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## HEATING SCHOOLS

HOW MORE SCHOOLS ARE USING LOW-TEMPERATURE HEATING SOLUTIONS TO IMPROVE COMFORT AND REDUCE COST



Many reading this article can likely remember days sitting in a classroom that never seemed to be the right temperature. As the clanking iron radiators heated up, the room was cold for hours, later becoming too hot in the middle of the day, forcing the teacher to open the window even if it was snowing outside. Other times, the opposite held true and students sat attentively listening to the teacher, teeth chattering from the chill.

With the developments in heating technology and the prevalence of alternative energy sources and high-condensing boilers, more school administrators are looking at maximum energy efficient solutions that not only heat the building more effectively, but more economically as well. It's been found that sustainable heating solutions such as low-temperature heating reduces costs and can improve student and teacher comfort, also improving productivity and student performance. Long gone are the days when energy and heat literally goes out the window.

## WASTED HEAT - WASTED MONEY

One particular challenge of heating schools is hours of operation. Because schools are vacant for approximately the same amount of time they are in operation, buildings do not require ongoing heat during evening hours. This has long been a challenge for school boards and administrators; however, due to the inherent inefficiencies of older boilers and cast-iron radiator

systems, there was never a way to avoid heating the building during hours when it was not in operation.

Low-temperature heating solutions provide an effective solution. Low-temperature radiators (see figure 1.1), when combined with a high-performing condensing boiler system, are able to react quickly and efficiently, promoting energy efficiency. For example, rather than requiring start up several hours before teachers and students arrive for the day, the system provides immediate output (within minutes), generating enough energy to heat the space in a short period of time. Or reversly if there is a warmer day the school is able to take advantage of the natural solar loads and internal loads. This results in a substantial energy savings compared to traditional systems, because the thermostat can be set to cooler temperatures for the evening hours when the school is unoccupied. Technology today can allow advanced radiators to function down to 95° F EWT. This is common in most European markets allowing maximum operational efficiencies with maximum outputs and maintaining minimum product sizing too.

Realizing these benefits, more low-temperature heating systems are typically being installed in both new build and retrofit applications. As more school boards look to renovate older school buildings with new technology or build new school systems, old coal and oil-fired boiler systems are slowly on the way out. School boards are realizing energy sav-

ings of up to 30 to 40 percent above ASHRAE 90.1 and ROI of less than five years with low temperature systems.

## INCREASED COMFORT, IMPROVED STUDENT PERFORMANCE

In addition to the financial and environmental benefits of these new heating technologies, schools are also starting to realize improvements in student and teacher comfort. Using low-temperature radiator systems allows for rooms to adjust more quickly to the desired temperature. So, if the sun comes out and shines brightly into a classroom, newer systems will react more quickly to the temperature increase and decrease its output so the room does not over-heat. This allows for the building to maintain temperatures naturally using ventilation and solar/internal loads throughout the occupied times of the day. Not only does this improve daily comfort but can promote reductions for cooling needs in the building, but it also simplifies the regular maintenance program of the schools.



FIGURE 1.1



Studies have shown that improved comfort can also impact occupant productivity. According to David Pogue, national director of sustainability at CB Richard Ellis, worker performance increases with temperatures up to 72° F, and decreases with temperatures above 73 to 75° F.

With the increasing focus on high-performing building envelopes and the prevalence of well-insulated buildings, installing a heating system that reacts quickly helps improve the overall performance of both the building and students.

### WHO'S USING IT...

Winston Churchill Public School (WCPS) (see figure 1.2) is a single-story school building located in the heart of Kingston, Ontario. Built in the 1960s, it serves 324 students in kindergarten through eighth grade. Always ahead of the curve when it comes to sustainable systems, the school wanted to find a method of heating the building more effectively and efficiently.

In 2008, the school board approved a complete overhaul of the school's heating system with the focus of reducing energy consumption. A local engineering firm, David W. Downey Engineering, Ltd., was hired to design a new system that would not only provide a sustainable solution, but one that was also cost-effective and safe for students.

To replace the original condensing boiler system, Downey installed five Viessmann Vitoden high-efficiency, natural gas-fired, wall mounted con-

densing boilers. Each unit serves as a fully modulating condensing boiler. Solar panels mounted on the roof provide an offloaded energy source from the new boiler plant.

To maximize the low temperatures and energy-efficiency of the condensing boilers, Downey replaced the finned tube radiators located throughout the school with 107 low-temperature radiators from Jaga Climate Systems. Unlike the original finned tube radiators, the new radiators operate at lower water temperatures of 130 degrees Fahrenheit and 20°F dT, reducing the firing rate of the boiler by 30 percent; thereby reducing the total amount of energy required to heat the building.

“Since installing the new system, we have substantially reduced the firing rates for each of the boilers,” said Downey. “In fact, it is not uncommon for all five boilers to be operating in condensing mode during peak times. During the spring or fall, only one or two boilers may be operating. This has resulted in substantially less natural gas consumption – as much as 25 to 30 percent over what was previously used.”

The new low-temperature system gives teachers greater control of the classroom temperature with individual thermostats. If students are more active, as in many kindergarten rooms, the temperature can be quickly reduced. By using radiators with built-in thermal mass the engineers were able to better control energy loss and maximize student comfort. In addition to offering easily adjust-

able temperatures throughout the day, each radiator in the new system is also linked to a timed schedule which reduces temperatures in the evenings when the school is closed. An hour before school is set to open, the system kicks on again, further limiting energy loss. In addition to classrooms, radiators were also installed in offices and corridors throughout the school.



**FIGURE 1.2**

As most schools are facing increasing budget cuts, the system has delivered on its promise of substantially cutting energy costs. With initial estimates of \$15,000 to \$20,000 a year, the school reports it has met projected savings, enabling it to recoup some of the system installation costs. The school anticipates saving as much as \$100,000 over the first five years. These savings are now accessible as future capital.

In addition to the financial return, the new heating system also reduces the school's dependency on non-renewable resources, further increasing its viability for future generations of Kingston children.

## WILL IT WORK?

It's been said that low temperature heating can work in a number of applications, including retrofits and new build scenarios. For any heating system that operates using a low-temperature heating source, such as a condensing boiler, solar or geothermal application, low-temperature radiators get the most energy efficiency from the system.

While proper use of the new technology requires some training, it is nominal. Teachers and students tend to operate by the traditional "hotter is better" mentality when setting the thermostat, meaning that if they want to quickly increase the temperature, they tend to set it to a temperature setting hotter than the desired final output. As a result, the room quickly overheats and occupants become uncomfortable. This issue is quick-

ly resolved with basic education and training. Teachers need to understand this is not your father's technology and the product responds immediately. Due to its numerous benefits and return on investment, low-temperature heating (95° F EWT) is a system more schools are starting to explore. For a solution that delivers the "triple bottom line" of people, planet and profit, it is a sustainable solution that makes sense for both today and tomorrow's heating needs.

*By Chris Heerius, executive director of Jaga Climate Systems. Jaga is a leading manufacturer of award-winning, energy-saving heating solutions and innovator of the Low-H2O radiator system. For more information on Jaga's solutions, go to [www.jaga-canada.com](http://www.jaga-canada.com).*

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