



Dodge City, Kansas

DODGE CITY SCHOOLS



CHALLENGE

Finding an efficient, whisper-quiet HVAC system that could pair with geothermal technology

SOLUTION

Mitsubishi Electric
Water-source VRF

RESULT

An improved learning environment and ENERGY STAR® certification

Kansas' Dodge City Unified School District provides education to 7,000 students. As the district's ten schools have gotten older and their noisy HVAC systems have impacted the students' classroom experience, the district has set out to renovate the schools with sustainable HVAC technology. So far, three schools have been renovated; **two schools have paired Water-source Variable Refrigerant Flow (VRF) from Mitsubishi Electric with geothermal technology.** The resultant whisper-quiet operation provides these schools' students with a better educational experience, while the energy efficiency provides the district with reduced utility bills.

The district renovated its first school in the summer of 2011, replacing noisy window units and an inefficient boiler with a geothermal system. Afterward, a student was overheard saying, "I can hear my teacher now." Drew Rose, electrical engineer, Integrated Consulting Engineers, Inc. (ICE), Wichita, Kansas, has served as the project manager and designer for the ongoing Dodge

City Schools projects. Rose said, "You hear that and it's just, oh my gosh, how do you say no to that? We have to do every school now."

That is exactly what happened: The district decided to renovate one school each summer, focusing on energy efficiency and quiet operation. Morris Reeves, the district's energy manager, said, "For the next summer, we looked at Central Elementary School—a 35,000-square-foot building in the center of Dodge City. It's a two-story brick building constructed in 1927, and the original coal-fired furnace and forced air system was converted to natural gas in the 1940s or 50s. In 1994, the school got window a/c units; before that there was no air conditioning. By 2012, the window units were well beyond their lifespan, and they were noisy and not very efficient."

He continued, "We work every day to conserve energy. Energy conserved is more money for the classroom—that's what we're all about. Ultimately, we want to

improve the teaching environment.” William Hammond, the district’s executive director of business and operations, added, “I like being green to save energy and resources, and being green to save money. I try to find projects that do both.”

That goal of saving both money and energy turned the district’s attention toward a pairing of water-source VRF and geothermal technology. The pairing would let the district claim \$215,000 in grant and rebate money, and VRF’s energy-efficient and discreet operation would offer the school reduced energy usage and increased occupant comfort.

Rose spoke to the importance of zoning and control in achieving occupant comfort and operational efficiency. “With the previous system, the control was on or off. No thermostat, no setpoint. So we needed efficient cooling and heating in these spaces, which meant we needed increased zoning and better control. VRF offers true zoning and excellent control.”

Chris Meyer, the district’s maintenance director, added, “VRF also offers an easy installation. The walls in Central—some are up to two feet thick, so **getting ducts through the walls without damaging**



the structure would have been impossible.” Rose added, “It’s also about money. A four-pipe system’s first cost would have been huge. When you run the numbers and do a life-cycle cost analysis, with VRF it’s all there.” With that, the team

decided on water-source VRF.

The district then decided that Mitsubishi Electric was a good brand to work with “since they were the biggest vendor in the area. It’s about service. And Mitsubishi Electric



Project Completed: August 2013 |

has been the leader of the pack in terms of equipment and versatility,” said Hammond. Dwayne Vaughn, president, ICE, served as the project’s mechanical engineer. He said, “I also personally like the two-pipe heat recovery system. The technology works.”

With the product decided on, installation took place. “It went pretty swift. We had a good contractor and good engineers,” said Hammond. The project was up and running before school started in August, and everything has been going well since. “The teachers love it. They don’t have the noisy a/c units going—don’t have to shut off the a/c to teach,” said Reeves.

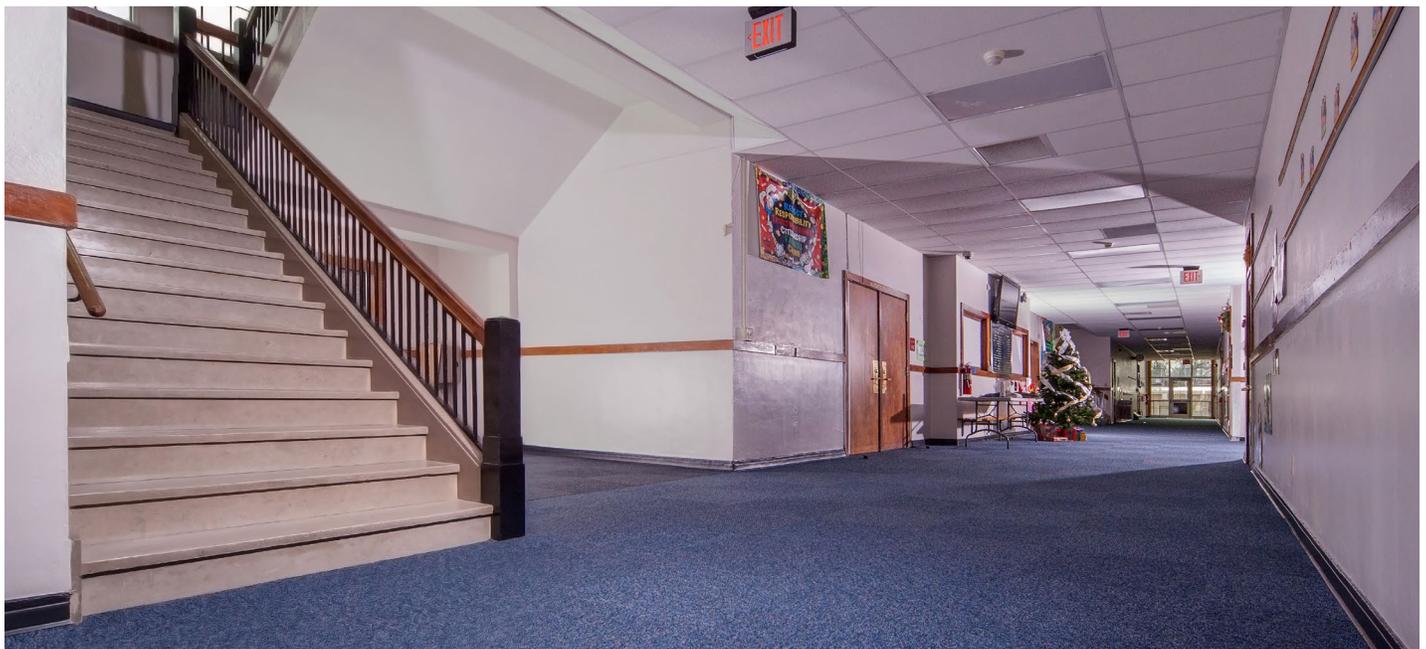
He continued, “In the summer, it’s very hot here—104 or 105 degrees sometimes—and we get hot, moist air. It’s very uncomfortable. Then in the winter we get these spells where it’s zero degrees and below. So it’s really been a plus that this system not only controls temperature, but helps with humidity. Our humidity extremes can make for a really uncomfortable environment otherwise.”

As the months passed with Central Elementary School’s students, teachers and staff enjoying their



“We now have individual control in every room, and that is huge. We set the system to 72 degrees, then teachers can adjust up or down three degrees from there. We can also do energy setbacks for the holidays.”

*— William Hammond, executive director of business and operations,
Dodge City Unified School District*



new HVAC system, the next project came into view: Wilroads Elementary School—a 19,600-square-foot building dating back to the 1950s, located 11 miles from the center of Dodge City. The school's previous HVAC system consisted of a hot water boiler and, in 1994, window a/c units were installed. Vaughn said, "The window units were cut into old windows that had been boarded up. The school wanted to get rid of the window units, since they knew doing that would get rid of half the leaks in the building."

Hammond explained why the building presented a challenging HVAC situation: "This school is just one story and has very low ceilings. There's just not much room to work." The roof couldn't support weight, either, but "the school has all the land in the world out there, which made VRF with geothermal a good fit. After the success of Central the summer before, we were working off of that experience. And this project, while a more difficult project because of the limitations of the building, turned out well.

Everyone's been satisfied since, and the teachers were really excited to get something that works without being loud," said Rose.

Another excitement: Both schools earned ENERGY STAR® certification. "Not just certified, but Central got a score of 91. When you think of how it was built in 1927, well, we think that's pretty impressive," said Hammond. The resultant utility savings for both schools combined, comparing the year before installation to the year after, was \$1,757. The school is pleased with the savings and, as Reeves noted, "you have to consider that there was an additional 17 percent of conditioned space after the renovation—almost 10,000 square feet more—and an entire air ventilation system. There was also a significantly improved learning environment."

He continued, "Looking back, I think we made the right decision to go with VRF and geothermal. I don't think we'd have done anything different." Vaughn added, "I've worked with Mitsubishi Electric VRF since; we even have it in our office. We see an awful lot of it because it's efficient, and in most cases a more cost-effective installation than equivalent systems. I like that Dodge City Schools use it, too. They're one of the most progressive school districts we work with. Instead of looking at what needs to be fixed this year, they're looking 20 years out." What might the student experience at Central and Wilroads look like two decades from now? Probably similar to Vaughn's current view: "There just really isn't anyone who's unhappy—the students, the teachers, the staff. These were some very successful projects."

PROJECT TEAM

Mechanical & Electrical Engineer:

Integrated Consulting Engineers, Inc., Wichita, Kansas

Distributor:

Knipp Equipment, Wichita, Kansas

Mechanical Contractor:

Tatro Plumbing Company, Inc., Garden City, Kansas

EQUIPMENT

Central Elementary School

- ▶ (4) PQRV WR2-Series Water-source Condensing Units
- ▶ (7) PEFY Ceiling-concealed Ducted Indoor Units
- ▶ (20) PLFY 4-Way Ceiling-recessed Cassette Indoor Units
- ▶ (3) PMFY 1-Way Ceiling-recessed Cassette Indoor Units
- ▶ (2) PVFY Concealed Vertical Indoor Units

Wilroads Elementary School

- ▶ (2) PQRV WR2-Series Water-source Condensing Units
- ▶ (16) PLFY 4-Way Ceiling-recessed Cassette Indoor Units
- ▶ (10) PMFY 1-Way Ceiling-recessed Cassette Indoor Units