

## VRF Zoning Turns 1960s School Into High- Performing, Smart Building

Built in 1963, the 75,778-square-foot Falmouth Elementary School (Falmouth ES) in Stafford, Va., was in urgent need of renovation by 2010. The Stafford County Public Schools Division (SCPS) had begun a shift towards sustainable building practices, including an emphasis on LEED® and participating in the Go Green Virginia Green Public Schools Challenge. The SCPS decided that Falmouth ES should be renovated with energy reduction as a top priority.

### ► Challenge

Selecting an energy-efficient HVAC system for an outdated building unable to accommodate ductwork because of its tongue and groove, pre-stressed precast concrete structure.

One of the critical challenges to the energy-efficient renovation for Falmouth ES was the selection of a new cooling and heating system. The existing through-wall unit ventilators on a two-pipe system were not working. The existing units did not have proper dehumidification capacity (cooling coils were not deep enough) and there were no dehumidification cycle controls, which contributed to poor indoor air quality and a constant battle with mold. The school also maintained a building housing the central boiler and an adjacent chiller garden that was inconveniently located in the school's parking lot, which made student drop off and pick up complicated. Lastly, the system was inefficient. Records show that Falmouth ES was operating at 90 kBtu/sf per year before the renovation – 30 percent higher than the average\* for educational facilities in that climate area.

Scott Horan, SCPS assistant superintendent for facilities, knew that creating a high-performance HVAC system in Falmouth ES was going to be problematic. The school's structure was a very complicated pre-stressed precast plank design which meant that there was little room for ductwork or piping above a suspended ceiling. Using a traditional VAV air-handling system would not be the most viable method for this project, he said.



The team included b2E Consulting Engineers (b2E), Leesburg, Va., to help them find a solution. “We wanted a design team with a track record of bringing huge energy savings to outdated school buildings. b2E is known in the area for applying the latest technology to reduce energy consumption in buildings with optimal results,” said Horan.

b2E and SCPS decided on a new mechanical system that included a Variable Refrigerant Flow (VRF) zoning system from Mitsubishi Electric US Cooling & Heating Division (Mitsubishi Electric).

b2E Founder, Bruce E. Beddow, PE said, “As a result of installing the Mitsubishi Electric VRF zoning system, we were able to keep the original ceiling heights and planned suspended ceiling heights, improve lighting levels, reduce sound levels in classrooms to NC [Noise Criterion] 30 or quieter, and improve occupant comfort.”

An important consideration for a school system is the automatic control system. The VRF zoning system comes on line at start-up. The system controls do not need to have the Energy Management System (EMS) tested and commissioned prior to opening the school. The system is fully operational upon start up. The EMS allows the system to be controlled from a remote off-site location via the internet.

### ► Solution

The Mitsubishi Electric VRF zoning system conquered the school's very complicated pre-stressed plank design and helped cut the operating energy costs by 40 percent and energy costs by 25 percent - saving \$70,000 per year.

### Falmouth Elementary School

Project Location:  
**Stafford, Va.**

Completion Date:  
**July 2012**

Project Team

**Owner:**  
Stafford County Public Schools, Stafford, Va.

**Architect:**  
Hayes Large Architects, LLP, Reston, Va.

**Mechanical Engineer:**  
b2E Consulting Engineers, P.C., Leesburg, Va.

**HVAC Contractor:**  
ACME Mechanical Contractors of Virginia, Inc., Manassas, Va.

**General Contractor:**  
Kenbridge Construction, Kenbridge, Va.

**HVAC Distributor**  
AIRECO Supply, Inc., Savage, Md.

### Mitsubishi Electric Equipment Installed

- (1) PURY-P240YSJMU-A R2-Series Outdoor Unit
- (2) PURY-P120YJMU-A R2-Series Outdoor Units
- (3) PURY-P192YSJMU-A R2-Series Outdoor Units
- (2) PURY-P96YJMU-A R2-Series Outdoor Units
- (1) PEFY-P48NMAU-E Ceiling-concealed Indoor Unit
- (3) PEFY-P24NMAU-E Ceiling-concealed Indoor Units
- (1) PEFY-P18NMAU-E Ceiling-concealed Indoor Unit
- (1) PEFY-P15NMAU-E Ceiling-concealed Indoor Unit
- (1) PEFY-P12NMAU-E Ceiling-concealed Indoor Unit
- (30) PLFY-P15NCMU-E Ceiling-recessed Indoor Units
- (9) PLFY-P12NCMU-E Ceiling Cassette Indoor Units
- (2) PMFY-P08NBMU-E Ceiling Cassette Indoor Units
- (9) PMFY-P06NBMU-E Ceiling Cassette Indoor Units
- (4) CMB-P1016NU-HA Branch Controllers
- (53) PAR-F27MEA-US ME Remote Controllers
- (2) GB-50ADA Central Controllers
- (2) BAC-HD 150 BM Adapters

Timm Guyer, project manager for Acme Mechanical Contractors of Virginia, Inc., Manassas, Va., installed the system. “The Mitsubishi Electric VRF zoning system was a perfect fit for the Falmouth ES installation. It was easy for us to install, is super efficient, and we have had zero warranty issues,” said Guyer.

From a utility bill comparison, Horan estimates a 25-30 percent average reduction in energy use. “This is impressive when you think that we increased the building area by about 20 percent, or 13,000 square feet,” said Horan. ■

\* According to the EPA's ENERGY STAR® Small Business Guide