SMART GRID INVESTMENT APPLICATION
UNDER DE-FOA-0000058 (THE “FOA”)

Title: Phasor Measurement Project
Topic Area: Electric Transmission Systems
Applicant: American Transmission Company LLC

This project is being undertaken by American Transmission Company LLC (“ATCLLC”). ATC Management Inc. is its corporate manager. Collectively, ATCLLC and ATC Management Inc. are known as “American Transmission Company” or “ATC,” which will be a frequent reference in this application. ATC is a standalone electric transmission-only company that interconnects with more than 57 municipal, cooperative and investor-owned distribution utilities as well as more than 50 electric generating facilities. ATC does not generate or distribute electric energy. ATC, as a Transmission-owning Member of the Midwest Independent Transmission System Operator, Inc. (“Midwest ISO”) owns operates constructs and maintains facilities to provide open access transmission service to all users of the electric transmission system.

PURPOSE

The purpose of this project is to expand the collection of real time phasor measurement unit (“PMU”) data from geographically disparate sites throughout the ATC electric transmission system to provide ATC’s Control System with additional data and tools needed to monitor the dynamic state of the electric transmission system.

This will be accomplished under this Project by installing standalone phasor measurement equipment as the primary collection device and/or replacing existing relay packages with relay packages that support the IEEE Standard C37.118 (“IEEE Standard for Synchrophasors for Power Systems”) protocol in our expanded program (discussed below). The primary source of PMU data in the baseline program (also discussed below) to date and to completion has been and will be incorporation of network capability to take advantage of existing Schweitzer Engineering Laboratories (“SEL”) 400 series relays which are presently installed at many locations on the system. However, throughout the Project, other devices will be evaluated for effectiveness when determining implementation needs at each site.

ATC plans to use the data for the following activities or potential activities:

- Dynamic electric transmission system computer model verification.
- Wide area overview for ATC System Control real time operations.
- Sharing of data with the Midwest ISO and others that have reliability obligations under the FERC-approve mandatory reliability standards.
- Detection of electrical islands (areas where elements of the transmission system have separated and are no longer operating as part of the electric transmission...
**Expansion/Replication of Smart Grid Technology**

Depending on the status of the projects at ATC and within the Midwest ISO, ATC will evaluate the benefits from this Project post 2011, and if it is deemed that this Project provides the benefits believed to potentially to provide, ATC anticipates continuing and potentially expanding the program.

**Operational Performance Evaluation**

ATC will monitor the expansion and benefit analysis within and beyond ATC on an ongoing basis. ATC expects to be able to show immediate System Control System Operator awareness improvement relating to the state of the transmission system at any given time. As to the future of State Estimation, this will depend on the industry initiatives and vendor initiatives. With regard to post-event evaluation improvement, ATC believes that with time-stamped phasor data in the event of a major or minor disturbance that this will be apparent as well.

**TECHNICAL APPROACH TO INTEROPERABILITY AND CYBER SECURITY**

**Interoperability**

Substation SCADA/PMU Communication Summary

ATC has standardized on TCP/IP\(^2\) which greatly enhances network interoperability for emerging technologies (e.g. NASPNet\(^3\)). Currently, ATC has Remote Terminal Units, Phasor Measurement Unit, video, voice, and remote management communications using Internet Protocol. SCADA/PMU data communications are being supported by Cisco and Check Point networking equipment.

\(^2\)TCP/IP - The Internet Protocol Suite
TCP/IP is the set of communications protocols used for the Internet and other similar networks. It is named from two of the most important protocols in it: the Transmission Control Protocol ("TCP") and the Internet Protocol ("IP").

\(^3\)NASPNet – North American Synchro-Phasor Initiative
NASPNet is a major effort by the North American electric power industry to create a robust, widely available and secure synchronized data (synchrophasor) measurement infrastructure for the interconnected North American electric power system associated with analysis and monitoring tools for better planning and operation, and with improved reliability.

Other Key points:
- Quality of Service (QOS) is configured to ensure data integrity and delivery.
- Open Shortest Path First (OSPF) is being used as the interior gateway protocol.
- Local Exchange Carriers will provide digital data services as an alternate commutations path during a primary communication path failure.
• Network monitoring through polling and event driven notifications.
• Hardware or software upgrades are tested in a lab environment before the changed is moved into the production environment.

Cyber Security

ATC identifies cyber security risks in several ways:
• Using industry resources to notify of risks or vulnerabilities associated with our implemented technologies.
• Attending security training to learn about new risks and to analyze future risk trends.
• Utilizing informal and formal risk analyses processes when new technologies or business processes are introduced.
• Utilizing change management processes to ensure awareness of system changes so that cyber security risks can be identified.
• Workstation and Server software is patched to mitigate latest threats throughout the lifecycle of the machine.
• Third party vulnerability scanning is implemented on weekly basis for all external facing devices.

Policy, Procedural and Technical Controls
• Firewall and Intrusion diction technologies are used to protect all data networks.
• Substation to Substation communication is blocked via Cisco Router Access Control Lists.
• Two-factor authentication (T-FA) is used on all Cisco equipment. T-FA delivers a higher level of authentication assurance.
• T-FA is used before network access is granted to firewall equipment.
• T-FA is used for any access into the Energy Management System equipment or substation equipment.
• Cisco devices are Secure Shell enabled offering encrypted communications with the network infrastructure.
• File monitoring software is in place to monitor all types of file access across file servers, including weekly reports on NERC/CIP Protected information file access.
• All servers and routers go through internal security checks before being released to production.

Securing, Logging, Monitoring, Alarming and Notification
• All Cisco routers SYSLOG and SNMP Trap notifications are sent to a Network Management Station.
• All local and remote access to Cisco equipment is logged.
- All local and remote access to firewall equipment is logged.
- All remote access to Energy Management System and System Protection equipment is logged.
- All Cisco router changes are logged.

**Logical and Physical Security**
- Network ports are turned “down” or off when not in use in the substations. Use of these ports need to be requested ‘turned on’ when needed.
- Restricted/monitored physical access.

**Potential Impacts from Cyber Security Threats**

This project should not introduce new impacts from cyber security threats which could affect other critical grid control functions.

**Validation of Cyber Security Controls**
- Cyber security controls are validated utilizing an annual Security Assessment, performed by a 3rd party vendor.
- Cyber security controls are validated using reports generated from ATC’s Intrusion Detection systems, firewall infrastructure, two-factor authentication system, web filtering system, network monitoring system, file monitoring system, and Anti-virus system.

**Cyber Security Criteria**
- Criteria is driven by industry standards, with influence from leading IT research and advisory firms such as Gartner.
- Criteria are also driven by recommendations from our strategic cyber security partners.

**Relevant Cyber Security Standards**
- ATC complies with all NERC-required cyber security reliability standards.
- ATC utilizes other best practices from the National Institute of Standards and Testing (NIST) and SANS (“SysAdmin Audit Network Security”) to implement defense in depth protection, hardening of our devices, security management policies, and incident response.
- Microsoft vulnerabilities are addressed and mitigated via our patching cycle.

**Support of Emerging Smart Grid Cyber Security Standards**
- ATC deploys security technologies that can adjust to industry standards as they are developed and also when the standards change. ATC’s environment is flexible enough to support emerging smart grid cyber security standards.
• With each cyber security solution that AC implements, ATC considers whether the solution can scale to adhere to industry standards, project expansion, as well as ATC’s own cyber security initiatives.

• ATC also considers future trends as well as future implications that each project introduces into ATC’s electronic environment, so that ATC is adequately prepared to adjust to new requirements.

• ATC deploys a defense-in-depth security posture, that enables us to be flexible in safeguarding against attacks, as well as using multiple layers and vendors to identify malicious activity.

• ATC avoids using one vendor or type of equipment across the board when possible so that vulnerabilities with one vendor do not allow access to our critical information or processes.

**Smart Meters**

This project does not employ smart meters.

**PROJECT COSTS AND BENEFITS**

**Data Collection**

The data collected will consist of individual phase voltages, frequency data, and phase angle data from each connected PMU. For 345 kV stations and sites, ATC determines or the Midwest Independent System Operator as ATC’s NERC-registered Reliability Coordinator determines to be of high interest for post disturbance analysis. ATC will also collect individual phase current readings analyze modes of oscillation on the system.

Most data will be scanned at a rate of 30 samples per second. These data will be stored in our PI Historian database which is expected to be operational in fall 2009. ATC will store high scan rate data in PI Historian for a minimum of 14 days. If significant events occur, ATC will capture and archive the data so that it is available for further review. ATC will store all data as required by any PMU data retention standards that evolve.

ATC does not expect the Project to have a significant impact on the metrics identified in Tables 3, 4 and 5 of the DOE Funding Opportunity Announcement. There is potential to enable increased transmission capability with an improved State Estimator solution, but at this time those impacts are unknown. ATC tracks congestion on its system and will be able to compare that information in future years to the period before PMU data is utilized.

While randomization will not be employed as part of our project, the PMUs will be located at points throughout ATC’s transmission system.