PACIFIC

U.S. DOE

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

The Ritz-Carlton Hotel, San Francisco

240-kW CHP System

Quick Facts

LOCATION: San Francisco, CA
MARKET SECTOR: Hospitality
FACILITY SIZE: 440,000 square feet
FACILITY PEAK LOAD: 1 megawatt (MW)
EQUIPMENT: Four 60-kW Capstone C60 microturbines and 120 RT double-effect absorption chiller from Carrier Corporation
FUEL: Natural gas
USE OF THERMAL ENERGY: Cooling
ENVIRONMENTAL BENEFITS:
TOTAL PROJECT COST: $1,012,640
ANNUAL ENERGY SAVINGS: $120,000
PAYBACK: 3 years with incentives
CHP IN OPERATION SINCE: 2005

Site Description

The Ritz-Carlton San Francisco is the city's highest-rated hotel, located in the upscale Nob Hill area. Owned by Host Hotels and Resorts, it includes 336 guest rooms plus a fitness center with an indoor pool, whirlpool and steam rooms. This trend-setting, five-star hotel was the first in the world to install the Capstone MicroTurbine-based UTC Power Company PureComfort™ 240 combined heating and power system to conserve energy.

Reasons for CHP

Host Hotels and Resorts strongly desired a highly efficient CHP system to offset peak energy demand, lower energy consumption and reduce energy expenses for the hotel. This resulted in the purchase of the PureComfort™ 240 combined heat and power (CHP) system from UTC Power Company. Former Director of Engineering John Traynor said, "Our philosophy is to reduce our carbon footprint and minimize our impact on our community and the environment. We're always looking to advance our sustainability profile and Capstone microturbines align with its industry-leading corporate standards for conservation."

- Reduce peak energy demand from utility
- Reduce energy expenses
- Decrease carbon footprint and advance corporate sustainability
- Increase system reliability with nominal maintenance

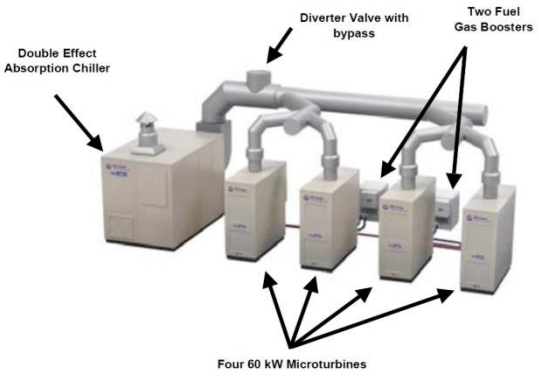
"We've always been at the forefront of sustainability, so it made sense to upgrade our traditional power to highly efficient microturbines to lower energy consumption. The big payback is the tremendous amount of heat that comes from the turbines. Heat recovery is key to reducing a hotel's energy consumption and costs."

– John Traynor, former Director of Engineering

CHP Equipment and Configuration

This system includes four 60-kW Capstone microturbines, running on natural gas, with the exhaust collected in a manifold and used to drive a 120-refrigeration tons (RT), double-effect chiller from Carrier Corporation. The absorption chiller produces chilled water and achieves approximately a 1.3 coefficient of performance (COP). The absorption chiller is oversized to 300 RT and currently delivers a maximum of 120 RT, giving the Ritz-Carlton the possibility of adding additional microturbines without the need to change the chiller. The peak electricity demand at the hotel is 1 MW and cooling requirements can reach almost 300 RT. The installed system provides 240 kW of power and 120 tons of cooling. The CHP configuration meets 70% of the hotel's cooling demand and allows the facility to shut off the 300 RT chiller for a portion of the year.

Schematic representing the Ritz-Carlton microturbine system



Courtesy of "NATIONAL ACCOUNT ENERGY ALLICANCE FINAL REPORT FOR THE FIELD SCALE TEST AND VERIFICATION OF A PURECOMFORT 240M COMBINED HEAT AND POWER SYSTEM AT THE RITZ CARLTON, SAN FRANCISCO, AUG 2007."

Under these operating conditions, when the CHP waste heat is fully utilized by the absorption chiller that displaces the existing electric chiller, the overall system efficiency can reach 70-80%. However, the hotel cooling demand is limited by the low demand during cooler months and night hours and by the interaction with a parallel, pre-existing electric chiller. This interaction suppressed CHP cooling because of a high minimum electric chiller output. During times when building cooling demand is high enough to require use of the electric chiller, the absorption chiller is not used. Therefore, the waste heat from the microturbines cannot be utilized, and the overall CHP system efficiency goes down. Due to the lower than anticipated thermal usage, the CHP efficiency is 54%.

System Economics

System costs

- Microturbines: $224,640
- Heat exchanger unit: $141,000
- Mechanical and electrical: $502,000
- Consulting: $16,000
- Project management: $77,000
- Other costs: $52,000
- Total: $1,012,640

The 240-kW microturbine system at the Ritz-Carlton saves enough electricity to power 200 average American households and reduces emissions of 800 tons of CO_2 per year – equivalent to removing 140 cars from California roads.

To mitigate costs, the Ritz-Carlton received a $150,000 rebate from California's Self Generation Incentive Program (SGIP) as well as a $500,000 grant from the Department of Energy for installing an advanced CHP demonstration project.

Lessons to Share

The following are items that could improve future installations in order to improve the overall process and system efficiency:

- The system could have been configured to provide simultaneous heating and cooling rather than just cooling alone. This would increase the thermal utilization and provide additional savings by offsetting expensive steam heating.
- Accurate predictions for thermal and electric demands are difficult for the hospitality industry, but are critical for achieving the maximum benefits of a CHP system.
- The challenges of CHP installations in urban environments can be overcome with proper planning and communication.

For More Information

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Date produced: 4/17/2015