



**BUILDING BACKGROUND**

## Candlebrook Elementary Upper Merion School District King of Prussia, Pennsylvania

Building Usage  
Elementary School

Occupants  
371

Size  
55,570 sq ft

Stories  
Two

Year Built  
1999

Start Year for Energy Management  
2006

Energy Efficiency Typology  
O&M, Institutional

### retrofit at a glance

- ..... Building Maintenance
- ..... Building Control System
- ..... Retro-Commissioning
- ..... Compact Fluorescent Light Bulbs
- ..... Cleaning Products

## Overview & Scope

Candlebrook Elementary School is a part of the Upper Merion Area School District (UMASD), located in King of Prussia, Pennsylvania. Candlebrook Elementary was built in 1999 and has an area of approximately 55,570 SF. It is home to grades K-4, with 371 students and staff.

Beginning in 2006, UMASD initiated a district-wide commitment to reevaluate general operating procedures in an effort to reduce energy usage, lower operating expenses, and improve the quality of the learning environment. UMASD selected Candlebrook Elementary as pilot facility to demonstrate energy management practices that could be applied to the five other schools in the district. Candlebrook Elementary was selected as the pilot facility because of its small size, its proximity to several town administration buildings that would facilitate monitoring, and because the proposed initiatives garnered the full support of the students and staff.

## Project Details

### Energy Management Approach

UMASD sought to identify areas within the district that could easily and cost-effectively be upgraded to yield rapid energy savings. To aid this process, UMASD reached out to local energy consultants for guidance, and learned by example from neighboring school districts that had already implemented similar energy reduction programs.

The school district's maintenance staff identified low-cost upgrades and operational improvements to the building envelope and lighting system at Candlebrook Elementary. Building management decided to first target low-hanging fruit and educate faculty, staff and students on the importance of turning off lights and equipment when not in use. In 2006, UMASD invested in the centralization of its building automation system (BAS) to enable remote monitoring and schedule of building systems throughout the district. The newly centralized BAS system was the largest project cost for the district, at \$6,000 per school.

### Operational Improvements

**Building Control System** - The centralized BAS allowed the maintenance crew to continuously monitor the district's heating, ventilation and air conditioning (HVAC) systems from a central computer. This technology enabled them to accurately engage mechanical systems to work in sync with the occupancy schedule.

to employ optimum start/stop features to limit equipment run times, and to use hot water heating and chilled water resets to ensure that boilers and chillers made sufficient adjustments to provide adequate heating or cooling.

**Retro-Commissioning** - Building management tested their existing mechanical systems to determine if they were running at their peak efficiency. System upgrades and general maintenance were performed to optimize output.

**Energy Staff** - In 2008, UMASD hired a Maintenance & Energy Coordinator to operate the districts energy management system and routinely monitor the performance of the buildings and equipment. Having a full-time staff person to conduct energy management and monitor the districts BAS led to a significant improvement in energy performance.

## Lighting

**Compact Fluorescent Light Bulbs** - The school removed inefficient incandescent light bulbs, and replaced them with energy-efficient compact fluorescent bulbs.

**Educational Outreach & Upgrading Lighting Technology** - The school educated their custodial staff, teachers, and students on the benefits of turning lights off when exiting a space. The success the school's collaborative effort to reduce light usage eliminated the need to purchase motion sensors for classrooms. Switch motion sensors were provided for auxiliary spaces such as restrooms, offices, closets, and conference rooms.

## Project Outcome

Candlebrook Elementary realized a 50 percent energy savings over the life of the project. The money saved was reinvested in the school, which enabled UMASD to fully fund the BAS system with only one year's worth of energy savings. Today, Candlebrook Elementary's average electric energy bill is 33 percent lower than it was in 2004 and 2005. Overall, the school's energy bills were reduced by \$105,000 total over the past five years. These achievements in energy savings were also made possible because the school used its existing maintenance staff and operating budget to implement the improvements, saving on labor and minimizing capital costs. This was coupled with improved energy conscious occupant behavior, augmenting the tremendous savings experienced at Candlebrook Elementary.

In the process of improving their facility, UMASD became an ENERGY STAR Partner. With the help of this partnership, they were

guided towards utilizing ENERGY STAR's free resources, such as Portfolio Manager, to calculate and track their building's energy usage.

Today, all six of UMASD's schools have earned an ENERGY STAR rating. Candlebrook Elementary received a rating of 98 out of 100 in 2009. In 2010, UMASD was also named an ENERGY STAR Leader for reducing their energy usage by more than 30% district-wide.

## Lessons Learned

1. Mechanical systems should be continually maintained to prevent inefficiencies from developing within the system.
2. Optimizing building equipment performance is a cost-effective alternative to costly building upgrades.
3. Hiring a trained professional to oversee the energy management system ensures that building systems will run properly. With UMASD, bringing in a manager for the daily mechanical system operations at their six schools was a cost-effective investment that demonstrated substantial energy savings.

## Economic Analysis

Energy Savings Investments		
	COST	PAYBACK
Siemens Building Automation System (BAS)	\$ 6,000	4 Months
Summary of Savings		
Annual Electricity Reduction (kWh)	211,200	
Annual Natural Gas Reduction (ccf)	9,300	
5-Year Energy Savings 2005-2010	\$105,000	
Greenhouse Gas Reduction (Tons CO <sub>2</sub> e)	503	