



SHORELINE COMMUNITY COLLEGE, SEATTLE, WASH.

A multisite project at Shoreline Community College near Seattle quickly won accolades from school administrators, bean counters and maintenance staff alike.

Working with engineers from the headquarters office of McKinstry Co. (ranked No. 58 in *PM's* 2004 Pipe Trades Giants list), the school obtained a new system that improves boiler operating efficiency alone by more than 20 percent.

Overall energy improvements are guaranteed to provide more than \$80,000 in annual utility savings and qualify the school for gas and electric utility rebates of nearly \$90,000.



A McKinstry contractor solders a connection to the Rheos boiler.



Mike Petterson (right), sales engineer for Columbia Hydronics, the manufacturers rep firm, explains to (left to right) King Tang and Tony Fajarillo from McKinstry Co. and Greg Angus, Shoreline Community College, how the Rheos boiler can be switched from BMS control to its own internal boiler control — accomplished with the flip of a switch on the front of the boiler.

EQUIPMENT USED

The Shoreline project used 12 Laars copper-fin, low-Nox boilers, including 10 stage-fired boilers (two 1,000 MBH, four 750 MBH, and four 500 MBH systems) and two 1,200 MBH fully-modulating Rheos boilers — reducing the former boiler count by nearly half.

In addition, the guaranteed annual utility savings will cover the principal and interest on a 10-year low-interest loan from the State of Washington treasurer's office. When everything is said and done, only 35 percent of the project's \$1.2 million cost will be funded from the college's capital budget.

"Normally boilers don't pay for themselves quite so rapidly because the equipment is expensive," says **King Tang**, P.E., senior program manager with McKinstry. "But by combining the savings from the utility rebates for boiler upgrades, heating controls and lighting, along with the state's low-interest energy financing program, Shoreline gets the benefit of many financial advantages."

According to Tang, Shoreline had been using 40 percent to 45 percent more energy than the benchmark for colleges in the region. That was the call to action.

"And we're now just beginning to make a real impact in the school's energy consumption by replacing some of the many inefficient and malfunctioning mechanical systems," Tang adds.

Two Problems: Before the retrofit, Shoreline was plagued by two key problems: poor system design and a maintenance regimen that became more difficult each year. Shoreline's original systems layout called for 22 boilers to be installed in 13 separate boiler rooms. Add to that an additional 50 HVAC units and Shoreline's modest maintenance staff was clearly overwhelmed. Boilers were operated with very low return-water temperatures; this caused acidic condensation and the premature corrosion of many boiler components and flue pipes.

The boilers also were plagued by combustion air problems. Many were housed in

rooms too small to adequately access or install air louvers for ventilation — a major code deficiency. In many cases, a build-up of leaves and debris in the air intake louvers contributed to an overall problem with incomplete combustion, as well as flame roll outs, flame impingement conditions and overheating of the rooms.

After a complete testing it was clear that more than 40 percent of the boilers had completely failed or burned out. And in cases where the boilers still functioned, carbon monoxide levels in some of the boiler rooms were deemed "very unsafe" which, according to Tang, "is an efficiency issue and, of course, a cause of health and safety concern."

The problems facing Shoreline were not an overnight occurrence — the hydronic systems' gradual decline continued to worsen during a period of several years.

Fast Track: But the need for an overhaul was recognized by several new administrators, including a new vice president, **Beverly Jo Brandt**, hired from another community college. Among the changes made by Brandt was the hiring of a new facilities director. Brandt also had worked successfully with McKinstry in a former college post and was familiar with the state treasurer's loan program. A retrofit quickly became a priority for her at Shoreline.

Getting the job done quickly also became a priority for McKinstry, manufacturers rep firm Columbia Hydronics, and boiler manufacturer Laars Heating Systems due to a tight budget and a compressed time schedule. Final approval of the project was not received until late June, and the new system was required to be operational by the beginning of the new school year — a "window" of only 10 weeks time.

One of the primary challenges for the project was getting the key players to agree on the choice of boilers.

The McKinstry team — after conducting a full analysis of compatible boiler types and suppliers — recommended the use of a new generation of copper-fin boilers from Laars. Based on McKinstry's findings, the copper-fin boilers would provide the lowest lifecycle cost, while significantly boosting operating efficiency, increasing system capacity, and reducing equipment footprint.



Energy Costs Up, Energy Costs Down



After the Pennant boiler is fired, Mike checks temperatures at the system's internal control board.

Meanwhile, **Greg Angus**, Shoreline's maintenance supervisor, needed to be sold on the ease of maintenance regarding this type of boiler.

So Columbia Hydronics sales engineer **Mike Petterson** arranged to take Angus on a factory tour of the Laars facility in Moorpark, Calif., to review the equipment and put his fears to rest.

"That trip really did the trick," Petterson says. "Greg was able to see firsthand how the heat exchanger is easy to get to. The panel pops off so you can easily access the igniter."

In the end, Shoreline agreed to install 12 Laars copper-fin boilers. Because of the fan-assisted, sealed-combustion design of 10 of the boilers, system efficiency was increased to 85 percent, and more than 87 percent with the other two boilers — substantially better than the 50 percent to 60 percent operating range of the remaining functioning boilers.

Modulation: The ability to stage or modulate individual boilers enables the system to efficiently meet varying heating system loads. And, now, each boiler room is equipped with a dedicated boiler system controller to maintain minimum boiler temperatures, reset temperatures, and to fire only the required number of stages, or boilers,

to meet the demand.

"Using these low-mass boilers in a primary-secondary system approach is an ideal solution for energy retrofits," says **Dave Lockhart**, sales manager, Columbia Hydronics. "Rather than maintaining high-mass, standby energy at considerable cost, these systems quickly inject incremental energy into system loops on demand."

Because of the staged boiler arrangements at Shoreline, the school benefits from several of the most efficient boilers on the market: the *off* boiler. Yet the standby boiler is fully available and exercised as the alternate lead boiler every 24 hours. For most of the season, system demand is met with just one boiler, frequently with partial gas input. No standby losses, and no wasted energy.

In addition to the new boilers, the school's hydronic systems also were upgraded to primary/secondary loop configurations (from earlier single loops), and each boiler now has its own dedicated pump to maintain constant water flow and consistent temperature, factors that help to extend boiler life expectancy.

The design team also worked closely with local code officials, providing fire dampers, smoke dampers



McKinstry technician checks voltage to a gas valve in the Pennant boiler.

for better fire rating, as well as increasing combustion air inlets where necessary to bring the boiler rooms up to code compliance.

In addition to boiler upgrades, outdated pneumatic HVAC controls were replaced with new direct digital controls for more precise system control and temperature accuracy. The boiler controls also are factory-equipped with alternate start/stop and a setback capability to provide additional energy savings.

Improved maintenance will be a major factor in keeping the new systems operating at their best. Columbia Hydronics led Shoreline's mechanical staff through several sessions that focused on boiler and boiler control operation and maintenance.

In turning over the systems, just prior to initial commissioning earlier this year, McKinstry provided a CD with all the mechanical plans and control documents. The McKinstry team also will provide seasonal commissioning and maintenance schedules.

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