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RANDOLPH COMMUNITY COLLEGE

CASE STUDY

CHALLENGE:

Turn an old industrial facility into a LEED® gold rated education center

Engineers and architects took the seemingly impossible task of recycling an outdated industrial factory into a LEED® gold showcase of the HVAC industry's most innovative equipment.

The plans for Asheboro, NC's Randolph Community College (RCC) involved transforming a 46,000-square-foot uninsulated brick shell into a high-efficiency educational facility. A Raleigh, North Carolina engineering consultant firm, Progressive Design Collaborative (PDC) as well as the Raleigh based, Smith Sinnett Architecture, were up for the challenge.

APPROACH:

Chilled beams paired with FläktGroup SEMCO's Pinnacle® System

With the encouragement of RCC's director of facilities, Cindi Goodwin, PDC's Scott Ennis, P.E., project engineer, and Steve Campbell, P.E., president, took the project well beyond convention. They designed one of the nation's first active chilled beam and off-peak hours ice storage/chilled water loop combination.

The Continuing Education and Industrial Center's (CEIC) cooling system is made up of 184 IQHC active chilled beams and two FläktGroup® SEMCO® Pinnacle® dedicated outdoor air systems (DOAS).

The two-pipe IQHC chilled beams, which range from 2 to 10-feet in length, supply 100% of the $7.6-million facility's cooling. Chilled beams have the potential for

condensation in humid environments such as North Carolina. However, when chilled beams are paired with the Pinnacle, the Pinnacle supplies dry outdoor air to the chilled beams, preventing condensation and complying with ASHRAE 62.1 - the standard for ventilation and indoor air quality. In addition to providing a comfortable relative humidity (RH), the Pinnacle/chilled beam combination allowed for small six-inch-diameter ductwork to be used. As a result, plenum height is reduced and comparatively less space is used.

"We wanted to keep ceiling heights at 10 feet, so the inherent feature of the active chilled beams' reduced duct sizes caught our interest." — Scott Ennis.

PHOTO CREDIT: LEWIS PERKINS

Ennis had not specified a chilled beam project before this one, but after the success of this project, he is specifying them again for a hospital with low ceiling height. Another huge benefit to using chilled beams is that they are highly energy-efficient, using approximately 40% less fan horsepower versus the alternative conventional rooftop and ductwork system.

The two 10,000-cfm Pinnacle DOAS are also extremely energy efficient and contribute to the project's sustainability and indoor air quality (IAQ). The Pinnacle® DOAS uses True 3Å molecular-sieve enthalpy wheel technology to dehumidify outdoor air. The True 3Å wheel recovers heat from exhaust air for pre-heating outdoor air. Pinnacle®'s True 3Å energy recovery wheel technology quickly adsorbs the exhaust air's moisture, but not any contaminants it might carry that may pollute incoming outdoor air. The True 3Å wheel also has acid-resistant, anti-microbial and anti-stick coating treatments applied to it, that help sustain the equipment's lifecycle and maintain design static pressures.

RESULT:

A highly energy-efficient educational facility, which will pay for itself in four-years.

With the comprehensive energy savings CEIC was projected to payback the mechanical, electrical and plumbing specification within six-years. The following equipment generated the greatest savings:

- Chilled beams and the FläktGroup SEMCO Pinnacle DOAS.
- Variable frequecny drives (VFD) on the piping loops and DOAS fans.
- Variable air volume (VAV) boxes with their own dedicated hot water loop.
- Calmac© ice storage system
- High-output T-8 fluorescent lighting by Philips® Lighting with occupancy sensors Wattstopper®.
- Solar domestic hot water heating system by Lochinvar®.
- 3,200-gallon rainwater harvesting tank
- Polypropylene manufactured by Aquatherm®,

  was used on piping runs less than three-inches in diameter. The piping helped attain LEED credits.
- Various other MEP equipment

In reality, the payback was reduced to only four years due to a $60,000 utility rebate offered by Duke Energy®. The rebate incentive was offered, because the CEIC's chiller operates mostly at night and is needed rarely, if at all, during daytime high-peak electric rate periods, according to David McDaniel, sales engineer at Brady Services Inc., Morrisville, N.C..

When compared to a more conventional designs, such as one with constant volume package rooftop HVAC units with VAV boxes, the college is saving 28.2% with PDC's innovative mix of high-efficiency technologies.

The LEED 2.2 project's HVAC equipment was directly responsible for 7 of the total 41 credits submitted for LEED® gold certification. The CEIC became the first LEED® gold Certified building in Randolph County in June 2013

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The CEIC, was the first North Carolina community college to become a challenge partner of the U.S. Department of Energy's Better Building Challenge program. The chilled beams at CEIC use a separate hot water loop and VAV box hot water coils that are supplied by two Lochinvar®, condensing boilers and VFD-controlled pumps by Bell & Gossett®. Specifying a separate heating loop saved tens of thousands of dollars in installation labor and material costs versus the alternative of piping hot water to each chilled beam.

The building envelope was a LEED® challenge for Smith Sinnett architect, Robert Carmac, AIA, LEED® AP, BD+C, because it lacked a vapor barrier, insulation and other modern energy-efficient building materials. The original building's wall and roof insulating values were low at R-3.45 and R-7.17, respectively. Carmac was able to increase the R-values with spray foam insulation. He was able to increase the wall and roof R-values to R-14 and R-30, which are considerably higher than the minimum building code of R-5.7 and R-15, respectively.

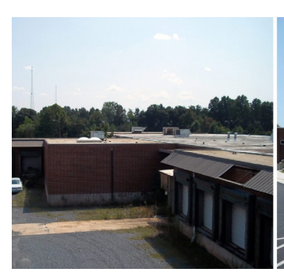
CONCLUSION:

A highly energy-efficient educational facility, which will pay for itself in four-years.

Due to the project's high energy-efficiency, many of the products used in the CEIC project will play a key role in future PDC projects, particularily schools and hospitals, according to Ennis and Campbell.

Converting the old Klaussner Furniture warehouse into a sustainable showcase was a challenging project, and RCC proudly promotes the project's energy savings with its BuildingLogiX®, building automation system's EcoRate® dashboard which uses web pages designed by Brady Trane®, Greensboro, N.C. The wall-mounted dashboard in the CEIC's lobby allows any visitor touch-screen access to a real-time analysis of the facility's ongoing water and energy savings.

PHOTO CREDITS: LEWIS PERKINS



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