



GMLC Security and Resilience

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Grid Modernization Initiative Peer Review

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Arlington, VA

Security and Resilience

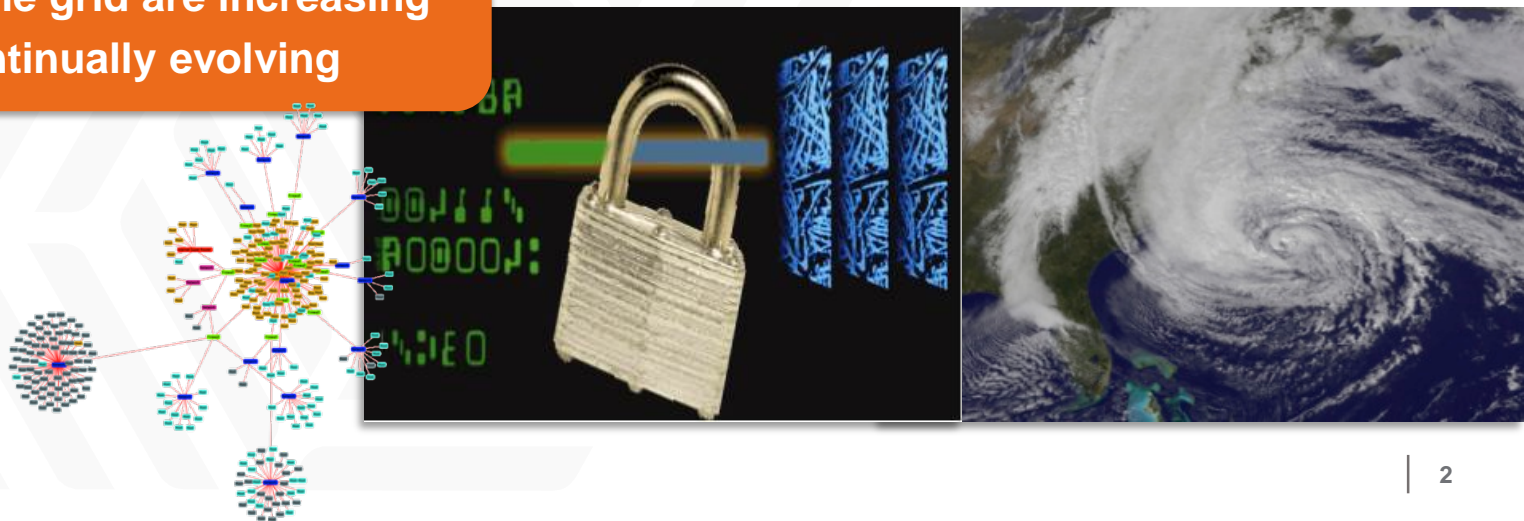
Expected Outcomes

- ▶ Holistic grid security and resilience, from devices to micro-grids to systems
- ▶ Inherent security designed into components and systems, not security as an afterthought
- ▶ Security and resilience addressed throughout system lifecycle and covering the spectrum of legacy and emerging technologies

Federal Role

- ▶ Lead and establish security and resilience research programs to develop technology solutions and best practice guidance
- ▶ Improve adoption of security and resiliency practices, and provide technology-neutral guidance
- ▶ Inform stakeholders of emerging threats and help address threats appropriate for government response

The Challenge:
Threats to the grid are increasing
and continually evolving



Program Elements

Based on NIST Cybersecurity Framework

Identify:

Develop understanding of threats, vulnerabilities, and consequences to all hazards

Outcome: Improved risk management and streamlined information sharing

Protect:

Inherent system-of-systems grid resilience

Outcome: Increase the grid's ability to withstand malicious or natural events

Detect:

Real-time system characterization of events and system failures

Outcome: Accelerated state awareness and enhanced event detection

Respond:

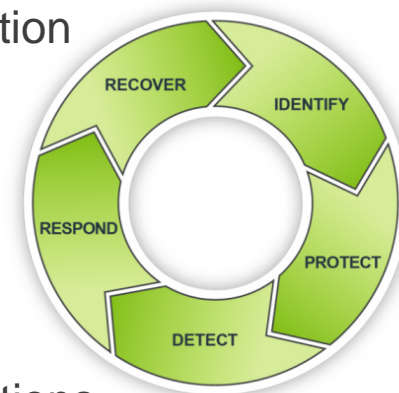
Maintain critical functionality during events and hazards

Outcome: Advanced system adaptability and graceful degradation

Recover:

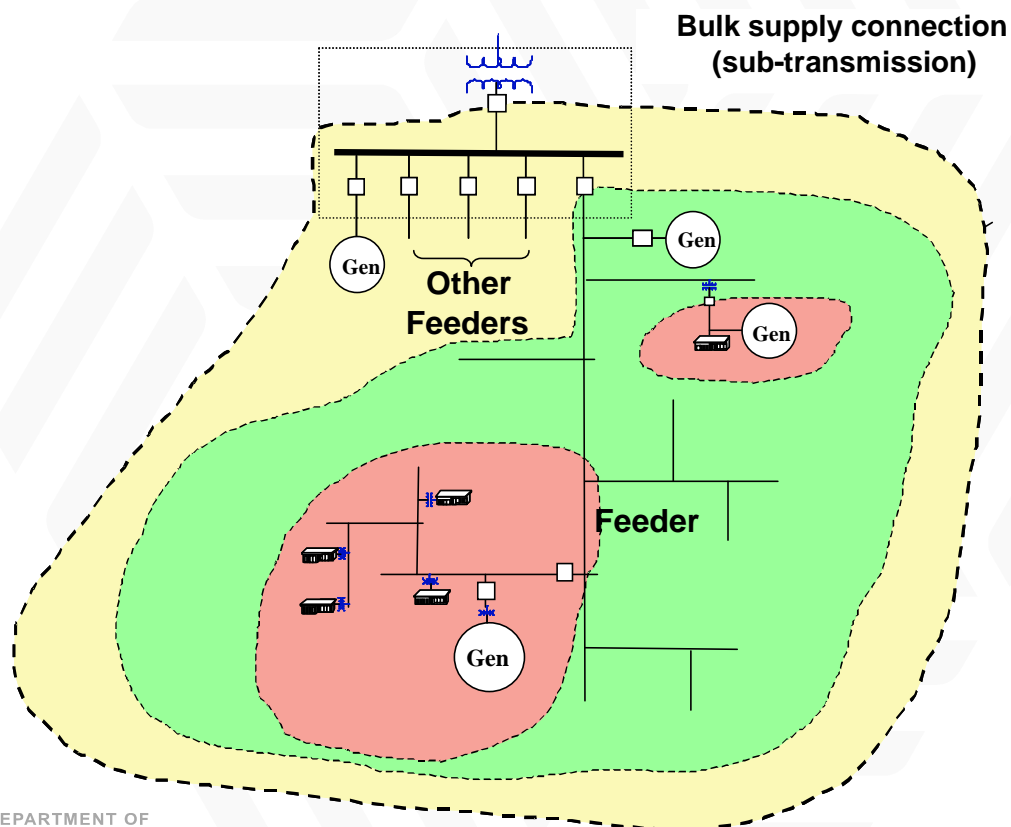
Real-time device management and transformer mobilization

Outcome: Timely post-event recovery of grid and community operations



1.3.04 - Industrial Microgrid Analysis and Design for Energy Security & Resiliency

Design and perform cost/benefit analysis of an industrial-scale microgrid with the goal of sharing lessons learned and best practices with other industries and utilities. The analysis will be performed on the UPS Worldport facility in Louisville, Kentucky.



PoP: FY16/17

Budget: \$1M

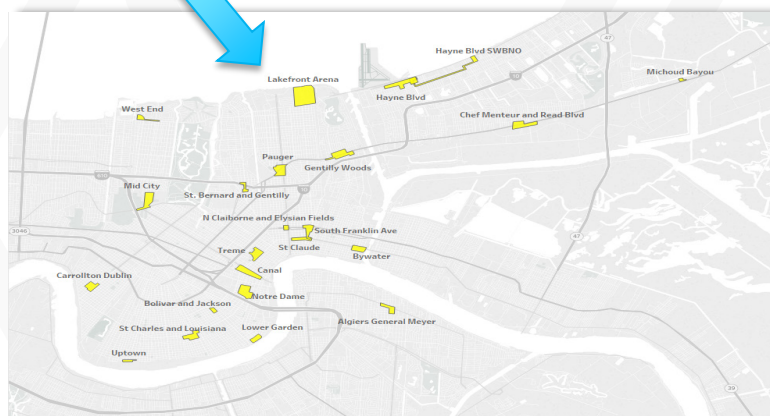
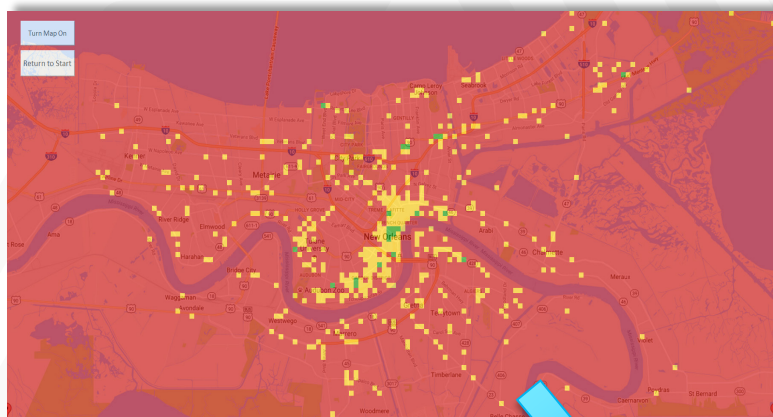
Labs: ORNL, SNL

Partners:

- United Parcel Service
- Waste Management
- Burns & McDonnell
- Harshaw Trane
- Louisville Gas & Electric
- State of Kentucky

1.3.11 - Grid Analysis and Design for Energy and Infrastructure Resilience in New Orleans, LA

Supports NOLA's resilience goals by leveraging infrastructure and grid modeling to develop cost-effective grid resilience enhancements for NOLA and the surrounding region. Focused on enhancing grid resilience in order to improve overall community resilience.



PoP: FY16/17

Budget: \$1M

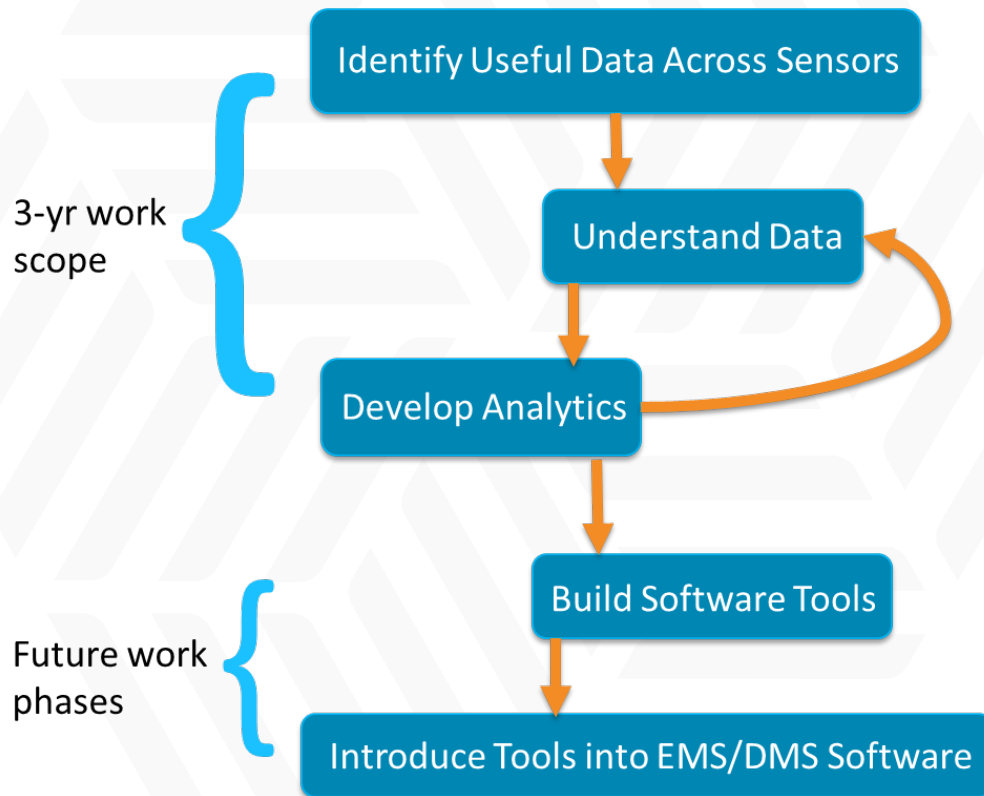
Labs: SNL, LANL

Partners:

- City of New Orleans
- Entergy New Orleans
- U.S. Army Corps of Engineers
- 100 Resilient Cities

1.4.23 - Threat Detection and Response with Data Analytics

Develop advanced analytics on operational technology (OT) cyber data in order to detect complex cyber threats. Differentiate between cyber and non-cyber-caused incidents using available cyber data.



PoP: FY16/17/18

Budget: \$3M

Labs: LLNL, LBNL, INL, ORNL, PNNL, SNL

Partners:

- Electric Power Board (EPB)
- Johnson Controls
- Schweitzer Engineering Laboratories (SEL)

Accomplishments and Emerging Opportunities



Accomplishments

- 1.3.04: - Modeling and simulation have resulted in improvements to existing DOE microgrid analysis tools.
- 1.3.11: First ever meeting between partners to collaboratively prioritize resilience-focused grid investments in NOLA.
- 1.4.23: Attack on peak load shaving implemented through direct load control.

Path Forward

- 1.3.04: Complete modeling and final report targeted to utilities and potential industrial users of microgrids.
- 1.3.11: Assure results are broadly available to 100 Resilient Cities and others.
- 1.4.23: Develop analytics for DERs, substations, AMI, buildings, and microgrids that fuse physical and cyber information.

Program Specific Projects



Energy Systems Risk and Predictive Capability (ESRPC)

- ▶ (GM0119) - Improved Forecasts of Electric Outages from Tropical Cyclones (ANL, PNNL)
- ▶ (GM0180) - Recommendations for the population, location, and operation of a strategic transformer reserve (ORNL, SNL)
- ▶ (GM0217) - Web Tool for Improved Electric Outage Forecasting for Response to Tropical Cyclone Events (LANL, PNNL)

Vehicle Technologies Office (VTO)

- ▶ (GM0163) - Diagnostic Security Modules for Electric Vehicle to Building Integration (INL, ANL, NREL, PNNL)

Cybersecurity for Energy Delivery Systems (CEDS)

- ▶ (GM0068) - MultiSpeak® - Secure Protocol Enterprise Access Kit (MS-SPEAK) (PNNL)
- ▶ (GM0100) - Cybersecurity for Renewables, Distributed Energy Resources, and Smart Inverters (ANL)

Smart Grid (SG)

- ▶ (GM0131) - A Closed-Loop Distribution System Restoration Tool for Natural Disaster Recovery (ANL, BNL)

Solar Energy Technology Office (SETO)

- ▶ (SI1541) - Secure, Scalable, Stable Control and Communications for Distributed PV (SNL)

- ▶ Security and Resilience is critical to grid modernization
- ▶ Program elements aligned with NIST Cybersecurity Framework
- ▶ Foundational/Demonstration Projects
 - 1.3.04: Industrial microgrid – KY
 - 1.3.11: Infrastructure resilience – NOLA (Complete)
 - 1.4.23: Threat detection with data analytics – distinguish cyber attacks from physical and other signatures
- ▶ Eight program specific projects
- ▶ Accomplishments and Emerging Opportunities