

Secure the Grid Coalition, August 24, 2020

Re: Comments of Secure the Grid Coalition Regarding Bulk-Power System EO RFI  
FR Doc. 2020—14668, pg. 4-6

Request (1)

**Immediately Identify and Remedy Vulnerabilities to Large Power Transformers**

**3 - Immediately Protect Large Power Transformers from Direct Current:**

We suggest neutral blocking as an immediate priority – to quickly protect the critical and very hard to replace transformers, generators and high voltage breakers of the bulk power system using tested and available hardware at relatively low cost.

Our alternating current (AC) bulk power system and its major components are not designed for direct current (DC). The significant effects of solar storms on the power grid are very similar to E3 HEMP in that they both induce quasi-DC currents in the ground which enter the bulk power system through the high voltage transformer neutral wires. A large Solar Storm or HEMP event could induce high levels of DC that are orders of magnitude greater than anything we have ever experienced on the modern grid. The results would be catastrophic to the grid and cause widespread and protracted blackouts.

We must keep DC out of our AC grid to allow critical components to operate as designed and remove the risks of voltage collapse, damage, cascading failures as well as many uncertainties in a HEMP attack or large Solar Storm event. With long lead times required to replace and the ever-increasing dependence on foreign entities for the critical components on our bulk power system, the mission to protect what is already installed on our grid is even more important.

Any protection plan against the threats of (intentional) HEMP and (statistical) major Solar Storms, must include blocking these induced DC currents from invading our AC bulk power system, as recommended by the Electric Power Research Institute (EPRI), US Congressional EMP Commission, Idaho National Laboratory, US Air Force Electromagnetic Defense Task Force and many others, as noted below:

*“A capacitor in the neutral of transformers was determined to be the most effective and practical blocking device.”*

**-EPRI EL-3295, Project 1770-1, Mitigation of Geomagnetically Induced and DC Stray Currents, 1983**

*“...inserting blocking devices in the neutral leads appears to be the most logical and effective means of preventing GIC flow.”*

**-EPRI TR-100450, Proceedings: Geomagnetically Induced Currents Conference, 1992**

*“The E3 pulse is similar in a great many respects to geomagnetic effects induced by solar storms... Steps taken to mitigate the E3 threat also would simultaneously mitigate this threat from the natural environment.”*

**-Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack, 2008**

*“Installation of blocking devices in the neutral to ground connections of transformers will significantly reduce the probability of damage from solar storms and ... EMP E3”*

**-Risk-Based National Infrastructure Protection Priorities for EMP and Solar Storms, Report to the Commission to Assess the Threat to the United States from EMP Attack, Baker, July 2017, p. 8**

*“The use of capacitors in the neutral of grounded-wye transformers...is an effective means of blocking the flow of GIC in transformer windings.”*

**-EPRI 3002014979, High-Altitude EMP and the Bulk Power System, Potential Impacts and Mitigation Strategies, April 2019**

*“Recommendations For Further Action...Invest in the \$2.5 billion to protect existing EHV transformers (all hazards = neutral ground blockers ...”*

**-Electromagnetic Defense Task Force 2018 Report, Stuckenberg, Woolsey, DeMaio, p. 48 – 49**

*“...there must be a priority to protect the most critical large power transformers in place... estimates are that this would cost less than \$4 billion if we made it a priority to install NBD’s [neutral blocking devices] at our most critical EHV substations. This is a small fraction of the value of replacement units, but more importantly is negligible compared to the loss of civilian life and long term recovery costs to the economy should they fail during a GMD or EMP event.”*

**-Statement before the U.S. Senate Homeland Security & Government Affairs Committee, Scott A. McBride, Infrastructure Security Manager, National & Homeland Security, Idaho National Laboratory, 2018**

*[Importantly, our Coalition receives no funding from the corporations that could profit from protecting these transformers from Direct Current.]*