Reliability and Resiliency of the Power Grid

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- Largest blackout in North American History strikes the United States and Canada
- 50,000,000 people interrupted
- Cost is estimated at $4-10 billion
- Congress passes, and the President signs, legislation that gives new, but indirect, authority to FERC (more later)
- Mandatory and enforceable reliability & security standards
Office of Electric Reliability
High Level Org Chart

- Office is divided according to function
- Experienced engineers – technical and industry knowledge
- Initiates research when necessary
FERC’s Reliability Authority

Users, Owners and Operators of the Bulk Power System
Findings of the FERC/DOE/DHS Joint EMP Study

- Study is a 3-agency initiative
- Conducted through Oak Ridge National Laboratory with Metatech as the primary subcontractor
- The study evaluated both SMD and manmade EMP
- Solar storm activity of varying intensity occurs frequently
  - 1-in-100 year event last occurred in 1921
  - Its effects today may be far amplified
  - Unmitigated effects would be world-wide but in the US
    - 130,000,000 may be without power
    - Cost would range between 1 to 2 trillion dollars
    - Recovery would take years
A map showing the at-risk EHV transformer capacity (estimated at ~365 large transformers) by state for a 4800 nT/min geomagnetic field disturbance at 50° geomagnetic latitude. Regions with high percentages of at-risk capacity could experience long-duration outages that could extend multiple years. SOURCE: J. Kappenman, Metatech Corp., “The Future: Solutions or Vulnerabilities?,” presentation to the space weather workshop, May 23, 2008.
Figure 4-1. Severe geomagnetic storm with a 50 degree geomagnetic disturbance scenario. The above regions outlined are susceptible to system collapse due to the effects of the GIC disturbance.
Cyber Security of BPS

• Critical Infrastructure Protection (CIP) reliability standards CIP-002 thru CIP-009
• First approved by FERC Jan. 2008
• Required many improvements such as:
  – Critical asset identification
  – Exceptions to compliance must be approved
  – Defense in depth
  – Revocation of access authorization
• Most improvements yet to be implemented
Cyber Security of BPS

• CIP topics include:
  – What to protect
  – Management involvement
  – Security of sensitive information
  – Security training and personnel risks
  – Physical security of cyber assets
  – Change and access controls
  – Electronic security perimeters
  – Incident response and recovery plans
Impacts of Geomagnetic Disturbances on the Grid
Questions?