November 10, 2009

Comments – NBP Public Notice #2 from Vermont Electric Power Company (VELCO) and Vermont Electric Cooperative (VEC)

GN Docket Nos. 09-47, 09-51, and 09-137

VELCO and VEC appreciate the opportunity to provide comments to the FCC on the implementation of Smart Grid applications and how they are an integral benefit of widespread broadband access. Smart Grid is a general term that includes various means of improving the efficiency of the power grid. As such, not every application requires the same solution, level of security, bandwidth requirements or latency tolerance. Considering Smart Grid applications are relatively new, understanding how various broadband technologies interact to support such applications is important.

VELCO is the only transmission utility company within the State of Vermont and provides power to the distribution utilities across the entire state. Vermont's population is approximately 630,000 and covers 9600 square miles. VELCO is in the process of installing approximately 1,000 miles fiber optic cable throughout the subtransmission system in Vermont to reach subtransmission substations. This effort is to improve power grid reliability, security, and enable Smart Grid applications by creating the opportunity for robust backbone connectivity. Considering Vermont is one of the "greenest" states and given its challenging topography, fiber optics are considered to be the most reliable broadband alternative. Being a transmission company VELCO does not reach the end power user and has no experience with several Smart Grid applications. In an effort to be responsive, we have collaborated with VEC to provide additional comments regarding Spectrum, Real-time Data and Home Area Networks to address these areas.

VEC is one of several distribution utilities in Vermont, encompassing over 2,000 square miles and with approximately 34,000 members. VEC is uniquely qualified as they have installed over 28,000 "smart" meters and

have deployed and reviewed various Smart Grid and broadband technologies to collect end user data.

We have prepared the following summary opinions for your review and consideration. The bolded sections were taken directly from the Public Notice DA 09-2017, released September 4, 2009.

1. **Suitability of Communication Technologies**

As discussed by many of the earlier respondents, different Smart Grid applications could use commercial or private communication networks. A primary question is does it make sense to utilize different means of communications for different applications. For VELCO's business of power transmission, we support simplifying our communications strategy for reliability reasons. For VEC's power distribution business, a combination of communication strategies may be the most effective.

VELCO's experience with commercial communication networks is they are not adequately reliable to address a power outage, especially during a major outage. However, they may be a satisfactory backup strategy. The over arching truism is that reliability needs to be governed by simplicity. Commercial networks are rarely wholly owned or controlled by one entity, governed by business contracts that add complexity, have been reluctant to prioritize usage for utilities, and are not standard within their industry. This all leads to uncertainty in availability, especially during a time of emergency.

Considering the power grid is comprised of many unique utility organizational structures, all being successful in delivering power to the end user, the concept of one shoe fits all is significantly overstated. Essentially the power grid is all interconnected and more importantly interdependent. This reality should be an important consideration when selecting an appropriate means of communication. With this said we do subscribe to the concept of

standardizing various operational requirements regarding latency and reliability.

The question of latency and reliability are tied to several technical relationships such as volume of users, applications, capacities along the commercial networks, technology limitations, etc. This is key when defining what the appropriate broadband communications approach for different Smart Grid technologies should be. Importantly this is recognized by the Northeast Power Coordinating Council (NPCC) in its Regional Reliability Reference Directory 8 regulations which mandate strict performance testing of all communications supporting "key facilities". The intent of this regulation is specifically to ensure reliability of the power grid, hence many of the Smart Grid applications. We do not believe, at this time, it is practical to say commercial communication networks can meet these requirements. This drives our opinion that a private communication network will better serve the requirements of the power grid and Smart Grid applications.

VEC has provided the following specific responses to this section.

a. For AMI applications VEC required latency no greater than 100ms, bandwidth of 512kb (future requirement – current bandwidth is 9600bps), downtime no longer then 8 hours. There are different requirements for SCADA.
b. VEC's preference is redundant fiber optic communication. If fiber redundancy is not possible, then we can use GPRS/GSM as a backup.
c. VEC's goal is to use SONET (OC-3) with different topologies, depending on availability of the fiber. SONET solutions provide enough bandwidth and security (separation) for different applications such as SCADA, AMI, VoIP, and LAN/WAN at the substation.
d. Some parameters of commercially available services are adequate but not all of them. For example, a DDS leased circuit provides enough bandwidth for today, but it is not currently

possible to order another line (for redundancy) which will go through a different physical path to provide true route diversity.

e. It's impossible to assess the reliability of commercial wireless networks (GPRS/GSM), because GSM operators do not provide key data such as power backup of BTS, network coverage with the outage of one BTS, etc. The delay on those networks might be too long for using these networks for control.
   Reliability of those networks can be improved, but this requires an active approach on the part of GSM network operators.

2. Availability of Communication Networks

The state of Vermont can be characterized as rural, mountainous, and sparsely populated. To date this has led to commercial communication providers being unable to justify building broadband or voice access to many areas of the state. Essentially this patchwork of commercial networks does not provide the necessary coverage for Smart Grid applications.

These challenges are deterrents themselves to specifically using commercial communication networks for Smart Grid applications. Without a common communication link throughout the power grid an impediment is realized due to the complexity of establishing consistent connections. A collage of communication links within a given geographic area would require an extraordinary, ongoing management challenge riddled with unnecessary complexity. This potentially leads to longer outages or degraded power grid performance conflicting with many power grid and Smart Grid goals.

The cost impacts of using commercial vs private communication networks to Smart Grid is too undefined for this response but can generally be categorized in two ways. First we have the direct capital cost to build the communication network infrastructure and second is the impact of reliability and performance. Suffice it to say, a private

communication network would be comparable in cost to deploy but would be more reliable.

VEC has provided the following specific responses to this section.

a. Most of VEC's substations do not have a permanent communication path. VEC prefers to use private fiber optic communications but when not available VEC has been forced to use:
    i. DDS leased lines provided by telecom company
    ii. Telemetric company who provides proprietary solution over GPRS/GSM network
    iii. Private, licensed radio (900Mhz range)
b. Most of the homes in VEC's service territory do not have broadband access; therefore VEC does not have specific data.
c. Even if such service exists, bringing it into the substation is creating significant costs due to electrical isolation requirements. VEC can recover that cost by switching to fiber, but presently radio (GPRS/GSM) is a more cost effective solution.
d. The system VEC is using (TWACS) requires communication to the substation. For the first phase of AMI project at VEC, we are using a GPRS/GSM solution and we have found it to be relatively inexpensive. For the second phase with real time pricing we need higher availability of the communication path than provided by GPRS/GSM. For this reason we are gradually switching to fiber optics. But even with fiber optic connections to the substation we are planning to keep GPRS/GSM as a backup in at least some of the substations, especially where we can provide redundant fiber optic connections. If fiber is broken we may not be able to restore communication within 8 hours which is the size of buffers with interval data on most of our meters.

3. Spectrum

If the goal is reliability and consistency then licensed spectrum would be preferred over unlicensed spectrum. Unlicensed spectrum is unprotected and if critical infrastructure is using this communications technology then a significant risk exists. Specifically, unlicensed spectrum affords the user no clear visibility as to who is or may be operating within that spectrum. This could lead to significant complications within the power grid considering identifying the entity interfering with the unlicensed wireless link would not be trivial and could take several days to rectify.

Security compliance requirements for the electric industry have excluded communications between security perimeters as a way to mitigate the lack of security control of these communications. A more secure implementation allows for control of the policies, procedures, architecture and change management by the entity/entities held accountable for the electric system reliability. At this point visibility of the security infrastructure, policies, etc has proven difficult to gather from public communications facilities. From a reliability/security perspective the time that operational tools are needed the most is when there are power disturbances or when there are neighboring or partial system communications issues. With the lack of visibility, or acceptance of the risks inherent in large scale public shared communications infrastructures communications events can have very widespread impacts to operational visibility and worst case, be concurrent with power events.

Bandwidth limitations of current wireless communication networks will often not be adequate for many Smart Grid applications. Operationally there are latency requirements that are sub-second up to several seconds. New visualization tools require extremely large amounts of data to be transferred at real time, these new tools along with additional video security monitoring require reliable high speed communications.

VEC has provided the following specific responses to this section.

a. VEC is using only one (MDS) radio system for SCADA. That system was installed about 10 years ago and it uses a frequency in the 900 MHz range.
b. VEC currently uses unlicensed spread spectrum radio only for short range applications, always with directional antennas.
c. VEC did not experience any problem with interferences while using unlicensed spectrum.
d. VEC will probably use of directional antennas and spread spectrum protection for our application.
e. Due to many obstacles with creating radio communication, VEC prefers to use leased lines or fiber for Smart Grid applications.
f. Probably not at this point.
g. Coverage: By using directional antennas and signal boosters VEC have AT&T (previously Unicel) coverage at all of our substations, where collection points for Smart Grid are located.
h. Throughput: VEC uses GPRS on AT&T (previously Unicel) which provides enough throughput for the AMI system we are using. The GSM network had no features such as private APN and static IP addresses which decreases reliability and complicates usage/maintenance.Latency: For AMI system VEC found that 100ms response to IP ping is sufficient.
i. Security: VEC considers the GSM network as relatively secure, especially if the GSM operator is able to create private APN for the electric utility. Private APN in combination with encryption methods may create a more secure solution but has not been accomplished as the date of this response.
j. Coordination: We have no opinion on that matter.
k. Spectrum allocation: We have no opinion on that matter.
l. Spectrum allocation for Smart Grid might be helpful but VEC has encountered other obstacles when trying to implement radio for Smart Grid:

i. Very complicated FCC regulations due to Canadian frequency coordination.
ii. Very complicated permit process in Vermont.
iii. Limited human resources to maintain radio in mountainous terrain.

4. Real-time Data

VEC has provided the following specific responses to this section.

a. VEC developed an in-house application to present hourly data consumption for all VEC members who have smart meters. Members' account data and meter numbers are encrypted and transferred to an external web server together with interval data. During the session with the web server, account data (entered by user) are encrypted and compared to the database.
b. Users can access data only from external web server (encrypted as described above), there is one direct connection to internal database server or to the meter. Because of the methods we use, there is no risk for our system or member's data (interval meter data). Even if external data is stolen, it's impossible to match interval data to account information. Our goal was to present interval data, but also to protect access to interval data at the same time.
c. We need to develop policy on the state level to recognize that interval data is very sensitive data and access to that data should be limited (including software developing companies, etc). PCI standard might be one of the guidelines to use while creating such a policy. Another option might be to create such a policy on country level, such as PCI did. This might be created by collaboration between electric utilities or by the Federal Government. We believe that the appropriate policy on the state level – strong encryption and authentication

methods (such as two-factor authentication) – should be sufficient to protect data.

d. We do not have such experience yet with reducing peak load, but we believe consumer education, marketing, and social studies are as important or more than technical solution.
e. Our Member Service Department is using daily usage data to resolve high bill complaints in most cases. From the consumer's point of view the hourly consumption data should be sufficient.
f. That question is too general and difficult to answer without additional assumptions or/and details.

5. Home Area Networks

VEC has provided the following specific responses to this section.

a. During the pilot installation VEC is planning to install TWACS IHD (In Home-Display) and Aclara DRU (Demand Response Unit). Both devices will use TWACS as communication path, so it will use the power grid as a communication medium.
   We do not expect direct information exchange between IHD and the meter.
b. We do not expect to connect any home devices (such as appliances) over the internet. Consumers may have access to the data over the internet but by using regular PC devices. We are considering strong authentication procedures such as two-factor authentication tokens.
c. Web presentment will require as fast as possible data transmission. Sending DR (Demand Response) or pricing signals (mostly broadcast) does not require broadband. Sending broadcast messages over the power line is very efficient.