



## Demand Ventilation Control in Commercial Kitchens

**"Melink works well in our kitchen - it saves energy, reduces hood noise and helped secure our certification as a Green Building."**

Ken Guerra, General Manager, Clark Kerr Campus Dining

PIER Buildings Program

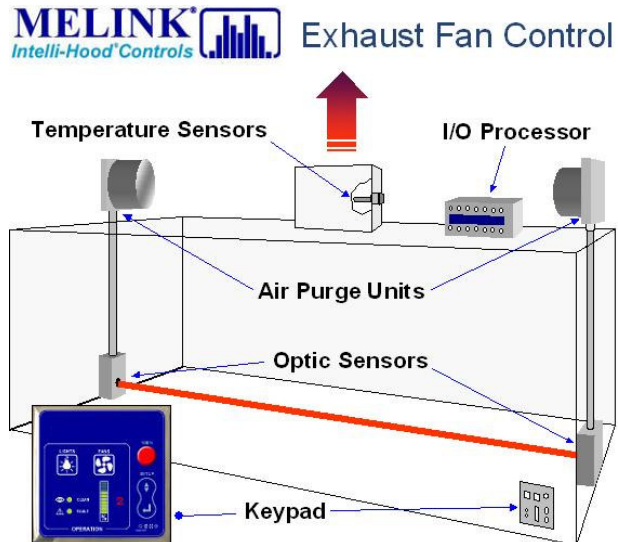
Research Powers the Future

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### Big Energy Savings, Reduces A/C Requirements

Most commercial kitchen hoods operate at 100% capacity all day long, even during idle (non-cooking) periods when ventilation rates can be safely reduced. The cost of wasted energy every year can be thousands of dollars per hood. An effective way to reduce energy consumption and cost is to control the speed of kitchen ventilation fans based on the demand for ventilation created by cooking. A properly implemented demand ventilation control strategy will minimize the energy burden while maximizing the ability of the hood to capture and contain cooking effluent.

The Melink *Intelli-Hood® Controls* package is a demand-ventilation-based energy management system for commercial kitchen exhaust hoods. Its processor controls the speed of the exhaust and make-up air fans through variable frequency drives (VFDs) based on two types of input signals: from temperature probes placed in the exhaust duct collars, and infrared (IR) beams that cross the bottom of the exhaust hoods. *(Continued on Page 4)*



### Product Overview

#### Energy Savings

Reduces fan speeds in response to lower cooking loads. Typical fan energy reductions range from 50 - 75%, while typical make-up air heating and cooling load reductions range from 20 - 30%.

#### Operation/Maintenance

Comprehensive programming capabilities with simple operator keypad. Periodic basic cleaning of optic and temperature sensors.

**Manufacturer:** Melink Corporation.

**Market:** Commercial and Institutional Kitchens

#### Availability:

Available from Melink Corp. (<http://www.melinkcorp.com>)

Public Interest Energy Research

University of California

California State University



## Field Demonstration

### UC Berkeley - Clark Kerr Campus

The Clark Kerr Campus dining center utilizes two separate demand ventilation fan speed controllers: one for the front servery cook line exhaust and supply fans and the other for the back cooking area exhaust and supply fans. The front line uses a single 4,800 CFM, 10-ft. exhaust hood and a 6,800 CFM supply fan with hydronic heating and cooling. The rear cooking area has four separate 8-ft. hoods tied in to a single 7,400 CFM exhaust fan and uses a 3,740 CFM supply fan with hydronic heating and cooling.



Outside the Dining Center Servery



Dining Center – Servery



Front Line Hood - Servery

### CPUC Partnership

The University of California/California State University (UC/CSU) and Investor-Owned Utility (IOU) Partnership Program has identified an incentive for this technology based on the energy saved per year. This is typically enough to pay for a significant portion of the installation cost. For more information please visit: [www.uccsuioeee.org](http://www.uccsuioeee.org).

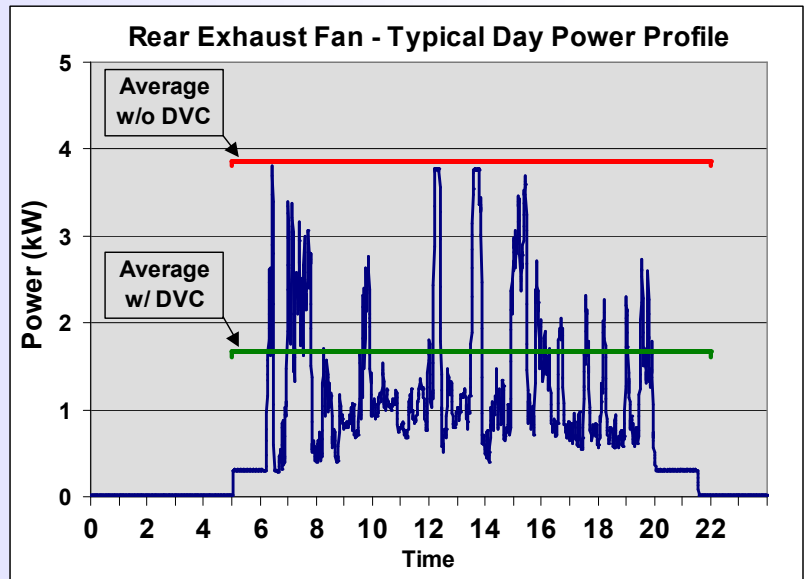
## Installation Cost and Payback

The installed cost of a Melink *Intelli-Hood® Controls* package at any particular kitchen facility depends on how many systems a particular kitchen needs -- there is a step up in cost every four hoods. Typical costs range from \$6,000 to \$18,000 per kitchen, depending on the number of hoods and fans, whether the work is new or retrofit, and the complexity of the system. The investment will usually be returned within two to four years.

## Study Results

Energy performance data for all four controlled fans was collected for 42 days in February and March 2006. The estimated combined fan energy savings were about 55 percent, which equates to annual savings of 35,600 kWh and \$4,095. Calculated make-up air average CFM reductions yielded an additional savings of about \$2,500 per year from heating and cooling load reductions (mostly heating at this location; savings based on \$1.00/therm and \$0.115/kWh).

The typical-day power profile (EF-2) illustrates the fan power modulation and average reduction with the DVC system in operation.

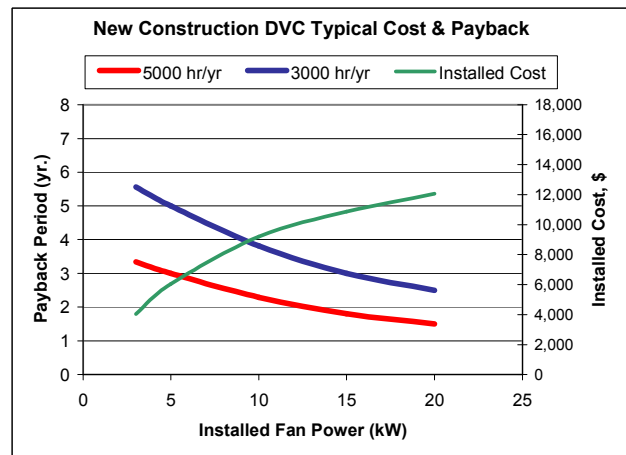
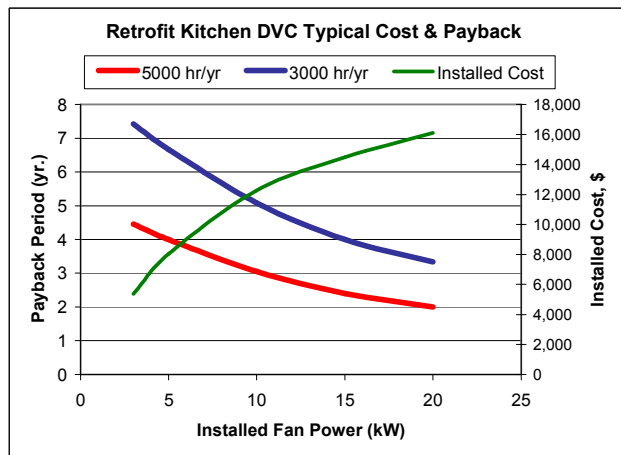


Fan	Full Speed Power w/o DVC		Average Power w/ DVC	Daily Energy Consumption		Yearly Energy Consumption		Savings		
	CFM	kW		w/o DVC	w/ DVC	w/o DVC	w/ DVC	Energy	%	Energy Cost, \$
EF-1	4,800	2.36	1.16	40.1	19.7	12,036	5,914	6,122	51%	\$ 704
EF-2	7,400	3.86	1.68	65.6	28.6	19,686	8,564	11,122	56%	\$ 1,279
MUA-1	6,800	4.52	1.95	76.8	33.2	23,052	9,952	13,100	57%	\$ 1,507
MUA-2	3,750	2	0.97	34.0	16.4	10,200	4,932	5,268	52%	\$ 606
<b>Total</b>	<b>22,740</b>	<b>12.74</b>	<b>5.75</b>	<b>216.6</b>	<b>97.9</b>	<b>64,974</b>	<b>29,361</b>	<b>35,613</b>	<b>55%</b>	<b>\$ 4,095</b>

Initial Cost: \$16,000  
 Payback, yr, based on Fan Energy Savings Only: 3.9  
 Energy Cost Savings with Estimated Heating & Cooling Savings of \$2,350 / yr: \$ 6,445  
 Payback, yr, based on Fan, Heating & Cooling Savings: 2.5

\* Based on full-speed power, operating 17 hr/day, 300 days/year, w/ manual control

\*\* Calculated using 17 hr/day, 300 days/year with averaged energy throughout monitoring period w/ DVC



(Continued from Page 1) As a temperature probe senses a rise in temperature, the controller signals the fans to ramp up proportionally from a predetermined minimum speed to a setpoint speed that is based on the temperature range programmed into the system. If an IR beam is broken by either smoke or steam produced by the cooking process, the exhaust fan and make-up air (MUA) unit will go to 100 percent speed (or a preset maximum speed) until the smoke or steam is cleared.

## Considerations

Since the fans will operate at full speed only when required, the system allows for a higher exhaust rate safety factor in the design without sacrificing the reduced energy consumption of a lower average exhaust rate. Optimized performance and savings can be achieved by effective controller programming tailored for each equipment line and accompanying hood during system commissioning.

Each Intelli-Hood processor can receive inputs from up to four separate hoods and then control the VFDs for each hood's accompanying exhaust and supply fans. Cost-effectiveness increases proportionally to the ventilation system size and airflow rates. Aside from the incremental cost difference for larger VFDs, the installed DVC system cost per hood is relatively independent of exhaust capacity. Furthermore, an estimated \$2000 per system can be saved if installed during new construction or remodel as opposed to a retrofit. One caution, take care at the design stage to integrate Melink with the main building HVAC system.

## Conclusion

Demand-Ventilation Controls are a cost-effective solution to reducing the energy load and cost associated with operating exhaust ventilation systems in college foodservice operations. DVC can also reduce electricity demand during peak utility periods because average reductions in fan power are realized throughout the day (see illustrated load profile). Although the DVC retrofit cost can be significant with respect to an operating budget, the investment will usually be returned within two to four years. And the bonus for kitchen staff will be an improved working environment with dramatically reduced noise levels from the exhaust ventilation system.

## Availability

The Melink *Intelli-Hood® Controls* package is available directly from Melink Corp. or *Intelli-Hood® Controls* dealers. Several major hood manufacturers are now supplying DVC as a factory-installed hood option. Two hood manufacturers (Captive-Aire Systems, Inc. and Spring Air Systems, Inc.) have introduced lower cost DVC systems that utilize temperature-only based sensors to modulate fan speed. It is anticipated that the energy saving potential of the lower-cost strategies will be reduced to some degree. However, both of these two manufacturers also offer Melink controls as an option.

## About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.



For more information see [www.energy.ca.gov/pier](http://www.energy.ca.gov/pier)

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1.26.2006  
Pub # 0000