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# **Ameren Illinois 1st Quarter 2016 Smart Grid Test Bed Report**

May 14, 2016

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## Executive Summary

Ameren Illinois Company (AIC) submits the following Smart Grid Test Bed Quarterly Report in accordance with the Energy Infrastructure Modernization Act (EIMA), 220 ILCS 5/16-108.5 et seq. This report provides updates on the steps Ameren Illinois has taken to implement its test bed plan during the fourth quarter of 2015. The report includes information on activities Ameren Illinois has undertaken to further develop its “primary” test bed location, discussions with potential test bed customers, and on the testing application process.

## DOE Funding Opportunity Projects

Technology Applications Center (TAC) personnel continue their work on the following DOE funded projects.

- **(CODEF) - Collaborative Defense of Transmission and Distribution Protection and Control Devices Against Cyber Attacks**

Primary Investigator – ABB

Partners – UIUC

This project will advance the state of the art for cyber defense methods for transmission and distribution grid protection and control devices by developing and demonstrating a distributed security domain layer that enables transmission and protection devices to collaboratively defend against cyber-attacks in an International Electrotechnical Commission (IEC) 61850 environment.

The Ameren Illinois team continued to attend bi-weekly project progress update meetings with the representatives from each project member organization. The project team successfully executed and demonstrated the test plan at Ameren Illinois’ Technology Applications Center on March 30, 2016. The testing results verified that the reverse blocking scheme application successfully identified and then executed the correct relay operation to isolate a faulted line segment through utilization of the IEC 61850 Goose messaging communications system.

Ameren Illinois also assisted in the development of an abstract that was submitted to the Protection Automation & Control World (PACW) America’s conference. If accepted, the abstract will be followed by a presentation/publication that will share with the industry the lessons learned and challenges experienced by the project teams and the journey towards a successful demonstration. The paper will also highlight the value of the Ameren Illinois’ Technology Application Center as a test bed for researchers, taking their ideas from a lab environment to a true utility infrastructure.



The above picture depicts the project team assembled at Ameren Illinois' Technology Applications Center to execute the test plan and demonstration.

- **(PBCONF) – Secure Policy-Based Configuration Framework**

Primary Investigator: Electric Power Research Institute (EPRI)  
Partners –UIUC, Schweitzer Engineering Laboratories

An extensible, policy-based configuration framework to support the secure configuration and remote access of modern and legacy devices from a variety of vendors. The open-source framework will combine a policy engine with a translation engine to address the interoperability challenges of various remote access control methods and provide utilities with a single, organization-wide view of the security configuration for their power delivery devices.

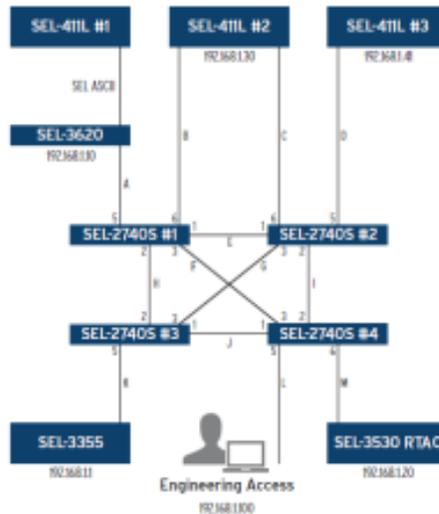
The Ameren Illinois team is presently waiting on other project team members to complete their software coding and preliminary testing of the PBCONF solution. Once these items are completed, Ameren Illinois will assist in development of the overall network communications test platform, including the TAC infrastructure, to enable testing of the PBCONF solution within a larger network communications system.

- **(SDN) – Software-Defined Networking**

Primary Investigator: Schweitzer Engineering Laboratories  
Partners –UIUC, Pacific Northwest National Laboratory

SDN allows a programmatic change control platform, which allows the entire network to be managed as a single asset, simplifies the understanding of the network, and enables continuous monitoring in more detail. Control system networks are often more static, while the corporate world is more dynamic.

The Ameren Illinois team participated in bi-weekly project update meetings with project team members. The project team successfully executed and demonstrated the test plan at Ameren Illinois' Technology Applications Center on March 1, 2016. The testing required installation of a fully meshed 4-switch network (see below diagram) that enabled fail over programming, application separation, quality of service testing, and support for the remaining testing steps.



The team identified thirteen different applications to test as sample services running in a substation. The physical installation of the prototype equipment was performed by project team members and Ameren technicians. See below picture of testing installation.



The final results of the test plan execution revealed that the technology covered the appropriate scope to be commercially released. Ameren plans to continue to work with project team members to create the final report that will be submitted to the Department of Energy.

## Other Current Test Bed Projects

- TAC personnel began testing Light Emitting Diode (LED) lights that are comparable to 250 watt sodium vapor high-intensity discharge lamps to provide testing results that will assist AIC leadership in making the determination of whether or not to develop a new lighting tariff offering to AIC customers. Testing completion is anticipated by the end of 2Q, 2016.
- Ameren Illinois developed and transmitted a Home Area Network (HAN) device interest letter to HAN Vendors. The purpose of this letter was to promote the testing processes that have been developed for AIC's Smart Device Validation testing process. This testing process allows AIC to validate that vendor devices operate correctly with Ameren Illinois' Advanced Meter Infrastructure (AMI) system. During the 1Q, 2016, Ameren received one additional vendor device as a result of the vendor outreach initiative.
- EPRI's Field demonstrations of the ANSI/CEA-2045 Modular Communication Interface Standard - Four field demonstration devices (Controllable Thermostat, Heat Pump Hot Water Heater, Pool Pump, and Electric Vehicle Supply Charger) are presently being developed by research partner vendors, to enable demand response testing of devices utilizing the modular socket communications platform. During the 1Q, 2016, Ameren received the universal control module that is being utilized to test the devices. TAC employees were trained on EPRI's Open Advanced Demand Response (Open ADR) System that will enable testing of each devices demand response capabilities.

## Test Bed Applications

- Energy Storage System Integrator Application – Ameren Illinois has not been able to make any progress in assessing this vendor's proposal. Ameren Illinois has made repeated attempts to acquire additional information regarding the operating characteristics of the energy storage solution and was unsuccessful in acquiring this information. This lack of information is affecting both the Interconnection Study and TAC applications.
- Ameren Illinois received an application from an Energy Management solutions provider. The vendor desires to have its newly developed smart thermostat tested with Ameren Illinois' AMI meters to validate that the device correctly communicates via a WiFi communication protocol. During discussions with the vendor, it was determined that the vendor is also developing the device's capability to communicate via a Zigbee communication protocol. Thus, this validation process has been placed on hold until the vendor can provide a device that is capable of communicating through use of both the WiFi and Zigbee communication protocols. Vendor has not provided a status update on when the solution will be available to be tested at the TAC.
- Ameren Illinois received an application from a Sensor solutions manufacturer. The manufacturer desires to have its application of smart partial discharge sensors tested inside an Ameren substation power transformer, to validate its functionality in capturing partial discharge

waves and its ability to provide trending tools that allow for data analysis. Ameren Illinois continues discussions with the vendor to develop project scope and has identified and communicated possible substation sites where this solution can be tested. Ameren Illinois is now developing cost estimates and contract documents for execution by the vendor.

- Ameren Illinois received an application from a Sensor and Network devices manufacturer. The manufacturer desires to have its application of bi-directional current sensing application equipped with a System Control and Data Acquisition (SCADA) communication package developed and tested at the TAC's infrastructure. Ameren Illinois plans to meet with the vendor in Q2 2016 to define the scope of work involved in testing and developing the product.
- Ameren Illinois received an application from a Power Equipment manufacturer. The manufacturer desires to have its application of soft closing protective devices to be verified and tested on the TAC infrastructure. Ameren Illinois continued discussions with the vendor to develop scope of work involved in testing and developing the product.
- Ameren Illinois received an application from a Power Equipment manufacturer. The manufacturer desires to have its application of distribution automation protective devices be developed and tested at the TAC's infrastructure using the IEC-61850 communication standard. Ameren Illinois continued discussions with the vendor to develop scope of work involved in testing and developing the product.

### Test Bed Marketing

TAC staff presented an overview of the Technology Applications Center to representatives of the Wabash Valley Power Association (WVPA) during the Ameren Illinois and WVPA network operations committee meeting.

### Industry Participation

On February 25, 2016, representatives from Ameren Illinois's Technology Applications Center and Ameren's Distributed Energy Resource Integration team visited Oncor in Dallas Texas. The purpose of the visit was to learn about Oncor's processes and efforts in studying and simulating the integration of DER and microgrids on to their electric distribution system. Ameren employees also toured Oncor's microgrid project.

On March 10, 2016, representatives from Ameren Illinois's Technology Applications Center and Ameren's Distributed Energy Resource Integration team visited Black & Veatch in Overland Park Kansas. The purpose of the visit was to learn about Black & Veatch's capabilities to assess electric distribution systems for integration of Distributed Energy Resources (Renewables) & Microgrids onto electric distribution systems. Ameren employees also toured Black & Veatch's microgrid project that has been installed at Black & Veatch's world headquarters.

Ameren worked with representatives from UIUC to develop a grant application to the United States Department of Defense – Defense Advanced Research Program Agency RADICS funding opportunity. The application addresses the development of a Cybersecurity testing facility that would be located at UIUC. Ameren’s engagement in this funding opportunity will be to advise UIUC researchers on the components and systems that a generic utility requires to securely operate their electric transmission and distribution systems. On March 22, 2016, UIUC was notified by DARPA that their application had been accepted for negotiations of the DARPA contract.

A member of the TAC staff attended an EPRI CEA-2045 work group meeting at Duke Energy in St. Petersburg Florida. The CEA-2045 working group discussed the project development progress and provided updates. Ameren Illinois received its CEA-2045 universal communication module that will be used to begin the verification and testing of the module on different appliances using EPRI’s Open ADR software. The working group received a tour of Duke’s Emerging Technology lab, where CEA-2045 applications are tested and implemented. Duke also provided the working group with tours of their dispatch center facilities.

### Test Bed Tours

- On January 25, 2016, TAC staff provided a tour of the TAC facility to representatives from S&C Electric Company.
- On January 27, 2016, TAC staff provided a tour of the TAC facility to 2 UIUC and 2 Rutgers University researchers.
- On February 1, 2016, TAC staff provided a tour of the TAC facility to 9 Ameren communications department employees.
- On February 23, 2016, TAC staff provided a tour of the TAC facility to Raja Parvex – Energy Foundry.
- On March 4, 2016, TAC staff provided a tour of the TAC to 4 members of the Ameren Distributed Energy Resource Integration team.
- On March 24, 2016, TAC staff provided a tour of the TAC to Energy Foundry Representatives.

### Smart Grid Test Bed Plan Success

Ameren Illinois' commitment to the successful implementation of its Smart Grid Test Bed plan is strong. However, as set forth above, Ameren Illinois reserves the right to modify, amend or alter this plan, as necessary and consistent with the law, to meet the requirements and objectives of the EIMA and other related provisions. Additionally, Ameren Illinois reserves its right to terminate this plan.