



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:**
 - Equity Office
 - California Public Utilities Commission (CPUC)
 - Pacific Gas and Electric (PG&E)

Project Overview

One Market Plaza, managed by Equity Office Properties Trust, 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 space that total nearly 1.5 million square feet of office space. Following the deregulation of energy markets in California, distributed generation became a viable option for commercial properties. As a result, Equity Office created a subsidiary, On-Site Energy Providers, to install cogeneration systems in their buildings. In addition to reducing demand for electricity from the utility, by using less power during peak times, Equity Office is also able to buy power from the grid at a less expensive rate.

In 2003, a 1.5 MW combined heat and power (CHP) system was installed at One Market by Northern Power Systems. The system consists of three 500-kW Waukesha gas engines with waste heat recovery, which produces 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 at One Market 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. Initially, Pacific Gas and Electric (PG&E) did not allow for the operation of an onsite generator in the downtown San Francisco area due to concerns of risks associated with operating with the "network" grid topology, but once safety could be assured, the project was given approval. The system is also upgraded to serve as backup power during blackouts.

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.

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, the engineers decided that One Market Plaza was an ideal 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 at Northern Power 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 amenable for the CHP system. Nevertheless, 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.

Further information can be found at

One Market Plaza:

<http://www.emporis.com/en/wm/cx/?id=105824>

Northern Power Systems, Inc:

<http://www.northernpower.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.”

*Chach Curtis,
Vice President of
onsite generation
for Northern
Power Systems
Inc.*

