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Ameren Illinois 4th Quarter 2015 Smart Grid Test Bed Report

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Executive Summary

Ameren Illinois Company (Ameren Illinois) 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. Work continues on creation of test plans as well as review of each project solutions design.

- **(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 IEC 61850 environment.

The Ameren Illinois team continues to attend bi-weekly project progress update meetings with the representatives from each project member organization. The Ameren Illinois team provided feedback to the proposed test plan that will be executed at the TAC. During the 4th quarter of 2015, Ameren Illinois reconfigured the normal circuit feed for the test feeder to accommodate the test platform requirements necessary for the demonstration phase of the project. Additionally, Ameren Illinois team prepared engineering drawings and schematics that will be utilized to install the relay and communication infrastructure necessary for the demonstration phase of the project.

- **(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.

Ameren Illinois team continues to participate in the bi-weekly project update meetings with the project team members. 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 the project team members. The Ameren Illinois team worked with the project team members to prepare the preliminary test plans that will take place at the TAC and reviewed the equipment available at the TAC and additional equipment that will be needed for the demonstration at the TAC. The Ameren Illinois team is still awaiting delivery of the SDN load flow controller and associated hardware that will be necessary to establish the TAC testing infrastructure for this project. Testing of this technology is now anticipated to occur in the first quarter of 2016.

Other Current Test Bed Projects

- Ameren Illinois has completed its testing of LED lights that are comparable to 100 watt sodium vapor high-intensity discharge lamps. This project's final report was - created by students at the Ameren Innovation Center and was submitted to management during the fourth quarter 2015. TAC personnel are now acquiring LED lights that are comparable to 250 watt sodium vapor high-intensity discharge lamps, to continue the LED light testing process in the second quarter of 2016.
- Ameren Illinois received additional vendor supplied Smart Devices that are being validated through Ameren Illinois's Smart Device validation program. As of the end of Q4 2015, Ameren Illinois had received four devices from three vendors and these devices have been validated to operate correctly with Ameren Illinois' Advanced Meter Infrastructure (AMI) systems.

- 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 produced by research partner vendors, to enable demand response testing of devices utilizing the modular socket communications platform. Ameren Illinois received and installed a heat pump water heater at the Technology Applications Center which is the first device that this project plans to research. Delivery of the control module to enable demand response testing capability is now anticipated in Q1 2016.
- Ameren Illinois determined that a solution for implementing distribution automation technologies was needed for improving the operations of its 69KV sub transmission system. Ameren Illinois researched vendors that might have a solution and identified one manufacturer that can provide this solution. Ameren Illinois has developed a pilot project that it plans to install in the Q3 2016 to test and validate this manufacturer's solution while being connected to the 69KV sub transmission system.

Test Bed Applications

- Ameren Illinois continues to work with an Energy Storage System Integrator for the installation of a battery storage system. This Energy Storage System Integrator has also submitted an interconnection study application to Ameren Illinois. Ameren Illinois engineering and TAC staff are jointly working to process both the TAC and Interconnection study applications. Ameren Illinois engineering and TAC staff sent requests for additional information to the vendor and are still awaiting response. Once Ameren receives all necessary information and are able to complete the Interconnection study, the TAC staff will then work with the vendor to finalize the TAC application work scope and contract.
- 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.
- 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 plans to meet with the vendor in Q1 2016 to define the scope of work involved in testing and discuss the details of the test plan.
- 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 SCADA communication package developed and tested at the TAC's infrastructure. Ameren Illinois plans to meet with the vendor in Q1 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 developed and tested at the TAC's infrastructure. Ameren Illinois plans to meet with the vendor in Q1 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 distribution automation protective devices to be developed and tested at the TAC's infrastructure using the IEC-61850 communication standard. Ameren Illinois plans to meet with the vendor in Q1 2016 to define the scope of work involved in testing and developing the product.

Test Bed Marketing

During this quarter, TAC staff continued to use its newly developed marketing process that identifies companies that are classified as startup or innovators within the power industry and connects with them via a common message that provides information about the Technology Application Centers testing capabilities as well as identifying the prospective company's product that might benefit from being tested through the TAC testing process. This process also included outreach to various university researchers who might be aware of innovative companies in order to increase size of the prospective client list.

Industry Participation

On December 26, 2015, representatives from Ameren Illinois's Technology Applications Center visited San Diego Gas & Electric (SDG&E) at San Diego, California. The purpose of the visit was to learn about SDG&E's processes and efforts in studying and simulating the integration of DER and microgrids on to their electric distribution system. Representatives from SDG&E hosted and provided Ameren's employees with an educational tour at their testing and research facility in Escondido, California. Ameren Illinois' employees also visited SDG&E's Borrego Springs microgrid project, learning about the initiative and gaining technical and operational insights from SDG&E's engineers as well as the community leaders of Borrego Springs.

Test Bed Tours

- On October 10, 2015, TAC staff provided a tour of the TAC facility to 10 Ameren Illinois employees who work in the Communication, IT, & AMI departments.
- On October 10, 2015, TAC staff provided a tour of the TAC facility to 4 Ameren Illinois employees who work in the Ameren Illinois Integrated Operations Center.

- On December 4, 2015, TAC staff provided a tour of the TAC facility to 4 S&C Electric employees to discuss various partnership and collaboration opportunities in the areas of testing & validation as well as the area of microgrid development.

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.