Advanced Metering Solutions for Federal Agencies
December 7, 2010 – Washington Convention Center
Meeting Report

Opening Remarks, Ab Ream

- Ab Ream, Chairman of the FEMP Operations and Maintenance (O&M) Working Group, welcomed the attendees by introducing the purpose of the forum: to exchange information and practices regarding advanced metering and to address the approaching metering mandates from Federal legislation, including EPAct 2005 and EISA 2007. The forum would feature agency success stories in implementing advanced metering, followed by three expert panels. The panelists were selected by the members of the FEMP O&M Working Group from publicly submitted abstracts.

John Park, U.S. Department of Veterans Affairs (VA)

- John Parks, the Energy Program Team Lead at the U.S. Department of Veterans Affairs, presented information on the VA's approach to satisfying metering mandates.
- The VA's Energy Portfolio includes (Fiscal Year (FY) 2009):
  - 300 facilities subject to mandates
  - 155 million square feet across 6,000 buildings
  - Energy and water cost and consumption:
    - Energy: $517 million (29 trillion Btu)
    - Water: $31 million (9 billion gallons)
  - In order to address the mandates, the VA implemented an Advanced Meter System Master Plan as part of the VA Energy Action Plan in 2006
- VA Advanced Meter System Master Plan
  - The plan accounted for the following VA buildings to be metered:
    - Buildings over 50,000 square feet (73% of VA square footage)
    - All buildings using high intensity energy
    - Each building will meter electricity, steam, and chilled water as well as natural gas
  - Types of meters installed at VA facilities:
    - Inversion or clamp-on meters
    - Flow meters (without moving parts, such as Vortex Meters or Electro-Magnetic Meters) were installed at critical VA facilities (such as hospitals)
- Pilot Meter Project
  - The VA selected two regions with differing sizes and climates (Ohio and California) in order to execute a pilot meter project as part of the Advanced Meter System Master Plan. The project was designed for each building to send meter data to a data aggregation device; the device then feeds information to a central website to be stored in the server.
  - The scope of work included:
    - Installation of electricity meters, steam, CHW, gas, and water (non-electricity) meters
    - A central website for data collection and analysis
    - Utility bill audits
    - The installation of 300 meters in 11 campuses
    - The projects were awarded in FY08 and were completed in FY10
- National Electricity Meter Project
  - After completion of the Pilot Meter Project, the VA enacted a nation-wide electricity metering project in FY09
  - The scope of work included:
    - Installation of electricity meters for the remaining VA buildings (>50,000 square feet with high electricity use)

        - All meter data to be sent electronically to the central website for collection and analysis
        - 1,600 meters at 160 campuses
        - 50% of all meters have been installed; the project will be completed in early 2011
- National Non-Electricity Meter Project
    - Next, the VA executed a nation-wide non-electricity meter project with the use of Recovery Act funding
    - The scope of work included:
        - Installation of non-electricity meters for the remaining VA buildings (>50,000 square feet)
        - 20 regional contracts (all awarded in FY10)
        - All meter data to be sent electronically to the central website for collection and analysis
        - 3,000 meters in 160 campuses
        - This project will conclude in early 2011
- VA Central Website
    - The website developed in the original Pilot Meter project serves as the central location for all metering data in a secure VA database
    - Website features:
        - Easy-to-use interface
        - Secure log-in
        - Data divided by region, facility, and building
        - Trending data and analysis capabilities, including power qualities, mode factors, and total energy usages
- VA Challenges
    - Integration of new meters with existing meters (different contractors)
    - New meters for renewable energy systems, new construction projects, installation by local facilities, and existing meters
    - Lack of energy savings in ESPCs (Energy Savings Performance Contacts) and UESCs (Utility Energy Service Contracts) as metering projects cannot be justified as saving energy (the VA applied direct funding to complete these projects)
    - Lack of firm data for the utility lines from campuses' buildings to campuses to buildings
    - Older facilities also presented a challenge (lack of historical data and information regarding the utilities on -site)
- VA's Future Plan
    - Additional meters to be installed in smaller buildings (>5,000 square feet)
    - New hires: Facility Energy Managers who will be responsible for analyzing metered data
    - The central website will data directly to the energy benchmarking tool in the Energy Star Portfolio Manager (currently, data is updated every 3 months)

QUESTIONS:

- Will the meters perform utility costing? Yes, the meters will be installed at each utility feed to verify utility bills.
- How were the contracts funded for each project (Pilot Meter Project, etc.)? The contracts were centrally funded except for the National Non-Electricity Meter Project, which used ARRA funding.
- Did the VA use any custom integration in the metering software? No, the software package was an off-the-shelf product. The metering feeding data has not been integrated yet; data dumps are performed manually every 3 months. The VA is currently working with the Environmental Protection Agency to feed data directly from their central website to the Energy Star Portfolio Manager
- How is missing data accounted for? Missing data is accounted for by programming in the software package.
- What were the direct benefits from the pilot project? Exact benefits are currently unknown since meter installation was just completed this summer; however, facility managers have been able to pinpoint some deficiencies using the trending data. All success stories will be collected and recorded by the VA.

- Did the VA experience difficulties in the network connectivity? Yes, 5% of the facilities involved did experience issues (medical equipment interference), but it was resolved.
- How did the VA determine its starting target point of buildings <50,000 square feet)? The threshold was determined by the construction cost ($10M); the VA also performed a survey for electricity, steam, and chilled water usage to determine the buildings using the most energy.

Keith Kautzman and Jeremy Zins, WBI Holdings, Inc., AF Advanced Metering System

- Keith Kautzman and Jeremy Zins presented information on Montana-Dakota Utilities (MDU) Resources Group's partnership with Ellsworth Air Force Base (EAFB) and Minot AFB (Montana-Dakota Utilities Co. service area) to install meters on each of the bases.
    - Project methodology:
        - Utilization of a wireless system (Itron)
        - Focus on the collection of basic data
        - Sole responsibility for the project was with Bitter Creek – MDU Resources, Inc.
        - Meter installation for electricity, natural gas, and water
        - The use of towers and servers as a data gathering system
        - A web-based data display system: an open protocol software that was customized to meet EAFB's needs
    - Project software
        - The project used a web-based, secure delivery method which allowed for ease in exporting for data reporting requirements
        - Easy interface with a base map, base trend data (daily or hourly) for electricity, gas and water, energy intensity data, building-specific data and meter-specific data
        - Quick reference tools such as top meters (top consumers by building)
        - Low and high alarms that alert staff to consumption in a specific building over (or under) a pre-determined amount
    - Data usage
        - Data collection began in May 2009 at EAFB
        - The base has begun using the data to instill competition between buildings
        - The data has helped EAFB identify potential energy savings projects and justify future energy projects
        - Usage validation (EAFB can validate utility bills and reimbursable utility invoices)
        - Increased accountability for utility consumption (building managers, building occupants, reimbursable customers)
- For more information on the future of the Air Force Advanced Meter Reading (AMR) standardization, please contact Mike Ringenberg:
    - Mike Ringenberg, AFCESA/CENE:
      Mike.Ringenberg@tyndall.af.mil
      HQ AFCESA/CENE
      139 Barnes Drive Suite 1
      Tyndall AFB, FL 32403
      TEL: 850-283-6012

QUESTIONS:

- What were the biggest concerns for website security? The biggest concern for the AF was data transmission from the collectors on base back to MDU (MDU hosts the web database).
- How often does the system update? The system is a completely separate system from AF systems on base; it is not real-time but updates about every hour.

- What are the information assurance components? The specific components were selected by Ellsworth; Itron provided specs for the project data which were certificated by the Air Force Civil Engineering Support Agency (AFCESA)
- What percentage of EAFB metered? Similar to the VA, EAFB chose to meter buildings over 50,000 square feet; a total of 208 meters were installed at EAFB (approximately 20% of the buildings).
- What was the driver for the customization? EAFB had specific needs such as cost and timing aspects; MDU had the basics of the system already in existence, but it was customized for EAFB.
- How often is data collected? Data is collected once an hour; electric meters collect every 15 minutes; natural gas and water meters collect every 20 minutes.
- How were the water sensors installed? The water meters were installed by breaking the pipes apart.
- Was demand power addressed at EAFB? The project focused on kilowatt-hours, not demand power.
- How are the "top" energy consuming buildings identified in the software? Buildings are compared between each other (using raw data); does not pinpoint the exact cause of the increased usage, i.e., the furnace.
- What is the maximum range on the remote wireless system? Gas meters: 1,000 meters, water : <1,000 meters, and electric: 1,500 meters; the collectors use a cellular data collection unit to send information back to the host system.

PANEL QUESTIONS:

- The software packages presented today do not appear to analyze the problem (diagnostic features), is there more out there?
  - The meters at EAFB were strictly for measurement and verification of utility data.
  - It seems that with most metering software, you must still drill down further to identify the problem. A possible solution: install a wireless meter on an AC chiller, for example.
  - A meter is a tool, not necessarily the only way to save energy.
  - Different tools are available now (more sophisticated data means more cost); paybacks still have to be justified.
- It is hard to perform the automatic process (startup and shut down trending), how do you automate when customers start complaining?
  - The General Services Administration (GSA) rate wizard can take measurements and see how much you could save when turning equipment off.
  - Metering net benefit is about 5% (private sector perspective).
- System integration and organization integration issues have a huge impact on energy savings, how do you incentivize facility savings?
  - The integration of personnel roles is key
  - Gaining funding and management support is necessary to re-coop savings for future projects.

Dan Vesey, Schneider Electric: NAVFAC Advanced Metering Infrastructure (AMI) Program

- Dan Vesey presented information on the NAVFAC AMI Program
- AMI Program History
      - Initial efforts began with DOD metering plan in 2006 by NAVFAC
      - Leveraged an Architecture/Engineering (A/E) contact to conduct global surveys, generate a Functional Requirements Specification (FRS) and preliminary design for a pilot project at Naval Base Ventura County (NBVC)
      - Developed the scope of work and awarded 5 year, $250M Indefinite delivery, indefinite quantity (IDIQ) contract
  - Program Goal: capture 95% of consumption
  - Program Funding: initially funded by CNIC (Commander, Navy Installations Command) for startup efforts and the Recovery Act (ARRA)
- AMI System Architecture:

- CIRCUITS (data made available globally)
  - Regions
    - CONUS (the contiguous United States): Southwest, Northwest, Midwest, Mid-Lant, Washington
    - OCONUS (Outside of Contiguous United States) : Hawaii, Far East, Europe Africa Southwest Asia (EURAFSWA), Marianas
- Each site has a data acquisition system collecting from individual meters

- Core Functional Requirements
  - Advanced electric meters that monitor and record: energy usage/demand, power quality, disturbances and events, store interval data logs, aggregate and store mechanical meter data logs (advanced utility logs)
    - Meters with multiple communication ports (Ethernet and IP addressable)
    - Utility class accuracy
    - Programmable frameworks
    - Alarm notifications
  - Mechanical meters
    - Water, natural gas, and steam (pulse or encoder outputs)
  - Data Acquisition System (DAS)
    - Tools for energy/system management and reporting (at 15-minute intervals)
    - Management of alarms and outages, unusual demand,and failures
    - All available at the desktop
  - Network Communications
    - Two-way communication to and from the meter by a wired and wireless ethernet
    - Integrated onto the Navy Public Safety Network (PSNET); new system for safety and AMI will eventually include Supervisory Control and Data Acquisition (SCADA)
    - Meets enhanced security requirements (Information Assurance [IA])
  - Meter: the PowerLogic ION8600 Electric Meter
    - Features: Smart Grid ready, logging and recording, multiple tariff and time-use calculations, alarming and control, power quality, equipment status monitoring and control, enhanced mobus mastering
  - Software
    - Features: energy and utility monitoring, reporting, historical analysis, trend analysis, power quality analysis, alarming and events, data and event logging, manual and automated control, interoperability (SCADA, DDC, or Display Data Channel, and BAS, or Building Automation Systems), stores collected data, equipment status monitoring and control, output data reports
  - Bill and Reporting
    - Energy cost reporting, power reporting, WAGES (Water, Air, Gas, Electric, Steam): can be broken out by facility
- AMI Network Communications
  - PSNET: required to integrate the communications onto PSNET
  - Wireless Technology: wireless approved for PSNET; the Federal Information Processing Standards, or FIPS, patrols the wireless network
  - IA and the DoD Information Assurance Certification and Accreditation Process (DIACAP): AMI systems are required to comply with information assurance (IA) and DIACAP
- Regional AMI System Architecture
  - Multi-point connection
  - WIDS (wireless intrusion detection system)
  - Wireless network control (automatic network shutdown)
- NAVFAC AMI Challenges:

- DIACAP accreditation
- Risk mitigation
- Controlled interface

Stan Lee, U.S. Army Engineering and Support Center

- Stan Lee presented information on the Army's Meter Data Management System (MDMS): an enterprise system to track the Army's energy consumption worldwide
- Army philosophy: use a utility monitor control system to provide the ability to track utility commodities consumption at the facility level
- MDMS Data Flow: data is collected at an installation, then it is transmitted to an enterprise meter data website reporting system
  - MDMS challenge: clearing the meter communication way at the local level
- MDMS Phased Approach
  - Phase 1: Pilot (prove the principal)
  - Phase 2: Expand the project and install MDMS at 43 installations (expand and improve reporting capability)
  - Phase 3: Maintain the system and expand it to include all installations
  - Design Principals
    - Simple (at first)
    - Develop standards that capture the necessary data
    - Match expectations to the desired outcomes
    - Short pilot studies
    - One size doesn't fit all; limit the solutions to the most common solutions sets
  - Phase 1 Goals:
    - Pilot at Ft. Caron and Ft. Stewart
    - Results: 117 meters at 3 sites, 5 standard data reports
    - Findings: power factor irregularities that resulted in significant annual penalties, power quality concerns, interest in master metering, desire for flexible reporting cabailities
  - Phase 2:
    - Planning for 100 additional sites
    - Upgrading the reporting capabilities
- Data
  - Able to present data by Army-level, region-level, facility-level to the building level
  - West Point: Global Information System (GIS) interface
- Challenges:
  - DIACAP Authority to Operation (ATO), or management approval
  - Interoperability with meters/head-end servers
  - Sustainability planning
- MDMS Outcomes
  - Identification of worst and best facilities
  - Standardization of meter data reporting
  - The system must pay for itself

QUESTIONS:

- How much did the MDMS system cost? The MDMS was $5M (so far); installation was $20M/year since 2008 (biggest undertaking in numbers of meters by the Army).
- What did you mean by the system "must pay for itself"? The goal is for the system to pay for itself (ROI) in savings.

- Who has access to the data? The data is available through the Army Knowledge Online (AKO) portal; currently anyone with an AKO login can access the data.

PANEL 1: METERING WHY'S AND WHEREFORE'S
Moderator: Dave Hunt, Pacific Northwest National Laboratory

Philip Barton, Schneider Electric: Advanced Metering Overview

- Metering Federal Guidance:
    - The FEMP-issued Guidance and the Metering Best Practices Guide are great resources
    - EISA 2007 and EPAct 2005 are key drivers with a focus on energy independence and energy security
    - It is understood that it is important to maintain a facility to prolong equipment life, but there are two parts: energy efficiency *and* reliability (both have great value for the facility)
- Metering cost justification: meters are expensive, but the entire system must be considered (engineering procurement, mobilization, communications and IT, DIACAP, cost of software, controls and installation, cost of hardware)
    - Installing meters for energy efficiency or reliability have the same cost, just different drivers
- Investment Goals Timeline
    - Today: meet the Federal mandates in order to support the improvement of baselines
        - Identify leaks and waste (a simple, but valuable step)
    - Next: sub-meter critical loads, measure CO_2 for Scope 1, 2, and 3 emissions and increase return on investment (ROI)
        - Consider greenhouse gas GHG) accounting requirements
    - Future: Manage reliability and control sources of power
        - Basic reliability
        - Minimize power system downtime (develop the ability to pinpoint problems)
    - The "next"and "future" goals are relatively low cost and add value in improving energy baselines

Dan Bielski, SAIC: A System Integrator's Approach

- Critical system design criteria to include in your metering system:
    - Open system (ensure that systems can talk to one another)
    - Multi-vendor applicability (vendors will change over time)
    - Extensible (allow room for growth)
    - Future proof (make your system compatible with future products)
    - Secure
    - Reliable data (gaps or incorrect information)
    - Make good use of existing infrastructure (often existing infrastructure can be utilized to satisfy your current needs)
    - Develop a single-access-point database
- System Integrator's Toolkit: tools and applications
    - Utility meters
    - Data collectors (and gateways)
    - Communications (address multiple protocols)
    - Database/historian:
        - Database: a sequel-series record
        - Historian: a time-series record
    - Servers and application software
    - Integration with other systems (import data from meters to energy management for analysis and trending)
- Building Block Approach to a Metering System (ground-up)

  - Meters: record the data and send to the data collector
  - Data Collector: hold the data sent from the meters
  - Historical Data Storage: a time-series record of the data
  - Applications: use the data from the data collector and the historical data storage device for analysis and trending
  - Users: apply the end product (charts/analysis) for decision-making
- Communication Architecture
  - Security requirements are a key aspect in integrating a metering system
  - Firewalls and other security features must be considered
  - The appropriate IT staff must be included in the project from the beginning
  - Recommended protocol: Modbus, a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). It has become a de facto standard communications protocol in the industry and is now the most commonly available means of connection industrial electronic devices.
  - Avoid using Energy Management Control Systems (EMCS) for metering and/or data collection (due to gaps) except for a small facility
- Value of your data: Web-based tools and features
  - Uniquely configure each trend data chart for your needs
  - Save trend charts
  - Add points and change devices
  - Overlay different trend charts for comparison
  - Capture point-in-time data values
  - Quickly remove unwanted points
  - Include capabilities to export to MS Excel
  - Shutdown tool graph
  - Emphasis on database/historian: the database information should be exportable to any application for analysis and trending

Jim Lewis, Obvius: Metering Strategies

- Tips for lowering installation costs
  - Match the meters to the specific application
  - Gather the data based on the type of building
  - Make sure the system architecture supports all utilities for future applications
  - Utilize wireless system options to reduce installation costs (widely used on military bases in mesh networks)
  - Understand exactly how the data will be used; consider the benefits and requirements
  - Future-proof the system
- Metering strategies: make your meters pay for themselves
  - Sub-metering
  - Install meters with software for collecting data
  - Billing and cost allocation software (assign responsibilities for utility consumption)
  - Building tune-up (metering, cost allocation, and data application to find the low hanging fruit)
    - Install sub-meters
    - Repair broken aspects before engaging in upgrades or continuous commissioning
  - Cost allocation to review operations and verification savings
- Typical Energy Savings
  - Meters save: 0%
  - Bill allocation saves 2.5%-–5% (assigning responsibilities)
  - A Building tune-up saves 5%–15%

    - Continuous commissioning can save up to 45% in energy consumption
- Disney World Case Study
    - Followed prescribed metering strategies
    - Experienced the following in energy savings:
        - Building tune up: 43% in energy savings
- U.S. Coast Guard Case Study
    - Problem: compressors left on at night (determined by metering)
        - Energy savings: $200/day (cost: investment of a meter)
- Load profile case study
    - Installed one circuit, which dramatically reduced the kW, consumed (20%)
    - Metering can be used for measurement and validation (M&V) and identify problems with the current system

QUESTIONS:

- What was the graphing software that was referenced that is available from Microsoft? Dundas Charts.
- Why is it that vendors do not want to interconnect advanced metering into Energy Management Systems 9EMS)? EMS can be connected with energy metering; the challenge is that the schedule is often unknown by maintenance staff (how low are unoccupied periods) and that the data has to show how low consumption can get and be able to drill down to figure out what equipment continues to run in downtime.
- How is the data system configured with SAIC? Data is pushed from the site to corporate level; users can see the data across all sites (hosted on an SAIC server). A stand-alone server is a possible solution, but can be very expensive. Again, working with IT is not a trivial task (but they provide a valuable resource).
- What is the future of metering?
    - There is a sense of future deployments of metering for energy generation from renewables, both consumption and production is required in mandates.
    - Meters are being installed on photovoltaics (PVs) in a similar fashion to monitor any other generation source

PANEL 2: SUB-METERING AND ADVANCED/SMART METERING
Moderator: Beth Shearer, Beth Shearer & Associates

Jim Plourde, Schneider Electric

- Meter Data Features to Consider
    - Ability to monitor your distribution system; possible devices: circuit breakers, advanced electric meters, protective relays
    - Require interface with third-party meters, transducers, programmable logic controllers (PLC), remote terminal units (RTU), and power distribution or mitigation equipment
    - Use a scalable platform (important in determining the equipment you'll need)
    - Use a vendor agnostic system
    - Integrate other systems
- Data Quality (Enterprise energy management-specific)
    - Poor data quality: incomplete or wrong data can cause big issues (biggest challenge in enterprise sytems)
    - Solutions to avoid poor data quality:
        - Automatic correction: duplications, straight-line interpolation over a range of gaps, automatic jitter correction
        - Measurement validation/validation schedules: any parameter can be established for data validation
        - Data quality reporting and editing: determine success or failure of the data quality with an audit trail

- Data Applications
    - Use data to:
        - Manage energy costs: cost allocation, procurement optimization, power factor correction
        - Perform energy conservation measures: M&V, demand response, load curtailment; renewable energy sources and net metering functionality (meter reads in both directions)
        - Reporting emissions
        - Monitor security and reliability: energy quality monitoring; enhanced maintenance capabilities
- EPAct 2005 Compliance
    - Use the legislation as a guide to create actions
    - Drive human behavior and culture change by employing dashboard displays
    - Encourage competitive environments within an office or an entire building (or even between agencies) to share trends

Claude Godin, Energy ICT: Life on the other side of the meter

- The challenge: energy managers are bombarded by data
- Key dimensions to consider along the value chain:
    - Infrastructure deployment: first, determine the type of meter (gas/electricity/water)
    - Data management and analysis: next, determine what type of network and data sharing devices to utilize
    - Databased actions: determine the exact purpose of the data (commercial, operational, etc.)
- Feasible energy savings activities
    - Adapt your processes to maximize efficiency
    - Determine which staff should be performing specific tasks
    - Install equipment such as sub-meters or automated controls to increase energy savings
    - Verify utility bills
    - Publicize energy savings
    - Check for faults
- Common barriers to metering, monitoring, and targeting
    - Lack of energy efficiency support on the agenda (perceived to be incompatible with business priorities)
    - Lack of internal awareness (anecdotal evidence)
    - Measurement, monitoring, and targeting is very difficult (skeptics on the value or payback)
    - Improper execution
- Metering, Monitoring and Targeting (M,M & T)
    - Recommend installing sub-meters
    - Utilize high-end meters on the main load in order to verify utility bills
    - Route all data back to a central location for collection/analysis
    - Employ continuous commissioning
    - Use performance dashboards in order to measure against yourself (facility vs facility), which is possible through sub-metering and data processing in a central location

Deanna Bebb, P&E Automation, Inc.

- The benefits of integrated metering
    - Meter to manage: measure energy generation, energy consumption, as well as energy storage at the facility
    - Easily report data per Federal mandates
- Meter integration
    - Integrated-meters, or Transmission Control Protocol/Internet Protocol (TCP/IP)-based metering allows integration with:
        - EMS systems

        - Master energy databases
        - Building automation systems
        - Defense Utility Energy Reporting System (DUERS) and other standard reporting systems
        - Base communications departments and Information technology (IT) departments
        - Base wireless/wired local area network (LAN)
        - Enables automated utility interfaces
- Lessons Learned/Examples
    - Project: hybrid renewable Distributed Generation (DG) and storage:
        - Purpose: reduce purchase power costs
        - Successes: achieved peak load reduction, integrated across DG and storage systems, and positive hydropower ROI
        - Challenges: compressed air storage had a poor ROI, utlity participation/incentives lacked in this project
        - Conclusion: Using hybrid DG for reducing peak loads works
    - Project: wireless metering at a Department of Defense (DoD) Site
        - Purpose: to fulfill an agency mandate
        - Successes: "smart" meter costs, ease of use, and competitive pricing
        - Challenges: the radios experienced communications issues (radio frequency [RF] interference)
        - Conclusion: mitigate risks by performing a design then build process; site with high RF interference are poor candidates for wireless metering
    - Project: Integrated utility metering at a DoD site
        - All utility metering over Internet Protocol (IP) LAN
        - Purpose: achieve energy conservation and fulfill agency mandate
        - Successes: Integration of the meter data was a huge success
        - Challenges: poor power quality; EMS implementation delayed meter data access
    - Project: advanced metering at a high-security site
        - Purpose: fulfill a mandate
        - Successes: installed fiber communications and integrated the meter data
        - Challenges: security concerns from the base communication department; the project was a low priority for the customer (agency mandate)

QUESTIONS:

- Why do you recommend Modbus as a communications protocol? Modbus is ubiquitous and has been an industry standard since 1979. Whether you are using a wireless or a wired meter, a separate system is required for time series and Modbus makes it much easier to manipulate the data.
- Why do you recommend the TCP/IP protocol over Modbus? TCP/IP is easier to work with when coordinating with agency communication departments. In addition, new software (such as Cap and Trade software) will work best on TCP/IP.
- How are data throughput issues handled on Modbus or Ethernet systems? Modbus is a matter of timing and orchestrating the communication (raw number of devices, timing of data transmissions and how much data), the way Modbus handles issues depends on the application at hand.
    - How are most enterprise systems in the market configured in terms of the network (internally or externally)? At large facilities, the equipment lies inside the firewall and pushes data out to an external database; Some facilities use the exisiting network as a backbone (no cost), but it is important to include relevant IT staff; Network configurations are on a case- by-case basis and often depend upon where the project falls with management priorities. Using private (corporate) networks still incur a charge for energy efficiency purposes, but may differ in the Federal sector (must meet DIACAP requirements) in addition DoD and civilian facilities employ different protocols.
- Do systems use internal benchmarkings between to create competition?

  - Yes, for example, a store manager’s bonus could be withheld if energy goals are not met.
  - There are often cases of competitions between dormitories on college campuses and benchmarking between tenants and facilities in the private sector (not witnessed in the Federal sector as much).

PANEL 3: COMMUNICATIONS AND IT SECURITY
Moderator: Ed St. Germain, EMR

Christoper Larry, Teng & Associates

- Purpose: provide Advanced Metering Solutions that share data and communicate within a network while maintaining IT security. Be sure to consider the degree of security that is required.
- IT Certification Requirements
  - Requirements are dictated by the agency (or client)
  - First: Develop a plan and outline how it will work (configuration, access, security, etc.)
  - Great resource: National Institute of Standards & Technology (NIST) Special Publication 800
  - Federal information system and certification and accreditation process
  - Involve the IT Security Team from the initial planning (notably the Chief Inforamtion Officer or equivalent): 6-month process for approval
    - Determine boundaries
    - Determine security level
    - Determine the potential impact of a security breach (helps to determine the risk)
- Content and Communications: What is being communicated?
  - Determine the to/from sources for the data
  - Plan for the data (communicate the purpose to upper management levels in a concise manner)
  - Data integration is recommended for complex IT matters
  - Demand Reponse: manage the data to prevent corruption, which can adversely affect the system’s overall operation
  - Communicate data summaries/analysis that have limited security risk (account for data sensitivity)
- Access: Which personnel need to view the data?
  - Managers
  - Energy managers
  - Accountants
  - Define and design access security features (think about who has access to the data and what they can do with it)
- Security Threats
  - Consider who or what is a threat (unfortunately, this is the most difficult question to answer because it is largely unknown)
  - Most of the data is just data (very little sensitive data will be compromised in the event of a security breach)
  - Determine the data’s sensitivity: a key aspect that is different in IT and commmunications security depending on the client or agency at hand
- Limiting access to the data
  - Establish network firewalls and internet protocols (static or dynamic)
  - Use sub-networks or isolated networks
  - Define each device with a Media Access Control (MACC) address (each device should have a MACC address that is access controlled)
  - Set access limits for specific agency workstations and loads
  - Only use network-approved devices or locate devices behind a firewall for added security
  - Data should be easily accessed by the appropriate parties (employees, etc.) but done so in the secure way, for example, SharePoint integration

David Olson, P&E Automation, Inc.

- David Olson provided information on communication options and lessons learned
- Common Communications Issues
    - Decision making between a wireless or non-wireless systems
    - Data Through-put (difficulty communicating or sharing data)
    - System Security
    - System Reliability
- Benefits of Wireless Communications
    - Low installation and operating costs
    - Zero network costs
    - Equipment longevity
    - Swift deployment
    - Easy configuration (most wireless systems are "plug and play")
- Challenges in Wireless Communications
    - Open to possible interference (signal interference, noise, channel sharing)
    - Industrial protocols (some are not supported on a wireless system)
    - Security concerns
    - Distance (wireless systems have a specific range in which data can be communicated back and forth and will not be effective if the range is exceeded)
    - New methods and technologies have been developed to help alleviate some of these issues
- Wireless standards and options
    - Unlicensed frequencies (each have pros and cons), note that some Federal agencies will allow for unlicensed spectrums established by the Federal Communications Commission (FCC)
    - Zig Bee: used for monitoring and controlling
    - Wi-Fi: used for cable replacement, large data transfers, and networking
    - Bluetooth: used for short distance cable replacement
    - Proprietary RF (P RF): used for cable replacement, monitoring, controlling and data transfer, P RF is customizable, experiences little to no interference, and the equipment is widely available (industrial SCADA)
    - Frequency range considerations for wireless systems: transmission of power, receiver sensitivity, line of sight, congestion issues, antenna considerations (multipoint or directional)
    - Consult with an RF professional when determining wireless standards for a facility
- Wired Communications
    - Advantages: Data Security, integrity of operations, equipment longevity, higher data transfer rates, and standard communications protocols
    - Disadvantages: installation costs (very expensive and intrusive), extended communications disruptions during the installation process
- Wired Technologies
    - Fiber optics: widely used for its high data transfer rate abilities
    - Ethernet/TCP-IP: common Industry standard and instant network setup
    - RS-232/RS-485 : very common industry standard and instant network
    - Phone lines: best for remote locations, easy set-up
    - Broadband over powerline (Powerline Carrier): used commonly for its high data transfer rate abilities
- IT/Communications Lessons Learned
    - "Soft spots" or open ports: areas in which noise interference and signal strength at military installations cause transfer issues (identify these areas before installing a meter)

    - Air Force example: consider the location of meters; radar can have a hugely adverse affect on the meter itself and the data being collected (especially in wireless applications)
    - Consider base architecture, line of sight, and even weather (lightening strikes) when deciding where to place meters
  - Optical port: a feature often requested by utilities, but there is no security protection for this feature (convenient for meter readers, but a huge IT concern)

Peter Virag, Weston Solutions & Matthew Franz, SAIC

- Peter Virag and Matthew Franz presented information on Advanced Metering Infrastructure (AMI) and Implementation
- AMI/Smart Grid Security Risks and Measures
  - Well- known application, operating system, and network security vulnerabilities apply to AMI
  - Concerns develop when integrating and sharing AMI networks with existing networks
  - Data sensitivity: spikes in energy usage may indicate specific activity within the agency that should not be made public (such as on a military base or secure facility)
  - A balance of availability, function, access controls, cost, and usability is necessary for success in AMI (accessibility in a consistent, secure manner)
  - A partnership approach is essential to understand security concerns of the client (develop the approach and consider who is involved)
  - Be aware of weak spots in security measures
- AMI Process: Four Main Efforts
  - Survey and design of facility (including meter locations and communications solutions)
  - Customization and hardening of DAS solution (required to meet client needs and satify information assurance requirements)
  - Security Architecture (should be documented and involve all parties)
  - Installation and Commissioning
- AMI Solution
  - Determine and define your boundaries (electronic security perimeter)
  - Look at what lies in the perimeter (meters and port scans, vulnerability scans, application components, communication flows, exposed interfaces that may be vulnerable)
  - Two aspects to emphasize: compliance and security
    - Know the system and the life cycle, monitor the users and access, define responsibilities for the network, and make communicable to IT and Information Assurance (IA) staff
    - Major lesson: don't blind side the IT staff but involve the relevant staff from the beginning

QUESTIONS:

- How was the line-of-sight issue solved in the AF example? A wired network was installed.
- What are the biggest concerns in IT/communcations securty? Be aware of compliance requirements and have a firm understanding of the software you will be using.