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INDUSTRY NEWS

Keeping It Simple

Engineers monitoring the performance of a Colorado near-zero-energy house are pleased with the home's performance to date, in spite of the fact that photovoltaic (PV) production is somewhat less than expected. The three-bedroom, 1,200-square-foot house in Wheat Ridge, Colorado, was completed in October 2005 by volunteers from the Metro Denver chapter of Habitat for Humanity, with support from the Department of Energy's Building America program (see "News Briefs," ***EDU***, August 2005).

Although 12 months of monitoring data from the Wheat Ridge house will not be available until April 2007 at the earliest, some limited monitoring data have been released. Another valuable source of information on the Wheat Ridge house is "A Cold-Climate Case Study for Affordable Zero Energy Homes," a paper by Craig Christensen and Paul Norton, two engineers from the National Renewable Energy Laboratory (NREL) in Golden, Colorado. In July, Christensen and Norton will present their paper at Solar 2006, the annual conference of the American Solar Energy Society.

Figure 1. To make them inconspicuous, the photovoltaic modules and solar thermal collectors at the near-zero-energy house in Wheat Ridge, Colorado, were mounted with minimal clearance to the roofing.

Offsetting Source Energy, Not Site Energy

As with most near-zero-energy homes, on-site energy for the Wheat Ridge house is generated by solar thermal collectors and a PV array (see Figure 1). The home includes both electric and gas appliances; as Christensen and Norton acknowledge, "The use of natural gas for heating, cooking, and clothes drying within a ZEH [zero-energy home] is somewhat controversial." Natural gas is also used to heat some of the home's domestic hot water.

According to NREL calculations, excess electricity produced by the grid-connected PV array should offset the home's natural gas consumption. The gas-offset calculation is made on a source-energy basis, not on a site-

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energy basis or a dollar-cost basis. In other words, the NREL engineers calculate that a unit of PV power sold to the grid offsets an amount of natural gas with three times the energy. If the homeowner sells 9.8 kWh of PV electricity to the grid, the electricity is assumed to offset 29.4 kWh of natural gas, or about 1 Therm.

Using a source-energy formula for calculating the value of excess PV production made it easier for NREL engineers to justify the decision to include natural gas appliances. With gas appliances specified, the home could get by with a 4-kW PV array—still expensive, at $29,000, but 1.1 kW smaller than would have been required for an all-electric house. However, including gas appliances carries at least one disadvantage: the local gas utility charges the homeowner a $9-per-month gas hookup fee, whether or not any gas is used.

Optimizing the Design

The design team for the Wheat Ridge home included construction experts from Habitat for Humanity as well as NREL personnel. According to Christensen and Norton, "The NREL engineers made suggestions based on modeling results and analysis and presented them to the design team who then grounded the discussion with practical concerns and insights."

All of the components specified for the Wheat Ridge house are readily available off-the-shelf items. "Because the home is expected to outlive all of the mechanical systems in the home, we wanted these systems to be easily replaceable by technicians the owners could find in the local yellow pages," wrote Christensen and Norton. "Many of the recently designed zero energy homes include complicated interconnected mechanical systems designed to maximize renewable energy use and distribution. … We believe a simpler system will have fewer problems and a greater chance at longevity."

NREL engineers used a new computer modeling program, BEOpt, to fine-tune specifications for the Wheat Ridge house. "At this point BEOpt is still a research tool, but some of the people in the Building America program are starting to use it," Norton told ***EDU***. "It's an optimization program that runs both TRANSYS and DOE2. Now that computing speed has gotten fast enough, it can perform hundreds of DOE2 and TRANSYS runs—it can run a one-year simulation in seconds. You don't have to use heuristic guesses any more when designing wall configurations or refrigeration or ventilation options. It can run all of the simulations and choose the least-cost option."

The BEOpt program determined that the Wheat Ridge house should have a very well insulated envelope (R-30 floor, R-39 walls, R-60 ceiling). Cost considerations dictated the use of double-glazed rather than triple-glazed windows (see Table 1, page 3).

NREL engineers predict that appliances and plug loads will consume about 57% of the energy used at the Wheat Ridge house. Since this category of energy use is notoriously elastic, sizing the PV array was a challenge. "The ZEH designer is faced with sizing a PV system for a home where the largest load is really not known with any accuracy," wrote Christensen and Norton. "If the actual household and weather are typical, the home will achieve zero energy. If the household or weather is atypical, the home may not achieve zero energy or may be a net producer."

A Simple HVAC Design

Because the home's space heating load is quite low (9,200 Btuh), the NREL team found it hard to justify the expense of a ground-source heat pump or an active solar space heating system. They ended up specifying a hybrid heating system consisting of a natural gas space heater in the living room and electric-resistance

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baseboard units in the three bedrooms. "This approach is relatively low cost, elegantly simple and provides zone heating because each appliance has its own independent thermostat," wrote Christensen and Norton.

From an energy-balance standpoint, however, including electric resistance heat in a near-zero-energy home is risky. According to a March 12, 2006, NREL report, "The baseboard electric heaters in the bedrooms are using a substantial amount of energy—nearly identical to the miscellaneous electric loads in February." Paul Kriescher, an Energy Star rater for Lightly Treading Energy in Denver, has been closely involved with the Wheat Ridge project. "We need to give the homeowner better guidance about how to use the baseboard heat," Kriescher told ***EDU***. "The monitoring data shows a lot of electric baseboard use—more than expected."

Preliminary Monitoring Results

Unfortunately, the PV array at the Wheat Ridge house

Table 1—Wheat Ridge House Specifications

		Incremental Cost of Upgrade
Location	Wheat Ridge, Colorado	
House size	26 ft. x 46 ft. (1,196 sq. ft.), 3 bedrooms	
Foundation type	Crawlspace with insulated joists above	
Floor insulation	R-30 fiberglass batts	$400
Wall construction	Double stud wall (2 rows of staggered 2x4 studs on 2x12 plates)	
Wall insulation	Three layers of R-13 fiberglass batts (nominal R-39) covered with an interior polyethylene vapor retarder	$2,100
Attic insulation	Attic floor insulated with 24" of blown-in fiberglass insulation (R-60) installed over bottom chords of raised-heel trusses	$415
Passive solar features	Long dimension of house oriented east-west; increased glazing on south side, reduced glazing on east, north, and west.	
Windows / glazing	South windows: U-factor = 0.30, SHGC = 0.58; East, north, and west windows: U-factor = 0.22, SHGC = 0.27	$640
Siding	Fiber-cement siding over housewrap	
Air-sealing measures	Spray foam at all envelope penetrations; airtight electrical boxes in exterior walls	$525
Blower door test results	0.15 ACHnat	
Domestic hot water	Drainback solar thermal system (96 sq. ft. of solar collectors connected to a 200-gallon storage tank) with instantaneous gas water heater backup	$7,250
Design heating load	9,200 Btuh at 0°F outdoor winter design temperature	
Space heating system	82% AFUE gas-fired Rinnai space heater in living room; electric resistance baseboard heaters in bedrooms	$100
Air conditioning	None	
Photovoltaic system	4 kW PV system (24 Sharp NE165U1 modules and a Sunny Boy SB3800U inverter)	$29,000
Ventilation system	Energy-recovery ventilator (Stirling RecoupAerator 200 DX with ECM blower) with dedicated ventilation ductwork	$1,000
Lighting	100% compact fluorescent	
Total incremental cost of upgrades	Not including labor	$41,430

Table 1. The incremental costs shown in this table represent material costs only. As with most Habitat for Humanity projects, almost all labor was donated.

is partially shaded by trees. According to an April 5, 2006, NREL report, "In February, the PV array produced 24% less energy than it would have without snow cover or shading. During the design phase, we estimated an annual PV output reduction of 15% due to shading based on a site shading analysis. With new shading loss expectations, the DOE2 model now predicts that the home will produce 92% of its energy, falling short of the zero energy goal."

Even if the PV array fails to produce enough energy to offset gas usage, the home may still produce more electricity than it uses. According to the April 5 update, "Since February 1, 2006, the PV system has produced 126 kWh more than the electricity used in the home, making it a net electricity producer."

Norton strongly believes that a successful near-zero-energy home should use simple equipment. "Hopefully, one of the things this will show is that it is possible to design a zero-energy house with a very simple approach," Norton told ***EDU***. "Active solar space heating is not a requirement, and it may not even be a good idea. I'd hate to see us build zero-energy homes that are maintenance nightmares."

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In Arizona, White Roofing Causes Wet Insulation

Southwestern builders have recently been perplexed by a new type of building failure involving truss uplift and wet ceiling insulation. In most cases, the problems show up in houses with truss-framed low-slope roofs and light-colored membrane roofing.

William Rose, an architect and building researcher at the University of Illinois in Urbana-Champaign, described the syndrome at a recent conference in Burlington, Vermont. "In Tucson, there have been problems in houses with white roofs—built-up roofs with a white coating," Rose explained. "These are energy-efficient houses with airtight ceilings, low-slope roofs framed with wood trusses, OSB sheathing, and R-38 fiberglass batts wired directly beneath the roof sheathing. There were complaints of truss uplift, so it looked like humidity was involved."

Called in to investigate, Rose installed sensors in one of the problematic roof assemblies. It soon became apparent that the roof sheathing was getting much colder than expected. "In December, January, and February, the fiberglass was wringing wet," said Rose. "The OSB was 5 to 7 degrees colder than the outdoor air—colder than the indoors or the outdoors. In this climate, radiant effects become really important. There is nothing standing in the way of the roof radiating out to space. You have a whole lot of heat loss from the roof surface, day and night. With this white roofing, 80 percent of the heat that hits the roof is reflected. The sun can't keep up with the heat losses to the sky. What you've created is a sky-powered cooling coil, and the fiberglass insulation is like a dirty condensate pan. The roof sheathing gets so cold that it is sucking wetness out of dry air."

The Trail, Like the Roof Sheathing, Goes Cold

Pursuing the story, ***EDU*** tracked down several leads, many of which turned into dead ends. Builders struggling to understand problems with wet roof insulation are very publicity-shy. Reportedly, some of the failures occurred in houses enrolled in a program funded by the Tucson Electric Power Company. However, Art McDonald, director of communications for Tucson Electric, was tight-lipped. "We have been collecting some data, but I have no further comment," McDonald told ***EDU***.

According to some reports, John Straube, a professor of engineering at the University of Waterloo in Ontario, Canada, investigated the problem. "What we discovered was surprising, but I can't tell you anything," Straube told ***EDU***. "I'm under a nondisclosure agreement."

Saturated Fiberglass

Fortunately, John Tooley, a senior building science consultant at Advanced Energy Corporation in Raleigh, North Carolina, was willing to discuss his Arizona experiences. "At one roof I investigated—it was a flat-top roof assembly with a hot tar membrane roof coated with an off-white elastomeric coating—we pulled the roof off to take a look," said Tooley. "The roof deck was totally saturated, and there was mold growth all over the bottom of the sheathing. The moisture content was greater than 30 percent. The fiberglass insulation was totally wet. This was in a house that was less than a year old."

According to Tooley, many Southwestern roofs get wet while construction is still underway. "During construction, builders are used to closing houses up at night,"

said Tooley. "Then all the water inside the building is trapped inside. If you close the door, the interior can be in the 90s during the day. But by 1:00 in the morning, the roof deck is 67 degrees. With night sky radiation, the interior moisture goes to the cold OSB. It can happen quickly, before the house is insulated. Houses can have a lot of water—from adobe block or concrete—and all the water goes to the cold roof deck. The more water you add to the building, the more tolerance you take away. If you install wet-spray cellulose, and then you slam the doors of the house shut, the next day you can have a delaminated roof."

Night Sky Radiation

The key to the phenomenon described by Rose and Tooley is radiation. Warm objects, including roofs, radiate heat continuously; unless the weather is cloudy, a roof sees nothing but infinite space above—cold, empty outer space. "With a clear sky, there's radiation loss to the sky, and it happens 24 hours a day," says Rose. "A clear sky is always really cold." In sunny weather, a dark roof will absorb solar heat; however, highly reflective roofing—the type often installed in hot climates—doesn't absorb much heat. "At the house we're monitoring, it appears that perhaps solar heating can't even compensate for the daytime losses," said Rose. "I wouldn't have anticipated this outcome."

Tooley echoes Rose. "With roofing, the closer you go to white, the more it is affected by sky radiation," he said. "One part of the story is that in Arizona, they don't have clouds."

A third consultant confirming details of the white-roof problem is Joseph Lstiburek, a principal of the Building Science Corporation in Westford, Massachusetts. "A bunch of houses in Tucson with flat unvented roofs and white membrane roofing had moisture problems," Lstiburek told ***EDU***. "There was truss uplift—sheetrock problems indoors. We opened the roofs and found stuff was wet. There was slight evidence of mold on the underside of the roof deck. A couple of things conspired together. Number one, it wasn't a black roof. Number two, the interior moisture level was higher than typical. Who knew that we would end up with high levels of interior moisture in Tucson? We were close to the boundary of performance. To some extent it was unexpected—it was unexpected that the daytime solar gain was not enough to drive out the moisture that accumulated during the night due to radiational cooling. I recommended installing 1 inch of foam insulation above the roof sheathing."

Figure 2. Usually, the first sign of the white-roof problem is cracked drywall caused by truss uplift.

Western Builders Learn About Truss Uplift

For builders, the first sign of the white-roof problem is usually cracked drywall (see Figure 2). Truss uplift occurs when the top chord of a roof truss is at a higher moisture content than the bottom chord. "People on the East coast have known about truss uplift for years," says Tooley. "But they never thought about having to be conscious of the issue out West, where they've been nailing drywall up to the interior partitions without drywall clips—nailing the trusses to the top plates. This is epidemic—it's not some small problem. The first time I saw it, I said, 'Holy cow'—I hadn't thought of this. Now this problem is causing millions of dollars of claims in places like Phoenix. All the large builders, including Pulte, have had this problem. I started to ask them about truss uplift, and they said, 'Hell yes, we've got problems with it.'"

Houses with low air leakage rates often have elevated levels of interior relative humidity. "The big change in recent years is that we have made the buildings much tighter," says Tooley. "In these climates—Nevada, Arizona, and southern California, where they build slab-on-grade houses with stucco—the houses are very tight. They only leak air to the top. One builder went from I-joists to web trusses, and immediately 45 houses had truss uplift. The problem comes from contraction and expansion of the upper chords of the trusses. For anyone switching over to web trusses, this has been a big issue. To prevent the problem, you have to use drywall clips and decouple the top plates from the trusses. You usually see it on flat-top or low-pitched roof assemblies. Once you get the pitch up to 6/12 or steeper, the problem drops off, because the volume of the attic is large enough that you don't get the problem."

Repairs Are Costing Millions of Dollars

According to Tooley, the white-roof problem is caus-

ing major headaches for Southwest builders. "I asked a very large builder who builds in Las Vegas and Phoenix how big this problem was for them," said Tooley. "They said they were spending $2,000 to $5,000 a house to fix the problem—$10,000 a month in Vegas alone. They were seeing these truss-uplift problems, but they didn't have a clue about what the problem really was. They have about $3 million of backlog—truss uplift issues—going on in the two cities. It is becoming a huge issue for the builders."

Tooley believes the problem is widespread. "If you busted open roofs all over the Southwest, you'd find that the lower the pitch of the roof, the more you would see the evidence of moisture," he said. "All of these roofs get wetting and drying cycles. If the wetting cycle is long enough, mold will grow and the insulation will get wet. I think if you cut roofs open, you will often find out that they are wet."

Solving the White-Roof Problem

Wet roofs in Arizona are radiating more heat to the sky than older houses because of the high reflectivity of some new types of roofing. "There is nothing wrong with a white roof or a flat roof or web trusses," says Tooley. "But if you have all three things in combination, you need to think about ways to heat up the condensing surface. If painting the roof black will work, that would be one answer. You have to change those surface temperatures—raise the temperature of the roof deck—or go back to I-joists."

Tucson's wet roof assemblies are like canaries in a coal mine. "The whole issue gets back to tolerance," says Tooley. "The more energy we take out of buildings, the less tolerant they become. What takes the water out of your building in the summer? It should be the air conditioner. We want lower heating and cooling loads—so now the air conditioner isn't running as much as it used to. But this truss-uplift problem is a warning. You have to think about what these changes are doing to the tolerance of the building."

As Bill Rose notes, "We have to play off energy conservation against durability."

NEWS BRIEFS

Two New Air-Source Heat Pumps For Cold Climates

BANGOR, ME -- In late 2006, two Bangor manufacturers will be releasing new models of air-source heat pumps designed for cold climates. Nyle Special Products, which ceased production of its cold-climate heat pump in 2005 (see ***EDU***, August 2004 and August 2005), expects to begin production of an improved unit this year. "There were technical problems with the system," said Don Lewis, president of Nyle Special Products. "The percentage of failures was higher than acceptable, and we needed to go back to the drawing board to make some corrections. We are just getting ready to get back into production." Meanwhile, another Bangor manufacturer, Hallowell International, has begun producing its own cold-climate air-source heat pump. Hallowell International was founded by Duane Hallowell, a former Nyle Special Products employee. Hallowell expects to begin shipping its new heat pump, the LT Hybrid, in June 2006. The LT Hybrid is being manufactured in two sizes: a 2-ton unit (about $5,500 for the outside condensing unit) and a 3-ton unit (about $6,500 for the outside condensing unit). Like the cold-climate heat pump formerly manufactured by Nyle Special Products, the LT Hybrid includes two compressors. According to preliminary test data, the LT Hybrid has a coefficient of performance of 2.2 at an outside temperature of 0°F. Hallowell says that the LT Hybrid is based on a design patented by David Shaw. "Nyle Special Products had a royalty agreement with David Shaw, the inventor," Hallowell told ***EDU***. "The patent was defaulted by Nyle." According to Lewis, however, Nyle never used the Shaw design. "David Shaw has a patent of a design, but no one has ever built one conforming to his patent," Lewis told ***EDU***. "We thought we were using David Shaw's design, but it turns out we weren't. His design uses a type of compressor—one with an oil sump—that is not available on the market." For more information, contact Hallowell International; Tel: (207) 990-5600; Web site: *www.gotohallowell.com*; or Nyle Special Products; Tel: (207) 942-2865 of (800) 777-6953; Web site: *www.nyletherm.com*.

California City Considers Limiting Energy Use of McMansions

PALM DESERT, CA -- The Palm Desert Office of Energy Management has drafted a local ordinance requiring new homes over 4,000 square feet to include features to limit their energy use to the same level as a new home measuring 4,000 square feet. The effect of the ordinance would be to promote efficient appliances, high levels of insulation, windows with spectrally selective glazing, and photovoltaic systems. According to an article in the *Desert Sun*, Palm Desert currently has between 800 and 900 single-family homes over 4,000 square feet; last

year the Palm Desert planning commission approved one single-family home measuring 34,000 square feet. Before the proposed ordinance becomes law, it must first be approved by the California Energy Commission and the Palm Desert City Council.

Ontario House Has A Solar-Assisted Ground-Source Heat Pump

OSHAWA, ONTARIO -- At a new residential development called Copperfield, a Canadian builder has completed a home equipped with Ontario's first solar-assisted ground-source heat pump (see ***EDU***, April 2006). The home's heat pump and three 4'x8' solar collectors provide space heating, cooling, and domestic hot water. The builder, Craig Marshall of Marshall Homes, celebrated the home's completion with a housewarming party attended by Ontario Energy Minister Donna Cansfield. The ground-source heat pump system includes three 185-foot-deep vertical ground loops. During the summer, these vertical ground loops will transfer excess solar thermal energy to the surrounding soil and rock. Marshall Homes offers several home models in the Copperfield development, ranging in cost from $294,000 to $417,000. As options, the builder offers three energy upgrades: Energy Star compliance costs an additional $7,229 to $9,519; a solar hot water system costs an additional $6,000; and a solar-assisted ground-source heat pump system costs an additional $22,000. (All prices are in Canadian dollars.) For more information, contact Marshall Homes, 1295 Wharf Street, Unit 9, Pickering, Ontario L1W 1A2, Canada; E-mail: craig@marshallhomes.ca; Web site: *www.marshalhomes.ca*.

Wall Street Journal Cites Flaws In Energy Star Program

NEW YORK, NY -- Consumers should be skeptical of the value of the Energy Star label, according to a recent *Wall Street Journal* article. "As consumers look to shave every nickel they can off their energy bills, the Energy Star label has served as a welcome shopping guide," wrote reporter Neil Parmar. "Unfortunately for millions of energy-conscious Americans, these ratings can be meaningless. The reasons run from outdated test procedures to a simple lack of policing of the program." According to the article, "the Energy Star label is often little more than a marketing gimmick." Parmar reports that, for many appliances, the Energy Star bar is quite low. "While the designation was originally supposed to apply to the 25% of products in any category that were most energy-efficient, the label is on 85% of all new dishwashers and 98% of desktop computers." To test policing of Energy Star label use, Parmar visited a Best Buy store in Manhattan. "We found an entire row of clothes dryers, all bearing big, oversize Energy Star stickers. Nothing would have looked out of the ordinary to the average shopper. But since all dryers consume roughly the same amount of energy, the category doesn't qualify for an Energy Star label. Best Buy, which joined the program late in 2004 during a larger push by the EPA to involve more retailers, says the labels were put on by mistake and is working to correct the problem."

Energy Star Bar Too Low, Say Europeans

BRUSSELS, BELGIUM -- Since the European Union's current agreement with the US Environmental Protection Agency governing the use of the Energy Star label in Europe is scheduled to expire in June 2006, the European Commission has proposed raising Energy Star standards for office equipment. According to a report by Environment Daily, an online environmental news service, "Advances in product efficiency [since 2000] mean the proportion of models complying with the label's criteria now approaches 100% in many product classes. … The commission says the scheme should be renewed for five years but on the basis of fresh, stricter criteria that would mean only 25% of the market qualifies for the label."

ASHRAE Proposes Raising Code Stringency For SHGC

ATLANTA, GA -- The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has sponsored a proposal to change the International Energy Conservation Code (IECC) prescriptive requirements for the solar heat gain coefficient (SHGC) for windows installed in southern climate zones 1 and 2. According to the proposal, the maximum SHGC would be lowered from 0.40 to a more stringent 0.37. Speaking in support of the proposal, window expert Chris Mathis noted, "A lower SHGC is a cost-effective way to reduce the air-conditioning load. This is fairly low-hanging fruit." If adopted and ratified by IECC members, the proposed code change will be integrated into the Supplement to the 2006 IECC.

Cornell Solar Decathlon House Sold For $121,000

ITHACA, NY -- At an April 8 auction, the high bid for the Solar Decathlon house built by Cornell University students was $121,000. The house, which cost $347,000 to build, is equipped with a 6-kW photovoltaic system. News reports did not identify the name of the winning bidder.

Energy Efficiency Center Opens In Davis, California

DAVIS, CA -- The University of California - Davis has established a new Energy Efficiency Center to develop

energy-saving products for use in residential and commercial buildings, transportation, agriculture, and food production. The research center is being funded by $1.3 million from the university, a $1 million grant from the California Clean Energy Fund, and a $500,000 grant from Pacific Gas & Electric. The director of the new center, Andrew Hargadon, told visitors attending the center's inauguration ceremony, "This center is going to change the way we research energy efficiency. It's going to change the way we teach energy efficiency. And I think it's going to change the way we have public and private partnerships that take this kind of research out of the laboratory and bring it into the marketplace."

New Head of EERE Is Alexander Karsner

WASHINGTON, DC -- Alexander Karsner, the former managing director of Enercorp, was recently sworn in as the DOE's new Assistant Secretary for Energy Efficiency and Renewable Energy (EERE). According to a news release from the DOE, "Mr. Karsner's global energy experience has encompassed a wide range of technologies including heavy fuel oil, distillates, natural gas, coal, wood waste/biomass, and wind energy and distributed generation based upon renewable technologies." Speaking at a conference on April 11, Karsner called President Bush's Energy Initiative a "vision for victory." Karsner continued, "Maximizing energy efficiency and renewable energy is the domestic epicenter in the war on terror, and it is imperative that we maximize the partnerships between the public and private sectors in new and creative ways with a sense of seriousness, national purpose, and the urgency the situation merits."

Roof Tiles Produce Hot Water and Electricity

LONDON, UNITED KINGDOM -- A British manufacturer, Solarcentury, is selling two types of roofing tiles as a bundled package called the Complete Solar Roof. The package includes both solar thermal tiles (called C21t) that produce hot water and photovoltaic tiles (called C21e) that produce electricity. For more information, contact Solarcentury, 91-94 Lower Marsh, Waterloo, London SE1 7AB, UK; Tel: 020-7803-0100; E-mail: mel.davis@solarcentury.com; Web site: *www.solarcentury.com*.

Borrego Springs Demonstration Homes Are For Sale

BORREGO SPRINGS, CA -- In the desert town of Borrego Springs, developer Clarum Homes has completed the construction of four energy-efficient demonstration homes, putting them on the market for prices ranging from $635,000 to $695,000 (see ***EDU***, December 2005). The specifications for the four houses were developed by consultants from ConSol and the Davis Energy Group (DEG), with funding provided by the Building America program. Engineers from DEG and the National Renewable Energy Laboratory have embedded a variety of sensors in the four houses, and home buyers must agree to a 12-month period of performance monitoring. Each home includes a 3.2-kW photovoltaic system. Two of the houses have Dow T-Mass walls, one has walls built from structural insulated panels, and one has 2x6 walls insulated with Icynene. The project will compare three cooling systems: two houses are equipped with OASys evaporative coolers (see ***EDU***, May 2005); one has a Freus air conditioner with an evaporatively cooled condenser; and one has a Lennox 20.5 SEER air conditioner. For more information, visit *www.clarumzeroenergy.com*.

In Oslo, a Sewage-Source Heat Pump

OSLO, NORWAY -- A new 18-megawatt district heating plant located under a hill in Oslo uses heat pumps to extract heat from sewage. According to a Reuters News Service report, the municipal sewage flows into the plant at 49°F and exits at 42°F. The $14-million plant heats water to 194°F; the hot water is then circulated through underground pipes to provice space heat for 9,000 apartments. "We believe this is the biggest heating system in the world using raw sewage," said Lars-Anders Loervik, the plant's managing director.

LBNL Awarded Funds To Develop Cool Roof Technology

BERKELEY, CA -- The Lawrence Berkeley National Laboratory has received a $1.25 million grant to develop cool roof technology (see ***EDU***, March 2002). The grant was awarded by the California Energy Commission's Public Interest Energy Research program.

Wisconsin Governor Implements New Energy Plan

GREEN BAY, WI -- Wisconsin Governor Jim Doyle has signed SB 459, the Energy Efficiency and Renewable Act, a bill which overhauls energy policy in the state. The new law implements recommendations made by members of the Governor's Task Force on Energy Efficiency and Renewables. Among the bill's provisions is a requirement to raise the stringency of Wisconsin's building energy codes.

Energy-Efficient Mississippi Home

OXFORD, MS -- A model home built by Bill Dunn Construction in Oxford, Mississippi, has been awarded

a five-star Energy Star rating. The 4,200-square-foot Icynene-insulated house includes a photovoltaic system and two ground-source heat pumps. For more information, visit *www.billdunnconstruction.com*.

A Colorado ZEH

LOVELAND, CO -- A Colorado builder, Aspen Homes, has signed a contract to build a near-zero-energy home for homeowners Dan and Katharine Gregory. According to Aspen Homes president Jammie Sabin, the home's energy-efficiency and renewable-energy features—including a photovoltaic (PV) array and a ground-source heat pump—will add $30,000 to the cost of the home. The homeowners will get a break on the cost of the 6-kW PV array, since the local utility, Xcel Energy, offers a $4.25-per-watt rebate for residential PV installations. The home will not include a solar thermal system. For more information, contact Aspen Homes, 3037 Taft Avenue, Loveland, CO 80538; Tel: (970) 461-9696; E-mail: jammie.sabin@aspenhomesco.com; Web site: *www.aspenhomesco.com*.

Connecticut Homeowners Offered Free Duct Sealing

ROCKY HILL , CT -- A new program, Duct Works, has been launched to offer customers of Connecticut Light and Power the services of a duct-sealing contractor at no cost. The program is a cooperative venture between Connecticut Light and Power, the Connecticut Energy Efficiency Fund, and Steven Winters Associates of Norwalk. To be eligible for the free duct-tightening services, a utility customer must have a home equipped with central air conditioning. For more information, visit *www.ctsavesenergy.org* or call (877) 947-3873.

Developing Zero-Energy Buildings

GENEVA, SWITZERLAND -- A coalition of corporations called the World Business Council for Sustainable Development (WBCSD) has announced its intention to promote technologies contributing to the development of buildings that are energy independent, without connection to existing power grids. The coalition hopes to present a "unified industry strategy" leading to grid-independent buildings by 2050. One of the members of the WBCSD is Hartford-based United Technologies Corporation. "Buildings of tomorrow should be self-sufficient in energy and have carbon neutral emissions," said Jan van Dokkum, president of UTC Power, a United Technologies subsidiary. "This can be done by incorporating renewable energy sources into a building's design, optimizing energy efficiency of support systems, and taking advantage of geographic and culturally acceptable building practices." For more information, visit *www.wbcsd.org*.

Chinese Government Launches Massive Energy Retrofit Program

BEIJING, CHINA -- China's Minister of Construction, Qiu Baoxing, has announced a massive government program to weatherize China's inefficient buildings. The program's ambitious goal is to complete energy retrofits of all existing urban buildings in China by 2020. According to the Xinhua News Agency, Qiu explained that energy retrofits are "part of the government's bid to build a resource-saving and environmentally-friendly society."

Trane Introduces Air Conditioners With Cromer Desiccant Wheels

COCOA, FL -- The Trane Company has won the 2006 Frost and Sullivan Product Innovation of the Year award for its air conditioner incorporating a Cromer desiccant wheel (see ***EDU***, October 2002). Trane is the first manufacturer to produce air conditioners incorporating Charles Cromer's desiccant wheel technology; the company has dubbed the new feature "CDQ dehumidification." (Unfortunately, CDQ does not stand for "Cromer's Desiccant Quilt"; according to Trane, the initials stand for "cool, dry, quiet.") Trane is now marketing its CDQ units to commercial customers; the smallest available CDQ unit is rated at 3 tons and 1,500 cfm. According to Ronnie Moffitt, a principal applications engineer at Trane, within a year the company hopes to release a smaller CDQ air conditioner sized for the residential market. Compared to a standard 3-ton air conditioner, the Trane CDQ unit, when running under part-load conditions, can remove 106% more moisture from the air with an additional run time of only 25%.

A New Line of LED Lighting Products

SPARTANSBURG, SC -- Two manufacturers of lighting fixtures (Permlight Products and Progress Lighting) are teaming up to develop a new line of LED lighting products called Hi-Ef. According to Progress Lighting, the Hi-Ef products will use Permlight's LED technology to meet California's Title 24 requirements for efficient lighting. The companies claim the Hi-Ef products, which are not yet available, will achieve efficiencies of 40 lumens per watt. (For more information on Permlight's LED products, see ***EDU***, March 2006.)

Spain Increases Code Requirements For Solar Thermal

MADRID, SPAIN -- The Spanish government has approved a new building code (Codigo Tecnico de la Edificacion) requiring new buildings and buildings undergoing renovation to obtain 30% to 70% of

their domestic hot water from solar thermal systems. According to the European Solar Thermal Industry Federation (ESTIF) in Brussels, Belgium, the new building code makes Spain "one of the countries with the most advanced solar legislation in the world." The new regulation includes an exception for buildings in shady locations. The new code, which takes effect in October 2006, also requires any building larger than 4,000 square meters to include a photovoltaic system.

Quote Without Comment

"Each year, Americans spend more money to power home audio and DVD products when turned off than when actually in use." [Alliance to Save Energy press release, February 15, 2006.]

Correction

In the May 2006 issue of ***EDU***, Steven Pedracine, executive director of the Minnesota Lath and Plastering Bureau, was quoted as saying, "Prior to 1997 we were using wood windows with brickmold around them, but around 1997 everyone switched to nailing-fin windows." In an e-mail to ***EDU***, Pedracine wrote that he was misquoted; the year in question was 1987, not 1997. ***EDU*** regrets the error.

RESEARCH AND IDEAS

Measuring MemBrain Performance

A recent Wisconsin study comparing the performance of two vapor retarders has shown that walls equipped with MemBrain (a "smart" vapor retarder) perform better during the summer months than walls equipped with polyethylene.

The DOE-funded study was conducted by Marc Zuluaga, an engineer with Steven Winter Associates of Norwalk, Connecticut. In a new home built by a Madison, Wisconsin developer, Veridian Homes, side-by-side test bays were included in the south wall. (The south orientation was chosen because it is the most challenging in terms of solar vapor drive.) The house has 2x6 walls insulated with loose-fill fiberglass insulation; the OSB-sheathed walls have a Tyvek weather barrier and vinyl siding.

One test bay included CertainTeed's MemBrain vapor retarder (see ***EDU***, June 2003 and May 2004), while the other test bay included conventional poly. Both test bays were equipped with a number of temperature and relative humidity sensors. The wall assemblies have been continuously monitored since August 2004.

In Summer, Inward Solar Vapor Drive

Although few differences in performance were noted between the two wall assemblies during the winter, the MemBrain wall performed better during the summer, when inward solar vapor drive can raise the relative humidity of a wall assembly (see ***EDU***, August 1996 and November 1997). "During the summer, the south-facing wall had episodes when solar-driven humidity entered into the wall system," Zuluaga told ***EDU***. "The sheathing temperatures were above 100 degrees pretty frequently."

According to the March 2006 issue of *CARB News*, "Humidity build-up consistently occurred behind both vapor retarders during summer afternoons. The build-up resulted largely from sun driving moisture into the wall. By allowing drying to the inside, MemBrain significantly reduced the magnitude and duration of this humidity build-up." The MemBrain wall had 70% fewer hours of elevated relative humidity than the polyethylene wall (see Figure 3).

Zuluaga emphasizes that there was no evidence that the wall with polyethylene was at risk of problems. "On average, we didn't find a significant difference between the two systems," said Zuluaga. "But if there were any extreme events, there were differences. On

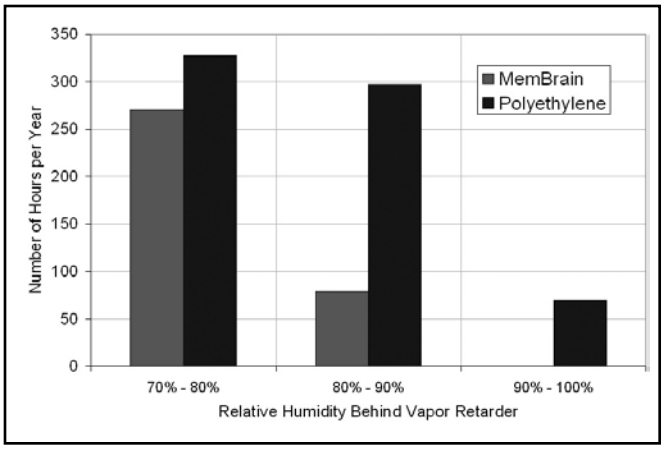

Figure 3. In Wisconsin, wall assemblies built with CertainTeed's MemBrain vapor retarder experienced fewer hours of elevated relative humidity than wall assemblies built with a polyethylene vapor retarder.

summer afternoons, in the wall with the poly, there was a buildup of relative humidity behind the poly until the sun went down."

Is MemBrain Worth the Added Cost?

Cold-climate builders considering the use of MemBrain have to weigh its advantages against its higher cost. "Using MemBrain costs a little more money, but it is something that can quantitatively give you a more forgiving wall system," says Zuluaga. A MemBrain-equipped wall is better able to handle occasional wetting. "Over the life of a building there are bound to be a few problems—that is a pretty safe bet," Zuluaga notes. "Builders need to decide how close to the edge they want to be."

For more information, contact Marc Zuluaga, Steven Winter Associates, 50 Washington Street, 6th Floor, Norwalk, CT 06854. Tel: (203) 857-0200, ext. 209; E-mail: marcz@swinter.com.

NEW PRODUCTS

Wood-Fired Water Heaters

Most Americans heat domestic hot water using gas, electricity, oil, or sunlight. While the number of Americans using firewood to make hot water is quite low, that number may increase as fossil fuel prices rise.

A Variety Of Approaches

If a home is heated with a wood-fired boiler—for example, an H. S. Tarm boiler from Denmark—the boiler can easily be equipped with a hot-water coil connected to an indirect water heater.

Most wood stoves can be adapted to heat water by installing a water coil in the stove's firebox. One source of wood-stove water coils is Thermo-Bilt, the manufacturer of the stainless-steel Hilkoil (see Figure 4). Several sizes of Hilkoil are available, priced at $165 to $200. Another model of water coil is the stainless-steel Hot Rod ($162 to $181) manufactured by Alpha American Company (see Figure 5). The Hot Rod is available in two sizes: 18 inches long ($162) and 24 inches long ($181).

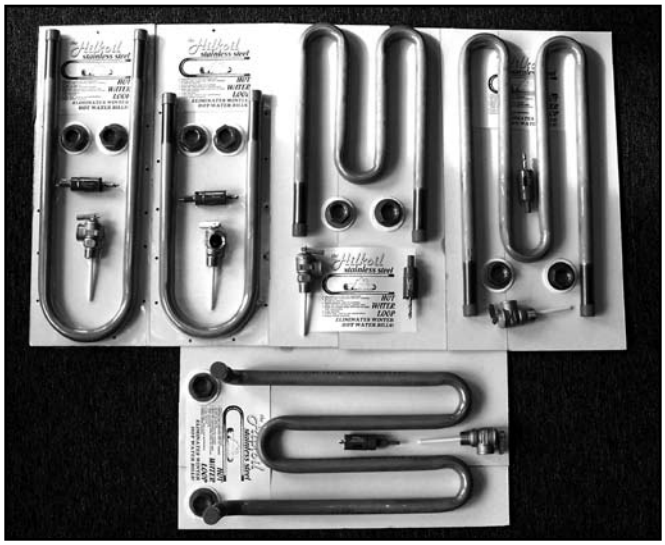

Figure 4. Hilkoil stainless-steel water coils are available in several sizes.

Installing a water coil in a woodstove requires drilling one or two large holes into the firebox. This step can be tricky; with some stoves, it is virtually impossible. It is certainly easier to do with a steel stove than a cast-iron stove. According to Thermo-Bilt manager Adam Murray, "You have to be particularly careful with a soapstone stove, because you can crack the stone."

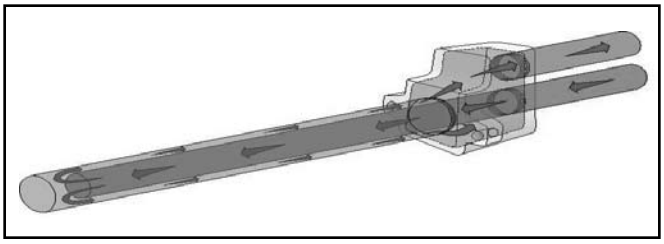

Figure 5. The Hot Rod is a pipe-within-a-pipe made of stainless steel.

A firebox water coil is usually connected to a storage tank (for example, a conventional electric or gas water heater) installed one floor above the woodstove; water circulates between the coil and the tank by thermosyphon. Of course, any pressurized wood-fired water heater requires one or two pressure/temperature relief valves.

Anyone considering installing a water coil in a woodstove should be aware of potential drawbacks to such an installation. Some woodstove manufacturers void the warranty if a stove is altered, although other stove manufacturers offer water coils as an option. According to Murray, "Keystone Manufacturing and Alaska Stove Company in Pennsylvania will predrill their stoves at the factory to accommodate a Hilkoil. We sell coils to just about every stove manufacturer, including Harman Stoves and US Stove."

Some critics claim that, since a water coil lowers the temperature of the firebox, it can reduce the wood-

Figure 6. The Fluemiser is a section of double-wall flue pipe that works as an air-to-water heat exchanger. Water circulating through the stainless-steel cylinder is heated by warm flue gases.

stove's efficiency and increase the rate of creosote formation on the walls of the flue. Yet many users of firebox water coils have enjoyed years of trouble-free operation. According to Dave Tjosvold, the owner of Alpha America, the manufacturer of the Hot Rod, "We've never heard of any problems due to creosote." Murray's experience has been similar to that of Tjosvold. "The coil does take heat away from the firebox, but the amount of heat is very marginal," says Murray. "It does not create any creosote problem, and it does not lower the stove's efficiency."

Fluemiser

Those who are reluctant to drill holes into the firebox of their woodstove might want to consider buying a Fluemiser (see Figure 6). The Fluemiser is an 18-inch long section of double-walled 22-gauge stainless-steel flue pipe, with water circulating between the two walls. The plumbing connections on the Fluemiser consist of two ½-inch IPS threaded fittings; the flue pipe is available in three diameters (3", 6", or 8"). Like a firebox water coil, the Fluemiser needs to be connected to a tank; the manufacturer recommends using a pump to circulate water through the Fluemiser.

The Fluemiser is available for $495 from Hamco Tank Systems. Hamco owner Jeff Hamel claims that he has had no reports of creosote problems from any of his customers.

Heavy-Duty Wood-Fired Water Heater

Those interested in a stand-alone wood-fired water heater have few models to choose from. Until just a few years ago, several US distributors imported galvanized steel wood-fired water heaters manufactured in Mexico; because of liability concerns, however, these models are no longer available in the US.

As far as ***EDU*** can determine, the only pressurized wood-fired water heater available in the US is the Heavy-Duty Wood-Fired Water Heater (item #26845) sold by Lehman's Hardware. These cylindrical units are hand-made by an Amish family out of 3⁄16-inch-thick welded steel (see Figure 7). With a capacity of 15 gallons, the water heater has a 2.4-cubic-foot firebox that can handle 26-inch-long sticks of firewood.

Figure 7. Lehman's Hardware sells a wood-fired water heater made of 3⁄16-inch-thick welded steel. Although this photo shows a greenhouse installation, the water heater is typically installed in a basement.

Figure 8. This simple unpressurized wood-fired water heater, the Unikot, is manufactured in Slovakia.

The flue connection is 6 inches in diameter, while the plumbing connections are 1-inch IPS. The water heater is 20 inches wide by 34 inches long by 24 inches high, and weighs 235 pounds.

The Lehman's water heater is designed for basement installation. The water heater must be connected to a storage tank; water is circulated between the heater and the tank by thermosyphon, or by means of a pump.

Because these water heaters have not been tested by Underwriters Laboratories (UL) or the American Society of Mechanical Engineers (ASME), they are usually sold to rural customers. Of course, the units should be installed by an experienced plumber; the Lehman's Web site notes, "If not properly used or installed, [the heater] may explode with life-threatening force." Lehman's sells the Heavy-Duty Wood-Fired Water Heater for $549; shipping costs about $150.

Unikot Water Heater

A distributor called Venkov imports a very simple wood-fired water heater, the Unikot, from Slovakia (see Figure 8). Venkov's owner, Martin Dzuris, has a long familiarity with the Unikot. "I grew up around these things," says Dzuris.

The Unikot water heater is an unpressurized open vessel equipped with a lid; it is not designed to be connected to domestic plumbing. The Unikot comes in two sections. The bottom section is a firebrick-lined firebox, while the top section is a double-walled tank of enameled steel with a capacity of 18 ½ gallons. The Unikot is equipped with a valve at the bottom of the tank. Most Unikot purchasers live off the grid; the unit is typically installed in a laundry room or in a bathroom, above the bathtub. If the Unikot is fired up to heat bathwater, it will simultaneously heat the room in which it is installed.

The Unikot is designed to burn either firewood or coal. It measures 22 inches in diameter and 42 inches high, and weighs 132 pounds. The flue is 5 inches in diameter. Venkov sells the Unikot for $395.

For more information, contact:

Alpha American Company, P.O. Box 20, Palisade, MN 56469; Tel: (800) 358-0060; Fax: (800) 440-1994; E-mail: sales@yukon-eagle.com; Web site: *http://yukon-eagle.com*.

Hamco Tank Systems, P.O. Box 135, Townsend, MA 01469; Tel: (603) 878-0585; Fax: (603) 878-1133; E-mail: hts@hamcotanksystems.com; Web site: *www.fluemiser.com*.

Lehman's Hardware, One Lehman Circle, Kidron, OH 44636; Tel: (330) 857-5757 or (888) 438-5346; Fax: (330) 857-5785; E-mail: info@lehmans.com; Web site: *www.lehmans.com*.

Thermo-Bilt, P.O. Box 3207, Schenectady, NY 12303; Tel: (800) 807-7041 or (518) 377-4004; E-mail: hilkoil@nycap.rr.com; Web site: *www.hilkoil.com*.

Venkov, P.O. Box 56, Harbert, MI 49115. Tel: (269) 469-9957; Fax: (269) 469-9958; E-mail: venkov@tradad.com; Web site: *www.tradad.com/venkov*.

READERS' FORUM

Low-Temperature Heat Pumps and CO_2 Refrigerant

Dear Martin,
The latest ***EDU*** [April 2006] is a good issue. Seems like ***EDU***'s language is becoming more direct. That's a good thing! I couldn't find anything to disagree with. I found the article about the Swedish experiments with ground storage quite interesting. [At the Cannon Beach house in Oregon] I think we're doing a lot better with our ground temperatures, perhaps because our bulk water movement through the rock is slower. Overall, though, I can't disagree with their conclusions. That's why we're working so hard on the low-temperature heat pump angle. I figure we can get about the same performance at half the cost. And one day, we'll use carbon dioxide (R-744) as the refrigerant and then we'll have something worth evolving.

Charlie Stephens
Oregon Department of Energy
Salem, Oregon

An Accurate Article

Dear Mr. Holladay,
I wanted to compliment you on a very well done and accurate article on the performance criteria for Energy Star windows [April 2006]. I'm not sure I have ever seen an article so accurate on a complex issue in my 15 years in Washington. Thanks.

Keith A. Christman, Director of Industry Affairs
The Vinyl Institute
Arlington, Virginia

Doom and Gloom to Liars

Dear Editor,
There is an insulation product called P2000 that is making inroads to the northeast US, distributed through 84 Lumber. Their Web site is at *www.p2insulation.com*.

They are claiming their 1-inch beadboard styrofoam (EPS) with foil on both sides is R-20 per inch of thickness. My question is this: Given the fraudulent R-value of this material, how does one go about getting the FTC to ban it? I thought there was a federal rule that brought gloom and doom to liars like this. How do I go about getting the ball rolling?

Pat Dundon
Dundon Insulation
Windsor, New York

Editor's Reply

Pat Dundon is correct: the exaggerated claims made by the manufacturer of P2000 insulation are blatant violations of the federal R-value Rule. Anyone wishing to report inflated R-value claims should contact Hampton Newsome, Federal Trade Commission, 600 Pennsylvania Avenue NW, Washington, DC 20580; Tel: (202) 326–2889; E-mail: hnewsome@ftc.gov.

P2000 is a brand of foil-faced expanded polystyrene insulation manufactured by Polar Industries of Prospect, Connecticut, under a contract with a Canadian building products manufacturer, R. R. & D. Enterprises (633 Chemin Sainte-Claire, Rivière Beaudette, Quebec J0P 1R0, Canada; Tel: 450-269-3197; Web site: *www.p2000insulation.ca*). It is distributed in the US by a Missouri company called Perka Building Frames (1111 Alabama Street, St. Joseph, MO 64504; Tel: 800-467-3752; Web site: *www.p2insulation.com*).

The manufacturers and distributors of P2000 make several outrageous claims. According to one marketing document, "P2000 insulation system with ⅝" board, average R-value = 18.95." Another document trumpets, "A calculation of the R-factor has been made to different temperature gradients within the required range. Values show that the P2000 ⅝" Bronze Insulation System is comparable to the 6" fiberglass insulation and that the P2000 1" Bronze Insulation is comparable to the 12" fiberglass insulation." Still another document claims, "P2000's insulation performance has been tested by a recognized testing lab under extreme winter temperatures. In that performance test, P2000 (one inch) performed equivalent to R27—significantly better than 6" of fiberglass batting." Elsewhere, the company claims, "P2000 is a new super-efficient thermal insulation product that delivers R20+ insulation protection in a one-inch board. It's tested! It's approved! And it works!"

Readers of ***EDU*** will not be surprised to learn, "It's a lie!" For the record, ⅝-inch expanded polystyrene has an R-value of about 2.5, while 1-inch expanded polystyrene has an R-value of about 4. The product's foil facing has no effect on its R-value. (If foil-faced foam is a component of a building assembly that includes an airspace adjacent to the foil facing, the entire building assembly, including the airspace, may have an R-value higher than the insulation alone.)

To justify its exaggerated claims, the manufacturer distributes copies of reports produced by two testing companies, Intertek Testing Services of Lachine, Quebec, and the Center for Applied Engineering of St. Petersburg, Florida. (The Center for Applied Engineering, a former subsidiary of Celotex Corporation, ceased operation years ago.)

Intertek tested several building assemblies according to its own idiosyncratic test protocol; there is no evidence that Intertek used accepted ASTM methods for determining R-value. The Intertek test report lacks a clear description of the materials used to fabricate the test assemblies. The report includes this disclaimer: "Note that the R-factor is not absolute due to non-homogeneities in the system under study. For example, the test samples (boxes) were designed to represent real-life buildings and therefore are not perfect scientific models; they consist of several materials, they are not leakproof and let the cold air inside; most importantly it introduced several thermal breaks throughout the surfaces. Values must be looked upon in comparison rather than in absolute values. … It shall be noted that, though the description 'R' factor is utilized when discussing the results, the nature of testing performed does not pretend to provide results which should be compared to those obtained from testing against standardized test methods like ASTM C-518."

According to Intertek employee Eric Gilbert, "It was an R&D test for research and development purposes. That's all we can say. Intertek has a policy of not giving out information on the procedures and testing that was agreed upon between Intertek and the client."

P2000 also distributes a November 1995 test report from the Center for Applied Engineering, written in part by Stanley Gatland II. (Gatland now works as the manager of building science technology at CertainTeed.) The test report includes the results of two ASTM C236-89 tests. This test, titled "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box," is intended to test the performance of building assemblies, not insulation.

One of Gatland's ASTM C236-89 tests measured downward vertical heat flow through a roof assembly consisting of several layers of building components. From the bottom up, the assembly included a layer of ½-inch drywall, a ¾-inch sealed airspace created by 1x3 strapping, a layer of ⅝-inch thick P2000 insulation, a 1 ½-inch sealed airspace created by 2x8 purlins, and steel roofing with air-sealing materials inserted into the tops and bottoms of the air channels formed by the roofing panel ribs. When tested with the exterior at 100°F and the interior at 70.4°F, the building assembly had a thermal resistance of R-12.3.

Gatland also performed another ASTM C236-89 test at different temperatures. The second test measured upward vertical heat flow through the same roof assembly, with the exterior at -2°F and the interior at 83.6°F. Under these test conditions, the building assembly was found to have a thermal resistance of R-7.5.

Neither of Gatland's test protocols measured the R-value of P2000 insulation. In a 33-page document distributed by P2000, "Application Installation Manual," the P2000 marketers excerpted tables summarizing the results of Gatland's two tests, appending photocopies of Gatland's signature beneath the tables. Astonishingly, the marketing document declares that the ⅝-inch thick P2000 insulation has a total R-value of 19.8, derived from the sum of the thermal resistance values measured in Gatland's two separate tests of building assemblies. According to this marketing document, Gatland's results showed R-12.3 under summer conditions and R-7.5 under winter conditions; ergo, the total R-value is 19.8.

Reached by telephone, Gatland expressed frustration with P2000's marketing campaign. "You can't take the two test results and add them to make a total. They don't understand the physics behind the testing."

In a follow-up e-mail to ***EDU***, Gatland wrote, "Results are specific for the assembly tested and cannot be added to give a total thermal performance. In addition, reports are not allowed to be used in publicity or advertising. Every report issued by the Center for Applied Engineering, Inc. had a disclaimer at the bottom: 'This report is for the information of the client. It may be used in its entirety for the purpose of securing product acceptance from duly constituted approval authorities; however this report or the name of Celotex Corporation shall not be used in publicity or advertising.'"

One US distributor of P2000 insulation, Gary Demasi of Honesdale, Pennsylvania, admitted in a phone conversation with ***EDU*** that the company is currently under scrutiny. "We've had disputes with other companies," said Demasi. "They all want to get their hands on the lab reports. We've recently had some great difficulties with these people."

BACK PAGE

Spraying Icynene On *This Old House*

In a recent television episode of *This Old House*, host Kevin O'Connor and contractor Tom Silva discussed progress at a remodeling job in Cambridge, Massachusetts. Behind them, an insulation contractor sprayed Icynene foam overhead, into the rafter bays of a flat roof. Silva explained, "This particular insulation doesn't require ventilation. It's so dense that when the warm air tries to get to the cold air, by the time it gets there, it's not cold enough to condense. … Another benefit to this insulation, Kevin, is I don't have to put a vapor barrier."

Unfortunately, Silva's discussion of Icynene confused air movement with diffusion. His explanation left viewers with the impression that although Icynene is not an air barrier, it is a vapor barrier. In fact, the opposite is true.

Silva implied that cold air can travel through the Icynene and contact the sheathing, maintaining its temperature as it travels. But since Icynene is an excellent air barrier, warm interior air will never "get there."

What Silva failed to explain is that while the interior *air* may not reach the cold roof sheathing, the interior *moisture* still can—by means of diffusion. Silva's statement that "a benefit" of Icynene is that "I don't have to put in a vapor barrier" is misleading. Icynene is very vapor open, and all experts agree that in many climates—certainly in IECC climate Zones 6 and higher—Icynene requires the installation of an interior vapor retarder.

The manufacturer of Icynene advises customers installing their product in Cambridge, Massachusetts (Zone 5) that they can omit the vapor retarder. To some experts, however, that advice is risky; the higher the indoor humidity, the greater the chance that interior moisture will diffuse through the Icynene and turn the roof sheathing soggy. Joseph Lstiburek, a principal of the Building Science Corporation in Westford, Massachusetts (and a fan of Icynene) advises anyone installing Icynene in Zone 5 to paint the interior of the cured foam with two coats of latex paint as an vapor retarder.

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