describes the "Prius Effect": when drivers have their mileage meters inside and can understand how the fuel is spent, they become more thoughtful drivers. When applying the same rationale to electrical consumption, Steffen observes:

> When we put the energy meter on the inside of the house, the household energy use goes down by 7%. Just by showing people their use of energy."

Risks of unlocking end-user data include privacy considerations (mitigated by applying existing best practices from the Information Technology sector) and utility concerns about possible mismatches between the rolling bill derived from instantaneous data versus the comprehensive, validated monthly bill from the providing utility.

What data is required to realize these benefits (e.g. how often, what type)?

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<#>Cite "Prius effect" (research available?) -- instantaneous MPG information, and effect the information has on increasing MPG¶
<#>Risks: privacy, utility concerns about mismatch between "rolling" bill from instantaneous data versus comprehensive VEE'd monthly utility bill¶

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There are increasing benefits that can be realized with increasingly sophisticated and granular data. In this regard, it is valuable to distinguish between the various types of information requirements. For example, it is clear that data used for billing requires additional verification than raw data delivered from the meter for information and home energy management purposes. At the same time, there are various degrees of timeliness requirements. Raw data for home energy management purposes must be delivered in near-real time to have value, whereas historical usage information can be delayed by hours or days.

Specifically, data types that enable Smart Grid Smart Grid benefits include:

- Instantaneous consumption information – higher frequencies enable greater benefits (e.g. 15 second consumption data is more powerful than 15 minute consumption data)
- Current price
- Comprehensive historical consumption data (annual, monthly, ... , fifteen minute interval) – this data provides a historical baseline of electrical consumption
- Current electricity source (e.g. coal, nuclear, hydro, solar, wind, etc.)
- Network events (outages, demand response, etc.)
- Home configuration (HVAC equipment, meter equipment, HAN equipment, etc.)

How should access to the data be provided (e.g. via the meter, via APIs, via web portal)?

Different data may have different access points based on the intended usage and timeliness requirements. As noted above, we believe that direct delivery of usage information from the customer meter is an important component of implementing home energy management strategies. This form of information delivery is also consistent with federal policy and emerging state policies. We believe that there should not be prescriptive limitations on how data should be accessed. Rather, to encourage innovation, we believe that a portfolio of delivery mechanisms should be enabled that match customer preferences, including from the meter, over the internet, an d through mobile devices.

One taxonomy of data access is the classification according to data sourcing, data presentment, and data consumption. According to that division, data sources include both premise equipment (Smart Energy-enabled devices, including the electrical meter, thermostat, appliances, load sensing and control devices, etc) and utility backend Information Systems. Data presentment includes web interfaces, inhome displays, thermostats, electronic messaging (email, SMS, social networks, etc.). Data consumption includes Demand Response aggregators, residential energy management decision systems, utility planning systems, and others.

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*1. **Suitability of Communications Technologies**. Smart Grid applications are being deployed using a variety of public and private communications networks. We seek to better understand which communications networks and technologies are suitable for various Smart Grid applications.*

a. What are the specific network requirements for each application in the grid (e.g., latency, bandwidth, reliability, coverage, others)? If these differ by application, how do they differ? We welcome detailed Smart Grid network requirement analyses.

Surprising, bandwidth requirements for existing and anticipated residential energy management systems are quite low – currently on the order of 10^2 kbps per home. Additionally, existing broadband latencies are quite acceptable for most residential energy management systems, and other existing and anticipated Smart Grid applications (e.g. Demand Response, Distributed Energy Resources, etc.).

Network reliability concerns, while significant, can be mitigated by techniques such as 1) queuing residential energy management data when the communications channel is unavailable; and 2) communicating schedules (pricing, outages, demand response events, etc.) well in advance of when that data is actually required.

e. How reliable are commercial wireless networks for carrying Smart Grid data (both in last-mile and backhaul applications)? Are commercial wireless networks suitable for critical electricity equipment control communications? How reliably can commercial wireless networks transmit Smart Grid data during and after emergency events? What could be done to make commercial wireless networks more reliable for Smart Grid applications during such events? We welcome detailed comparisons of the reliability of commercial wireless networks and other types of networks for Smart Grid data transport.

In our experience, many existing commercial wireless networks are sufficiently reliable for carrying Smart Grid data. If proprietary networks are required for end-to-end security reasons, that should not preclude the use of commercial networks for commercial applications (such as home energy management, dynamic pricing and demand response). There should not be a single network that is prescribed. Various networks can be employed for different applications.

*2. **Availability of Communications Networks**. Electric utilities offer near universal service, including in many geographies where no existing suitable communications networks currently exist (for last-mile, aggregation point data backhaul, and utility control systems). We seek to better understand the availability of existing communications networks, and how this availability may impact Smart Grid deployments.*

c. In areas where suitable communications networks exist, are there other impediments preventing the use of these networks for Smart Grid communications?

One perceived impediment to using existing communications networks is when those networks support only proprietary standards, rather than open, royalty-free industry standards.

*4. **Real-time Data**. The Smart Grid promises to enable utility companies and their customers to reduce U.S. energy consumption using a variety of technologies and methods. Some of the most promising of these methods use demand response, in which utility companies can directly control loads within the home or business to better manage demand, or give price signals to encourage load shedding. Other methods reduce energy consumption simply by*

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providing consumers access to their consumption information, via in-home displays, web portals, or other methods. Central to all of these techniques is energy consumption and pricing data.

a. In current Smart Meter deployments, what percentage of customers have access to real-time consumption and/or pricing data? How is this access provided?

Unfortunately, we're unable to provide specific percentages of customers with access to real-time consumption and/or pricing data. However, we can cite specific barriers for many customers with respect to access to real-time information, including 1) data access is delayed (i.e. data is not accessible directly from the meter); and 2) meter technology is proprietary (often preventing consumer access altogether).

b. What are the methods by which consumers can access this data (e.g., via Smart Meter, via a utility website, via third-party websites, etc.)? What are the relative merits and risks of each method?

One immediately advantage of sourcing data directly from the premise electrical meter is that is it can enable home energy management technology. Web delivery of information is, in our experience, delayed by hours or days and therefore cannot be used for home energy management (though it still has value for historical analysis of usage patterns).

c. How should third-party application developers and device makers use this data? How can strong privacy and security requirements be satisfied without stifling innovation?

Third-party application developers can use this data to provide greatest insight to allow consumers to tune energy consumption and energy choices (e.g. source of power). Additionally, third-party application developers can present guided alternatives to consumers, based on current and historical environments (e.g. suggest switching to alternate rate plan)

Security and privacy can be guaranteed by existing IT industry best practices (e.g. federated identify management, application-level encryption, etc.)

f. What are the implications of opening real-time consumption data to consumers and the energy management devices and applications they choose to connect?

Opening real-time consumption data to consumers and their designated devices and applications permit greater insight into immediate consumption, and the effect on that consumption of various in-home devices (HVAC, LCD TV, refrigerator, etc.). Additionally, consumers can be much more nimble w.r.t. energy pricing, usage plans, etc.

One concern that we've repeatedly encountered in the marketplace is that utilities are concerned that consumers will object to mismatches between the energy management system preview of bill versus utility presentation of bill (post-VEE, etc.)

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Tendril Networks appreciates this opportunity to provide targeted information about smart grid technologies and share some of our experiences and insights as an innovator in this field. We are available to provide additional information or otherwise respond to any questions you may have. Any inquiries can be directed to: Cameron Brooks, Senior Director, Tendril Networks, Inc. (303) 468-4455, cbrooks@tendrilinc.com.

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Deleted: *5. **Home Area Networks**. We seek to understand the ways in which utilities, technology providers and consumers will connect appliances, thermostats, and energy displays to each other, to the electric meter, and to the Internet.* ¶
a. Which types of devices (e.g., appliances, thermostats, and energy displays, etc.) will be connected to Smart Meters? What types of networking technologies will be used? What type of data willbe shared between Smart Meters and devices? ¶
<#>List all Tendril devices¶
<#>ZigBee, HomePlug, IP (wired and wireless)¶
<#>ZigBee Smart Energy Profile (plus extensions)¶
<#>Also list or describe partners… appliances (GE), televisions (Intel), generation (Fat spaniel, others?), vehicles (?)…¶
¶
b. Which types of devices (e.g., appliances, thermostats, and energy displays, etc.) will be connected to the Internet? What types of networking technologies will be used? What type of data will be shared betweenthese devices and the Internet? ¶
<#>Transport, IHD, PCT¶
<#>IP (wired and wireless)¶
<#>Pricing, utility network events (existing and upcoming), weather forecast, bill presentation, etc.¶
¶
c. We welcome analyses that examine the role of broadband requirements for Home Area Networks that manage energy loads or deliver other energy management services. ¶
<#>Again just stress that our application requires (relatively) low bandwidth, medium latency but ubiquitous access.¶
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Conclusion.¶ ... [18]

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comments, the bulk of which focus on [insert characterization]. Part I provides an overview of the interplay between advanced communications technology and smart grid functionality. Part II of these comments address specific information sought by the Comission, including [insert] Part III Summarizes our comments to state Public Service Commissions that have or are currently examining similar issues involving the smart grid. currently pending in before various state Public Service Commisions. [I suggest giving some thought to whether you want to include this section. If you do, it should be significantly shortened.] Part IV concludes with key recommendations.

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to the Federal Communications Commission in response to the NBP Public Notice #2 ("Comment Sought on the Implementation of Smart Grid Technology"). We vigorous agree with the FCC's early conclusion that smart grid technology is a promising way to use broadband and advanced communications to promote energy efficiency, reduce greenhouse gas emissions and foster innovation in the electric industry. We further believe that the American Recovery and Reinvestment Act of 2009 (ARRA) provides a unique opportunity to leverage funding to support multiple federal public policy goals, particularly as they relate to job creation, clean energy development and technology innovation. We applaud the FCC for their efforts to take advantage of these opportunities.

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b. Which communications technologies and networks meet these requirements? Which are best suited for Smart Grid applications? If this varies by application, why does it vary and in what way? What are the relative costs and performance benefits of different communications technologies for different applications?

c. What types of network technologies are most commonly used in Smart Grid applications? We welcome detailed analysis of the costs, relative performance and benefits of alternative network technologies currently employed by existing Smart Grid deployments, including both "last mile," backhaul, and control network technologies.

d. Are current commercial communications networks adequate for deploying Smart Grid applications? If not, what are specific examples of the ways in which current networks are inadequate? How could current networks be improved to make them adequate, and at what cost? If this adequacy varies by application, why does it vary and in what way?

Contrast bandwidth / latency details above versus existing consumer Internet access and utility backhaul networks -- conclusion: adequate, where available

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Presumably, commercial networks are good?

If proprietary networks are required for end-to-end security reasons, that should not preclude the use of commercial networks for commercial applications (such as home energy management, dynamic pricing and demand response).

There should not be a single network that is prescribed. Various networks can be employed for different applications.

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Just that ubiquitous bidirectional access (with parameters described above) are sufficient to satisfy our application (residential energy management)

a. What percentage of electric substations, other key control infrastructure, and potential Smart Grid communications nodes have no access to suitable communications networks? What constitutes suitable communications networks for different types of control infrastructure? We welcome detailed analyses of substation and control infrastructure connectivity, potential connectivity gaps, and the cost-benefit of different alternatives to close potential gaps.
b. What percentage of homes have no access to suitable communications networks for Smart Grid applications (either for last-mile, or aggregation point connectivity)?

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d. How does the availability of a suitable broadband network (wireless, wireline or other) impact the cost of deploying Smart Grid applications in a particular geographical area? In areas with no existing networks, is this a major barrier to Smart Grid deployment? We welcome detailed economic analyses showing how the presence (or lack) of existing communications networks impacts Smart Grid deployment costs.

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*3. **Spectrum**. Currently, Smart Grid systems are deployed using a variety of communications technologies, including public and private wireless networks, using licensed and unlicensed spectrum. We seek to better understand how wireless spectrum is or could be used for Smart Grid applications.*

a. How widely used is licensed spectrum for Smart Grid applications (utility-owned, leased, or vendor-operated)? For which applications is this spectrum used? We welcome detailed analyses of current licensed spectrum use in Smart Grid applications, including frequencies and channels.
b. How widely used is unlicensed spectrum? For which applications is this spectrum used? We welcome detailed analyses of current unlicensed spectrum use in Smart Grid applications, including frequencies and channels.
c. Have wireless Smart Grid applications using unlicensed spectrum encountered interference problems? If so, what are the nature, frequency, and potential impact of these problems, and how have they been resolved?
d. What techniques have been successfully used to overcome interference problems, particularly in unlicensed bands?
e. Are current spectrum bands currently used by power utilities enough to meet the needs of Smart Grid communications? We welcome detailed studies and discussion showing that the current spectrum is or is not sufficient.
f. Is additional spectrum required for Smart Grid applications? If so, why are current wireless solutions inadequate?

i. Coverage: What current and future nodes of the Smart Grid are not and will not be in the coverage area of commercial mobile operators or of existing utility-run private networks? We welcome detailed descriptions of the location, number and connectivity required of each node not expected to be in coverage.
ii. Throughput: What is the expected throughput required by different communications nodes of the Smart Grid, today and in the future, and why will/won't commercial mobile networks and/or private utility owned networks on existing spectrum be able to support such throughputs? We welcome detailed studies on the location and throughput requirements and characteristics of each communications node in the Smart Grid.
iii. Latency: What are the maximum latency limits for communications to/from different nodes of the Smart Grid for different applications, why will/won't commercial mobile networks be able to support such requirements, and how could private utility networks address the same challenge differently?
iv. Security: What are the major security challenges, and the relative merits and deficiencies of private utility networks versus alternative solutions provided by commercial network providers, such as VPNs? Do the security requirements and the relative merits of commercial versus private networks depend on the specific Smart Grid application? If so, how?
v. Coordination: Are there benefits or technical requirements to coordinate potential allocation of spectrum to the Smart Grid communications with other countries? What are they?
vi. Spectrum allocation: Are there any specific requirements associated with Smart Grid communications that require or rule out any specific band, duplexing scheme (e.g., FDD vs TDD), channel width, or any other requirements or constraints?

g. If spectrum were to be allocated for Smart Grid applications, how would this impact current, announced and planned Smart Grid deployments? How many solutions would use allocated spectrum vs. current solutions? Which Smart Grid applications would likely be most impacted?

Page 8: [9] Deleted **David Mollerstuen** **10/2/2009 8:57:00 PM**

Cannot provide specific numbers, but there are barriers for many consumers to access real-time information because (1) information delivery is delayed (not directly from the meter), (2) meter technology is proprietary.
These issues are addressed by policies that promote consumer access to data and open standards.

Page 8: [10] Deleted **David Mollerstuen** **10/2/2009 9:01:00 PM**

The merit of direct, real-time access to usage information is

Page 8: [11] Deleted **David Mollerstuen** **10/2/2009 9:02:00 PM**

Consumers should be enabled to access information in the form that is most useful to them.

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Page 8: [14] Deleted **David Mollerstuen** **10/2/2009 9:06:00 PM**

As part of a comprehensive decision system around energy usage, storage, generation

Page 8: [15] Deleted **David Mollerstuen** **10/2/2009 9:06:00 PM**

d. What uses of real-time consumption and pricing data have been shown most effective at reducing peak load and total consumption? We welcome detailed analyses of the relative merits and risks of these methods.
e. Are there benefits to providing consumers more granular consumption data? We welcome studies that examine how consumer or business behavior varies with the type and frequency of energy consumption data.
Allows "fine tuning" of consumption within the home (e.g. baseline versus baseline plus HVAC versus baseline plus LCD TV)
Allows more comprehensive decision systems (e.g. defer additional usage until lower pricing in effect)

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Page 9: [18] Deleted **David Mollerstuen** **10/2/2009 9:10:00 PM**

*5. **Home Area Networks**. We seek to understand the ways in which utilities, technology providers and consumers will connect appliances, thermostats, and energy displays to each other, to the electric meter, and to the Internet.*
a. Which types of devices (e.g., appliances, thermostats, and energy displays, etc.) will be connected to Smart Meters? What types of networking technologies will be used? What type of data willbe shared between Smart Meters and devices?
List all Tendril devices
ZigBee, HomePlug, IP (wired and wireless)
ZigBee Smart Energy Profile (plus extensions)
Also list or describe partners… appliances (GE), televisions (Intel), generation (Fat spaniel, others?), vehicles (?)…

b. Which types of devices (e.g., appliances, thermostats, and energy displays, etc.) will be connected to the Internet? What types of networking technologies will be used? What type of data will be shared betweenthese devices and the Internet?

Transport, IHD, PCT
IP (wired and wireless)
Pricing, utility network events (existing and upcoming), weather forecast, bill presentation, etc.

c. We welcome analyses that examine the role of broadband requirements for Home Area Networks that manage energy loads or deliver other energy management services.

Again just stress that our application requires (relatively) low bandwidth, medium latency but ubiquitous access.

Conclusion.

[2-3 brief paragraphs summarizing key points you want to highlight here]We

Page 9: [19] Deleted **David Mollerstuen** **10/2/2009 8:22:00 PM**

: Cameron Brooks, Senior Director, Tendril Networks, Inc. (303) 468-4455, cbrooks@tendrilinc.com.

Respectfully submitted,

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