

DHS Science and Technology Directorate

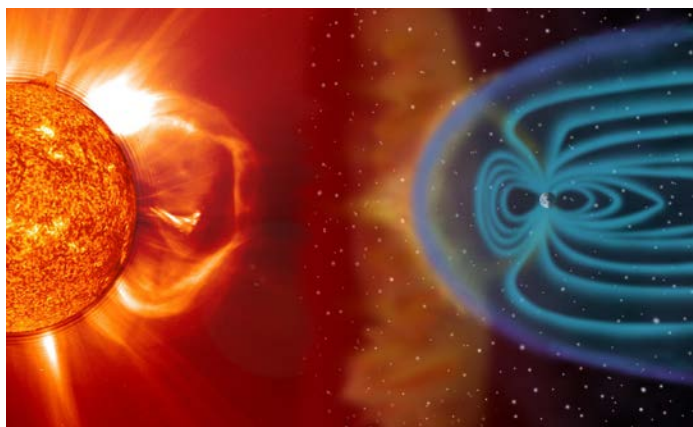
Solar Storm Mitigation

Solar storms can cause grid damage and outages

Space weather is a naturally occurring phenomenon in which the sun releases solar flares, energetic particles and/or coronal mass ejections (CME). These events are known as solar storms. In particular, if a CME is directed towards Earth, it can interact with the Earth's magnetic field and cause geomagnetic storms. Under these circumstances extra currents, known as geo-magnetically induced currents (GIC), are created in the ground which can impact the electric grid.

These GICS can cause widespread outages in two ways: First, they can cause permanent damage of critical grid components, such as high-voltage power transformers. This is of particular concern as high voltage transformers are not easily replaceable. Second, the GICs can cause voltage instability in the grid and cause the system voltage to collapse, resulting in a widespread but temporary outage.

[Presidential Policy Directive \(PPD\) 21](#) “identifies energy... as uniquely critical.” Thus, to address the threat to the grid from solar storms, the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) has two projects underway to aid utilities.



CMEs impact the Earth's magnetic field and cause geomagnetic storms. These can cause GICs and impact the electric grid. (Credit: NASA).

Protecting the grid with localized GIC forecasting

Currently, regional-level space weather warnings and alerts are provided by the Space Weather Prediction Center at the National Oceanic and Atmospheric Administration. To provide grid owners and operators with actionable in-

formation, S&T is working with NASA to develop a forecasting tool to enable more localized and precise GIC forecast levels.

By providing accurate and tailored forecasts specific to a utility's location and infrastructure, utility operators will be better informed to make operational decisions to mitigate the impacts from solar storms. This can range from canceling maintenance work to temporarily shutting down vulnerable grid components and preventing permanent damage. Utilities will also be informed when it is “all clear” and safe to resume normal operations.



Permanent damage to the Salem New Jersey Nuclear Plant GSU Transformer caused by the severe geomagnetic storm of March 13, 1989 (Credit: PSE&G).

Reconfiguring the grid against voltage collapses

To protect against voltage instability impacts to the grid, S&T is also working with Sandia National Laboratories (SNL) and PJM Interconnection to develop a process for analyzing and quantifying the resilience of a power grid to solar storms, using risk-based probabilistic methods, along with a methodology for optimizing generation dispatching to prevent voltage collapse during solar storms.

Partners

- National Aeronautics and Space Administration
- Electric Power Research Institute
- Sandia National Laboratories
- PJM Interconnection



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To learn more about the Solar Storm Mitigation project, email us at SandT.RSD@hq.dhs.gov.