Combined Heat & Power Microgrid

NASA Johnson Space Center, Texas

Contract and Savings Details

- Department of Energy (DOE) Energy Savings Performance Contract (ESPC)
- 22 Year Contract Term
- $49.9 Million Project Size
- Annual Energy and Operational Savings over $3.9 Million

CHP Microgrid Components and Benefits

- Two 5.7 MW Caterpillar Solar Taurus T60 Combustion Turbines
- Two 50,000 lb/hr Heat Recovery Steam Generators with Economizers
- Two Selective Catalytic Reduction (SCR) Emissions Control Systems
- Two Continuous Emissions Monitoring Systems (CEMS)
- 500 kW Back Pressure Steam Turbine Generator
- Paralleling Substation and Combustion Turbine Motor Control Centers (MCC)
- Steam Turbine Generator Step-up Transformer
- High-Pressure Natural Gas Line and Meter
- 750 kW black start emergency generator furnished by NASA, installed by ESG

The NASA Lyndon B. Johnson Space Center (JSC) was established in 1961 as the home and Mission Control Center for NASA's U.S. Human Space Flight Program. Consisting of 163 buildings and occupying 1,581 acres southeast of downtown Houston, its early days saw the Center direct Mission Operations for the Gemini, Apollo, and Skylab projects. JSC also served as NASA's lead center and Mission Control for its 30-year long Space Shuttle Program. Presently, JSC serves as Mission Control and NASA's lead for the International Space Station, a U.S.-led collaborative effort of 16 nations and the largest, most complex human facility to ever operate in space. JSC is also home to the Orion Spacecraft, the Astronaut Corps, various other advanced human exploration projects, and is one of NASA's largest R&D centers.

The system produces 11.9 MW of onsite electricity, ensuring power to critical loads such as Mission Control.

As JSC has evolved into one of NASA's most critical facilities, grid outages and upset conditions, whether resulting from capacity constraints, severe weather events, or renewable intermittency factors, accentuated the need for increased onsite energy reliability and availability for mission assurance.

ESPC Funded CHP Microgrid

The intent of the combined heat and power (CHP) microgrid project is to improve utility infrastructure resiliency in support of enhanced mission readiness and continuance. The grid-tied system provides JSC with self-generation capacity at 70% of its peak demand while being capable of extended islanding vis-à-vis an onsite microgrid that Energy Systems Group (ESG) designed, constructed, is operating, and will guarantee performance of for 22 years.

The microgrid increases resiliency of onsite utility infrastructure and improves disaster preparedness for the Center.

The CHP portion of the project offsets purchased electricity and steam produced from dual fuel boilers with on-site cogeneration of 11.9 MW of electricity and 100,000 lb/hr steam. Chilled water production is optimized by employing existing steam turbine chillers to maximize their output, thus shifting the base cooling load from electric chillers to steam turbine chillers. Electrical power generation of the combustion turbines is supplemented by a 500 kW back pressure steam turbine generator.

Power output from the 11.9 MW CHP plant is via interconnect at two substations, both of which are primary components of the Center's 12.47 kV distribution system. Back-up automated electrical power control is also provided via these same interconnects, ensuring power to critical loads such as Mission Control.

This project supports improved energy security and resiliency at the center, while also accelerating JSC's alignment with NASA energy intensity reduction goals. Implementation of the CHP project alone is achieving a 51% reduction in JSC energy intensity as compared to FY 2014 levels. This level of reduction exceeds JSC's site energy intensity reduction goals through 2032 and is significant enough to have a visible impact on NASA's agency-wide goals. JSC's carbon footprint is also being greatly reduced, with greenhouse gas emissions cut by 19,750 CO_2 equivalent tons annually.