

# Cupertino Garage: Demand-Control Ventilation System Pays for Itself with Energy Savings

## Summary

One of the greatest sources of energy consumption – and consequent operational costs – for an enclosed, commercial garage is the mechanical system that ventilates it. Ventilation can account for more than 30 percent of a property's total, annual energy bill, consuming upwards of 400,000-kilowatt hours (kWh) per year. Some 35 percent of U.S. garages rely on "on/off" carbon-monoxide (CO) sensor systems, which activate fan motors only when increased CO levels require it. California, Oregon, and Washington have adopted stricter requirements, requiring continuous ventilation even when a CO system is in place, thereby rendering type of "on/off" ventilation strategy out of code. Other states are expected to follow suit in the next few years.

When Sand Hill Property Company built a stand-alone, 1,370-space garage in Cupertino, Calif., in 2015, they decided to invest up front in cutting-edge garage ventilation control technology. The garage's enclosed portion required a sizable mechanical ventilation system that would consume 527,000 kWh per year – some \$108,000 annually – to run on a 24/7 basis. The developer hired Nagle Energy Solutions to design and install its digital, "variable flow" demand-control ventilation (DCV) system. The system keeps garage fans running continuously, varying motor speeds based on CO concentrations in the garage. The system continuously monitors energy consumption. At its



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present rate, it will reduce kWh consumption and peak kW demand by 500,600 kWh and 58.6 kW, respectively. Its projected annual utility fee for ventilation is \$5,400 – representing an annual cost savings of \$102,600. Besides meeting the stricter energy-efficiency and health and safety standards, the system's \$117, 200 installation cost will pay for itself in just 13.7 months – and yield a \$1.4 million energy savings during its 15-year lifespan.

**Project Goals:**

- Meet stricter state and local requirements for continuous ventilation
- Save energy costs annually by installing a state-of-the-art system during construction

**Challenges/Obstacles Overcome:**

- The need to limit the energy consumption of a sizable garage ventilation system
- The requirement to meet minimum and maximum ventilation rates, per the California Energy Code (Title 24)
- The developer’s objective to incorporate building automation/management technology in the garage

**Return on Investment**

Based on a total installation cost of \$117,200, the system’s net present value (NPV) exceeds \$1.18 million, and it paid for itself in just 13.7 months. It will provide minimum cash inflow (from the savings it generates) exceeding \$1.4 million throughout its 15-year lifespan.

**Metrics Used to Track Progress Towards Achieving Original Goals/Objectives**

- Continuous power (kW) measurements via the NES system

Consumption	Without Controls	With NES TR50 System	\$ Savings	% Savings
Total kWh	\$ 526,904	\$ 26,345	\$ 500,559	97.4%
Total Cost @ \$0.205/kWh	\$ 108,015	\$ 5,401	\$ 102,615	97.4%
Total kW Demand	\$ 80.15	\$ 1.56	\$ 58.59	97.4%

- Annual kWh consumption and peak kW demand reduced by 500,600 kWh and 58.6 kW, respectively.



**Conditions included a tight site with adjacent buildings, granular soils, and construction below the water table.**

**Project Team:**

- Sand Hill Property Company, owner
- Copello Electric
- South Bay Construction
- Trillo Mechanical

**Project Manager:**

Frank Nagle, Nagle Energy Solutions  
 (650) 854-1992  
 frank@nagle-energy.com  
 www.nagle-energy.com