SOUTHEAST

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

Mississippi Baptist Medical Center

4.6 MW CHP System for Critical Infrastructure

Project Overview

Mississippi Baptist Medical Center (MBMC) is a 624-bed urban hospital located in Jackson, Mississippi that has been operating for over 100 years. The hospital has significant requirements for electricity and steam, with small load variations and a need for high reliability. These attributes make it an ideal candidate for combined heat and power (CHP).

In 1991, MBMC installed a 4.6 megawatt CHP system with the intent of meeting a large portion of its energy needs. The system was designed to provide MBMC with 80% of its electrical needs, 95% of its steam demand, and 60% of its cooling.

Performance During Hurricane Katrina

In the early morning of August 29, 2005, Hurricane Katrina, a Category 3 tropical cyclone, made landfall on the Mississippi Gulf coast. The hurricane resulted in more than 1,200 deaths and over $108 billion in damage, making it the third deadliest and most costly storm to strike the United States to date. Hurricane Katrina also caused extensive power outages; 1.7 million in the Gulf states of Alabama, Mississippi, Louisiana and Texas, and 1.3 million in Florida from the initial landfall.

Mississippi Baptist Medical Center's onsite CHP system provided power and thermal energy to the hospital for more than four days following the storm. With no reliable grid power available and after implementing load shedding of around 1.2 MW of non-critical loads, the CHP system operated in island mode for 52 hours. **MBMC was the only hospital in the Jackson metro area to remain nearly 100% operational and was able to receive patients from other medical facilities, as well as serving as an operations center for emergency responders.** After the power grid stabilized, MBMC reconnected to the grid and resumed normal operation.

Quick Facts

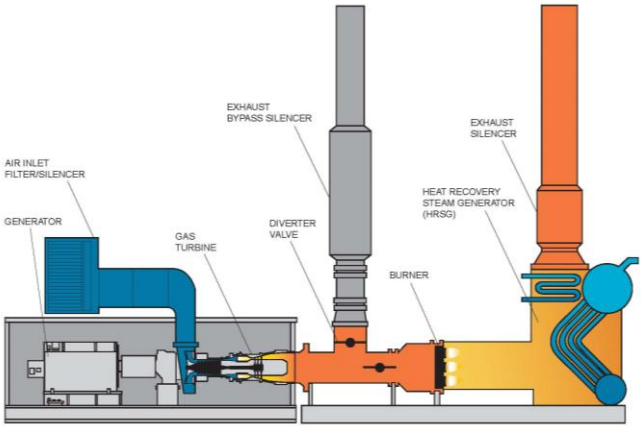
LOCATION: Jackson, Mississippi
MARKET SECTOR: Hospital
CHP IN OPERATION SINCE: 1991
GENERATING CAPACITY: 4.6 Megawatts (MW)
THERMAL OUTPUT: 30,000 lbs/hr steam
COOLING CAPACITY: 2,000 tons chilled water
EQUIPMENT: Solar Centaur Gas Turbine
Heat Recovery Steam Generator
Auxiliary Duct Burner
Two (2) Absorption Chillers
FUEL: Natural Gas
USE OF THERMAL ENERGY: Heating, domestic hot water, thermal cooling, and sterilization
TOTAL PROJECT COST: $4.2 million
ANNUAL SAVINGS: > $800,000
SIMPLE PAYBACK: 6.3 years
BENEFITS: Critical infrastructure operation during grid outage, utility cost savings and reduced greenhouse gas emissions

Mississippi Baptist Medical Center

Equipment and Configuration

The Solar Centaur gas combustion turbine installed at MBMC is rated to produce 4.6 MW of power with an exhaust flow rate of about 151,000 lbs/hr and an exhaust temperature of 950ºF. The exhaust is run through an ABCO waste heat recovery steam generator (HRSG) rated at 30,000 lbs/hr of steam at 125 psi. The amount of exhaust gas supplied from the turbine to the HRSG is regulated with a diverter valve based on steam requirements. If at any time the thermal energy recovered from the exhaust gas is insufficient to meet steam production needs, a 5.8 MMBTU duct burner fires to provide additional heat. The HRSG is equipped with an economizer that increases the overall system efficiency by heating incoming feed water with the boiler's waste heat. Two backup boilers are provided for use during turbine maintenance.

Steam supplied by the CHP system directly produces domestic water heating and building heat, and is also used in absorption chillers to produce chilled water. Two double-effect absorption chillers, a 1250-ton unit and a 750-ton unit, provide 60% of cooling requirements for the hospital. The double-effect absorption cycle uses a solution of water (refrigerant) and lithium bromide (absorbent), which are separated and recombined to provide the required cooling. By relying mainly on thermal driven cooling, the hospital reduces peak demand on the electric grid during the summer by approximately 1.2 MW. The remaining cooling demand is met using water-cooled electric centrifugal chillers.



Typical Gas Turbine CHP system configuration

Lessons to Share

An on-site CHP system offers significant annual energy cost savings compared to purchasing utilities from off-site. MBMC's CHP system demonstrated success in its early years, with an average net annual cost savings of $701,000 in the first years of operation, meeting expected payback. After contracting for natural gas at a rate of around $4.00 per MMBtu, the average annual cost savings rose to $737,879 for the years 2001-2004. Today, savings are over $800,000 per year, due to higher electricity prices and availability of lower priced natural gas.

Mississippi Baptist Medical Center's CHP system has proven its value in assuring power to this critical infrastructure facility during grid power outages. This success was the result of long-term planning, that has yielded immeasurable results in terms of energy assurance and continued operation.

For More Information

U.S. DOE SOUTHEAST COMBINED HEAT AND POWER TECHNICAL ASSISTANCE PARTNERSHIP

BAPTIST HEALTH SYSTEMS / MISSISSIPPI BAPTIST MEDICAL CENTER
https://www.baptistonline.org/locations/jackson

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