NREL Transforming ENERGY

Path Toward Cybersecurity Standards for Solar PV and Other DERs

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UL/NREL Cybersecurity Overview of Standards and Protocols for CPUC & CA IOUs
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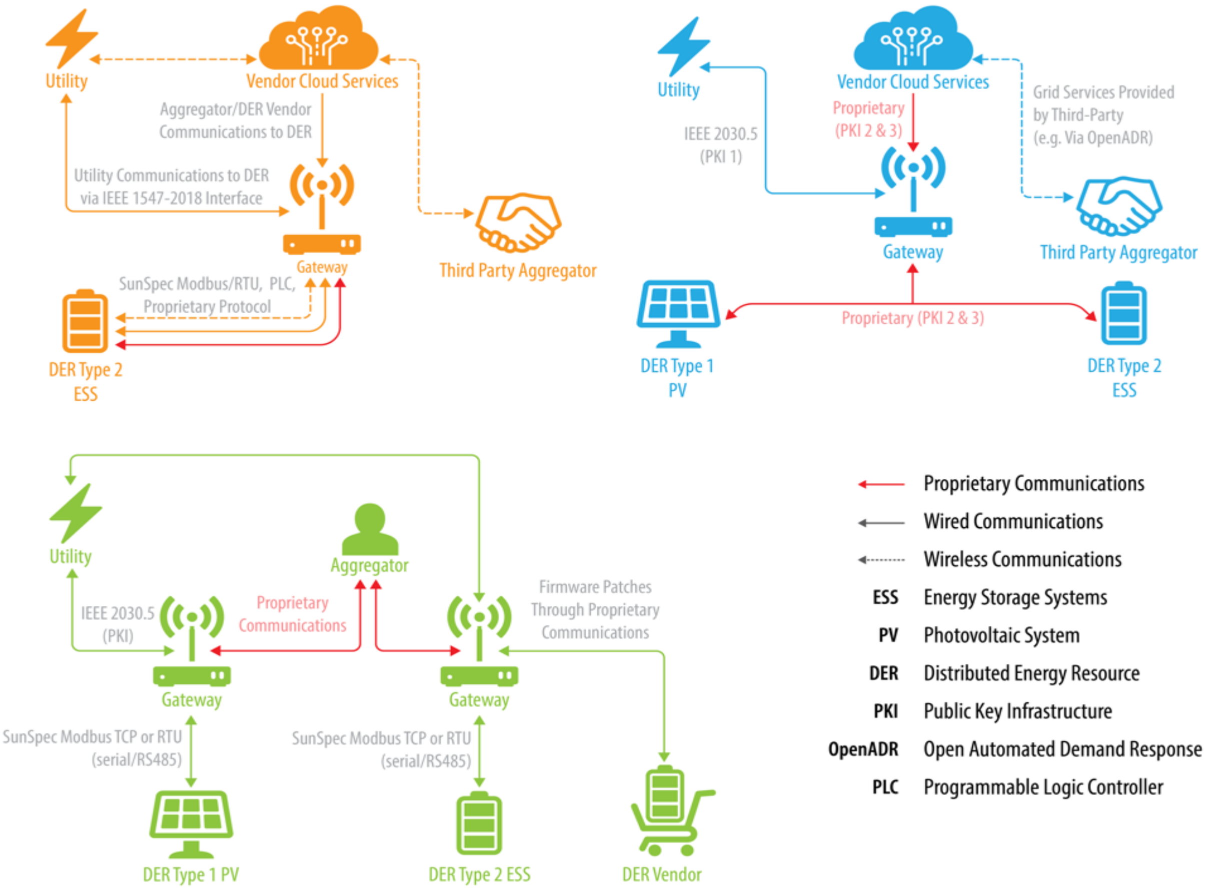
Energy systems across the globe are changing.

Advancements in future systems are needed to ensure the safety, reliability, security, and resilience of those systems.

Grid Security and Reliability Must Keep Pace

To manage, optimize, and secure the future grid, new technologies and control techniques will be required that don’t currently exist.

What Future Distributed Energy Resource (DER) Systems Might Look Like

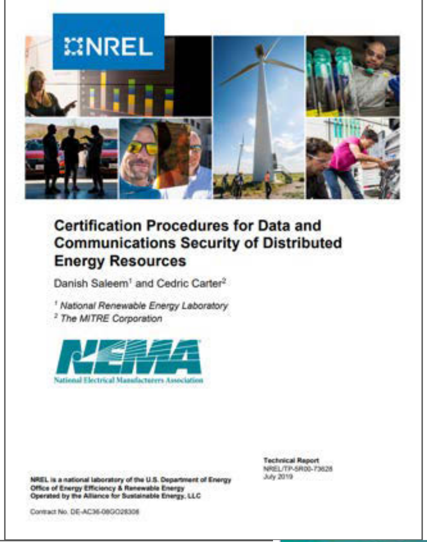


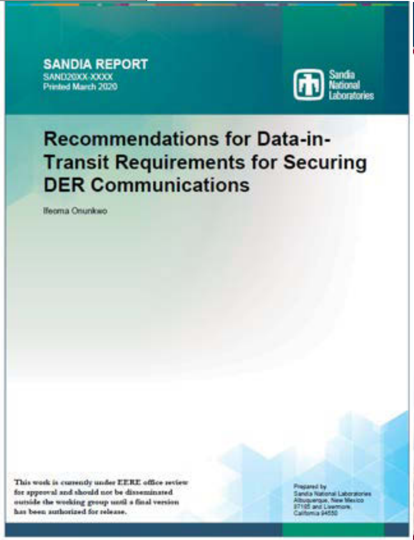
The **Cybersecurity Information Sharing Act of 2015** authorizes and encourages private companies to take defensive measures to protect against and mitigate cyber threats.

Cybersecurity Information Sharing Act of 2015. S. 754, 114th Congress (2015).

Cybersecurity Standards Initiatives

- IEEE 1547.3 Working Group
  - Provides guidelines for cybersecurity for DERs interconnected with the electric power system
- SunSpec/Sandia National Laboratories working group
  - Six subgroups, each led by different organization
- National Renewable Energy Laboratory/Underwriters Laboratories partnership for establishing certification standards for DERs
- National Association of Regulatory Utility Commissioners and National Association of State Energy Officials partnering with industry to establish cybersecurity advisory team for state solar (CATSS)
- Laboratory Coordination Committee (LCC)





Cybersecurity Advisory Team for State Solar

- What are the key challenges of PV solar and/or DER cybersecurity?
- Why have these challenges not been addressed to date?
- What would be the ideal solution for addressing solar cybersecurity challenges at the state level?
- What role should state energy officials, public utility commissions, manufacturers, electric utilities, certification labs and standard development organizations take on to address these challenges?

Relevant Standards and Guides

- **IEEE C37.240-2014:** IEEE Standard Cybersecurity Requirements for Substation Automation, Protection, and Control Systems
- **NIST SP 800-82 Revision 2:** Guide to Industrial Control Systems (ICS) Security
- **NIST Interagency/Internal Report 7628:** Guidelines for Smart Grid Cybersecurity
- **NIST Cybersecurity Framework**
- **IEEE 2030.5-2018:** SEP2–Smart Energy Profile 2.0
- **NERC Reliability Guideline**: Cyber Intrusion Guide for System Operators
- **IEC 62351**: Information Security for Power System Control Operations
- **IEC 62443**: Industrial Automation and Control Systems Security
- **DOE/DHS ES-C2M2**: Electricity Subsector Cybersecurity Capability Maturity Model (ES-C2M2)
- **DOE/NIST/NERC RMP**: Electricity Subsector Cybersecurity Risk Management Process Guideline
- **IEEE 1547.3:** Guide for Cybersecurity of DERs Interconnected with Electric Power Systems
- **Potential new UL/ISA Standard:** Cybersecurity Certification Standard for DERs

Basic Cybersecurity Principles

- Recent FERC order 2222 enables DERs to participate alongside traditional resources in regional organized wholesale markets through aggregations.

- The need is to develop intrinsic security design principles for the future grid—a grid that can operate autonomously, with millions of advanced grid devices to support high penetrations of distributed energy resources.

- Future research should focus on how to integrate high penetration levels of DERs seamlessly onto the grid in a secure and reliably manner.

1. **Incorporate security at the design level.**
2. **Advance security updates and vulnerability management.**
3. **Build on proven security measures.**
4. **Prioritize security measures according to potential impact.**
5. **Promote transparency across grid.**
6. **Connect carefully and deliberately.**

Sources:
- 2016 U.S. DHS report on *"strategic principles for securing the internet of things"*
- *FERC order 2222 " https://www.ferc.gov/sites/default/files/2020-09/E-1_0.pdf "*

Thank you

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