

Case Study: Roof Top Units V. Central HVAC

Looking beyond the short-term fix

School districts statewide are learning the hard way that a short-term fix may be the most expensive choice in the long run.

“When it comes to choosing between roof-top HVAC (heating, cooling and air conditioning) units and central HVAC systems, we are finding this to be true,” said Greg Churchill, energy analyst for the Oregon Department of Energy’s School Team. “The initial cost for roof-top units is considerably less than that for central systems. But, if you consider the life expectancy and added maintenance costs for the roof-top units, you soon recognize that roof-top units are actually the more expensive choice.”

Several school districts throughout the state already have learned this lesson first hand. Churchill said that one Oregon school district is having roof-top unit failures after just three years of use and another wants to replace its roof-top units only seven years after converting from a central system.

Roof-top units are “. . . made to be disposable. The compressor is 2/3 of the roof-top unit cost, so when it goes, you might as well buy a new unit.”

-Ron Junker
Facilities Manager
Oregon Trails School District



Philomath Elementary School has individual roof-top units for each classroom.

Chuck Volz, Maintenance Department supervisor for the Bend-La Pine School District in Central Oregon, has been with the Bend-La Pine district for two years, but previously was with the Redmond School District for 17 years. He had a roof-top unit fail within the first year after a central system to roof-top unit conversion when he was at Redmond.

“Luckily, it was still under warranty so we were covered, but it took a lot of time to get resolved,” Volz said. “It was a quick fix that came back to bite us.”



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Tom Ries, facilities manager at Philomath School District, discusses his options in dealing with roof-top units.

Ron Junker, new facilities manager for Oregon Trail School District in Sandy, calls the roof-top units “throw-aways.”

“They are made to be disposable,” Junker said. “The compressor is 2/3 of the roof-top unit cost, so when it goes, you might as well buy a new unit.”

Tom Ries, Director of Facilities for the past four years at Philomath School District, is struggling to keep 35 roof-top units running. The district placed the units on Philomath Elementary School in 1996 instead of upgrading the central HVAC system because roof-top units were the least expensive choice. Nearly all the roof-top units have rusted where the exhaust comes out of the unit.

And Ries is especially challenged by the maintenance the units require.

Extra maintenance

“We’re looking at 35 compressors, 35 fire boxes and multiple heat exchangers on each of the units that require attention,” Ries said. The small district’s maintenance staff has dwindled due to budget cuts from seven people 10 years ago to two and a half today.

“We try and change the filters and belts and perform maintenance checks quarterly, but we’re lucky to do it twice a year,” Ries said. “And, if school is closed for a day, we have to have someone come in and manually turn each unit off individually in 35 rooms. They are labor intensive.”

Maintenance, according to Churchill, is where the real costs with roof-top units are incurred. Because there are numerous compressors and fire boxes with multiple roof-top units, there is more need for preventative maintenance.

“It is estimated that roof-top units on classrooms require three times as much preventive maintenance as an equivalent central heating and cooling system,” Churchill said.

Preventive maintenance

Ron Junker concurs. With 34 years of experience as an engineering maintenance manager for Weyerhaeuser and Oregon Metallurgical Corporation before joining Oregon Trail School District, Junker is a big believer in preventive maintenance. His district has a roof-top unit on one school, but it is a large central unit that is used to service the entire school. “The preventive maintenance on the one unit is far less than if the school had the typical multiple roof-top units serving individual classrooms,” said Junker.

And, preventive maintenance is key.

“If you don’t do preventative maintenance, the hours you spend trouble-shooting a break down will be incredible,” Volz said.

For Volz, whose maintenance staff has also endured cuts, this was a critical point. With 23 school sites, Bend-La Pine made the decision to have a dedicated PM (preventive maintenance) specialist who goes from building to building and cleans coils; checks refrigerant; changes oil; replaces belts; checks mechanical valves,

pumps, motors, and bearings; and keeps a log of the equipment at each site and the necessary supplies required at each site. The district also had a dedicated boiler technician. Having a specialist who was familiar with the equipment paid off when he discovered that the relatively new boiler at one school had been incorrectly installed and condensation was building up.

Having these specialists reduces emergency calls 75 percent according to Volz. This past year, the PM specialist and boiler technician positions were combined so Volz has his fingers crossed that the work can be done in a timely manner.

Less expense

Junker notes that preventive maintenance is less expensive than unplanned emergency work. “The benefit of conducting PM inspection is identifying elements of a piece of equipment before they fail. Once identified, repair can be planned and scheduled during low attendance days,” Junker said. “Historically, emergency repairs cost 2.5 times more than planned work.”

Volz oversees 23 school sites. While the average building age is 32 years, the fast growth in Central Oregon has meant a new high school, a new middle school and four new elementary schools in the past five years. All have central HVAC systems. And, that’s a good decision Volz believes for the present and the future.

The Philomath School District, however, is not in a building mode and is reluctant to ask the voters to pass a bond issue for maintenance issues. Tom Ries lists his choices:

1. Replace the failing roof-top units with a traditional boiler system. The roof-top units currently provide air conditioning, which is difficult to take away from staff and students. To provide air conditioning, the district would also have to add a central chiller. The total cost would be an estimated \$1 million to \$1.5 million.
2. Replace the failing roof-top units with more efficient roof-top units made of stainless steel. Cost for replacement units would be approximately \$550,000.

Given the choices his district has, Ries does not see the 35 roof-top units going away. The district can’t afford it. They chose a central HVAC system for the last new building project, the primary school built in 2000, but replacing the roof-top units at the elementary school for \$1 million to \$1.5 million will probably not happen.

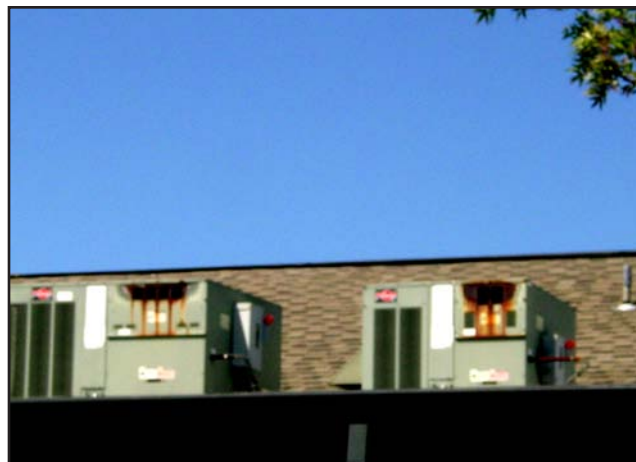
Initial cost per square foot

The Oregon Department of Energy has calculated the initial cost of central HVAC for a typical school building in Oregon to be approximately \$20 per square foot. A boiler is expected to last 30 to 50 years. Many older Oregon schools have boilers that are 70 years.

Roof-top units, on the other hand, have a much lower initial price tag of \$8 per square foot. While initially less expensive, roof-top units life expectancy is 8 to 10 years. This means the total capital cost to a school district installing roof-top units is \$24 per square foot in 30 years and \$40 per square foot in 50 years.

“In the long haul, analyzing the life-cycle cost will save expenses on your operating budget for years to come,” said Junker.

The frequent turnover of school administrators and school board members compounds the problem. Ries has been with Philomath for four years. The current superintendent started his job with the district this summer.



All the roof-top units on Philomath Elementary have unsightly rust marks due to condensation.

Neither made the decision to go with the roof-top units, but both must deal with the mounting maintenance problems of the units while facing a dwindling budget.

When Volz took over the job at Bend-La Pine, he was pleased to see that his maintenance manager and head electrician Mike Tiller, the director of the maintenance department John Rexford, and school administrators had made the decision to go with central HVAC and no roof-top units on their new buildings.

“They wanted to do the job right with what we had,” Volz said. “A quick fix made today might not be my problem, but it will be next person’s problem and it will end up costing you. I want to leave something that will last.”

“With school districts throughout the state slashing their maintenance budgets, the choice between central HVAC and roof-top units is more important than ever,” said Churchill.

	CENTRAL HVAC	ROOF-TOP UNITS
PROs	Long lasting (30 to 50 years)	Initial cost low (\$8/sq. ft.)
	Easy to maintain (2 fans, boiler, chiller)	System failure will affect small number of students/staff
	Lower utility bills (less than \$1/sq. ft.)	
	Easy to access	
CONs	Initial cost high (\$20/sq. ft.)	Short life (8 to 10 years)
	System failure will affect large group of students/staff	Difficult to maintain (multiple fans, equipment, etc.)
		Higher utility bills (more than \$1/sq. ft.)
		Difficult to access during inclement weather – worker safety issue
		Units are exposed to weather
		Units are unsightly
		Air intakes close to roof-top level may draw in roofing material off-gas and mold spores

School districts that need guidance should call the Department of Energy. The Department’s Schools Team members are available to present information to school facility and business managers, school board members, and superintendents concerning the roof-top units/central HVAC system issue. Staff can also explain how school districts can get financial assistance with the Business Energy Tax Credit Pass-through Option and Energy Loan Programs. Call 1-800-221-8035 or (503) 378-4040 in Salem.