Electric Sector Resilience in the Face of Threats

Mark McGranaghan
VP, Integrated Grid
Electric Power Research Institute

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IEA Experts Workshop: Challenges in Electricity Decarbonization
Paris
Electrification is a critical element of sustainability
But what about the risks of outages?
We have built a reliable system

United States

Europe

FIGURE 2.2 OVERALL PLANNED AND UNPLANNED LONG INTERRUPTIONS (MINUTES LOST PER YEAR); ONLY COUNTRIES NOT EXCEEDING 400 MINUTES
Resilience not the same as Reliability

Weather Events

Electro-Magnetic Pulse

Cyber Events

Solar Storms

Equipment and Protection System Failures
Storms - Just this year

**Hurricane Harvey Strikes a Powerful Blow to Texas, and Lingers**

Hurricane Maria knocks out power to entire island of Puerto Rico, population 3.5m

People fear the long term damage to the already bruised economy as they are hit by the worst storm in 80 years

Irma causes one of the largest natural disaster power outages in U.S. history
Cyber Security

Ukraine Power Outage Confirmed as Cyber Attack

Cyber firms warn of malware that could cause power outages

Security concerns rising for Internet of Things devices

Call it the Attack Vector of Things
Physical Security

Assault on California Power Station Raises Alarm on Potential for Terrorism

April Sniper Attack Knocked Out Substation, Raises Concern for Country’s Power Grid

SECURITY

Substation attack is new evidence of grid vulnerability

Peter Behr, E&E News reporter
Energywire: Thursday, October 6, 2016

With just a few shots from a high-powered rifle, an unknown gunman knocked out an electric power substation in rural south-central Utah last month, cutting off electricity to 13,000 customers for a day and forcing the utility to wait at least six months until the station's disabled transformer is repaired or replaced.
Electro-Magnetic Pulse (EMP)
Improving Grid Resilience – Multiple Approaches

Prevention

Response

Customer Resilience
Investing in the Grid – Grid Hardening and Grid Modernization

- Insulated Conductors and Steel/Concrete Poles
- Vegetation Management
- Undergrounding
- Sensors and Automation

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Using technology to respond faster
New approach – advanced energy communities

Local energy systems can incorporate local storage, generation, and advanced energy management to optimize energy use while also providing local resilience.
Combining IT and OT – Integrated Threat Analysis Facility (ITAF)

IT Cyber Security

IT Events
- Network Device Logs
- IT System Logs
- Business Systems

OT Cyber Security

OT Events
- Control Center Systems
- Substation Gateways
- Field Devices

Physical Security

Log and Event Aggregation

Behavioral Learning Appliances
Industrial Security Appliances

Physical Security Systems

Threat and Vulnerability Information Sources

Correlation Engine

Power System Events

Field Network Operations Center

Reporting
The Vision – An Integrated Grid

Integration of:
Electricity, Telecommunications, and Customer Local Energy Networks

The Integrated Grid Enables Optimization of Local and Central Resources with Customer Needs
Together…Shaping the Future of Electricity