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 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

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Without Controls</th>
<th>With NES TR50 System</th>
<th>$ Savings</th>
<th>% Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total kWh</td>
<td>$ 526,904</td>
<td>$ 26,345</td>
<td>$ 500,559</td>
<td>97.4%</td>
</tr>
<tr>
<td>Total Cost @ $0.205/kWh</td>
<td>$ 108,015</td>
<td>$ 5,401</td>
<td>$ 102,615</td>
<td>97.4%</td>
</tr>
<tr>
<td>Total kW Demand</td>
<td>$ 80.15</td>
<td>1.56</td>
<td>58.59</td>
<td>97.4%</td>
</tr>
</tbody>
</table>

- 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

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