Garage DCV System Case Study: Pacific Renaissance Plaza, Oakland

NES increases fan runtimes by 317% after replacing faulty "on/off" CO sensor system – Reduces kW demand by 95% and annual consumption 208,000 kWh

The Property

Pacific Renaissance Plaza is located in the heart of Oakland's thriving Chinatown. It is a multi-story residential and commercial complex housing a large, below-grade parking garage and featuring two levels of shops and restaurants. The Plaza is also home to the Oakland Asian Cultural Center and the Asian branch of the Oakland Public Library.

The garage provides three levels of underground parking, each measuring 100,000 square feet, for a total of 300,000 square feet. The garage can accommodate a total of 900 vehicles, which it often does, as it routinely experiences heavy, daily and weekend traffic volume.

Pacific Renaissance Plaza, Oakland

"We reduced our annual operating expenses by more than $42,800 while ensuring the health and safety of building staff, tenants and visitors. The net present value (NPV) on a project cost of $119,000 exceeds $409,000 and the minimum cash inflow it provides surpasses $525,000 throughout the 15-year life of the system. That's money well spent."

Sylvia Rampi, General Manager

The Energy Savings Challenge

NES confronted two, key factors in project designing the retrofit of the Pacific Renaissance Plaza garage.

The first is the considerable amount of total horsepower powering the property's garage ventilation system, which is comprised of 10 garage-fan motors possessing a total of 375.5-HP, including one (1), 125-HP and three (3) 75-HP exhaust fan motors and smaller motors of disparate sizes.

The property was constructed when the maximum ventilation rate for commercial garages (as set by the International Mechanical Code) was 1.5 cubic feet per minute (cfm) per square foot. Today, due to catalytic converter technology, it's half that – .75 cfm/sq. ft. That means that, as it's originally designed, the Pacific Renaissance Plaza's garage ventilation system wastes a lot of energy.

The second key factor was the fact that an "on/off" carbon monoxide (CO) sensor system installed in the early '90s to save energy had been failing for quite some time – without anyone recognizing the severity of the problem.

"On/off" CO sensor systems leave garage-fan motors in the "off" mode until tripped on by high CO levels. For the past five-plus years, the CO sensors in the Pacific Renaissance Plaza garage had been emitting "fault" signals, which are designed to frequently trip on the garage fan motors and thereby notify building engineering the system requires maintenance, e.g., recalibrating the CO sensors.

Energy Use	Pre Installation	Post Installation	$ Savings	% Savings
Total kWh	254,094	43,777	208,242	82.0%
Total Cost @ $0.20/kWh	$ 52,252	$ 9,002	$ 42,823	82.0%
Total kW Demand	295.6	7.9	281.5	95.2%

Unfortunately, when the motors ramped up – a very loud occurrence given so much horsepower cranking on simultaneously – it was interpreted to mean the CO system was operating in the manner it should, i.e., dissipating high CO levels. Yet the amount of traffic, hence CO levels, in the garage often did not warrant it.

The constant powering up and down of the garage fan ultimately resulted in mechanical issues with the 125-HP motor, which was shut down two-plus years ago.

Even then, power measurements and data logging undertaken in December 2013 determined the fault signals resulted in the remaining fan motors consuming an average of 254,094 kWh per year. Peak kilowatt (kW) demand amounted to 295.64 kW. As such, at a utility rate of $0.2056/kWh, Pacific Renaissance Plaza management was spending $52,252 a year to ventilate its garage – all while believing the "on/off" CO sensor system was saving significant energy costs.

The NES Solution

NES installed an innovative, sensor-based, demand-control ventilation (DCV) system for commercial garages based on its ability to manage significant increases in fan runtime(s) while significantly reducing kWh and peak kW demand consumption.

Pacific Renaissance Plaza Summary	
Discount Rate	5.00%
Inflation Rate (2.4% over last 10 years)	2.40%
Annual Savings	$ 42,823
Cost of Project	$ 119,150
Payback Period In Months	33.39
NPV net of investment	$ 409,537
Minimum cash inflow	$ 523,195

The garage DCV system deployed by NES utilizes a proprietary, smart-control logic that detects and measures vehicle fumes in the space and then modulates fan speeds to prevent CO levels from exceeding 10 parts per million (ppm) for extended periods of time. In doing so, the NES system better ensures (vs. "on/off") the health and safety of building occupants and visitors by continually ventilating the garage while maximizing energy savings – up to 97%.

The Results

Two (2) weeks of post-installation data logging showed exceptional results. NES set the garage fans to run continuously during garage operating hours – 15 hours per day Sunday through Monday and 16 hours per day on Fridays and Saturdays. That's represents a 317% increase in total fan runtime, accounting for 367.5 total horsepower. (Our ventilation strategy eliminated four (4), 2-HP supply motors from the final equation, as we relied on the total horsepower of the exhaust fans to draw supply air into the garage via the supply fan ventilations shafts. Additionally, the 125-HP motor was back online by the time we commissioned the garage DCV system.)

		Baseline (From data logging and kW measurements)						Post Installation Usage (Measured)			
HP	# Fans	Total HP	Run Time	Utility Rate	kW	kWh	Annual Utility Cost	Run Time	kW	kWh	Annual Utility Cost
125	1	125.0	893	$ 0.20564	78.20	69,856	$ 14,365	5,579	2.41	13,460.38	$ 2,768
75.0	3	225.0	2,680	$ 0.20564	197.00	173,399	$ 35,658	5,579	4.91	27,417	$ 5,638
2.0	4	8.0	1,870	$ 0.20564	6.30	2,076	$ 427	5,579	-	-	$ -
7.5	1	7.5	465	$ 0.20564	7.17	3,337	$ 686	5,579	0.29	1,595	$ 328
10	1	10.0	778	$ 0.20564	6.97	5,427	$ 1,116	5,579	0.23	1,305	$ 268
	10	375.5	6,687		295.64	254,094	$ 52,252	27,896	7.85	43,777	$ 9,002
								317.19% increase in run time			
						21,175	$ 4,354 /mth				$ 750 /mth

The garage DCV system achieved an 82% kWh savings and a 95% reduction in peak kW demand, reducing overall energy consumption by 208,200 kWh and peak kW demand by 281.5 kW. From a cost savings standpoint, the property's energy bill dropped from $52,250 to $9,000 a year – or from $4,350 to just $750 per month. That amounts to a repeated, annual cost savings of $42,823 for the 15-year life of the system.

Pacific Gas & Electric rebated nearly $30,000 the energy savings captured. The system pays for itself in just 33.4 months.

About Nagle Energy Solutions (NES)

Nagle Energy Solutions, LLC (www.nagle-energy.com) is a manufacturer, distributor and installer of an innovative demand-control ventilation (DCV) system for commercial garages that reduces energy consumption by an average of 93% – with quantifiable savings as high as 97% achieved. NES digital controllers and peripherals are scalable and conform to several building management system (BMS) and energy management system (EMS) communication platforms, as well as monitor / report on energy consumption/savings.

Nagle Energy Solutions Contact: Frank Nagle (650) 854-1992 or frank@nagle-energy.com.