Office of the Deputy Assistant Secretary for
Environment, Safety, and Infrastructure

AIR FORCE ENERGY

The Department of the Air Force is leveraging system models to understand and manage electrical grid capacity to meet mission requirements in a dynamic environment.

Electrical Grid Modeling

To support the Warfighter, the Department of the Air Force (DAF) is working to provide a better understanding of the link between energy system operations and mission assurance. With a growing reliance on energy, a comprehensive analysis must connect energy system operations to mission operations and success. In developing tools and guidance to support this coordinated analysis, the DAF seeks to increase its understanding of how energy disruptions might lead to the degradation or failure of key mission assets and how those could ultimately impact mission execution. Through this analysis, DAF installations can leverage system models not only to look at baseline performance, but also to better understand and manage the system's capacity to meet mission requirements in a dynamic environment.

Electrical Grid Modeling Levels of Effort

The DAF recognizes there is no one-size-fits-all electrical grid modeling approach that will serve the needs of all installations. Consequently, the DAF is developing guidance to help installations determine which modeling level of effort (LOE) is best suited for them. A precursor to any LOE is to have up-to-date electrical data and schematics that will facilitate the construction of an LOE 1 or 2 model.

LOE 1

As a baseline, all installations should have a distribution level power flow model to meet the requirement outlined in AFI 32-1062, Electrical Systems, Power Plants and Generators. This model should be updated every five years. If an installation's power flow model is older than five years, updating the model should be an installation's first priority.

LOE 2

Several factors influence whether an installation should pursue a more involved LOE 2. Factors may include, but are not limited to: the nature of a mission supported by an installation, whether the mission can readily be relocated, or the mission criticality. Though there are many advanced electrical grid modeling options, the DAF is working with Los Alamos National Lab to develop a modified Severe Contingency Solver (SCS) Tool for the benefit of installations.

Did You Know...

The Air Force has conducted Severe Contingency Solver analyses at two installations:

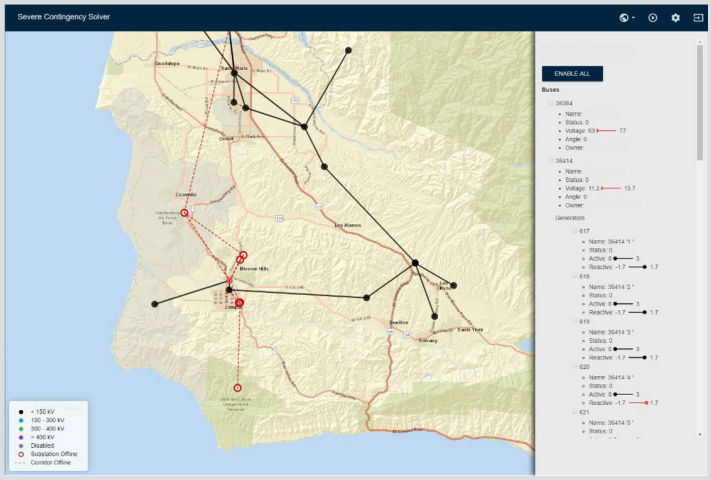
Vandenberg Air Force Base

Hill Air Force Base

FY 2020 Activities

Severe Contingency Solver Tool

The SCS Tool is a power flow optimization model that can assess electrical system performance under N-1 and certain N-k scenarios at the distribution, sub-transmission, and transmission levels. Under the designated scenario, which assumes the removal of one or more electrical assets, SCS can evaluate the electrical system's ability to maintain power to a facility that houses a key mission asset. The solution from a SCS run will indicate the switching and/or load shedding options within a power network that satisfy the problem of maintaining power to the designated key facilities. In this way, the SCS Tool helps to identify how an electrical denial-of-service at the distribution or near-transmission level might impact the mission.



Example SCS: Red indicates failed or removed electrical assets and the minimum load shedding done by the system to preserve as many assets as possible.

Applying Outputs to Improve Mission Assurance

No matter the electrical grid model being used, an installation can apply results to further advance mission assurance. Model outputs can give a clearer indication of how disruptions at the electrical grid level can impact key mission systems and assets. Additional efforts such as an Electrical Infrastructure Resilience Analysis can give further context by looking at the resilience level of key electrical assets, which can help inform the development of energy resilience projects. Model outputs can also aid in prioritizing asset upgrades and maintenance in a resource-constrained environment. As tools and analyses continue to develop, the DAF will seek to make these resources available to installations to ensure the enterprise remains ready to fly, fight, and win in air, space, and cyberspace.

The Department of the Air Force is taking a resilience-focused approach to future energy and water projects concentrated on providing strategic agility for missions and installations.

For more information:

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