Solar Storms and Terrorists: the Risk to Our Power Grid

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New technology to protect the U.S. power grid from solar storms and EMP threats
Three Related Electromagnetic (EM) Threats

- Damages critical infrastructure
- Destroys control systems
- Trips safety systems
- Disrupts sensors
- Corrupts data

**Intentional Electromagnetic Interference**

- Plans & devices available to everyone – untraceable
- Covert, Silent, Invisible

**Nuclear EMP**

- Rogue countries

*EMP* ~ Extreme range

*Altitude of Detonation*

**Geomagnetic Storms**

- NASA: 2012 peak activity could cause catastrophic consequences for the world’s health, emergency services and national security unless precautions are taken

Protection from IEMI and Solar Storms provides much of the Nuclear EMP protection as well.
We depend on reliable power and computer systems to provide competitive advantage and necessary services.

- Critical electric & telecom infrastructure
- Data centers
- 911 and Emergency operations
- Pipelines, water, and wastewater
- Manufacturing processes
Solar Storms and EMP / IEMI Can Damage the Power Grid

Protection Against HV Transformer Damage & Power Grid Voltage Collapse Needs to be Developed & Implemented
2008 EMP Commission Report

Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack

Critical National Infrastructures:

– Electric Power
– Telecommunications
– Banking & Finance
– Petroleum & Natural Gas
– Transportation Infrastructure
– Water Infrastructure
– Emergency Services
– Space Systems
– Government
– Manufacturing Control Systems
June 9, 2010
Electric Grid Security Bill Passes in House

The House on Wednesday easily passed legislation that would authorize the Federal Energy Regulatory Commission (FERC) to respond quickly to protect the nation’s electric grid from threats, including cyber-attacks.

The bill (HR 5026): . . . Would allow FERC to create a mechanism to allow owners, operators or users of the bulk-power system to recover any “substantial costs” that are incurred as a result of complying with the emergency procedures in the event of a grid security threat.

. . . Such vulnerabilities would include cyber-security weaknesses or the potential for an attack with an electromagnetic pulse large enough to disrupt the bulk-power system.
Solar (Geomagnetic) Storms

Charged Particles from Coronal Mass Ejection Interact with Earth’s Magnetosphere

- Earth’s magnetic field is vibrated and currents are generated
- Large DC currents are created in HV Transmission lines
- Power Grid becomes Unstable & HV transformers can be damaged
Coronal Mass Ejection Photo

December 6, 2010
Solar Flare

Jupiter and Earth images superimposed to demonstrate the size
Aurora Borealis Photos
SolidGround operation has been validated in numerous ways

Software Simulation Modeling at the Univ. of Manitoba

High Voltage Ground Fault Current Testing in Phil. PA

Idaho National Laboratory Grid Experiment

Before

After

20kA symmetrical
49kA peak

11kV across arrester
SolidGround™ Equates to Large Savings

- SolidGround™ Protection allows Utility Operators to Avoid the so called “Non-Economic Dispatch Procedure”

- Huge Annual Savings can be Realized

- “Solar Magnetic Disturbance: An Operator’s Wish List,” Greg A. Gucchi, PJM, EPRI-EPRI TR-100450: If we responded to every K alert of level 5 or greater, **PJM would have spent over $100 million in excess incremental operating costs**.......The ultimate protection against SMD is mitigation.”
Summary

• EMP/ IEMI Threats and Geomagnetic Storms can cause serious disruptions to our economy

• Low Cost Protective Solutions need to be developed

• Emprimus LLC is focused on protective solutions for:
  – The Power Grid,
  – Data and Computer Centers,
  – And Telecommunications
Grid Resiliency System

Protects the power grid from solar storms and Electromagnetic Pulse (EMP) threats

SolidGround™

Automated protection (with manual overrides)
Transformer is always effectively grounded
Uses commercially available components
Laboratory and field verified
Factory assembled; arrives ready to install
Offers financial operating advantages
Applicable to HV transformers, SVC’s, station power