



MIDWEST BUILDINGS

TECHNOLOGY APPLICATION CENTER

Connecting and empowering the Midwest states with information, education and technical assistance

University City High School

ENERGY EFFICIENCY AND CONSERVATION MEASURES

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PROJECT PROFILE

MARKET SECTOR

K THROUGH 12 SCHOOLS

QUICK FACTS

LOCATION:

University City, Missouri

FACILITY TYPE:

High school facilities

OWNER:

University City School District

SIZE:

Combined indoor area of over 300,000 square feet

MEASURES INSTALLED:

2003–2006

ENERGY EFFICIENCY AND CONSERVATION

- Attic insulation
- Window replacement
- Lighting upgrade
- Motion sensors
- Heating plant replacement
- Pipe insulation
- Web-based Building Automation System

“It is vitally important that building owners realize that their utility bills are a gold mine waiting to happen. Why keep buying energy when you can very cost effectively not need it anymore—forever?”

—Tim Michels,
Energy Solutions, Inc.



PHOTO COURTESY OF ENERGY SOLUTIONS, INC.

University City High School.

PROJECT OVERVIEW

The original structure of the University City High School was built in the early 20th century, and has undergone various additions and modifications over the years. During the energy crisis of the 1970s some energy efficiency measures were implemented such as adding insulation in parts of the building. By the start of the 21st century, the building needed significant work to upgrade and replace aging systems.

With support from the Missouri State Energy Loan Program, the school board commissioned Energy Solutions, Inc. (ESI) to do an energy audit of the University City School District facilities including the high school. The school district had a goal of sheltering itself from future energy price shocks.

ESI identified several energy saving measures many of which have since been implemented. These included:

- convert steam systems to hot water replacing aged steam boilers
- install systems controls and sensors for energy management
- rectify inadequate or missing insulation for attics and piping
- replace windows
- update lighting

HVAC

The high school’s two steam boilers were nearing the end of their useful lives and were requiring increasing maintenance attention. In addition, an energy audit of the buildings showed that the existing system was oversized; it had about double the needed capacity for the structures it

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Energy Saving Measure	Estimated Annual Energy Savings/Payback	Annual Economic Savings
Attic insulation	Reduced cooling by 17 tons and reduced demand by 20 kW (16,000 kWh)	\$1,300 (at 8 cents per kWh)
	380 MMBtu	\$4,000
Window replacement	Reduced cooling by 29 tons and reduced demand by 32 kW	N.A.
	1,650 MMBtu	\$17,325
Lighting upgrade and motion sensors	6-year payback on \$300,000 investment	\$50,000
Heating plant replacement	10-year simple payback on \$1,000,000 investment	\$100,000

Note: Due to interaction of energy savings measures, savings are estimated not observed.

served. On ESI's recommendation the district replaced the old steam boilers with four 2 MMBtuH high efficiency condensing hot water boilers. This change also required a retrofit of the terminal heating devices, removal of steam traps and changing out some air handlers. The switch-over cost the district about \$1 million. They are saving about \$100,000 in energy costs per year resulting in a simple payback of about 10 years on a needed replacement.

The district also installed a centralized remote monitoring and management system for major equipment. This Web-based system allows maintenance people to manage the equipment from off-site enabling greater flexibility and timeliness in addressing issues. Equipment now operates based on space temperature and occupancy requirements allowing for more effective maintenance programs and reduced runtime hours.

LIGHTING

The school's lighting was also due for an overhaul. The existing fluorescent fixtures were upgraded and numerous incandescent fixtures within the school

were replaced. In addition to installing 165 standard T8 electronic ballasts, they installed 1,065 AXIS Technologies lumen maintenance ballasts which include light sensors that auto-adjust the lighting intensity to maintain pre-set light levels in the room. They also put in 185 occupancy sensors and 125 timer switches that allow lights to automatically switch off in offices and classrooms. The lighting changes cost approximately \$300,000 for the high school. In combination, they expect these technologies to reduce energy use for lighting by 40 percent and have a payback of less than 6 years.

BUILDING SHELL

ESI identified replacement of over 8,500 ft² of single glazed windows in the science wing and smaller gymnasiums as a priority. The school district replaced these with double-glazed windows in the science classrooms and KalWall brand insulating translucent panels in the gyms. They estimated that double glazing with high efficiency windows would reduce AC load by about 29 tons and reduce peak electric demand load by 32 kW. For heating, the savings were predicted to be 1,650 MMBtu of natural gas per year.

Overall electricity savings from the above measures have been about 20 percent compared to previous use, including a reduction of 14 percent when the buildings are occupied and 30 percent when they are unoccupied.

Finally, ESI measured 23,000 square feet of attic space with missing or suboptimal insulation. They recommended the district have 5.5 inches of BioBase® foam insulation sprayed in to bring the insulation rating up to R19. They expect this insulation to reduce cooling load by 17 tons and reduce peak electric demand by 20 kW, saving approximately 16,000 kWh or \$1,300 in electricity costs. During the heating season they expect an overall savings of 380 MMBtu/year in heating load and \$4,000 in heating costs.



FOR MORE INFORMATION

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