SOUTHWEST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

Houston Methodist Hospital

4.6-MW CHP System

Quick Facts

LOCATION: Houston, Texas
MARKET SECTOR: Hospitals
FACILITY SIZE: 1,000 bed hospital and four other buildings in complex
FACILITY PEAK LOAD: 11 megawatts (MW) for two main buildings served by CHP plant
EQUIPMENT: Combustion turbine (Solar Turbine Centaur 50S) with heat recovery steam generator, supplementary duct burner, 2800 ton steam driven chiller
FUEL: Natural gas
USE OF THERMAL ENERGY: Steam-driven chillers, hot water, space heating, and humidification
CHP INCREMENTAL COST: $4.0 million
ANNUAL ENERGY SAVINGS: $1.8 million
PAYBACK: 2.2 years
ENVIRONMENTAL BENEFITS: Reduced NOx emissions by 71% & CO_2 emissions by 28%
CHP IN OPERATION SINCE: 2011

Site Description

Established in 1919, Houston Methodist Hospital is a recognized leader in several specialties, including cardiovascular surgery, cancer, diabetes, organ transplants, and neurology.

The main campus is located at the heart of the Texas Medical Center in Houston, Texas. A central utility plant serves the cluster of five buildings for its chilled water and steam needs. The most recent additions to the campus include a 1.1 million square foot research center and a 26-story, 1.6 million square foot outpatient center.

Project Description

In 2008, planned expansions at the Houston Methodist Hospital campus, including a new research building, made it necessary to expand the capacity of the existing Central Utility Plant. The expansions needed were additional steam and cooling tower capacity, and back-up power for the cooling system. A more traditional alternative (additional boiler, diesel generator, cooling tower, etc.) was compared with a CHP alternative. Despite its higher initial costs, the CHP alternative was chosen, mainly due to the added energy security/reliability benefits.

CHP System and Operation

The CHP system includes a 4.6-MW natural- gas driven Centaur 50S gas turbine from Solar Turbines, a 2,800-ton steam drive centrifugal chiller, heat recovery steam generator with a supplementary duct burner, and an aqueous ammonia selective catalytic reduction scrubber. The CHP system operates 7,000-8,000 hours per year, and can provide up to 48% of steam demand and 55% of chilled water demand for the five building complex served by the central utility plant. The CHP system also provides about 40% of electricity needs for the complex's two main buildings, improving the hospital's energy security and reliability and eliminating the need for a diesel back-up generator.

The gas turbine-based CHP system at Houston Methodist Hospital improves the hospital's energy security and reliability and eliminates the need for a diesel back-up generator

Reasons for CHP

Key drivers for the installation of CHP at the hospital were energy security, reliability and emergency preparedness. The CHP system was very cost-effective compared to the more traditional alternative, with about $1.8 million in annual energy cost savings. In addition, the gas turbine's selective catalytic reduction scrubber, rated at 5 PPM NOx, resulted in significantly lower NOX emissions than the high pressure steam boilers.

Lessons To Share

- Evaluation of CHP costs and savings incremental to the "business as usual" case made project economics attractive.
- The installation of a high pressure gas line (200 psig) by the gas utility was necessary for operation of the gas turbine.
- A continuous emissions monitoring system (CEMS) was required for in order to get an air emissions permit.
- Integration of the CHP equipment into existing infrastructure, space constraints during construction, and the need for hospital operations to run continuously during startup of the CHP equipment required meticulous planning, and contributed to an increase in construction costs.

"With the CHP installation, the hospital ensures that it had the ability to generate electricity and provide chilled water and steam, even during extended electrical outages caused by hurricanes or other natural disasters."

— Bruce Flaniken
Manager of D&C Engineering

For More Information

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