

HVAC Technology Report: Greening schools

The building envelope is the top priority when designing and engineering green schools.



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When planning a green building, designers and engineers face a chicken-and-egg question: What comes first, the building envelope or the mechanical systems? In the case of green schools, the building envelope comes first. If the building's envelope and siting are considered before any mechanical systems are put in place, engineering the building is easier and less costly.

The experts interviewed for this article agree that the building envelope—not the mechanical systems—must be the starting point when designing green schools. For example, to achieve greater control of a school's indoor environment, Donald Clem, LEED AP, senior architect with Steven Winter Assocs. Inc., Norwalk, Conn., tries to convince his clients not to

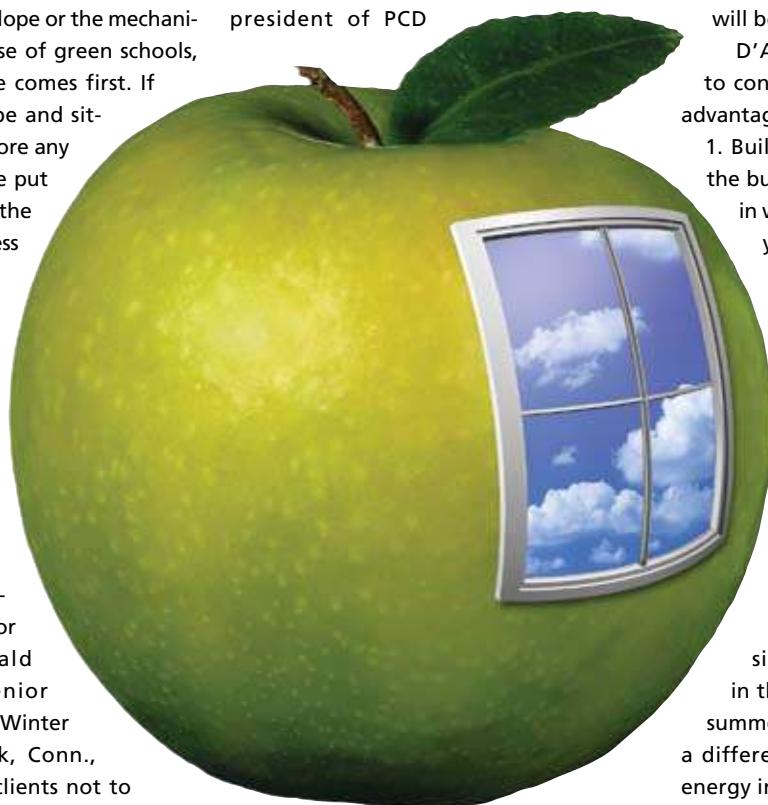
order operable windows. By considering the physical aspects of the building first, they can save money on engineering the HVAC system.

Peter D'Antonio, PE, president of PCD

Engineering Services Inc., Longmont, Colo., expands on the concept: "We've found that putting your money in the building envelope gives the best return on your investment because then your mechanical systems will be as small as possible," he said.

D'Antonio advises design teams to consider three passive ways to take advantage of solar energy:

1. Building orientation: "Can we open the building to the south to allow heat in when it's needed in the winter, and yet keep heat out with shading devices in the summer?"
2. Daylighting: "Because lighting is typically about half of the electric energy load of a school, we look for the possibility of long, narrow buildings, open to the south, to maximize daylighting opportunities in all rooms."
3. High-efficiency building envelope: "Can we tune the windows—with glass on the south side that allows more solar gain in the winter but keeps it out in the summer? And on the north, can we use a different type of glass that keeps the energy in and supplements daylighting?"





Chicago's Albany Park Multicultural Elementary School uses traditional heating and cooling options, and optimizes daylighting to cut down on energy costs. Photo: Myles Adamson

mer months. And if there is condensation, you need to provide some way to drain the water away harmlessly."

Ahuja cited a different kind of barrier to specifying chilled beams in schools: unions. "Most of the mechanical contractors are experienced only in installing traditional mechanical systems," said Ahuja. "The sheet metal workers are not really trained [to install chilled beams] and their union is concerned that you will eliminate their workers—and they're very powerful."

Mechanical insulation

Given the importance of mechanical insulation in energy and acoustical performance of school buildings, Clem stated that mechanical insulation is a factor. "There are the whole acoustic requirements of LEED for Schools that affect mechanical [systems] with sound attenuation concerns (e.g., duct lining, sizing and duct placement, and fan discharge)," he said.

Clem also noted that some green building tax credit programs specifically address insulation/mechanical use. For example, un-faced

batts or blankets and blown- or sprayed-in insulation materials are not allowed in plenum spaces above ceilings or in areas where air handling equipment is located due to potential of respirable fibers.

Commissioning and O&M: The final frontiers

No matter how energy-efficient an HVAC system is on paper, it may never save a nickel's worth of energy if it is not properly commissioned and if the school's O&M staff members don't understand how to run it.

Clem emphasizes the importance of having the right players on the design team. "The owner has to really be involved, and you want your commissioning agent (CxA) at the table early in the process," he said. He also stressed the importance of training for the commissioning and operations staffs, which is required in LEED.

D'Antonio agrees that the staff must be trained in and committed to energy conservation. "Energy conservation deals not only with design, but with the operational phase—the

teaching element, training, and behavioral practices at schools," said D'Antonio. "We've seen schools with very basic systems achieve the Energy Star rating because they were practicing good energy management."

Ahuja points out that many old school buildings are just now receiving their first air conditioning systems because of the resurgence of summer school programs. "The maintenance staff came from janitorial ranks," he said. "When we go back to schools where we installed direct digital control (DDC) in the 1990s, we see that the digital controls have been bypassed or not kept up because the guys are intimidated by the system. Or they've incorrectly reset the setpoints. Or they open the ceiling and jam the damper open." Ahuja said his company educates the superintendents to ensure they understand these issues.

Ahuja also notes that high-performance systems such as geothermal require commissioning to ensure that they are working per specification. Most geothermal systems include multiple pumps, two-way valves, de-superheaters, flow controls, and extensive piping. The CxA must verify that those components were installed correctly and are operating as intended.

"We have been asked to review recently constructed buildings in which the geothermal system is so complicated that no one knows if the system is working correctly," Ahuja said. "In fact, in one case, the building engineer operated the building in manual mode in order to avoid a complicated control system. The system was running around the clock 365 days a year. In that case, a CxA would have recognized the problems right away and saved the school district thousands of dollars."

So after all of the high-tech modeling and designing, and after the super-efficient systems have been installed, it still comes down to the most basic issue: How do you convince everyone at a school—superintendents, teachers, students, and on down to the janitor—that the goal of energy-efficiency is worth their time and attention? **lcsel**