

#### Cybersecurity for Utilities: Capabilities and Overview

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### **Cybersecurity Building Blocks**

Cybersecurity building blocks include elements that are internal to the utility (dark blue) and outside the utility (light blue):



Source: Martin et al. 2023.

#### **Energy Systems Across the Globe Are Changing**



As energy systems change, they are becoming more complex.



#### A new frontier:

*The grid is evolving to become more distributed, intelligent, and complex.* 

Coupled with aging infrastructure, the risks of emerging energy systems to disruption are not yet well understood.

#### **Cybersecurity for Distributed Energy Resources**

Modern energy systems are increasingly reliant on smaller decentralized generation sources, i.e., **distributed energy resources (DERs)**, such as solar, wind, and storage.



- DERs are equipped with complex, data-driven communication networks to connect with the electric grid.
- The increasing number of smart devices that support DERs can increase the number of access points outside a utility's administrative domain, which can increase the potential for cyberattacks.

The expanding quantity and diversity of connected devices is increasing complexity. Ownership of utility operational technology and information technology systems necessary for grid monitoring and control is no longer exclusive. Less tractable supply chains impact trust in edge devices and services. Legacy and current solutions are not prepared for technology and threat revolutions.

#### **Energy Transformation: Grand Challenges**



#### How and Why Is NREL Working on Cybersecurity?

NREL's energy security team helps partners achieve a rapid transition to energy system decarbonization by addressing grid interconnection challenges and a secure and resilient deployment of renewable energy assets.

### Recall the Cybersecurity Building Blocks

Cybersecurity building blocks include elements that are internal to the utility (dark blue) and outside the utility (light blue):



Source: Martin et al. 2023.

#### NREL and Cybersecurity

NREL Risk Assessment Tools ARIES Cyber Range

Cybersecurity Technical Training Cybersecurity Strategy Development Incident Response Planning and Training

# Risk Assessment Tools





The Distributed Energy Resource Cybersecurity Framework (DER-CF) helps organizations mitigate gaps in their cybersecurity posture for distributed energy systems. This tool is freely available online (dercf.nrel.gov).

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#### Distributed Energy Resource Risk Manager (DER-RM)

- NREL extended the scope of the DER-CF to include the National Institute of Standards and Technology (NIST) Risk Management Framework (RMF).
- The NIST RMF is a cyclical process designed to incorporate principles of security and risk management into an organization's system policies and procedures.
- As an additional tool, NREL's Distributed Energy Resource Risk Manager (DER-RM) is independent of the DER-CF's existing selfassessment and allows users to focus on the RMF process.



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#### DER-VE: Integration With NREL's ARIES Cyber Range

NREL's Advanced Research on Integrated Energy Systems (ARIES) cyber range provides an innovative way to research and analyze energy systems and can replicate an energy site through data visualization. Combined with the integration of data from the DER-CF, the cyber range can help merge the two complex cybersecurity topics of policy and technology by providing an integrated method to interact with cybersecurity logs and alerts. This integration was recently named the Distributed Energy Resource Visual Emulator (DER-VE)

#### The ARIES Cyber Range Helps Us by:

Hosting Co-simulations

Orchestrating and Automating

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Emulating Communication Facilitating Hardware-in-the-Loop Studies

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Visualizing Results

### NREL ARIES Cyber Range Testing and Validation

NREL's ARIES cyber range offers testing and validation of energy systems to educate users on a broad range of cybersecurity threats.

With the help of NREL researchers, organizations can:

- Use NREL's ARIES cyber range to test and validate their security controls.
- Enable technical implementation changes that improve the security, efficiency, and reliability of an organization's core mission.
- Improve organizational decision making on procurement and third-party risk.



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#### Cyber Range Use Case

NREL is currently working with a U.S. federal agency to test and validate the security and resilience of its advanced metering infrastructure. These efforts will:

- Evaluate the advanced metering infrastructure systems against attack scenarios, such as denial-of-service and adversary-in-the-middle attacks.
- Identify security risks that need immediate mitigation and illuminate gaps within their security architecture.
- Boost the overall cybersecurity posture of the organization's operational technology network.



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### Cybersecurity Technical Assistance



#### Our Comprehensive Technical Assistance Addresses the Full Spectrum of Cybersecurity Risk Planning and Management

#### Expertise



Photo by Dennis Schroeder, NREL 62674

- ✓ Modeling and data visualization
- ✓ Renewable energy technologies, including buildings and mobility
- ✓ Distributed energy systems and microgrids
- Cybersecurity and supply chain disruptions
- ✓ Stakeholder convening.

#### Partners



Photo by Dennis Schroeder, NREL 56330

- ✓ Federal agencies
- ✓ Federal, state, local governments, and tribes
- ✓ Private industry
- ✓ Emergency managers
- ✓ International governments
- ✓ Community leaders and nongovernmental organizations.

#### Services and Solutions



Photo from Getty Images 1166464106

- ✓ Cybersecurity strategy assistance and support
- ✓ Cyber risk assessment tools
- ✓ Identification and mitigation of cybersecurity risks
- ✓ Incident preparation and response
- ✓ Capacity building and technical trainings.



#### Cyber Example: The Caribbean

Risk assessment results serve as the basis for prioritizing organizational cybersecurity efforts and defining key areas on which to focus follow-on technical assistance efforts.

NREL's technical assistance offerings provided holistic support for developing, implementing, and monitoring an organization's cybersecurity strategy.

Partners: Deloitte, Caribbean Electric Utility Services Corporation Sponsor: USAID

**Impact:** Stronger cybersecurity posture via informed governance decisions Photo from iStock 950739780

## Select Resources



### Power Sector Cybersecurity Building Blocks



#### POWER SECTOR CYBERSECURITY BUILDING BLOCKS

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National Renewable Energy Laboratory

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A product of the USAID-NREL Partnership Contract No. IAG-17-2050 USAID sponsored NREL's development of a framework called the **Power Sector Cybersecurity Building Blocks.** 

The Building Blocks are clusters of related activities that support a well-rounded cyber program and encourage utilities to think about different areas of cybersecurity.

The Building Blocks bring together a variety of applicable cybersecurity guides, standards, and frameworks into one user-friendly resource to help international stakeholders prioritize cybersecurity efforts and investments.

> *Read the full report at:* <u>https://resilient-energy.org/cyber</u>.

### **Resilient Energy Platform**

Another USAID-sponsored tool, the Resilient Energy Platform, provides **expertly curated resources, training materials, tools, and technical assistance** to enhance power sector resilience.

The platform enables decision makers to assess power sector vulnerabilities, identify resilience solutions, and make informed decisions to enhance power sector resilience at all scales.





Developed through the USAID-NREL Partnership, the Realient Energy Platform provides expertly curated resources, training materials, data, tools, and direct technical assistance in planning resilient, sustainable, and secure power systems.

#### www.resilient-energy.org

For more information on any of these tools, contact Tami Reynolds at Tami.Reynolds@NREL.gov

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