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How To Save Money And Energy With Garage Ventilation Upgrades

by **Suzannah Rubinstein** on April 7, 2016 in **how to**, **influencer**, **technology**

About the author: *Frank Nagle is the founding principal of NES, which manufactures, distributes and installs an innovative, energy saving ventilation control system for commercial garages.*

He is an active member of the International Parking Institute (IPI) and Green Parking Council (GPC), serving on the IPI's Sustainability Committee and the GPC's Sustainable Technologies Committee, for which he helped craft the Green Garage Certification Standard for garage ventilation. In 2011, he served on the California Energy Commission (CEC) task force that revised California's Energy Code.

Lighting retrofits (upgrading your lighting system) in commercial garages have become the trendy choice for saving energy. And for good reason, since lighting retrofits provide an effective way to reduce energy consumption. That said, changing a few light bulbs can pale in comparison to the energy (and cost) savings retrofitting a garage ventilation system generates.

Is Your Garage Ventilation System Wasting Money?

All enclosed parking garages in North America have to meet ventilation standards. These standards are established by the International Mechanical Code (IMC) and the American Society of Heating, Refrigeration and Air Conditioning (ASHRAE).

Both the IMC and the ASHRAE agree garage ventilation systems must always run during garage operating hours. The only time it's not required is when carbon monoxide (CO) sensor-based demand-controlled ventilation (DCV) systems are used.

For commercial garage owners meeting the IMC/ASHRAE requirements and NOT using sensor-based DCV, **as much as two thirds of the garage's monthly/annual energy bill is going towards ventilating the garage**. And the remaining one third is spent on lighting, elevators, and other sources of power consumption.

There is a big opportunity to reduce energy and costs by upgrading your ventilation system.

Buildings Can Spend up to 40% Of The Property's Total Energy Bill On Ventilating Enclosed Garages

It's not uncommon for a large office building or mixed-use development to spend more than 40% of the property's total annual energy bill on garage ventilation.

For example, let's look at the Main Street Cupertino development in Cupertino, CA.

Calculations during construction of their stand-alone 1,370-space garage revealed that, with no means of control and running on a 24/7 basis, the garage ventilation system would consume approximately 527,000 kWh per year. The system would have a correlating peak kW demand greater than 60 kW.

At a utility rate of $0.205/kWh, **the property owner's annual cost to ventilate the garage would be slightly more than $108,000 (or $9,000 per month).**

Fortunately, Garage DCV technology has made huge progress in the past few years, converging with stricter energy efficiency and health/safety standards to provide a real means to generate energy savings in a cost-effective manner.

The 2 Main Drawbacks of Incumbent Technology

Until recently, the owner of Main Street Cupertino would have installed an "on/off" CO sensor system in its garage. "On/off" systems switch "on" garage fan motors to ventilate the a garage only when increased CO levels require it. Otherwise, garage-fan motors are left in the "off" mode.

In the past, experts have credited "on/off" systems with capturing an average energy savings of 90%.

On average, garage fan motors wired to an “on/off” DCV system remained in the “off” mode 90% of the time a garage is occupied.

But beyond answering the fundamental question of how energy that’s not being consumed can be reduced – the motor is off, after all – deployment of “on/off” CO systems creates as many issues as it does solutions.

1. You Might Not Be Alerted When DCV Systems Fail

The first issue is that, due to a somewhat primitive design, a good portion of “on/off” CO sensor systems installed throughout the years “fail off.” This means they don’t notify property managers and/or engineers when they stop working properly.

In California, for example, an audit showed the failure rate of older “on/off” systems to be 90%.

The unintended consequence has been to create health and safety risks for commercial garage

workers and visitors alike, as well as for those who live and/or work above a below-grade parking facility. CO concentrations can rise to unhealthy levels in these commercial garages without anyone being aware of the issue.

“On/off” CO sensor systems also run against the mechanical design of properties with garages below office, retail or residential buildings.

HVAC equipment (exhaust and supply motor/fan units, ventilation shafts, etc.) in these properties are installed to let the substructure maintain negative to neutral air pressure in relation to the space(s) above. Why?

- It prevents the property’s primary HVAC system (the one heating and cooling the office/living/shopping spaces above the garage) from having to work beyond its design capacity and ventilate the garage, too.

  Anytime you’ve tried to open the door of an office building and had to pull hard due to a suction-like feel, that’s what engineers refer to as the “stack effect.” The property’s primary HVAC system is “sucking up” the available air in the garage and essentially “sealing” the building.

- It enables potentially harmful gases (not just CO, but NO2, radon and other fumes) to be sucked up through elevator and ventilations shafts into the building. This creates an unnecessary health and safety risk for building occupants and visitors.

2. DCV Systems Are Subject To Demand Charges

“On/off” CO sensor systems have peak demand charges due to most regional utilities since the time

they typically switch on garage fan motors is in the middle of peak demand time (roughly from noon to 6 p.m., depending on the region).

That's when most people leave work, and it's when cars emit the highest concentration(s) of CO. This is because it takes five minutes before a car's catalytic converter has warmed up sufficiently to be effective.

Taking into consideration the time of day the fans cycle on and the correlating peak kW demand charges incurred as a result, **the actual monetary savings captured by an "on/off" system typically falls in the range of 60 to 70 percent**

New, Stricter Standards Create A Big Opportunity For Savings

Due to the drawbacks presented by "on/off" CO sensor systems, an increasing number of states and municipalities are revising their energy code requirements for ventilating commercial garages.

States and municipalities are emphasizing health and safety while recognizing innovation to further the ability of control systems to save energy while improving operational efficiencies.

States such as California, Oregon and Washington now require continuous ventilation in the garage *even when* a CO system is in place, thereby rendering "on/off" ventilation strategies out of code.

New And Improved DCV Systems Eliminate Previous Drawbacks

A proven way to meet the challenge is a "variable flow" DCV system. The system is designed to keep the garage fans running continuously and "vary" motor speeds based on CO concentrations in the garage.

Variable flow systems use Variable Frequency Drive (VFD) technology for a control strategy that:

1. Enables the motors to run continuously at low speeds – when CO levels are minimal – while adhering to code and design ventilation rate requirements.
2. Creates a reservoir of fresh air in the garage so that CO concentrations are prevented from exceeding pre-defined sensor trip points for an extended period of time. This minimizes the number of times the motor(s) must ramp to "flush out" the garage.

3. Incrementally increases fan motor speed(s) (i.e., the ventilation rate) whenever CO concentrations exceed pre-set CO trip points. Said another way, the motors don't instantaneously ramp from low to high speed(s), but rise proportionally (in speed) to counter CO concentrations with an equivalent amount of fresh air.

The result enables property owners to continuously ventilate their garages in an exceedingly energy efficient manner while ensuring the health and safety of building occupants and visitors.

This brings us back to Main Street Cupertino, where Nagle Energy Solutions (NES) installed its innovative, digital garage ventilation control system.

Data logging after the installation showed that, with the NES system controlling continuous (24/7) ventilation of the garage, annual kWh consumption and peak kW demand were reduced by 500,600 kWh and 58.6 kW, respectively.

As a result, the property owner's annual utility fee for ventilating the garage is limited to roughly $5,400 – representing an annual cost savings amounting to $102,600.

Based on a total installation and commissioning cost of roughly $117,200, the NES system's net present value (NPV) exceeds $1.18 million, and it pays for itself in just 13.7 months.

The NES system will provide minimum cash inflow (from the savings it generates) exceeding $1.4 million throughout its 15-year lifespan.

Clearly, the benefits that came with recent innovations in garage ventilation are too compelling to be ignored.