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An energy-saving enthalpy wheel reduces the temperature of incoming air.

Developers of the Turtle River Montessori School in Jupiter, FL, wanted students to have the best possible indoor air quality. They also wanted to provide it in the most energy-efficient manner. When they sought solutions to make the new school's HVAC system green, they approached Charles Eno, sales engineer for Miami-based Florida Air Conditioning Distributors. Eno suggested a high-efficiency air-to-air Energy Recovery Ventilation (ERV) system to reduce outside air (OA) load— *the required rate of heat removal from outside air.*

The Airxchange ERV enthalpy wheel installed in the school's rooftop HVAC unit dramatically reduces the cost of conditioning outdoor air by recycling energy from exhaust air as it leaves the building, significantly reducing the OA (and total) load on the HVAC system.

The energy recovery wheel

Eno's recommended system contained an energy recovery wheel, also known as a heat wheel or enthalpy wheel. The wheel is an air-to-air heat exchanger. Composed of a rotating cylinder filled with an air-permeable media, it rotates between the supply air stream and the exhaust air stream, recycling energy from the exhaust stream into the incoming air. This reduces the OA load on the HVAC system. The key to its effectiveness is the difference in temperature between the two air streams.

The wheel can be a practical way to reduce HVAC costs while complying with code-mandated outside air requirements. Because ERV wheels can reduce the load on the HVAC system by as much as 80%, continuous savings are possible. It also allows for the downsizing of HVAC equipment, reducing first cost and providing an immediate return on investment.

Florida Air Conditioning Distributors says it prefers ERV wheels manufactured by Rockland, MA-based Airxchange, Inc., because of the wheels' history of reliable service, AHRI-certified performance and ease of maintenance. In addition, Eno knew that, with a standard 5-year warranty, Airxchange ERV wheels would outlast the competition's aluminum energy-exchange devices in the salt air of Florida's east coast.

Because the Airxchange energy recovery ventilation wheel reduces the outside air load on the HVAC system at the school, mechanical consultants recommended a rooftop unit about half the size of the one that would have been required without ERV.

A smaller HVAC system

Eno was able to demonstrate that by lowering the system's OA load, the ERV system he recommended would allow the architect to reduce the size of the school's packaged HVAC unit by half. The design was modified accordingly, and the ERV system was paired with a high-efficiency unitary air-conditioning unit on a single plenum curb to minimize internal duct connections and to simplify installation on the roof of the school.

The Airxchange energy recovery wheel was mounted horizontally, keeping the height of the packaged HVAC system to a minimum and preserving the building's architectural profile. With the ERV wheel in this configuration, it is easy for maintenance personnel to check its operation and change filters. Airxchange wheels include lightweight segments shaped like pie slices that can be easily removed for cleaning on or off the site. In less than 30 minutes, one person can replace all segments with new or previously cleaned spares and return the wheel to service.

Savings

The ERV system installed at the Turtle River Montessori School saved approximately $25,000 in construction costs. And since the school's fall 2009 opening, the system has delivered savings at the rate of approximately $6000 per year, compared with the utility costs the school would have had with a conventional HVAC system.

The downsizing of the overall HVAC system essentially paid for the ERV system. In addition, thanks to ERV, the school saves approximately $500 every month on its utility bill. Humidity is well controlled by the school's HVAC system despite the high intake of outside air, and indoor comfort levels are excellent. The system manages all of the outside air ventilation for the whole building, conditioning it and feeding it into the returns of all the air handlers. The air handlers are part of a building-wide variable refrigerant flow (VRF) system that modulates the refrigerant flowing through the coil. This maintains desired humidity without overcooling the building and prevents the coil from icing up. The success of the HVAC system at the Turtle River Montessori School has led its developers to specify this same type of ERV design on several other projects. According to Eno, each will feature an Airxchange energy recovery wheel. **UM**

Turtle River Montessori School HVAC Stats

Location: Jupiter, FL

Completion date: 2009
Building size: 21,000 sq. ft.
Building occupancy: 175 people
Building design load: 45 tons, satisfied by 4 VRF systems (three 12.5-ton systems and one 8-ton system)
Outside air flow at design: 750 CFM
Outside air load on a "design day": 424,430 BTUH (35.4 tons)
Outside air load using energy recovery ventilation: 132,000 BTUH (11 tons)
Total recovered energy: 24.4 tons
Energy-efficiency ratio of the HVAC rooftop unit: 16 EER
Recovery efficiency ratio (RER) of the energy recovery wheel: 90
Combined efficiency factor (CEF): 17.8
Improvement over an HVAC system that would cool outside air with no energy recovery: 70%
Estimated first-cost savings due to unit downsizing: $25,000
Estimated ongoing savings: Approximately $12,000 per year ($6000 from the downsized HVAC unit and $6000 from energy-recovery ventilation)
Source: Florida Air Conditioning Distributors, 2009

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