combined heat & power at a hospital

The Methodist Hospital

4.6 MW CHP Application

Project Profile

Quick Facts

Site location: Houston, TX

Market Segment: Hospital

CHP equipment:
One combustion turbine (Centaur 50S Solar Turbine) with Heat Recovery Steam Generator, supplementary duct burner, 2800 ton steam driven chiller and aqueous ammonia SCR Scrubber

Fuel: Natural Gas

Generating Capacity: 4.6 MW

Steam Production (fired):
50,000 lbs/hr @ 210 psig

Site Overview

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

The TMH main campus is located at the heart of the Texas Medical Center in Houston, Texas. A central utility plant serves the cluster of buildings for its chilled water and steam needs. The most recent additions to the campus included a 500,000 square feet research space and a twenty six-story, 1.6 million square feet outpatient center.

Project Description

In August 2008, The Methodist Hospital (TMH) campus required expansion of utility capacity at the existing Central Utility Plant. With the new research building coming on-line in the 4th quarter 2010, the steam demand on the utility plant would require operation of the two existing natural fuel boilers, leaving the plant without a standby unit. Furthermore, while the existing plant had sufficient chiller capacity, it was deficient in the necessary cooling tower capacity to support operation of all of the chillers simultaneously. Additionally, none of the chillers and ancillary equipment (cooling tower cell fans, condenser/chiller water pumps) was connected to standby power and thus could not provide emergency cooling; a requirement for TMH. Initially, a new 2,000 ton steam drive centrifugal chiller, additional cooling tower capacity, cross connectivity at the condenser/Chilled water pumps/piping, a new 2,500 KW diesel generator and a new 60,000 PPH steam fired high pressure steam boiler was proposed at an estimated budget of $25 million. Due to the added energy security and reliability benefits, the project morphed to include a new 2,800 ton steam drive centrifugal chiller, additional cooling tower capacity, cross connectivity and VFD's at the condenser/chilled water pumps, a new 4,600 kW natural- gas driven Solar Centaur 50S gas turbine, heat recovery steam generator with a supplementary duct burner and an aqueous ammonia selective catalytic reduction scrubber. The **incremental cost of the CHP plant was $7.4 million**, above and beyond the original proposal, resulting in **a simple payback of roughly 5 years**. The project was also the first CHP project in Texas to receive an incentive from CenterPoint Energy (local electric utility) for energy savings achieved due to avoided operation of electric chillers.

CHP Drivers

Key drivers for the installation of CHP at the hospital were energy security, reliability and emergency preparedness. With the installation of the CHP, the hospital ensured that it had the ability to generate electricity, provide chilled water and steam, even during long term electrical utility outages that might be caused by natural disasters (such as hurricanes). Additionally, the selective catalytic reduction scrubber rated at 5 PPM NO_x ensured significantly lower NO_X emissions, due to a reduction in hours of operation of two existing high pressure steam boilers, which were rated at 30 PPM NO_x each.

Lessons Learned

- 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 this project in order to get an air permit from TCEQ.
- A City of Houston HazMat permit for the aqueous ammonia storage tank and delivery system was also required for this project.
- Since the equipment was elevated, site adaptation in terms of structural roof support was necessary.
- Integration of the CHP equipment into existing infrastructure, space constraints during construction and the need for hospital operations to continuously run during startup/commissioning of the CHP equipment required meticulous planning, which contributed to an increase in construction costs during the design build phase.

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Energy Security & Emergency Preparedness were key drivers for the project. Consideration of CHP costs as incremental costs when compared to the business as usual scenario, enhanced project economics resulting in a simple payback of 5 years.