

Saving Energy via Pneumatic HVAC Retrofit for Existing Government Buildings in the County of Santa Clara

Retrofit of pneumatic HVAC system cost 20% of conventional solution, required 95% less time to install, received PG&E Auto Demand-Response incentive payment, and saved 7% of total building electrical consumption.

Addendum to Case Study: “Implementing Smart Grid Auto-Demand Response for Existing Government Buildings in the County of Santa Clara”

Santa Clara County retrofitted the pneumatic HVAC system at their 300,000 sq-ft Julian St. buildings primarily to enable Auto-Demand Response (ADR). The County felt ADR was the “low hanging fruit” since it was easily quantifiable and PG&E grants incentives to defray the initial cost of retrofit.

However, after the Wireless Pneumatic Thermostat (WPT) system was installed in March 2009, the county realized *significant additional savings* in energy and maintenance costs above and beyond the original planned ADR benefits.

ENERGY SAVINGS

Compared to the same period in the prior year, an average 7% reduction or 227,327 kWh, in electrical energy consumption was observed in the seven months after the WPT system was installed. The estimated annualized savings are \$42,000, or \$0.12 per sq-ft per year (at \$0.12 cost per kWh). The County believes these savings were derived from two areas:

- a) Improved temperature setpoint management – the WPT system enabled global setpoint control which prevented inappropriate user temperature settings.
- b) Identification and repair of mechanical deficiencies, and Continuous Commissioning activities which used data and diagnostics provided by the Wireless Pneumatic Thermostat.

The repair activities took place three months after initial installation. Analysis of data and diagnostics provided by the WPT system (setpoint and ambient temperature and branch pressure) uncovered deficiencies in mechanical equipment (VAV boxes, pneumatic compressors, fans, reset velocity controllers etc.) which likely degraded in performance since their original commissioning. The county corrected these deficiencies, and over the subsequent three months, energy savings increased an additional 2-4%.

	2008		2009		Delta 2009 vs. 2008	
	kWh used	days in month	kWh used	days in month	% Savings	kWh saved
Apr	564,800	32	505,239	29	1.3%	6,839
May	583,600	31	546,563	30	3.3%	18,211
Jun	626,000	31	590,818	31	6.0%	34,047
Jul	606,000	29	578,392	30	8.4%	48,505
Aug	600,000	30	592,785	29	-2.2%	-13,226
Sep	620,400	32	561,241	32	10.5%	55,462
Oct	513,200	28	456,622	29	16.4%	77,490

MAINTENANCE COST SAVINGS

In addition to energy savings, the county also realized significant maintenance cost savings. In the prior year, an average on \$25,000 per month was spent on mechanical maintenance activity. However, since the WPT system was installed, the average spend has dropped to \$12,000 per month due to improved diagnostics and problem identification. Conversely, the data also helped to avoid unnecessary maintenance efforts. The annualized savings from maintenance cost reduction is \$156,000 or \$0.52 per square foot per year.

DEMAND RESPONSE SAVINGS

The county buildings are enrolled in Demand Response program with PG&E where during peak periods, electricity rates are increased significantly. By using the WPT system, the county was able to temporarily adjust temperature setpoints and reduce energy consumption during the peak periods. Based on analytical models, 10,080 kWh are curtailed during the peak periods annually, at an average cost of \$0.70 per kWh. This translates into \$7,450 annual savings, or \$0.02 per sq-ft per year. (Assumes 12 events per year, 4 hours each, 0.6kW shed per thermostat, 350 thermostats).

PAYBACK CALCULATION

Based purely on savings from energy, maintenance, and demand response, the payback period for the WPT retrofit is estimated at 16 months, without any utility incentive. Utility incentives would reduce the payback period.