JLC Report

Bare-Bones HVAC Proves Its Worth in Affordable Development

In a typical residential hvac system, the ductwork or plumbing that distributes the output of a furnace or boiler can cost as much as or more than the appliance itself. Add a separate mechanical ventilation system with an HRV or an ERV, and costs mount even higher. But a recent project in Greenfield, Mass., shows that it's possible to distribute heat and ventilation air effectively with surprisingly little hardware.

A tight, well-insulated envelope. The Wisdom Way Solar village — a project of the Massachusetts nonprofit Rural Development Inc. — is a 20-unit development of two-, three-, and four-bedroom duplex units priced for low- to moderate-income buyers. The simple rectangular structures feature double 2x4 walls insulated with blown cellulose and conventional truss roofs insulated with R-50 cellulose at the attic floor.

Most of the units have no dedicated air barrier or vapor retarder. (A layer of polyethylene installed beneath the drywall of the first two units was omitted from those built later.) Thanks to careful air-sealing beneath the plates and at sheathing joints, however, they're very tight: Blower-door testing put their air leakage at 280 to 300 cfm (about 1.4 ACH) at 50 pascals.

Mechanical ventilation is supplied by a simple exhaust-only system, in which a two-speed Panasonic WhisperGreen fan operates continuously in the bathroom on low speed. A manual override switch and timer allow occupants to turn the fan to an 80-cfm "high" setting as necessary. The units have no passive air inlets; fresh air finds its way in through small

Although the solar arrays on these energy-efficient duplex units draw the most attention, it's the exhaust-only ventilation, single-source heating systems, and simplified ductwork that really set the Massachusetts complex apart.

■ A 25-story Seattle apartment building has been slated for demolition after engineers concluded that improperly grouted post-tensioned cables have corroded beyond repair. Since the 9-year-old Carpenter's Tower is too close to other high-rise buildings to demolish with explosives, it will be taken down floor by floor with a crane. Among those who will be displaced when the building is demolished — sometime before the end of this year — is the building's owner, Seattle Carpenters Union Local 131. "You expect a building to last three, four, five generations," union financial secretary Ken Milici told radio station KPLU. "We wanted to be in our building for a hundred years plus."

■ Production home builder Hovnanian Enterprises has agreed to settle alleged Clean Water Act violations at 591 construction sites in 18 states by paying a $1 million fine. Government agencies accused the Red Bank, N.J.–based company of engaging in a pattern of violations, among them improper discharge of storm debris and silt, failure to obtain permits until after construction had begun, and failure to obtain permits at all. The allegations were based on state and federal site inspections and EPA reviews of documentation submitted by the company.

Bare-Bones HVAC
continued from page 1

random openings in the building envelope.

Single-source heating and a distribution fan. The exhaust-only ventilation strategy means that the indoor air is at a slight but continuous negative pressure relative to the outdoors, ruling out the use of conventional atmospherically vented combustion appliances. Space heating comes from a single sealed-combustion gas space heater in the main downstairs living space, which easily meets the 12,000 Btu-per-hour design heating load.

Most heat distribution to the upstairs bedrooms takes place through natural conduction and convection. Additional upstairs heat and ventilation is provided by a second continuously operating WhisperGreen fan installed in the downstairs ceiling, which delivers 25 cfm through short duct runs to registers in each bedroom. The temperature of the ducted air is typically in the high 60s or low 70s, depending on the thermostat setting of the downstairs heater, so the amount of heat transported is quite small. But given the efficient building envelope, it's enough.

"The design heating load for the bedrooms was about 2,000 Btu," says Robb Aldrich, an engineer with Steven Winter Associates, who helped design the system. "When you factor in the incidental heat given off by an occupant, you just don't need much additional heat."

Preliminary testing. In February of 2008 — after construction was complete but before most residents had moved in — a team of researchers from the DOE's National Renewable Energy Lab (NREL) evaluated the heating and ventilation systems in four unoccupied units. Tracer-gas testing confirmed that with the distribution fan in operation, airflow to the bedrooms was comparable to that in the open downstairs living space.

In a second round of tests, the researchers examined overnight temperature changes under various conditions. As expected, they found that the bedrooms cooled off substantially when the doors were closed and the distribution fan was deactivated. (The fan is not user-controlled, and ordinarily remains on without interruption.) With the bedroom doors closed, the distribution fan operating, and a 60-watt bulb switched on to simulate the heat given off by a sleeping occupant, the temperature of the downstairs

■ OSHA has announced plans to enlist building inspectors in nearly a dozen U.S. cities as undercover safety officers. Under the pilot program, the agency will train the building inspectors to look for hazards associated with the four leading causes of construction-related fatalities: falls, electrocution, being crushed or caught between objects, and being struck by falling or moving objects or machinery. Inspectors who discover unsafe conditions in the course of their work would be encouraged to notify OSHA, which would then send a compliance officer to the site to perform a safety inspection. The cities in which OSHA is seeking to partner with building inspectors are Austin, Texas; Boise, Idaho; Cincinnati; Concord, N.H.; Greenwood Village, Colo.; Madison, Miss.; Atlanta; Newark, N.J.; Oakland, Calif.; Washington, D.C.; and Wichita, Kan.

■ Bankrolled by $20 million in federal stimulus funds, Detroit is embarking on an ambitious project to "right-size" itself by demolishing some of an estimated 90,000 abandoned or vacant homes. The excess houses have been piling up for several decades, as job losses in the auto industry and elsewhere have led to a steady decline in the city's population. The city hopes to raze at least 3,000 buildings by September of this year. Mayor Dave Bing has proposed converting some of the bulldozed neighborhoods into parks or urban farmland. "There's going to be a lot of empty space," building department director Karla Henderson told the *Wall Street Journal.*

■ Few former Boy Scouts now earning their living as carpenters can trace their career choice to that long-ago carpentry merit badge, and for good reason: Most had yet to be born when the badge, first offered in 1911, was discontinued in 1952. But some future carpenters will have that chance, thanks to the Boy Scouts of America's decision to reintroduce the carpentry badge — for this year only — in commemoration of the organization's 100th anniversary. Other historic merit badges being brought back temporarily are in signaling, tracking, and pathfinding.

Bare-Bones HVAC
continued from page 2

living space and the bedroom varied by less than 5° on a cold winter night.

No complaints. As the NREL report noted, the maximum measured 4.95° temperature difference between the main living space and a bedroom did exceed the Manual RS specification of the Air Conditioning Contractors of America, which calls for a room-to-room variation of no more than 4°. The report's authors suggested that homeowners might want to consider using small 200- to 300-watt electric space heaters in bedrooms to more closely control their temperature.

During the winter of 2009–2010, Steven Winter Associates followed up on the NREL tests by installing temperature data loggers in the bedrooms of four occupied units and conducting interviews with homeowners. The firm found that few occupants had resorted to the supplementary electric heat proposed in the NREL report. One homeowner, who uses a bedroom as a home office, reported that the room was typically somewhat warmer than the downstairs living space, apparently as a result of heat generated by a computer, monitor, and other equipment. Others had found that simply leaving bedroom doors open when the rooms were unoccupied prevented them from becoming too cool.

Back to the future. The units at the Wisdom Way development are compact and small in size, ranging from 1,100 to 1,800 square feet. Could a heating and ventilation strategy similar to the one applied there work for larger structures as well? Robb Aldrich is convinced that it could.

"If you're talking about a 4,000-square-foot house you might want more than one source," he says. "But if you get the heating loads down far enough, you could probably design a good system with a couple of gas heaters, or even a couple of mini-split heat pumps."

And while single-source heating may seem radical, it's far from new: Even in very cold climates, homeowners who heat with wood have traditionally relied on a single strategically located stove or masonry heater. The familiarity of that basic concept, Aldrich speculates, may be why the project ran into so little resistance. "I was a little surprised," he says. "The contractors, the building officials, the homeowners — there was very little skepticism from anyone." — *Jon Vara*

Proposed Clampdown on Fly Ash Draws Wary Response From Concrete Industry

Concrete producers are scrutinizing a recently released EPA proposal to tighten regulation of ash from coal-burning power plants, which the agency calls coal combustion residuals, or CCR.

Top to bottom. About 130 million tons of CCR are produced in the U.S. each year, of which about half is fine-particulate fly ash recovered from the chimneys of coal-burning plants. (The remainder consists of so-called "bottom ash" from the furnaces and flue-gas desulfurization material from stack scrubbers.) Fly ash is commonly used as an admixture in concrete, where it serves to reduce the amount of cement required, increase workability, and provide a higher-strength finished product. It's also used in lean fill — also called flowable fill — as backfilling material in place of expansive clay or other problem soils.

Subtitle C or Subtitle D? At present, it's up to individual states to set their own rules for the disposal of CCR. In most cases, the ash is dumped in dry landfills or stockpiled as a slurry in storage ponds. The spectacular failure of such a coal-ash pond in Kingston, Tenn., in December of 2008 — necessitating a $1.2 billion cleanup that is still far from complete — prompted the EPA to begin developing uniform regulations of its own.

The EPA proposal lays out two possibilities for bringing CCR under the Resource Conservation and Recovery Act (RCRA), which is the primary federal law regulating solid waste. In the first, more restrictive option, coal ash would be classified as "special waste" and regulated under Subtitle C of the RCRA, which deals with hazardous waste. Under that approach, the use, storage, transport, and disposal of coal ash would be subject to

Fly-Ash Proposal
continued from page 3

yet-to-be-developed permitting requirements. In the second option, regulation would take place under Subtitle D, allowing for a greater role for individual states, no direct federal enforcement, and fewer restrictions on how the ash could be handled.

Change in perception. According to the Portland Cement Association (PCA), manufacturing a ton of cement releases about a ton of CO_2 into the atmosphere. Because fly ash can substitute for some of that energy-intensive cement, it has long enjoyed a reputation as an environmentally friendly additive, and in theory that should not change under the proposed new regulations. The EPA Web site notes that the agency "continues to strongly support the safe and protective beneficial use of CCRs."

Like other byproducts of coal combustion, however, fly ash does contain small amounts of mercury and other heavy metals. Such substances are generally considered safe when encapsulated in concrete, but if the EPA designates fly ash as a form of hazardous waste — as may happen if the agency chooses to regulate it under Subsection C — builders and the concrete producers could face public relations problems.

"We have some concerns about the potential for stigma," says Andy O'Hare, PCA vice president of regulatory affairs. "In the end, I think the EPA will come down on the side of Subtitle D, but we won't know that for a while."

The unofficial version of the agency's proposal was released on May 4. After a 90-day public comment period, marked by the publication of an official version in the Federal Register, the agency is expected to move forward with one of the two regulatory options, probably by late summer or early fall. — *J.V.*