An Airxchange Case Study

School District Triples Ventilation Rates, Saves Energy, And Improves Humidity Control with Airxchange Wheels

Background

The St. Lucie County school district, located 40 miles north of Palm Beach on the east coast of Florida, was faced with the need to upgrade the HVAC system in five school buildings.

Two elementary schools, two middle schools, and one high school, were built in 1989 when the building code requirement for outdoor air ventilation was 5 cubic feet per minute (cfm) per person for a total of 50,000 cfm for all five schools. By the mid 1990's, building codes tripled outdoor air supply requirements to 15 cfm per person in response to air quality complaints attributed to the lower ventilation rates.

In 1995, St. Lucie County decided to obtain the benefits of improved indoor air quality by increasing the outdoor air ventilation rates to meet the new codes.

Challenge

Upgrading to the revised code created a challenge: the installed HVAC systems were incapable of conditioning the required additional 100,000 cfm of outdoor air.

To meet this challenge, while minimizing the strain on capital and operating budgets, the school district selected Landis & Staefa; now the Landis Division of Siemen's Building Technologies.

The Landis team determined that adding 100,000 cfm of outdoor air would require an increase of the cooling systems design capacity by 479 tons. Two solutions were available to address this issue: increase the chiller capacity, or eliminate the added load.

Solutions Evaluated

The first solution evaluated, adding 479 tons of chiller capacity to the HVAC systems, was impractical. First, the cost to replace or upgrade the chillers was prohibitive, and space was unavailable to accommodate larger chillers. In addition, retrofitting the existing air handlers to accommodate the increased load was too costly. Secondly, the team determined that the time needed to implement this solution was too long, since the retrofit had to be completed during the summer school break.

Impact of Airxchange Wheels on Load

	5 cfm Ventilation Rate	15 cfm Ventilation Rate without Airxchange	15 cfm Ventilation Rate with Airxchange
Outdoor Air Supply (cfm)	50,000	150,000	150,000
Load due to Outdoor Air (tons)	231	710	230

The second solution evaluated, reducing the added outdoor air load by decoupling the outdoor air supply from the existing air handlers and supplying it through rooftop energy recovery ventilators (ERV's) with Airxchange wheels, proved far more attractive. Airxchange wheels recycle energy from the building exhaust air to pre-condition the outdoor air before it enters the building. This recycling reduces the energy needed to heat, cool, humidify, and dehumidify the entering outdoor air by approximately 70 percent. Calculations showed that this pre-conditioning would eliminate the added load from the increased outdoor air enabling the existing air handling systems to comfortably condition the remaining building load.

The ERV's also minimized installation cost by utilizing the existing duct work for distribution of the fresh outdoor air to the classrooms, gym, and auditorium.

Energy and Operating Savings

Moreover, this alternative was significantly more energy efficient. The avoided 479 tons of cooling capacity translated into an avoided 335 kW of peak demand and an estimated 4200 kWh per year.*

Over 10 years, this increased efficiency saves the school district approximately $700,000.*

Improved Humidity Control

The ERV's improved humidity control by reducing the moisture coming into the building with the outdoor air. The air conditioning system was then able to control humidity in the building more effectively resulting in improved comfort and air quality for the students and teachers, as noted by the Landis team.

"The ERV's allowed us to get better humidity control. The teachers were pleased with the superior teaching and learning environment."

Les Orosz
Siemen's Project Manager

Reliable Performance

Eight years after installation, the removable energy transfer segments from the Airxchange wheels were tested in an ARI correlated laboratory to evaluate wheel performance. Test data showed that the wheels were performing at nearly the same effectiveness as the day they were installed. The non-corroding energy transfer material and stainless steel wheel structure proved to be of significant benefit in the challenging salt air environment of Florida coast.

"The system maintains the 15 cfm requirement by measurement and the school district personnel are delighted. The original energy savings continue and are recorded by Landis as are the individual unit's performance. While some of the original chillers have now been replaced with exact duplicates, the energy recovery units and wheels are the factory original products."

Ron Montoya
Siemen's Service Account Manager

St. Lucie's experience confirms that energy recovery ventilation works to resolve the conflict between the need for ventilation and energy conservation, and illustrates the reasoning behind the DOE's and EPA's position in support of energy recovery ventilation.

* Estimate based on 11 month,12x5 operation; $.06 kWh electric rate

EPA Recommends Energy Recovery Ventilation

According to the EPA's "IAQ Design Tools For Schools": "First cost, energy costs, and moisture control do not have to be at odds with good IAQ [indoor air quality]. Energy recovery ventilation equipment can make the negative implications of 15 cfm per person of outdoor air behave like 5 cfm, while retaining the IAQ advantage of 15 cfm. This approach has been proven in many schools in various regions east of the Rockies, where advanced HVAC systems cost roughly the same as conventional systems, yet provide significant operating cost savings and IAQ advantages."

More information can be found at the following web site address: http://www.epa.gov/iaq/schooldesign/hvac.html

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