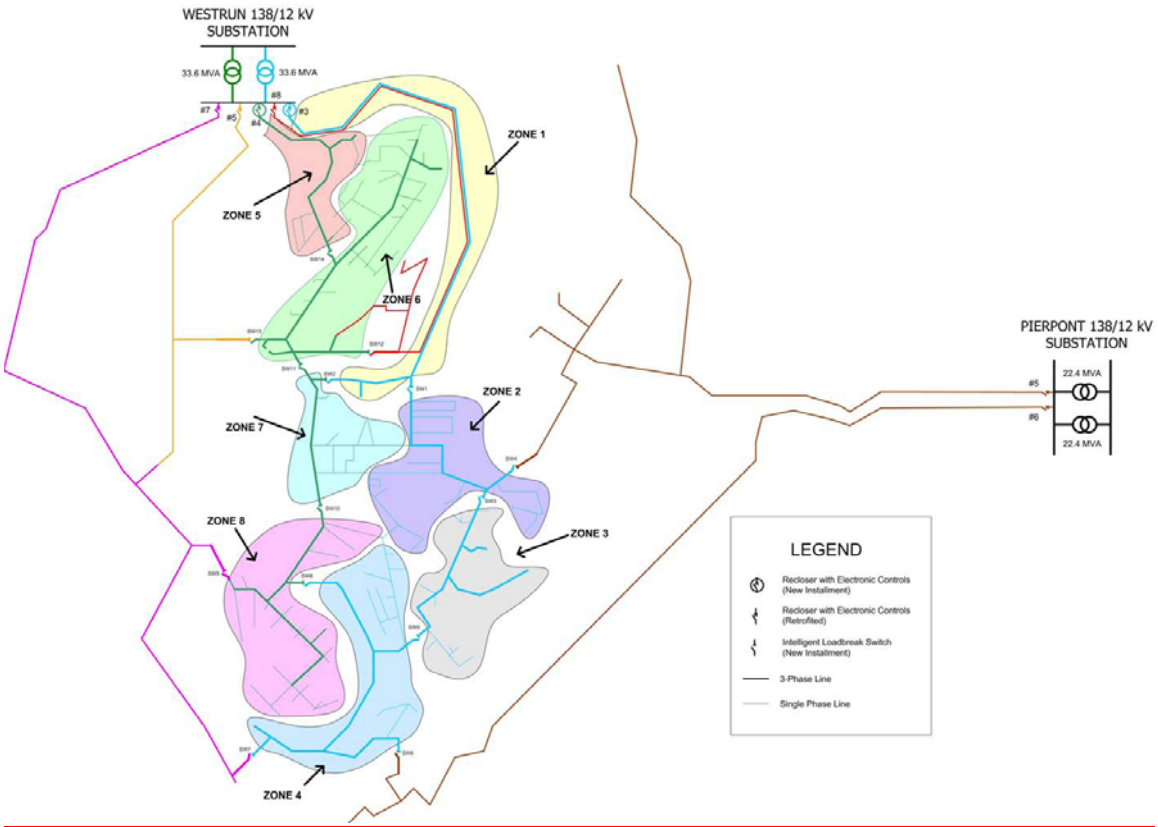
Allegheny Power RDSI Demonstration Project
"West Virginia Supercircuit Project"



West Virginia Supercircuit Project Overview

The West Virginia Supercircuit Project (WVSC) promises to substantially increase the use of distributed resources to supply power during peak load periods and support other functions and services of electric distribution systems. This project will also conduct research, development, and demonstration (RD&D) of advanced sensors, communications and control technologies, monitoring, diagnostic, automation capabilities, and two-way communication between load serving entities and electric loads within consumer premises. Implementation of these advanced capabilities will support modernizing the nation's electric grid for increased efficiency, reliability, and security to meet the needs of the 21st century. The project seeks to accomplish the following:

- Achieve greater than a 15 percent reduction in the peak power demand supplied by grid power on an Allegheny Power circuit (e.g., West Run #3 [WR-3]) and demonstrate that this can be done at a cost competitive with capacity upgrades
- Demonstrate the viability of advanced circuit control through multi-agent technologies
- Leverage advanced wireless communications to address interoperability issues between control and protection systems and distributed energy resources

- Demonstrate the system and societal benefits of the integrated operation of rotary and inverter-based distributed generation, energy storage, advanced metering infrastructure (AMI), Automated Load Control (ALC), advanced wireless communications, and advanced system control technologies
- Demonstrate advanced operational strategies such as dynamic islanding and micro-grid concepts and examine new ways to serve priority loads through the integration of automated load control with advanced system control
- Demonstrate the reliability benefits of dynamic feeder reconfiguration across multiple adjacent feeders (e.g., up to two additional feeders)

DOE Renewable and Distributed Systems Integration (RDSI) Demonstration Projects

In 2008, DOE selected nine microgrid projects for federal funding, totaling $55 million over five years. The objective of these Renewable and Distributed Systems Integration (RDSI) Demonstration Projects is to increase the use of renewable and distributed generation and decrease peak loads on a distribution feeder by 15%. The systems can operate in both grid parallel and islanded modes. The projects are aligned with RDSI goals of increasing reliability, reducing emissions, using fuel more efficiently, resolving cyber system vulnerabilities and allowing consumers to manage their energy costs. Five of the projects are in the western half of the continental U.S., three are in the eastern half, and one is in Hawaii.

Project Criteria 6 Critical Elements

The WVSC project can be aligned with the six critical elements that EPRI has identified as key criteria to achieve the goals of its five-year Smart Grid Initiative.

Integration of multiple distributed resource types

To further expose issues that need to be addressed and enable widespread integration of DER.

The integrated technology demonstration shall include the installation of multiple distributed generation (DG) and storage units within multiple zones (e.g., up to four zones) of an Allegheny Power circuit (e.g., WR-3 located in Morgantown, WV). The DG and storage units will be used to serve peak load demand, improve system reliability, and support microgrid operation in grid-connected and islanded modes. The DG will consist of rotary generators, photovoltaic (PV) arrays, and battery storage. The project also includes three 400-kW standby biodiesel internal combustion engines (ICEs) at West Virginia University (WVU) Research Park.

Application of critical integration technologies and standards

To identify gaps associated with standards, harden critical integration technologies, and advance adoption.

This project will use applicable National Institute of Standards and Technology (NIST) Smart Grid interoperability standards. The AMI will also use standard home area network and wide area network protocols, as well as applicable cyber security standards. Interconnection of the PV arrays, natural gas-fired generators, battery storage, and

biodiesel ICEs will demonstrate compliance with IEEE 1547. For substation communications protocols, the project will migrate from the legacy Distributed Network Protocol DNP3 protocols to IEC 61850.

Incorporation of dynamic rates or other approaches to link wholesale conditions to customers

To evaluate integration issues and incentives associated with customer response and linking supply with demand.

Although no new rate programs are proposed as part of this project, customers will use net metering for the DG and may use a rate program from the PJM interconnection (of which Allegheny Power is a part).

Integration into system planning and operations

Demonstrate integration tools and techniques to achieve full integration into system planning and operations.

On the operations side, the team will install an AMI and advanced communication system to support ALC programs. The team will integrate ALC with microgrid operation to demonstrate improved load management and microgrid performance. The team will conduct R&D of low-cost sensors for distribution level cables and advanced monitoring for distribution automation. The team will also deploy new, low-cost sensors for locating faults on multiple distribution circuits. Sensor operation will be studied to optimize performance in conjunction with an existing dynamic feeder reconfiguration system. In addition, the team will develop, analyze, and deploy an advanced control and protection scheme that uses multi-agent systems. This R&D work will leverage an advanced communication system installed under the demonstration portion of this project. Distribution system planners will be able to use much of this to gather data to analyze the adequacy of the power system and equipment to support loads.

Compatibility with initiative goals and approach

Enable high-penetration of DER and advance interoperability and integration for the electric power industry.

This work will demonstrate improved electricity distribution system performance, reliability, and security of electricity delivery through the integration of distributed resources and advanced technologies. Lessons learned in a variety of subject areas, including wireless communication systems and cyber security can be transferrable to other utility projects.

Leverage of additional funding sources

Secure required participation, commitment, and funding for a successful project.

Each of the following project team members is contributing funding and/or resources: Allegheny Power (the prime contractor), West Virginia University (WVU) Research Park, WVU Advanced Power and Electricity Research Center, North Carolina State University, and Augusta Systems, Inc. (a communication integrator). Vendor partners (not contributing funding or resources) include Science Applications International Corporation and Tollgrade Communications.

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