



The Ritz-Carlton in San Francisco

240 kW microturbine/abs. chiller system

Project Profile

combined heat & power in a luxury hotel

Quick Facts

- Location:**
San Francisco, CA
- Capacity:**
PureComfort™ system from UTC
Power with 240-kW (four 60-kW
Capstone C-60 microturbines)
- Fuel:** Natural gas
- CHP system:**
120 RT double-effect absorption
chiller from Carrier Corp.
- Chiller performance:** >1.3 COP
- Noise:** <65dBa at 30 feet with sound
suppression system
- System Online:** October 2005
- Total Project Cost:** \$1,012,640
- Energy Cost Savings:**
Approximately \$120,000/year
- Estimated Payback Time:**
8 years (without incentives),
under 3 years with incentives
- Funding Sources:**
Host Hotels and Resorts, CA
Self-Generation Incentive
Program, and U.S. Department of
Energy

Project Overview

The Ritz-Carlton San Francisco is the city's highest-rated hotel, located in the upscale Nob Hill area. This luxury hotel, which is owned by the Host Hotels and Resorts, accommodates 336 guest rooms, Fitness Center, indoor pool, whirlpool, and steam rooms.

A plan to lower energy consumption and reduce energy expenses for the hotel resulted in the purchase of the PureComfort™ 240 Combined Cooling, Heating and Power (CCHP) package from UTC Power Company. 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 (a sister company from UTC Power). The peak electricity demand at the Ritz-Carlton is 1 MW and chilling requirements can reach almost 300 RT. The PureComfort™ solution provides 240 kW of power and 120 RT of chilling and is therefore able to run base-loaded for the entire year, resulting in near maximum overall efficiency for this type of system. The system is designed to satisfy the base-load chiller demand for the whole year and run the chiller in the most efficient mode. The PureComfort™ solution is able to achieve an overall fuel utilization of greater than 80%.

Originally, the hotel used a 300 RT electric chiller. This was relatively inefficient because it had to run 24 hours a day year-round, even though typical chilling needs were well below its capacity – only about 100 RT for eight months of the year. Operated in this way, the chiller accounted for about 20% of the hotel's total electricity use. The new configuration - using the absorption chiller - allows for shutting off the 300 RT chiller for eight months of the year. The overall net energy cost saving is estimated at \$120,000 per year.

Costs & Financial Incentives

- Turbines: \$224,640
- CHP unit: \$141,000
- Mechanical and electrical: \$502,000
- Consulting: \$16,000
- Project management: \$77,000
- Other costs: \$52,000, **Total: \$1,012,640**

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



The picture to the left shows the four C-60 Capstone microturbines. 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.

To ensure the luxurious ambiance for guests of the five-star hotel, CHP system noise and visibility was a major issue. The picture to the right shows the view from the cocktail lounge towards the microturbine system. The system is placed behind the white wall and does not affect the guests' view.



The 240 kW
 “Pure
 Comfort”
 microturbine
 system at the
 Ritz-Carlton
 saves enough
 electricity to
 power 200
 average
 American
 households.

The CHP
 system
 installed at The
 Ritz-Carlton
 reduces
 emissions of
 800 tons of
 CO₂ per year.
 This is
 equivalent to
 removing 140
 cars from
 California
 roads.

UTC Power PureComfort™ System

The PureComfort™ 240M microturbine-based CHP solution is one of three available standard packages from UTC Power. Other available packages include the 300M and 360M systems, with 300 or 360 kW of power output rating. Each system consists of a double-effect absorption chiller/heater from Carrier Corporation and four to six 60-kW microturbines. This standardized approach reduces system costs and results in an average overall thermal efficiency of greater than 80%. The relatively quiet system (65dBa @ 30 feet with sound suppression system) consists of the core microturbine units with height of 83”, width of 30”, length of 77”, and weight of 1,700 lb., as well as the chiller with a height of 82”, width of 79”, length of 145”, and weight of 18,544 lbs. The system emits less than 0.49lb/MWh_{electricity} of NOx.

PureComfort™ 240 System	Hot Day (ARI Cond.)	ISO Day (59° F.)	Cold Day (32° F.)
Net Power [kW]	193	227	231
Cooling Output [RT]	124	142	
Heating Output [MBh]			1,100
Net System Effic. [% LHV]	80	91	68

Typical performance values for the 240M system under different conditions are shown in the table to the left.

Note: ARI conditions are 95° F. outdoor temperature, 44° F. chilled water output, and 85° F. condensed water input

Further information can be found at
 The Ritz-Carlton, San Francisco:
http://www.ritzcarlton.com/hotels/san_francisco
 UTC Power: <http://www.utcpower.com>
 Microturbines: www.capstoneturbine.com
 Carrier Corporation (absorption chiller):
<http://www.corp.carrier.com>
 PRAC: www.chpcenterpr.org

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