



One Market Plaza

1.5 MW CHP System

Project Profile

combined heat & power in a commercial complex

Quick Facts

Location: San Francisco, California

Capacity: 1.5 MW (three 500-kW Waukesha VGF L36GSID natural gas-fired engine systems)

System Online: 2003

Fuel: Natural gas

System Efficiency: Estimated 62% overall efficiency

Power Output: 30% of electricity and 85% of steam demand

State Rebate: 30% of capital costs

Expected Payback Time: 5 to 6 years (with incentives)

Funding Sources:

Financed capital (by Equity Office Properties Trust)

California Public Utilities

Commission (CPUC)

Pacific Gas and Electric (PG&E)

Project Overview

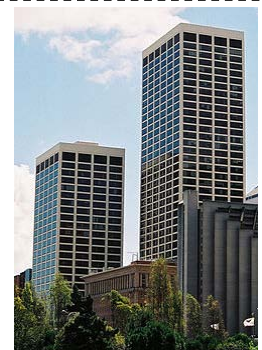
One Market Plaza, owned by Paramount Group and Morgan Stanley Real Estate, is located in the financial district of San Francisco, California. Built in 1976, the complex consists of two high-rise towers, a six-story annex, and retail and office space that total nearly 1.5 million square feet. With changes in energy markets in California and advances in technology, distributed generation became a viable option for commercial properties in the early 2000s. In addition to reducing demand for electricity from the utility by using less power during peak times, properties that produce their own power can sometimes then also procure their remaining needs from the grid at a less expensive rate.

A 1.5 MW combined heat and power (CHP) system was installed in 2003 at One Market by Northern Power Systems. The system consists of three 500-kW Waukesha gas engines with waste heat recovery, producing 1800 kg of steam per hour. The waste heat from the engine cooling water and the exhaust is converted into steam for heating the building.

The system operates at near capacity for maximum efficiency and provides approximately 30% of the complex's annual electricity demand. The captured heat displaces 85% of the natural gas needed for steam boilers. The installation is the first of its kind to in a metropolitan area and is one of the largest to be interconnected to the grid in the US. The project faced initial hurdles because of downtown San Francisco's "network" grid topology, but once safety was assured, the project was given approval. The system is also upgraded to serve as backup power during blackouts. The property at One Market including the CHP plant is owned and managed by Paramount Group, Inc. and is maintained by Endurant Energy.

Financial Incentives

In order to qualify for the California Public Utility Commission's (CPUC) Self-Generating Incentive Program, which provided for 30% of the capital costs, the system needs to provide a combined electrical and thermal efficiency of 62%. The engine itself runs at 32% efficiency in converting to electricity. Another 30% was achieved through the recovery of the heat from the exhaust, for an overall efficiency of operation of about 62%.



One Market Plaza

500 kW Waukesha VGF generation set



Heat Recovery Steam Generator

Interconnection and Rule 21

At One Market Plaza, an Intertie protection relay is used to regulate abnormal voltage and frequency of the power flows from the generators to the building's electrical network. The system also helps to prevent back feeding into the city's grid. Utilities like PG&E have taken extensive measures to prevent this as it would pose a risk to both the system itself and anyone working on it when the utility grid is down. The installation complies with the CPUC's Rule 21, which specifies interconnection standards for distributed generation. The rule is not limited to CHP systems but also includes solar, wind, and hydro systems that work in parallel with the existing grid. Although many states now have interconnection standards, they have in some cases been problematic due to open interpretation.

Intertie M-3520 regulator



Installation Challenges

After reviewing the energy needs, economics, existing electrical and mechanical systems of the complex, engineers from Northern Power Systems decided that One Market Plaza was a good site for distributed generation. However, due to the lack of a centralized plant and the lack of physical space, one of the main challenges was determining the location for housing the generators. Working with facility managers who were aware of the needs and outputs of CHP systems, the engineers considered various options. Initially, the team had procured adjacent parking spaces for accommodating the equipment but due to losses in rental revenues, it was decided that a room in the basement that formerly housed backup generators was better for the CHP system. In order to properly accommodate all the auxiliary equipment, the heat-recovery steam generators (HRSG) and the gas metering apparatus were housed in rooms above the gen-sets. In addition, various engineering requirements were met for ventilation, accessibility, and for interfacing with the existing electrical network – involving some challenges but that were ultimately overcome.

Further information can be found at

Paramount Group Inc.:

<http://www.paramount-group.com/properties/onemarket/>

Endurant Energy: <http://www.endurantenergy.com>

PRAC: www.chpcenterpr.org

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At One Market, the incentives pay for 30% of the capital costs as long as the system provides an overall electrical and thermal efficiency of 62%.

“The engines run at approximately 32% efficiency. The other 30% is obtained through recovering the heat of the exhaust and converting it into usable thermal energy.”

- Greg Carey,
Vice President of
Service for
Endurant Energy

