PACIFIC

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

Transamerica Pyramid Building

1-MW CHP System

Quick Facts

LOCATION: San Francisco, CA
MARKET SECTOR: High-rise Development
FACILITY SIZE: 600,000 square feet
FACILITY PEAK LOAD: 2.1 MW
EQUIPMENT: 1 MW (two 500-kw Waukesha VGF L36GSID natural gas-fired v-12 engine systems, 800 HP each), one 300-ton absorption chiller
FUEL: Natural gas
USE OF THERMAL ENERGY: Space heating, domestic hot water and chilled water
CHP TOTAL EFFICIENCY: 64-72%
ENVIRONMENTAL BENEFITS: Reduced carbon footprint
TOTAL PROJECT COST: $4.6 million
REBATES: $600,000 (California's Self-Generation Incentive Program)
ANNUAL ENERGY SAVINGS: $700,000-$800,000
PAYBACK: 5 years
CHP IN OPERATION SINCE: 2009

Site Description

The 48-story Transamerica Pyramid Building is the tallest and most recognizable building in the San Francisco skyline. It was built in 1972 on the former location of the historic Montgomery Block. Today, the building houses offices and retail space but is no longer headquarters of Transamerica Corporation for which the building is named.

Reasons for CHP

The addition of the on-site combined cooling, heating and power (CHP) system was initially driven by Transamerica's desire to eliminate need for city steam and reduce electricity demand from the local utility. Using less electric power during peak times enables the building to buy power at a lower average rate. The system is responsible for generating approximately 70% of normal daytime electricity consumption and 100% of its heating and domestic hot water needs.

- Increased cost efficiency
- Increased energy efficiency
- Improved energy reliability for tenant's critical infrastructure

CHP Equipment & Operation

Installed in 2007, the Transamerica CHP system is comprised of two 500-kW Waukesha reciprocating engines paired with a 300-ton absorption chiller. The system is maintained by GI Energy, ABLE Engineering Services and is owned and operated by Transamerica Pyramid Properties, LLC.

> ***"The economic and environmental benefits of installing the CHP system were compelling. The system is primarily responsible for the Pyramid's certification as prestigious LEED Platinum."***
>
> - ***Mark Novack, Real Estate Portfolio Manager, Aegon USA***

Approximately half of the recovered heat energy from the engines goes to power the York absorption chiller. The York unit has a 300-ton capacity operating on the heated jacket water and recovered waste heat from the exhaust of the engines.

Transamerica operates the CHP system according to two unique schedules during the workweek: normal business hours Monday – Friday, 6:00 a.m. to 6:00 p.m., and a weekday evening schedule. The CHP system does not operate on weekends due to a lack of workers to oversee the system. During normal business hours, the system operates at full capacity with both engines online providing approximately 1 MW for the building's electrical loads. The absorption chiller also runs during this time and supplies a portion of the building's cooling requirements. A chilled water plant, composed of three additional electric chillers (total of 1,160 tons), supplies the remaining building cooling needs. Heat recovery off the engines supports 100% of the building's space heating and hot water requirements. The system produces a combined electrical and thermal efficiency of approximately 72% during the day. The weekday evening schedule entails running only one engine in conjunction with the absorption chiller. The off-hours load drops down to only 400 kW. The engine runs at part-load capacity of 200-300 kW output in order to meet a utility requirement stating that Transamerica must always draw at least 100 kW from the grid. The absorption chiller is able to meet 100% of the building's evening cooling demand, thereby allowing the electric chillers to be turned off at night. Night time overall system efficiency is approximately 64%.

Transamerica does not push power back to the utility grid as part of an agreement with the local utility provider. The installation is required by interconnection agreement to power down upon grid failure, but could in the future be upgraded for blackout ride-through capability.

As local utility electrical costs continue to increase with focus on the rising cost of peak demand operations, the reliability of the CHP system is essential. Natural gas prices are at historic lows and play a major role in how the building operates. For example, all major shutdowns are scheduled during off-peak hours and during winter months when peak demand charges are not as high. They also are aware that they are not to bring large electrical loads online during the peak demand hours. If an engine does trip off or shutdown, on-site engineering staff will attempt to bring the unit back online as soon as possible. Operational measures like this are driven by the rising cost of peak demand charges.

Lessons To Share

Locating Transamerica's CHP system in the basement required installing chilled-water cooling coil units to remove surplus engine heat from the basement rooms. The city planning department elected to not install a third cooling tower at street level in an effort to preserve the building's historic features. Space to locate the absorption chiller close to the engine units was unavailable, so instead, heat is transferred from the engine unit via the jacket water where it travels the perimeter of the underground parking unit to the York chiller located across the building and one floor away. Overall, the on-site CHP system is a very successful in operations and reliability, but like most complicated projects, there were a few difficult lessons learned.

- The CHP feasibility study was inaccurate in hours of operation, which affected the project ROI.
- Components of the system were incapable of operating under the high pressures and temperatures required. Replacement parts and modifications negatively affected ROI.
- A more efficient jacket water (byproduct hot water) piping system connecting the absorber chiller and heat exchangers could have been designed.
- On-site engineering staff should have been properly trained to become operators of the CHP system.

For More Information

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