Stewart Air National Guard Energy Independence Program

Project Overview

The Stewart Air National Guard Base (SANG), located in New York, is home to the 105th Airlift Wing, whose missions include air mobility, homeland defense and ground support during both peace and wartime inter-theater airlift operations. The facility located in Newburg encompasses approximately 265 acres.

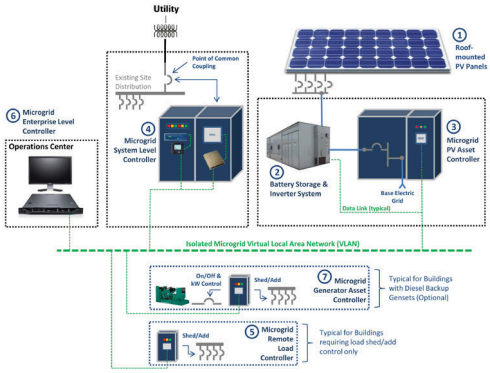
Prolonged power outages are a major threat to mission-critical U.S. military operations. In addition to normal day-to-day military activities, U.S. bases provide homeland security and civilian emergency response services. All of these missions require 24/7 electric power. While diesel generator back-up systems are an acceptable short-term solution, they are not a viable option for a prolonged regional power outage due to possible fuel supply constraints and emission regulations.

In 2011, the Air Force Research Laboratory (AFRL) contracted CB&I to design, procure, install, test and validate the operation of a state-of-the-art hybrid microgrid at SANG. This microgrid prototype was designed to operate in both grid-connected parallel and disconnected island modes, providing a long-term, sustainable back-up power source for the base.

Employing key aspects of CB&I's patent-pending Hardened Smart Microgrid® (HSM™), Encorp developd an advanced smart microgrid power and control system that integrates a solar photovoltaic (PV) generating system, bi-directional power inverter, battery energy storage system, and digital controls with an overarching monitoring and communications system. During normal operations of the system and the utility power grid, the microgrid enabled by the Egility platform, will control and optimize on-base power distribution to reduce the cost of purchased energy from the local utility grid. In the event of a utility grid failure at SANG, the microgrid system will use solar PV-generated power and a battery storage system to support selected mission-critical operations, reducing reliance upon the past practice of relying solely on back-up diesel generators.

Sustainable Energy Independence Program Scope of Work

- Assess SANG's existing power requirements and deliver a hybrid power system conceptual design
- Finalize design for a state-of-the-art prototype microgrid system
- Investigate the U.S. Air Force's communication security requirements and develop a plan to integrate the microgrid communication system onto the installation's existing communication network infrastructure
- Evaluate selected solar PV installation locations using a geometric analysis, in accordance with Federal Aviation Administration (FAA) criteria, to identify potential reflected sunlight impact to airport operations
- Prepare technical documents and submit application for a distributed generation interconnection agreement with the local electric utility
- Complete all environmental impact analysis studies, including permits and approvals
- Procure, install, commission and test the system for grid stability, operational dynamics, inverter harmonics, electromagnetic interference and abnormal grid characteristics
- Provide a final report with cost benefit analysis of the system, results of all technology assessments and recommendations for improving the base's power distribution system



Hardened Smart Microgrid reduces demand for purchased power when the utility grid is operating and delivers mission-critical emergency power during extended utility outages.

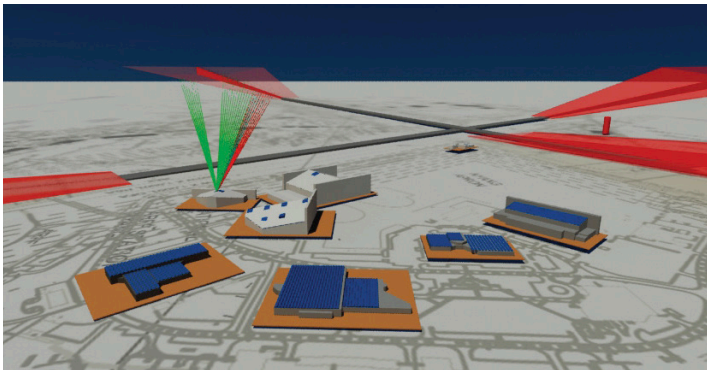
Hardened Smart Microgrid

The Hardened Smart Microgrid development process creates a road map for upgrading a power distribution system based on mission criticality and program funding constraints. The result is a reliable, resilient and secure microgrid that helps a military base's power distribution system survive human-made and natural assaults, such as recent extreme weather events such as hurricanes. The power system can automatically transfer to an off-grid, island mode of operation to continuously power mission-critical loads. The process is a structured and quality-controlled methodology that includes the following design criteria:

- Integration of multiple energy sources through various power paths
- Overarching two-way communications backbone
- Cyber security (NIST, NERC, FERC for CIP, etc.)
- EMP defense
- Physical attack protection
- Self-healing capabilities
- Weather protection – active and passive
- SCADA functionality
- Cost payback functions
- Environmental stewardship

Implementation of HSM design criteria is achieved with the following:

- Project definition
- Energy efficiency and load reduction consulting
- System engineering (preliminary)
- Partner organization selection (national labs, universities, etc.)
- Equipment supplier selection
- Microgrid /grid interface master controls definition
- Enterprise level control definition
- Funding
- Engineering (final), procurement, construction (EPC)
- Operations and maintenance programs
- Measurement and verification
- Asset monetization planning



A 3D model was created for the SANG Base and Stewart IAP. For each of the proposed solar PV installation locations, case studies were performed to identify when reflected sunlight, over the course of a year, would intersect with one of the FAA defined aircraft exclusion zones and/or the control tower. The above image shows reflections from one of the locations that intersect with one of the runway exclusion zones. Once the reflections were identified, calculations were performed to determine the potential for an after-image to occur.