



combined heat & power in healthcare

Spectrum Health, Butterworth Campus

3.8 MW CHP Application

Project Profile

Quick Facts

- Location:**
Grand Rapids, Michigan
- Facility Size:**
Over 1 million square feet
- Number of Staffed Beds:**
738 Beds
- Facility Type:**
Medical Campus
- Maximum Electric Demand:**
9 megawatts
- Generating Equipment:**
3.8 MW natural gas fired turbine/generator set
- Generating Capacity:**
3.8 megawatts (MW)
- Primary Fuel:**
Natural Gas
- Heat Recovery:**
Domestic Hot Water, ambient heating and cooling, sterilization, chilled water.
- Operation Schedule:**
Continuous operation
- Local Electric Utility:**
Consumers Power Electric (CMS)
- Began Operation:**
May 1993

Project Overview

Spectrum initially purchased its electricity from Consumers Energy and its steam from a district steam system. High steam costs, concurrent with the cheap price of natural gas, were what initially piqued Spectrum's interest in CHP. The ability to cogenerate electricity and steam at a higher efficiency and lower than market cost, in addition to reducing on-peak power demand, encouraged the installation of the 3.8 MW natural gas fueled system in 1993.

The Spectrum system is composed of one 3.8 MW gas fired generator, whose waste heat is recovered by an exhaust gas heat recovery steam generator (19,000 lb/hr of 125 psi steam). During summer, this steam is converted in two absorption chillers for cooling, which are supplemented by 3 electric chillers. In 2004, the system met approximately 50% of the hospital's summer electricity load, and 75% of the winter load. Almost all of the hospital's annual steam needs are met through cogeneration, with the emergency or supplemental steam available through a contract with the county.



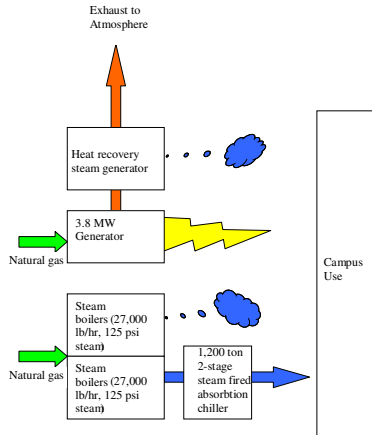
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CHP Operation

Jim Karas, Energy Coordinator of the hospital's cogen plant, has been "very pleased" with their CHP experience. Their turbine is still going strong in its seventh year of operation.

The key, says Karas, is "to learn your specific engine's quirks," which varies, he believes, from machine to machine. For example, Karas discovered that the high heat produced from firing the engine was taxing on the system. The engineering crew therefore has adapted to ramping up the engine more slowly to avoid fatigue on the parts. As of September 2005, the Spectrum crew is running their CHP system on weekdays, and shutting it down over holidays and weekends in order to extend the useful life of the engine and to use less natural gas.

CHP Configuration



Steam is used for :

- Outside air preheat
- Generation of hot water for heating
- Domestic hot water
- Humidification
- Sterilization
- Chilled water

Additional Facts

- When in operation, the CHP system supplies nearly 50% of the facility's annual electric demand, and 50-100% of its steam load. Seasonally, the CHP system covers approximately 50% of summer electricity demands, and 75% of winter. Maximum electric demand is approximately 9 MW.
- The Spectrum Health engineering staff provides the daily maintenance of the CHP system, checking the oil, battery and standard operation of the system.
- A third-party service firm provides a maintenance and check-up of the engine 6 times a year.
- **Lessons learned:** fuel cost variability needs to be included in the initial cost calculations as they greatly affect the system's profitability. Karas states that Spectrum would run the system full time if gas were \$4.50 per MCF, but with higher gas prices, Spectrum considers shut downs during some off-peak times such as mild weather weekends.

In 2004, the system met around 50% of the hospital's summer electricity load, and 75% of the winter load.

Almost all of the hospital's annual steam needs are met through Combined Heat and Power.



3.8 MW Natural Gas Fired Turbine



Three 2 MW Diesel Generators Provide Emergency Power

Power House Equipment

The following equipment is housed in the hospital's Power House in addition to the 3.8 MW Engine:

- One (1) exhaust gas heat recovery steam generator (19,000 lb/hr of 125 psi steam)
- Two (2) gas/oil fired steam boilers (27,000 lb/hr of 125 psi steam)
- One (1) 1,200 ton 2-stage, steam-fired absorption chiller

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