Regulatory Impacts on Research Topics

Jennifer T. Sterling

Director, Exelon NERC Compliance Program

Exelon.

The 2003 Blackout

On August 14, 2003, an electric power blackout affected large portions of the Northeast and Midwest United States and Ontario, Canada.

- 50 million customers, > 61,800 MW load

Blackout Final Report

- Issued April 5, 2004
- Identified 46 specific recommendations
- Identified several direct causes and contributing factors
  - —Failure to maintain adequate reactive power support
  - —Failure to ensure operation within secure limits
  - —Inadequate vegetation management (VM)
    - ➢ *March 2004 FERC report on VM – Blackout likely would not have happened with adequate VM*
  - — Failure to identify emergency conditions and communicate that status to neighboring systems
  - — Inadequate regional-scale visibility over the bulk power system

U.S.-Canada Power System Outage Task Force, August 14th Blackout: Causes and Recommendations, April 5, 2004, page 139

NERC Standards - Background

The Energy Policy Act of 2005 authorized the creation of a self-regulatory electric reliability organization (ERO) that spans North America, with FERC oversight in the United States.

- Made compliance with NERC and regional reliability standards **mandatory and enforceable** as of June 18, 2007
- On July 20, 2006, FERC issued an order certifying NERC as the ERO for the United States
- NERC recognized as the ERO by provincial authorities in Canada

NERC has transitioned its planning and operating standards to a consistent ANSI-based standards development process

- Version 0 Standards went into effect on April 1, 2005
- New and revised standards are in development

Under Section 215 of the EPAct, FERC can:

- Remand for further consideration a proposed reliability standard or propose a modification to a reliability standard that FERC disapproves in whole or in part
- Order NERC to submit a proposed reliability standard or a modification to a reliability standard that addresses a specific matter

NERC Reliability Standards

Resource and Demand Balancing
Critical Infrastructure Protection
Communications
Emergency Preparedness and Operations
Facilities Design, Connections and Maintenance
Interchange Scheduling and Coordination
Interconnection Reliability Operations and Coordination
Modeling, Data, and Analysis
Nuclear
Organization Certification
Personnel Performance, Training, and Qualifications
Protection and Control
Transmission Operations
Transmission Planning
Voltage and Reactive

Threats

Lions and Tigers and Bears, Oh My!

Source: The Wizard of Oz , Metro-Goldwyn-Mayer (1939)

Current Conversations…..

- The industry along with Federal and State Legislators, FERC, NERC, DOE, DHS, National Labs, Vendors, and other interested parties have been discussing a number of issues brought about by events and evolving technologies, including:
  - GMD
  - EMP
  - Resiliency and Threat Vectors
- In some cases, the regulatory discussions are ahead of current understanding of science and/or techniques to analyze and mitigate ← Thus, more research is needed

Geomagnetic Disturbance (GMD)

- A temporary disturbance of the Earth's magnetosphere caused by a solar wind shock wave and/or cloud of magnetic field that interacts with the Earth's magnetic field. (Wikipedia)

- Geomagnetic disturbance (GMD) events have the potential to adversely impact the reliable operation of interconnected transmission systems.

- During a GMD event, geomagnetically-induced currents (GIC) may cause:
  —Transformer hot-spot heating or damage,
  —Loss of Reactive Power sources,
  —Increased Reactive Power demand,
  —Protection System Misoperation

Geomagnetic Disturbance (GMD), continued

- NERC GMD Standards - Developed at request of FERC
  - —EOP-010 -To mitigate the effects of geomagnetic disturbance (GMD) events by implementing Operating Plans, Processes, and Procedures.
    - GIC levels are monitored and mode of operations is conservative.
  - —TPL-007 - Establish requirements for Transmission system planned performance during geomagnetic disturbance (GMD) events.

- Research Areas include:
  - —Improved Space Weather Forecasting
  - —Improved ground conductivity modeling
  - —Improved GIC modeling to determine potential equipment impacts
  - —Assessment and modeling of blocking devices

Electro Magnetic Pulse (EMP)

- A short burst of electromagnetic energy. Such a pulse may occur in the form of a radiated, electric or magnetic field or a conducted electric current depending on the source, and may be natural or man-made. (Wikipedia)
- Primary threat is from two sources: Nuclear Detonation and EMP Weapon Technology
- Three pulses:
  - —E1 pulse: Initial (early-time) pulse from high altitude nuclear explosion dislodging electrons from atoms in upper atmosphere – fast rise time waveform which produces extremely high voltage (appears to be most problematic)
  - —E2 pulse: generated by scattered EM radiation, much less intense than E1 – similar to conventional lightning strike
  - —E3 pulse: generated by perturbations of Earth's magnetic field – similar to GMDs

Electro Magnetic Pulse (EMP), continued

- Effects on Power Grid
  - —Transformer failure
  - —Electronic / microprocessor based relay failure
  - —Damage to conductors and cables
  - —Smart grid technologies utilize electronics impacted
  - —SCADA systems and PLCs could be damaged
  - —Interference of communications

- Research Areas include:
  - —Modeling of impacts
  - —Assessment of shielding techniques

Resiliency and Threat Vectors

- Resiliency is used quite frequently as a term but there is no industry-accepted definition.
- High-Impact, Low-Frequency Event Risk to the North American Bulk Power System Report, June 2010 – *"Various planning tests stress the resilience of the grid to accommodate a wide range of severe multiple contingency conditions without resulting in cascading outages. From a physical security perspective, this planned resilience affords significant protection from many physical threats; however, a highly-structured physical, cyber, or blended attack could potentially target multiple assets at once, pushing the system outside the protection provided by system design criteria."*
- Power system has a level of redundancy and therefore resiliency by design but current physical and cyber threat scenarios go beyond traditional "N-1" planning criteria.
- Raises planning criteria and rate recovery issues.

Resiliency and Threat Vectors, continued

NERC CIP Standards

- CIP-002 – CIP-011 – Cyber Security ← Under Revision
- CIP-014 – Physical Security ← Developed at request of FERC
- FERC Notice of Proposed Rulemaking on Supply Chain Security

Research Areas Include:

- Physical and Cyber Security Prevention, Deterrence, and Detection Techniques
- New analysis techniques to deal with planning paradigm shifts
- On-going assessment of scenarios for ever-evolving threats