Opto Generic Devices V-HVAC, Inc. technology was analyzed in a recent NYSERDA sponsored study. The results of that study are summarized in the following pages.

The savings data in the report are so encouraging, and the market for fractional horsepower motor upgrades is so significant similar to the findings of many other studies of our technology, that OGD V-HVACs line of products are eligible for NYSERDA incentives through four separate programs. These programs are NYSERDAs Program Opportunity Notices (PONs) # 855 Commercial and Industrial Performance Program, # 853 Smart Equipment Choices, # 835 Peak Load Reduction, and # 869 New Construction / Green Buildings Program.

We are very pleased with the results of this *Independent Study* and are excited about the impact our products will have on the HVAC and Energy Industries. Following is the information presented on the cover page of the Study and subsequent to that are excerpts from the study. In addition to these excerpts, we have prepared a tabular representation of the study results which provide savings and payback data for different sizes of motors and various project sizes.

Unit Ventilator VSD Energy Analysis

Prepared for

The Olde Draper Centre
7 Draper Avenue
Rotterdam. New York

Sponsored by

New York State Energy Research & Development Authority
17 Columbia Circle
Albany, New York 12203-6399

Prepared by

EME Group Consulting Engineers
135 Fifth Avenue
New York, New York 10010
212-529-5969

June 30, 2004

This project was conducted at the Olde Draper Centre facility in Rotterdam, New York. This building is the former Draper High School, portions dating back to the 1920s, with 130,000 square feet of space. Classroom Unit Ventilators with 20+ year old fan motors were selected for the study. The following facts were excerpted from the Report:

1. Executive Summary

The *intent of this project is to monitor the electric energy consumption of* steam unit ventilator *electric fan motors* retrofitted with thermostatically-controlled variable speed drives (VSDs).

EME used energy dataloggers to *monitor the combined* energy consumption of three unit ventilator fans for a period of one month while controls were alternated between standard line control and the VSD controls

2. Introduction

Three unit ventilator (UV) *fans in the building [classrooms] were retrofitted with VSDs manufactured by Opto Generic Devices, Inc*. Called the V-HVAC 120 Va c Adaptive Speed Al Controller, the VSD is *designed for economic control of fractional horsepower motors.*

Fan motors are standard efficiency and are generally *over twenty years old*.

3. Data Collection

The selected units had been fitted with new thermostatically controlled steam control valves and new fractional horsepower variable speed drives (VSDs) manufactured by Opto Generic Devices, Inc.

The VSD *[OGDs A1 Controller] is a small unit installed adjacent to the motor. A thermistor installed near the steam valve provides the temperature sensing by which the unit alters motor speed. A switch on the unit provides the option to control the motor by the VSD control or by the [units existing control system].*

After a week of baseline measurement [the bypass switch on the A1 Control Unit was switched to bypass mode no other modifications were made], test measurements were taken for one week, followed by another week of baseline and then another week of test measurements. Separately, heating degree days (HDD) were collected from the National Weather Service NOAA in order to normalize the data.

4. Energy Savings Analysis

Figure 1 shows the fan motor energy consumption for the period of study. Weeks one and three of the graph represent baseline data, when the fan motors were

powered using [the units existing control system with no other modifications] . Weeks two and four represent testing with the VSD on the fan motors.

Tabulated and normalized for HDD, the total energy consumption for each week is:

Week	Total kWh	Total HDD	kWh/ HDD
1 (baseline)	80.8	183	.44
2 (test)	45.1	220	.21
3 (baseline)	81.1	259	.32
4 (test)	45.4	111	.41

Table 1. Baseline and control test data indicating kWh consumption and HDD.

Normalization to HDD is typically used with temperature-sensitive measurements to eliminate the temperature variable from the data

The logged data shows a decrease in daily consumption from the baseline to the test period of nearly 6 kWh, or 44% [reduction in kWh usage] . This reduction occurs in both testing periods and remains relatively constant over the course of each test period.

A small energy spike occurs that causes the kW value to rise approximately 0.1 kW nearly twice per hour for both cases. The rise is likely typical for the electrical system and is assumed not to affect this study. Aside from the semi-hourly spike, the average kW readings change little. For the base case, the average value without spiking is 0.463 kW, with a standard deviation of 0.005 kW. For the test case, the average value without spiking is 0.254 kW, with a standard deviation of 0.013 kW. *[This represents a 45% in kW demand].*

5. Conclusion

The VSD control reduces both energy consumption and demand of the motors. Recorded data indicate the control causes an immediate decrease in consumption, with little variation thereafter. As the control is based on temperature in the UV, changes in fan speed would be expected to coincide with changes in steam flow, as determined by the room thermostat. The variability of load conditions is evidenced by the change in heating degree days over the period of study of 35 HDD.

The above excerpts from EMEs NYSERDA sponsored report showed a 44% reduction in kWh usage and a 45% reduction in kW demand. Based on the information provided in the report, we have prepared the following extrapolations. Following the extrapolations are the conservative assumptions we used to prepare them.

> The *Unit Ventilator VSD Energy Analysis* project that was performed at the Olde Draper Centre was performed on Unit Ventilators that utilized 1/8 hp motors. ASHRAE now recommends that all Unit Ventilators utilize 1/2 hp motors to insure adequate capacity to meet outside air requirements. With our line of products, whether the motor is 1/8 hp or 1/2hp or even 1-1/2hp, the same unit same cost controls any one of them.
>
> The following page presents an Extrapolation of the Savings and Payback data that were presented in the above named report. Following is a list of the Conservative Assumptions made to prepare the Extrapolation.

In addition to extrapolating out the savings to different horsepowers, the installation costs are also extrapolated out, in that as the quantity of units installed increases the price per unit decreases (economy of scale). The report indicated a $450 installation cost which we believe to be a significantly high number. We have provided paybacks on several "typical" scenarios.

Motor	Annual	Installation Cost per Unit				Simple Payback (years)			
HP	Savings	< 10	10+	100+	1,000+	< 10	10+	100+	1,000+
1/8	$30	$450	$350	$250	$195	15.0	11.7	8.3	6.5
1/6	$40	$450	$350	$250	$195	11.3	8.8	6.3	4.9
	$60	$450	$350	$250	$195	7.5	5.8	4.2	3.3
1/3	$80	$450	$350	$250	$195	5.6	4.4	3.1	2.4
	$120	$450	$350	$250	$195	3.8	2.9	2.1	1.6
	$180	$450	$350	$250	$195	2.5	1.9	1.4	1.1
1	$240	$450	$350	$250	$195	1.9	1.5	1.0	0.8
1.5	$360	$450	$350	$250	$195	1.3	1.0	0.7	0.5

Data highlighted in Green are actual data from Analysis

Some Typical Project PayBacks: (based on above data)

A typical building with a mix of < 100 motors, 1/8 thru 1-1/2 hp: PayBack = 2.5 yrs.

If 1/8, 1/6, 1/4, 1/3 hp motors are eliminated from project: PayBack = 1.6 yrs.

If number of motors on project is > 1,000 and all hps: PayBack = 1.4 yrs.

Assumptions:

1 No kW demand savings are included in any payback calculations

2 No maintenance, replacement, or repair savings are included in any of the payback calculations

3 Savings assumed to be linear as horsepower increases from 1/8 to 1 hp but larger motors typically require more watts per horsepower and will likely generate higher levels of savings

4 We have accepted the $450 unit cost that was provided to EME by contractor but feel that cost is excessive

5 Since our product is the exactly the same for all motor sizes there will be no cost difference in terms of equipment or labor regardless of motor size

6 Price breaks dependent on number of total installed units have been provided starting at the $450 per unit cost but all costs and price breaks are very likely to be significantly less

7 The Analysis assumed 3,000 hours of operation annually which may be conservative if the Unit Ventilator performed in both the heating and cooling modes (as many do) and may be a conservative estimate for other types of equipment (which can also be upgraded with this technology)