

Solar Flares Imperil Grid

By Salvatore Salamone

SCIENTISTS AT THE National Center for Atmospheric Research predict that during the next several years solar activity will be unusually high — and this could bring down power systems.

The heart of the issue has to do with the large in-ground currents that can be induced as a result of solar activity. Specifically, solar disruptions eject charge particles that can interact with the earth's magnetic field, causing what is called geomagnetically induced currents.

These currents can overwhelm electrical transmission systems. For example, "the high direct current [in GICs] could cause a transformer to fail," says Lou Leffler, manager, situational awareness and emergency response at the North American Electric Reliability Council (NERC) Electricity Sector Information Sharing and Analysis Center.

This problem is not new, yet in the past the impact of high solar activity has typically been limited to high-latitude electrical grid and transmission systems. For example, in March 1989, during an unusually high level of activity, the entire Hydro-Québec system experienced a GIC-triggered blackout.

If the NCAR predictions hold true and the level of solar activity is as high as anticipated, the impact could extend to more U.S. grids. In particular, the NCAR model forecasts that solar activity over the next 11-year solar cycle will be 30 percent to 50 percent more intense than the current cycle. This next cycle will start in late 2007 or early 2008 and will peak in about 2012.

According to the NERC, geomagnetic disturbances from increased solar activity can cause a number of problems including unusual noises and heating in transformers, real and reactive power swings, elevated neutral amperes in transformers, frequency excursions, tripping of capacitor banks by neutral ground current, voltage fluctuations, and communication system problems.

To avoid outages, companies can minimize potential problems by using a two-prong approach that combines equipment protection and monitoring.

"You can harden a system by isolating a transformer or reducing its load," says Leffler. The trick is knowing when to do these things. For that reason, getting advance notice of impending activity is essential.

The Space Environment Center of the National Oceanic & Atmospheric Administration monitors solar activity and provides a solar disturbance forecasting

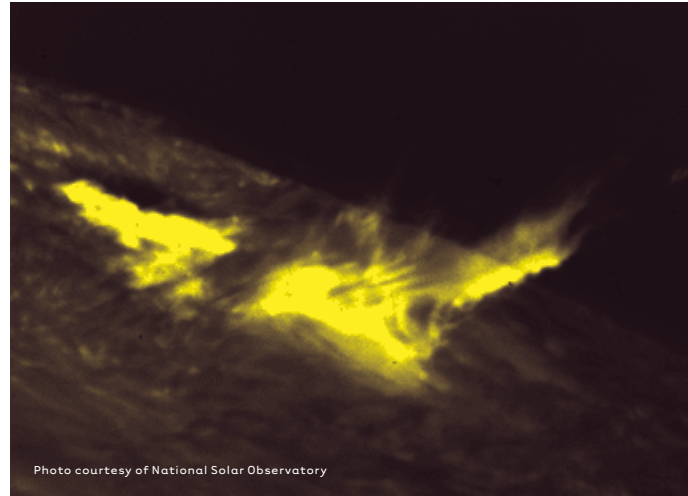


Photo courtesy of National Solar Observatory

service, which relays alerts to reliability coordinators at electric power companies and other operating entities.

For example, the SEC monitors a number of indicators of solar activity such as sun spots and solar flares. Using this and other information, the SEC categorizes the level of geomagnetic disturbance on a scale from zero to nine called the K-Index, where zero is quiet and nine denotes a severe geomagnetic storm.

When the K-Index is seven or higher, alerts and warnings are sent to designated reliability coordinators in the grid and power companies. In turn, the reliability coordinators distribute the information to operators in their group.

According to the NERC, the information from SEC is made available to the Midwest Independent Transmission System Operator, which sends the warnings to reliability coordinators, balancing authorities, and transmission operators in the Eastern and the Electric Reliability Council of Texas interconnections. The alerts are also sent to the Bonneville Power Administration, which in turn distributes the information reliability coordinators and other entities within the Western Interconnect.

These SEC warnings give companies a heads-up. Often times, disturbances on the sun can be detected a day or more before the impact is felt on earth.

The warnings, however, do not indicate and cannot predict when or if a specific location will be affected. For that reason, Leffler notes that some companies install their own devices to monitor currents so they may take corrective action once a GIC surge is detected.

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SOLAR FLARE ALERT

New predictions of solar flares are increasingly accurate and based on new innovative ways of predicting outbursts, the *New York Times* reported.

Mausumi Dikpati, a scientist at the National Center for Atmospheric Research, told the newspaper that the work is based on physics and not past data and simulations.

Richard Behnke, at the National Science Foundation, said the focus of research is now to develop new ways to predict individual storms.