absolute comfort case by case

Daikin VRV, controls, and lighting retrofit gives St. Louis area high school new life

The Challenges

The original 1957 wing had no existing cooling system and structural limitations that left precious little available space for ductwork and piping. The 1964 wing had an obsolete chilled water cooling system that needed to be demolished and replaced.

Daikin's Solution

The Daikin VRV system provided the school with energy efficiency equal to or greater than a geothermal system, with a significant reduction in noise levels previously generated in the classrooms.

Application:
Commercial

Location:
Affton, Missouri

While embracing VRV technology, officials at the Bayless High School District insisted that the existing unit ventilators be retained as backup. However, even during the coldest winter in three decades, the backup has never been called upon.

Located in Affton, Missouri, the award-winning Bayless School District serves over 1,500 students in suburban St. Louis. The district's eponymously named high school, while small, is noted for its sports teams and highly successful graduating classes.

In the summer of 2008 when the district sought to upgrade Bayless High School as part of a long range facility improvement plan, HVAC and lighting modernization were top priorities. With over 110,000 square feet spread over three stories, the facility consists of general and specialized classrooms, library, auditorium, kitchen/cafeteria, administration offices, and a gymnasium. The original building and gym were built in 1957, with additions in 1957, 1964, and 1998.

District officials engaged the office of Facility Solutions Group (FSG) in nearby Fenton, to help realize the following modernization goals: enhancing the learning environment, improving the interior aesthetics, and boosting energy efficiency. FSG is a leading provider of mechanical, electrical, lighting, and energy services focused on K-12 educational facilities.

For years most of the building was served by electric resistance heat, which according to Superintendent, Maureen Clancy-May, had resulted in escalating

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heating bills. FSG engineers were forced to deal with two unique retrofit scenarios within the building: First, the original 1957 wing had no existing cooling system and structural limitations that left precious little available space for ductwork and piping. Second, the 1964 wing had an obsolete chilled water cooling system that needed to be demolished and replaced.

According to Jeff Lowe, Principal with FSG, the building's structural characteristics made most traditional HVAC system options unaffordable due to excessive constructability costs. A water source heat pump (WSHP) system was considered, but would have required removing all of the existing piping.

An Option New to the Region

However, a Variable Refrigerant Volume (VRV) system was a superb option for this application for a multitude of reasons. One key benefit was that since the VRV condensing units are relatively light compared to traditional roof top units, they could be placed on the roof without compromising the roof structure. Additionally, the elimination of chillers and boilers would free up space in the mechanical room.

"Given the physical and fiscal restraints of the project, our team determined that a VRV system in conjunction with a dedicated ventilation system represented the best life cycle choice," explained Lowe. Using the FSG-directed design-build project delivery approach, the job was designed, bid, and under contract within 60 days, with the Daikin VRV III system a key component of the effort.

Since this was the first commercial VRV System of its size installed in the St. Louis area, both designers and contractors faced a steep learning curve. Lowe explained that Daikin's extensive portfolio of successful commercial installations and the company's support system convinced the team that any potential obstacles could be quickly conquered.

The Daikin VRV system provided the school with energy efficiency equal to or greater than a geothermal system, with a significant reduction in noise levels previously generated in the classrooms. The Daikin fan coil units only emit between 30-35 dba at full operation, and Lowe explained that this capability was important to the school staff.

According to Dave Rich, the local Daikin manufacturer's representative with Thermal Mechanics, Inc., another reason Daikin was selected over WSHP was that the compressors for those units would have been located throughout the building's corridors, creating a significant maintenance challenge.

One key benefit is the Daikin VRV condensing units are relatively lightweight compared to traditional roof top units, they could be placed on the roof without compromising the roof structure.

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Jeff Lowe, Principal with FSG

Installation and Maintenance Advantages

Rich said that ease of installation was another key selling point for Daikin's VRV system. Since a VRV system allows for the installation of small diameter refrigerant lines and requires little to no ductwork – unlike large forced air ducts – the installation was easier and less expensive than other options. "They really liked the fact that the building could remain operational during the installation, that the system would be better maintenance-wise, and that there would be no water in the system. Those were all pluses," Rich said.

Sheet Metal Contractors Inc., a family-owned HVAC contractor offering architectural sheet metal services as well as geothermal and heat pump union work on commercial, industrial, and residential jobs, was hired to handle the HVAC installation. Located in nearby DeSoto, the firm was also new to VRV technology, so its lead for the project's installation team, Tom Pilliard, traveled to Daikin AC's training center in Carrollton, Texas.

"The training in Texas was invaluable," Pilliard said. "Pat Sankolewicz, Daikin's area service tech, was very helpful in the process. He also came onsite to assist with the commissioning," he added. After completion of the Bayless project, Pilliard also attended advanced service training in California. He highly recommended both training sessions.

Beating the Bell

In order to meet the scheduled HVAC completion of mid-August 2008, it was necessary to begin construction in the spring while class was still in session. FSG worked with the district administration to rotate a few classrooms of students per week into the library, freeing up these rooms for the construction team.

SMCI, which has long served as the school district's high school and junior high school HVAC maintenance provider, began the installation of the new heating, cooling and ventilation systems in spring 2008, on a very aggressive construction schedule.

SMCI installed 180 tons of Daikin VRV equipment, nine heat pump and five heat recovery condensing units along with 81 fan coils, 100 tons of Daikin McQuay MPS II packaged roof top units and 100 tons of Addison fresh air units. The project was completed over the summer break and was aided by the fact that the existing system was left intact (piping and unit ventilators) which removed the necessity of demolition.

Bayless High School facility director Jeff Timeus inspects one of several Daikin VRVIII, four-way ceiling mounted cassettes installed throughout the school.

The entire system is controlled by the Daikin Intelligent Touch Controller, which allows administrators extensive control of up to 64 indoor units (double that with the addition of an optional external adapter). The Intelligent Touch Controller also provides remote interface via the web for the owner as well as the servicing contractor.

While optimistic about the cutting-edge system, school officials did voice concerns about whether the Daikin system would be able to keep the building warm in the harshest winter conditions. "They had us leave the existing unit ventilators to act as backup to the Daikin system, but the unit ventilators haven't been needed in the three winters since the Daikin system was installed, including the winter of 2009-2010, the coldest St. Louis winter since 1980," Pilliard said.

Although the VRV installation was somewhat groundbreaking in the St. Louis area, it served as a regional springboard for the technology. The school district was so impressed with the Daikin VRV system that it had SMCI install a similar system in the junior high school a year after the high school was completed, and it has permitted SMCI to showcase their facilities. Meanwhile, Thermal Mechanics and SMCI have honed their VRV expertise and done several other Daikin VRV jobs in the area.

Passing with Honors

According to a detailed study of the high school's utility bills over the past few years, the energy savings derived from the renovations are substantial: The old system provided heating to the entire facility and air conditioning to approximately 40% of the building. The new system provides 100% heating and cooling, in addition to meeting current ventilation code by utilizing neutral air units to ventilate the entire building. However, the most astounding aspect of the project is that all of the heating, cooling and fresh air is delivered with the district spending less than it had spent operating the existing system. The old system cost $69,992.24 to operate for a year, while the new system cost $68,761.15.

Through more efficient equipment and intelligent controls systems, along with a total building lighting upgrade, Bayless High School was able to add air conditioning to the remaining 60% of the building while reducing the annual utility cost.

"That is what I call school improvement," Pilliard said.

On top of the tremendous savings, the entire building was ready for occupancy with new lights, ceilings, and HVAC for the first day of classes in August 2008. Superintendent Clancy-May was thrilled with the finished product. "It's almost as if we'd built a new building. It's fantastic!"

The VRV heat pump performance has been fantastic as well. Through some bitterly cold winters, the VRV heat pumps were able to maintain all heating set points at 0ºF ambient without any supplemental electric heat.

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Clancy-May, Superintendent

Commenting on the system's performance in the particularly cold 2009-2010 winter, Bayless facility director Jeff Timeus said, "If I hadn't seen it myself I wouldn't have believed it." As a result of the full range of renovations and improvements, the building was awarded ENERGY STAR certification in 2011 – an achievement realized by only a handful of schools in the region.

The VRVIII units pictured here helped provide the high school with energy efficiency equal to or greater than a geothermal system, with a significant reduction in classroom noise levels.

Additional Information

Location

Bayless High School
Affton, Missouri

Contact Information

Manufacturer
Daikin AC
1645 Wallace Drive, Ste. 110
Carrollton, TX 75006
www.daikinac.com
972-245-1510

Owner/ Builder
Bayless Schools
Jeff Timeus
Phone: 314-713-7062

HVAC Contractor
Sheet Metal Contractors Inc.,
DeSoto, Missouri
Phone: 636 - 337-2150

HVAC Manufacturer's Rep.
Thermal Mechanics, Inc.
Dave Rich
Phone: 636-236-4596

Engineer
FSG (Facility Solutions Group)
Fenton, MO
Jeff Lowe
Phone: 636-537-0203

Product Profile
Daikin Equipment

Model	Qty	Description
REYQ192PYDN	2	Heat recovery VRV P R410A (460V)
REYQ240PYDN	1	Heat recovery VRV P R410A (460V)
RXYQ192PYDN	1	Heat pump VRV P R410A (460V)
RXYQ216PYDN	4	Heat pump VRV P R410A (460V)
RXYQ240PYDN	1	Heat pump VRV P R410A (460V)
BSVQ36PVJU	7	Branch selector unit R410A
BSVQ60PVJU	9	Branch selector unit R410A
FXAQ07MVJU	14	A - Wall Mounted Unit
FXAQ09MVJU	2	A - Wall Mounted Unit
FXAQ18MVJU	5	A - Wall Mounted Unit
FXAQ24MVJU	2	A - Wall Mounted Unit
FXFQ12MVJU	3	F - 4-Way Discharge Ceiling Mounted Cassette (3' x 3')
FXFQ18MVJU	8	F - 4-Way Discharge Ceiling Mounted Cassette (3' x 3')
FXFQ24MVJU	18	F - 4-Way Discharge Ceiling Mounted Cassette (3' x 3')
FXFQ30MVJU	13	F - 4-Way Discharge Ceiling Mounted Cassette (3' x 3')
FXFQ36MVJU	16	F - 4-Way Discharge Ceiling Mounted Cassette (3' x 3')
FXHQ36MVJU	2	H - Ceiling Suspended Unit
FXMQ48MVJU	2	M - Concealed Ducted (Medium Static)
KHRP25M72TU	7	REFNET branch piping kit
KHRP25M73TU	6	REFNET branch piping kit
KHRP26A22T	31	REFNET branch piping kit
KHRP26A33T	10	REFNET branch piping kit
KHRP26M72TU	19	REFNET branch piping kit
KHRP26M73TU	3	REFNET branch piping kit
BRC1D71	85	7 Day Programmable Controller
BYC125K-W1	58	Decoration panel - All FXFQ
BHFP22P100U	6	Outdoor Multi Connection Pipe Kit - VRV P Series HP
BHFP26P90U	3	Outdoor Multi Connection Pipe Kit - VRV P Series HR

About Daikin AC

Daikin AC offers North America intelligent heating and cooling solutions with superior energy performance and sophisticated design. These advanced systems fall under the Daikin Altherma, Quaternity, VRV, VRV-S and SkyAir product names. The company located in Carrollton, Texas, is owned by the Japanese-based Daikin Industries, Ltd.
For more information, call 866-4DAIKIN or visit www.daikinac.com.

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