



Center for Rural Innovation
TENNESSEE TECH



Center for
Energy
Systems
Research

Developing a Multi-State Smart Grid Deployment Consortium

Tennessee Tech University Center for Rural Innovation &
Center for Energy Systems Research

Overview

- Project is a down payment on the development of a future battery manufacturing and supply chain ecosystem in Appalachia
- This ARISE project proposal builds on the work of two ARC POWER projects:
 1. Technology demonstration of the HILLTOP platform in Tennessee
 2. Energy storage roadmap for Ohio, Pennsylvania, and West Virginia

The Problem

- **Electric utilities in Appalachia and elsewhere are under pressure to modernize their electric grids**
 - This pressure could come from customers, regulators, environmental activists, and competitors
 - Grid modernization essentially involves integrating the traditional electric grid with new Internet-connected technologies like smart meters, EV charging stations, large-scale battery storage, solar, wind generation, and controllable appliances
 - For example - phones and cameras used to be separate devices
 - The smartphone changed all that by integrating the camera into the phone
 - Grid integration and modernization are conceptually comparable to integrating a bunch of different technologies into the smartphone (camera, GPS, games, videos, music, etc.)

The Problem

- Many utilities are uncertain about how to navigate this complex and shifting technology landscape
 - Should they deploy large-scale batteries, and if so, what kind?
 - Should they deploy EV chargers, solar, or wind? Now or later? Where?

The Solution: HILLTOP

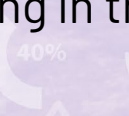
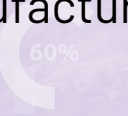
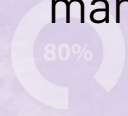
- The HILLTOP grid modeling platform was expressly designed to solve grid modernization problems
- HILLTOP models and tests new technologies in a virtual “safe space”
 - Tool for capital planning, procurement assistance, and asset management
 - Fee for service model deployed by university collaborators
 - Test how well their technology works with other technologies (interoperability) and test how widely their technology can be deployed (scalability)
 - Give utilities more confidence around when, where, and how to deploy these technologies in the field

The Solution

- HILLTOP is not generic modeling
- It is as close to custom modeling as the utilities can get
 - The researchers start by modeling a digital copy of the utility's actual grid infrastructure, including substations and feeder circuits that run to the surrounding neighborhoods
 - Then, model the actual level of electricity consumption that flows through that substation from the various customers
- This approach gives the utility more realistic results, and it works
 - During the current POWER grant, Tennessee Tech researchers modeled 1.5 MW of large-scale storage
 - Their modeling results estimated **\$9,200 per month in cost savings per MW of deployed storage.**
 - This matches well with the real-life results of \$10,000 per month in cost savings per MW of Tesla Megapacks that VEC deployed in 2020

Benefit to Appalachia

- **Electric utilities in Appalachia risk missing out on the opportunity to transform the region economically by deploying new battery technologies**
 - These battery technologies are more likely to be manufactured in the region and more likely to rely upon supply chains in the region
- **Electric utilities are largely captive to a way of thinking that pushes them to deploy conventional “tried-and-true” technologies instead of new ones**
 - Utilities prefer conventional lithium-ion batteries
 - Those batteries require cobalt - the Congo produces 70%
 - Much of Congo’s cobalt is controlled by China and other adversaries to the US
- **Newer battery technologies use iron, sodium, and ethane as their raw materials**
 - Appalachia is in a much better position to develop raw material supply chains and battery manufacturing in the region with these newer technologies



Benefit to Appalachia

- **HILLTOP can compare lithium-ion batteries to these newer battery technologies**
 - Evaluate whether each technology meets the utility's technical needs
 - It can also determine the impact that each technology will have on the utility's bottom line in the form of cost savings
- **Realistic technical and economic modeling results for rural electric utilities:**
 - Provides more confidence to procure and deploy these new battery technologies
 - Supports the long-term development of battery manufacturing and supply chains in Appalachia
 - Expand capabilities to model electric customer load data



Benefit to Appalachia

- **HILLTOP can help modernize Appalachia through smart grid modeling**
 - Batteries
 - Expand to
 - EV charger networks
 - Solar
 - Wind
- **HILLTOP can help to improve the quality of life in Appalachia**
 - Modernization benefits
 - Hedge against rate increases/reduced rates
 - More uptime
 - Promotes increased entrepreneurship and industry activity
 - Economic impacts of manufacturing and supply chain

Project Collaborators

- **3 Years, \$10M multistate project**
 - Cost of purchasing and installing various types of grid modeling and simulation equipment for each participating university
 - Personnel and contractual costs to cover the work effort of university professors and students
 - Commercialization operations and outreach
 - Business plan to form national non-profit



Project Collaborators

- **Tennessee Tech University**
 - TCRI – multi-state commercialization lead
 - CESR – partner technical advisor (along with MIT Lincoln Lab), modeling services, EV expansion
 - CEROC – cybersecurity
- **LaunchTN Entrepreneur Centers**
 - The Biz Foundry and Knoxville Entrepreneur Center – entrepreneurship, industry, corporate immersion
- **Penn State University**
 - Modeling services, wind expansion
- **West Virginia University**
 - Modeling services, battery comparison
- **MIT University**
 - Development of synthetic customer electric consumption data (generative AI model)
- **MIT Lincoln Lab (federally-funded research center that is separate from MIT University)**
 - Co-technical advisor (along with Tennessee Tech University)



Project Collaborators

- Target TN, WV, PA, OH
 - Four (4) electric co-ops and two (2) small energy tech startups served by grid modeling services
 - Fee for service modeling
- Cloud-connected system
- Share resources
- Form non-profit
- Expand reach nationally





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Thank You

Q&A and Discussion