Tenino Innovation and Education through Renewables

TIER

Grid Modernization

Customer choice is changing the grid. The need for grid modernization stems from the rapid, consumer-driven evolution of edge computing, IoT devices, smaller and more affordable distributed energy systems, and preference for decarbonized electrical generation.

The increasing need for climate resiliency and the promise of renewable energy have significantly accelerated the adoption of installed photovoltaics. The growth of distributed generation (DG) is driving job creation and innovation in Washington and beyond.

Yet, as DG markets approach scale, cost and reliability questions threaten the industry's growth. IREC reports, "In highly active DG states, we are already seeing stalled DG development, as distribution circuits surpass the ubiquitous 15% penetration level that serves as a review checkpoint in most state interconnection procedures. As a result, it's becoming increasingly difficult for developers to find circuits with available capacity to host additional DG."

PECI will work with a local utility to provide a proactive Hosting Capacity Analysis (HCA) model for how distribution utilities can help speed the interconnection of distributed energy resources (DERs). This Grid Modernization project will fairly allocate costs for associated grid upgrades and provide benefits to the electric system that utilities are uniquely positioned to realize. This Grid Modernization project is a component of the Tenino Innovation & Education Through Renewables (TIER) Project, which provides a Living Lab for this work.

Grid Modernization Objectives

Create an HCA model that will support the interconnection of DERs on the distribution grid; enable robust distribution system planning efforts, including understanding how DERs support distribution reliability and capacity as non-wires alternatives; enable DER controls integration with advanced distribution management systems (ADMS); and inform pricing mechanisms that support rapid DER adoption through plug-and-play customer choice programs.

Test assumptions within a Living Laboratory: Partner with community testbed TIER to install energy assets increasingly requested by customers. Refine HCA model by gathering real-time information and understanding interaction between energy assets, grid reliability, customer programs, costs, and system operations.

Develop a roadmap for iterative HCA development and integration with ADMS, utility procurement and training processes, interoperability, pricing, and controls advancement to incorporate it into evolving utility business models and use cases.

A Comprehensive, Iterative Approach

Two components make the Grid Modernization project an invaluable investment: EPRI's DRIVE HCA method and actual distributed energy assets within a utility's distribution grid.

To determine optimal DER siting, HCAs evaluate the distribution grid's ability to host DERs. As EPRI explains, "The range of DER a feeder can host depends on a wide range of factors, some of which are well known (DER location, DER type, feeder configuration, etc.). [Additional factors include] the inputs and assumptions used for DER and grid models used for the analysis."

This project's combination of an iterative HCA methodology (EPRI's DRIVE method) and system reliability planning information improves the accuracy of grid models. The integration of use case and operating data from DERs operating on a specific distribution node validates assumptions about DER models. This integration improves the HCA through grid and DER models that more accurately reflect reality.

Data gathered regarding grid and DER interaction within a system node improve HCA assumptions. Assumptions can then be applied to comparable nodes and DERs throughout the distribution system, making DER siting more transparent and optimizing DERs' interconnection, value, and affordability.

DERs in the TIER Living Lab

Tenino is a small town with grid infrastructure and community demographics similar to many Washington communities, meaning lessons learned will be replicable throughout the northwest.

Tenino's Living Lab includes the following DERs and use cases, the operating characteristics of which will fundamentally improve our HCA:

1 Energy storage to improve distribution reliability

PECI will work with a utility to install a pad mount 100kW/500 kWh battery near McIntosh Lake in Tenino to improve distribution reliability at the end of a radial feeder. The utility will investigate dispatch strategies using ADMS for improved fault detection and power service restoration on radial feeder line BLU-13. Real-time data from this node and the DER will enhance our HCA's ability to improve distribution planning and non-wires alternatives use cases.

2 Energy storage + solar for environmental arbitrage and resiliency

The partner utility will install a 1MW /2MWH Lithium-Ion battery on an open bus at Tenino's Blumaer substation, including a 15kV breaker for fault protection. The utility will also install a 150kW ground mount solar array on land adjacent to the substation. During normal grid operations the 150kW and the 64kW array already installed at Tenino High School (THS) may be combined with the battery to investigate environmental arbitrage opportunities utilizing the solar and storage for Tenino loads.

Under extended outage conditions, a recloser on the overhead line to THS (a designated emergency shelter) will allow the line to shed feeder loads while the battery continues energizing the THS overhead line. The battery will provide enough stored energy to power peak load during cloudy conditions for several hours or days when solar can serve daytime loads.

Inverters will comply with IEEE1547/UL 1741 Smart Inverter standards, providing greater reliability and control under a wider variety of operating conditions. The flexibility of the loads will allow us to test automated disconnect, islanding, protection, and power quality controls strategies and improve our HCA's understanding of microgrid interconnections.

3 Energy storage + economic arbitrage

The partner utility will install a 50 kW solar array, 100kW/500 kWh battery, and recloser at the generation interconnect at the Tenino water treatment plant. During normal conditions the utility will investigate automated dispatch strategies that use behind-the-meter assets to shape loads. Real-time data from this node and the DER will help our HCA's understand the value of and eventually capture locational and innovative grid services pricing. PECI is learning from states like Hawaii, California, Massachusetts, New York, and North Carolina, where rapid adoption of DERs and backlogged interconnection queues have slowed the process for delivering on the promise of carbon-free electrical generation and storage.

Continued...

Clean Tech

The Grid Modernization project defines planning standards, benefits, and use cases, which helps level the playing field and lower cost for the clean energy technology sector.

The project speeds definition of fast track and interconnection specifications, making the process more transparent and easier for developers to navigate.

Incorporating operating DER projects helps inform assumptions, models, and control strategies used to define what second-by-second control signals should be sent to the DERs, grid operators, and sometimes to the site host. Articulating such assumptions increases transparency and allows the market to create products and services that can meet the required specifications.

Carbon-Free Power Generation and Storage

The Grid Modernization project establishes an outline for piloting real-time dynamic planning and control within the distribution grid in order to determine operational protocols and optimal dispatch strategies for battery storage and behind-the-meter DERs.

Infrastructure Resilience

The Grid Modernization project minimizes voltage and reactive power problems associated with increasing intermittent generation and loads.

Beyond interconnection, this project begins modeling how DERs can actually defer distribution upgrades and improve system reliability and flexibility.

Economic Growth

The Grid Modernization project provides a roadmap and HCA model for Washington load serving entities.

It makes grid needs clearer to interested parties, thereby increasing development of DER projects.

The project promotes a transparent and proactive HCA model intended to speed adoption, inform the public, and keep DER implementation costs affordable.

For information regarding the TIER project, and to get involved, contact info@PECI.org.