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Community Energy Resilience Investment Program

See attached document to see comments. Thank you.

Additional submitted attachment is included below.

California Energy Commission
Docket No. 22-ERDD-01
Community Energy Resilience Investment Program

Dear CEC:

On behalf of EMPRIMUS, a research and development company working with major utilities and various departments of the United States to protect our bulk power grid against the effects of solar storms and high-altitude electromagnetic pulse (HEMP), I am pleased to submit this letter in response to the California Energy Commission's information request (RFI) relating to the Community Energy Resilience Investment (CERI) Program. I understand that CERI will be the California program that implements and provides subgrants to utilities within the State of California, pursuant to and based on Section 40101(d) of the Infrastructure Investment and Jobs Act (IIJA), also known as the "Preventing Outages and Enhancing the Resilience of the Electric Grid Formula Grants to States and Tribes" program.

My comments go to the substance of the activities for which eligible utilities will be required to spend subgrant monies received from the CEC and its CERI program. In particular I am commenting to recommend the installation of Neutral Blocking Devices (NBDs) 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.

The significant effects of solar storms on the electric grid are very similar to the "E3 Pulse" of a high-altitude nuclear electromagnetic pulse (HEMP). They both induce quasi-DC current in the ground - geomagnetically induced current (GIC) which invades the electric power grid through the grounded neutral wires of high voltage transformers. Small amounts of GIC from common low-level solar storms are estimated to cause on the order of \$10 billion in economic loss each year in the U.S. (per insurance studies by Lockheed Martin/Zurich/NOAA). A large Solar Storm or HEMP event could induce high levels of GIC 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 GIC out of our AC electric grid to allow critical components to operate as designed and remove the risks of voltage collapse (long term blackouts), harmonics, damage, cascading failures as well as many uncertainties in a large Solar Storm event or HEMP attack. 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 hardening of the electric grid or resilience plan against the threats of (intentional) HEMP and (statistical) major Solar Storms and common low-level Solar Storms, must include blocking these GIC 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

“Hardening will likely require a phased approach ... focusing initially on protecting the largest, most important transformers ... the entire 5,000 [HV Transformers] could be outfitted with state-of-the-art, field tested and proven technology ... GIC/EMP neutral blockers...”

-Grid Resiliency From Electromagnetic Threats; the Infrastructure Plan Provides an Opportunity for Substantial Investment, Janney Report, January 2018

Thank you for allowing us to comment on this RFI. I would be happy to discuss Neutral Blocking in more detail and can be reached at the contact information below.

Sincerely,

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