



“The printable sensors we’re developing at ORNL offer a low-cost alternative for real-time continuous monitoring to advance grid security and resiliency.”

Marissa Morales-Rodriguez,
Sensors Research Scientist



Security for the Modern Power Grid

America’s safety, security, and overall health and vitality depend on the uninterrupted delivery of electricity to homes, businesses, and public spaces. The nation’s power grid, one of our greatest strengths, is also uniquely vulnerable to attack as people and machines become increasingly connected to the public internet.

As the US Department of Energy’s (DOE’s) largest open science and energy laboratory, Oak Ridge National Laboratory (ORNL) is uniquely positioned to modernize the grid and to address security challenges in partnership with the private sector through scientific discoveries, innovations in power systems, and improvements to critical infrastructure.

Cybersecurity

The single step of moving utility control systems off the public internet and onto secure private networks promises to eliminate significant vulnerabilities. ORNL’s expertise in encryption, embedded and wireless systems, testing, and controls is strengthening information security technologies and improving methods for detecting and responding to cyberattacks.

Monitoring and Visualization

To stop security breaches and minimize disruptions, utilities need to know about problems as quickly as possible. ORNL researchers have developed breakthrough methods to detect emerging issues before they become problems, resulting in avoidance of or faster recovery from outages.

Resiliency and Controls

ORNL expertise and technologies support the grid’s need for energy storage, advanced components, and control technologies that will handle growing demand and the greater variety of power supplies such as wind and solar.



ENGINEERING power systems with modern electronics



AUTOMATING control monitoring with sensors



GUARDING the grid with novel cyber-physical security methods



MODELING concepts on supercomputers for fast results



EMBEDDING secure systems and wireless technologies



Grid Technology Portfolio

Analyzing and optimizing grid performance for improvement of existing systems and better infrastructure planning

Cybersecurity	
BEHOLDER	Uses timing data from utility systems to reveal the presence of software and network intrusions.
HYPERION	Detects dormant, malicious code.
ORCA	Monitors and detects advanced, persistent threats in real time.
AQCESS	Leverages quantum communications technologies to harden grid cybersecurity.
Monitoring and Visualization	
GridEye	Uses low-cost, easily installed devices to continuously watch for wide-area electrical disturbances.
Eagle-I	Monitors the nation's energy sector in real time using data science and utility feeds.
MOVARTI	Evaluates voltage issues across utility systems.
Advanced sensors	3d-printing technology provides low-cost, easily installed sensors and other tools to identify voltage issues, power failures, cyber intrusions, and weather indicators as they occur.
Resiliency and Controls	
Secondary use battery storage	Repurposes electric car batteries to create low-cost energy storage systems for residential and business community use.
GLIDES	Stores electricity mechanically in the form of compressed gas that displaces water in high-pressure vessels.
Power flow controllers using new wide bandgap materials	Handles higher voltages and temperatures, improving grid reliability and use.
CSEISMIC	Open-source microgrid controller that securely integrates distributed energy resources like solar and wind into the larger grid.
SI-GRID	Software-defined grid that serves as an open, low-voltage physical test bed for microgrid controllers.



Partnerships and Collaborations

Reflecting the unique interconnected nature of the grid, ORNL collaborates with thousands of industry and academic partners from utilities such as Duke Energy, Chattanooga EPB, Southern Company, and the 900 companies represented by the National Rural Electric Cooperative Association to universities to hardware and cybersecurity firms and other national labs as we devise and deliver solutions for a secure, reliable electric grid.

As part of DOE's Grid Modernization Laboratory Consortium and Cybersecurity of Energy Delivery Systems initiative, we are focused on the following.

- Removing grid controls from the public internet
- Devising quantum solutions to protect vital communications
- Improving the connectivity and security of distributed energy resources such as microgrids



Since we started our partnership with ORNL over 3 years ago we have enjoyed real success, the kind of success that makes a difference to EPB business capabilities and to the quality of life enjoyed by the people of our community. I have no doubt that we have just begun to realize the benefits of our success."

— EPB Chairman Joe Ferguson

Contact:

Tom King, Sustainable Electricity Program Manager
kingtj@ornl.gov, 865-241-5756
One Bethel Valley Road, Oak Ridge, TN 37831

