INL performs full-scale, end-to-end grid reliability testing for industry and government

Electric Grid Reliability

In 2000, the National Academy of Engineering named modern power grids the top engineering technology of the 20th century. This designation is remarkable considering that the first utility in 1880 provided electricity to fewer than a hundred New York City residents. Today, nearly everyone in the United States and many around the world have universal access to electric power.

In just 130 years, the power grid has seen fundamental changes and growth. It's transitioned from operating on direct current (DC) to alternating current (AC), it's been internationally standardized to operate on the 240/120-volt current, it's been regulated, deregulated, monopolized and shared, and now it includes digital technology to speed delivery and control to consumers.

But no matter the changes, one thing remains constant. The power grid is an essential resource that must be protected against natural and man-made threats. That's where we come in. At Idaho National Laboratory, we've pioneered energy generation, transmission and distribution for more than 60 years. And now, we're taking a leading role in protecting the modern power grid from cyber and physical threats.

Engineering Discipline

In the 1950s, a team of INL engineers built and demonstrated a series of nuclear reactors capable of generating useable electricity. At first, they lit four light bulbs. Then a small city. These scientists designed, constructed, operated and maintained these systems from start to finish. And in the years since, our employees have done the same thing for 51 additional reactors and hundreds of related components including transmission lines, substations and control systems.

Over the last six decades, we've designed energy systems to withstand harsh environmental conditions while remaining reliable for critical missions, and we've used our test range to push systems to intentionally fail in order to build a better

Continued next page

The Energy of Innovation

INL
Idaho National Laboratory

Continued from previous page

performing and more secure product. Today, the cumulative effect of research at INL is a single location rich in power industry knowledge and applied engineering skills that is providing real value to utilities and governments.

It's this depth of knowledge that has allowed us to form partnerships and provide unbiased cyber assessments for leading power companies, governing bodies, interconnects and standards organizations. To date, we've signed agreements, tested and provided feedback on 13 major control systems. This testing has led to the issuance of patches and upgrades affecting domestic and international power grids.

In addition to conducting vulnerability assessments in Idaho, our engineers and cyber specialists have performed on-site assessments at transmission and generation control centers, SCADA and distributed control system facilities, and at substation automation installations.

We also lead immersive red team / blue team cybersecurity training events and reach out to owners and operators at industry events. Since 2004, we've trained more than 4,000 people from 32 countries on ways to improve SCADA security. Finally, our researchers have begun conducting in-depth cyber testing on advanced metering infrastructure and wireless devices for the proposed smart grid, and we're using our background in nuclear safeguards to develop physical security solutions for the power industry.

Unique Infrastructure

Geographically the largest national laboratory in the Department of Energy complex, INL's vast terrain consists of 890 square miles of desert plains. The laboratory's facilities are spread across this landscape in clusters similar to modern cities and urban environments. In between these nodes lie utility-scale infrastructure systems ranging from an independently operated and isolatable power grid to a low-interference telecommunications network. We also own multiple test beds and ranges that provide demonstration space and equipment for cyber assessments, electromagnetic pulse experiments, sensor testing, explosives, and modeling and simulation.

Our facilities are matched with equally impressive technical experts. In fact, we employ dozens of power engineers, control systems experts, cybersecurity researchers, network security specialists and others who work in a build-test-build environment geared toward improving grid security. And since many of our employees have industrial backgrounds or government experience, they understand how to introduce modern-day security requirements into a complex system originally designed for reliability and efficiency.

Today, electric power is a vital resource that powers our homes and businesses and provides us with modern conveniences and fundamental needs. Protecting this system is INL's focus and mission. And as the nation turns toward a smarter grid system, we will continue to provide valuable information and technical expertise that utilities and governments alike have grown accustom to receiving.

Quick Facts

- INL operates a 61 mile, 138kV dual-fed power loop complete with seven substations
- Portions of the power loop can be isolated for independent, real-time testing
- INL manages the DOE National SCADA Test Bed Program and the DHS Control Systems Security Program
- These programs have led to CRADA agreements with power companies and vendors
- The laboratory owns a complete library of power simulation tools including a supercomputer for grid modeling called RTDS

For more information

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