

# Ventilation unit recovers energy while resolving smoking issues

*This hvac system pretreats outside air using energy recovered from the building exhaust, resulting in lower operating costs while boosting ventilation to 2,000 cfm.*

At an elegant yacht club in Florida's Coconut Grove, tobacco smoke had become a serious problem. Non-smoking members and their guests in the dining room were disturbed by smoking odors drifting from the bar and lounge area nearby.

The conventional solution to this problem — increasing ventilation and adding air conditioning capacity — would have been

of 30 cfm per person for the bar area (at an occupancy level of 100 people/1,000 sq ft), and 20 cfm for the dining area of the lounge (70 people/1,000 sq ft).

The standard allows the outside airflow rate to be determined on the basis of the average occupancy of the space. Thus, for the overall bar-lounge area, the standard translates to an outside air requirement of 2,000 cfm.

## ENERGY RECOVERY OPTION

To provide that much ventilation, the club could have replaced one of the existing packaged units with a much larger one or installed a supplemental system.

In both cases, reheat would have been required to control space humidity, and the initial and operating costs would have been prohibitive.

At first glance, replacing the old equipment seemed too expensive as well, but John Graves proposed a better solution. Graves operates an hvac installation contracting company, Grove Air Conditioning, and is president of Graves & Associates, representative for SEMCO, Inc., Columbia, Mo.

"There's only one solution for smoking in any type of facility, and that's fresh outside air of good quality," says Graves. To save energy, reduce operating expenses, and minimize capital costs, he recommended SEMCO's FV-2000 fresh-air ventilation module, which recovers energy from the building's exhaust airstream. The energy recovery module is designed to bolt onto the 7.5-ton Trane "Voyager" rooftop unit.

"Because of the hot, humid conditions in south Florida, the most economical way to introduce outside air is with an enthalpy wheel that recovers both sensible and latent heat," Graves explains.

The wheel uses this recovered energy to cool and dehumidify ventilation air in summer, or to heat and humidify it in winter. Outdoor air is conditioned before it enters the rooftop unit, which reduces loads on the cooling coil and, thus, energy consumption.

The Exclu-Sieve™ energy recovery system (Diagram 1) uses an aluminum substrate coated with a 3-Angstrom molecular-sieve desiccant. As the wheel rotates slowly between the outdoor and exhaust airstreams, the higher-temperature air gives up its heat to the aluminum.

In addition, latent energy is recovered as moisture and is adsorbed by the desiccant. The difference in vapor pressure between the two airstreams provides the driving force for latent energy transfer.

Overall, the ventilation mod-

ule recovers up to 80% of the total energy normally exhausted from the building. John Fischer, SEMCO technology consultant, explains, "This allows a traditional cooling system to accommodate increased quantities of outdoor air, on a continuous basis, while minimizing energy costs and controlling space humidity."

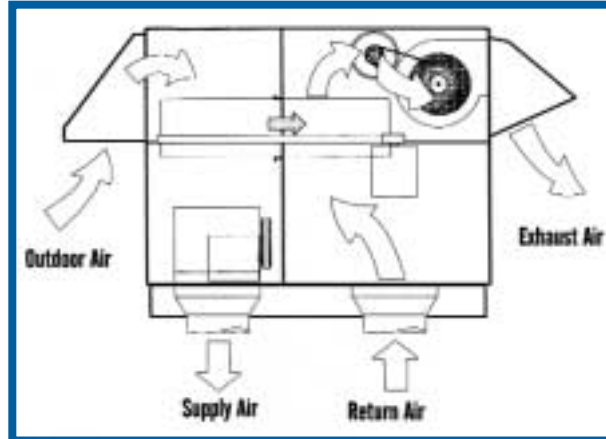


Diagram 1. Schematic of the FV system with its Exclu-Sieve energy recovery wheel.

At the Coral Reef Yacht Club, the energy recovery module enables the 7.5-ton rooftop system to do the job of a 15-ton unit. Reheat is eliminated because the ventilation air is dehumidified before entering the air conditioner, and because less airflow is delivered to the occupied space.

For further improvement, airflow at the club is directed from non-smoking areas toward the bar-lounge, where several exhaust grilles were installed. The canopy over the bar acts as a hood to exhaust air quickly from the smoking area.

Ducting to the ventilation module includes a SEMCO "scoop kit," which allows the exhaust air to be pulled from the heavy smoking areas and the recirculated air to be pulled from the light- or non-smoking areas.

## AIR QUALITY IMPROVES

The renovated system began operating in August 1997. Its performance was documented over a three-month period by Georgia Tech Research Institute.

Researchers collected air samples at four sites and monitored a variety of airborne contaminants, including tobacco smoke-related compounds. Tests were conducted with and without the ventilation module in operation, with smoking either allowed or banned.

The research showed that the indoor air quality with smoking allowed — but with adequate, strategic ventilation — was on par with the air quality when no smoking was allowed while operating the previous, conventional hvac system (but without the ventilation module in operation).

According to Georgia Tech's results, air quality was signifi-



Figure 1. Coral Reef Yacht Club.



Figure 2. The SEMCO FV-2000 fresh-air ventilation module is bolted to the 7.5-ton Trane Voyager rooftop system.

cantly improved by the energy recovery unit, which reduced levels of aldehydes, ketones, respirable particles, and other environmental tobacco smoke-related compounds,

as well as ethanol, carbon dioxide, and other volatile organic compounds that were analyzed. Also, humidity was shown to be controlled more effectively than with conventional equipment.

Bob Grassi, general manager of the Coral Reef Yacht Club, reports that members are quite pleased with the new system. "Now they can sit in the bar-lounge area and eat because they're not disturbed by smoking. People enjoy the facility more."

And there's a bonus for the bartender, who's been with the club for 30 years. His wife used to complain about the smell of smoke in his hair and clothes when he came home every night. "Now it's no longer an issue," says Grassi.

As a former club board member, Graves, the installation contractor, has also visited the club frequently. "The bar has become the favorite place to eat because the air is nicer there than anywhere else," he says.

## COSTS REDUCED

Careful consideration of equipment lifecycle costs allowed the yacht club to select the most economical system and enjoy the added benefit of better humidity control.

A conventional replacement hvac system would have required 15 tons of air conditioning capacity and major ductwork revisions, at a total cost ranging

from \$35,000 to \$43,000.

The entire cost of the new, smaller system was almost 30% lower. The 7.5-ton rooftop unit, matched with the energy recovery module, cost a total of about \$25,000 to \$28,000. Of this total, SEMCO donated the cost of the module, about \$10,000, in return for access to the facility for research purposes and as a demonstration site.

In operation, the new system saves about \$4,000/year in energy costs, according to an analysis performed by SEMCO's Fischer. Approximately \$3,200 of the savings is associated with the energy recovery wheel; the rest derives from using a smaller motor to move less air than would have been required by a 15-ton unit. The calculations assume an electricity rate of \$0.08/kWh.

Grassi confirms the economy of the new system. "If you evaluate the dollars and cents, it's money well spent. And it certainly allows us to accommodate both smokers and non-smokers in the same environment."

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## Heating Components

& ACCESSORIES too expensive, and the club's management was reluctant to institute a total ban on smoking.

Then a local hvac contractor came up with a cost-effective solution: pretreating outside air with an energy recovery system, integrated with a 7.5-ton rooftop unit.

Without preconditioning the ventilation air, at least 15 tons of cooling would have been required. The new system provides ventilation rates up to 30 cfm per person, and because of its energy recovery efficiency, the system costs \$4,000/year less to operate than the conventional alternative.

## VENTILATION NEEDED

The Coral Reef Yacht Club on the Miami waterfront (Figure 1) hosts several international events each year, including the Olympic trials, but club members are its bread and butter.

Many of them were unhappy with the air quality in the non-smoking dining room, which is connected by a large doorway to the bar-lounge area, where smoking is allowed.

Also, the dining room ambiance is more formal, compared to the camaraderie in the bar-lounge area. So non-smoking members sometimes wanted to eat in the dining area of the bar-lounge, but the smoky atmosphere deterred them.

Like many facilities in the hospitality industry, the yacht club could hardly afford to ban smoking altogether, which would divide club members, discourage participation in regattas, and possibly decrease membership and revenues.

So the club management decided to look at its options. The bar-lounge area was served by two air conditioning units (7.5 and 4 tons), with virtually no outside air delivered to the space other than infiltration. An exhaust fan over the bar had been shut down because of noise and uncomfortable drafts.

Typically, about 40 people occupy the 1,050-sq-ft bar-lounge area at lunchtime, 100 to 125 on busy weekend evenings, and even more during major events. ASHRAE Standard 62-1989 prescribes ventilation rates