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Passive Survivability:
A New Design Criterion for Buildings

IN DECEMBER 2001 AN EDITORIAL IN *EBN* introduced the concept of "passive survivability," or a building's ability to maintain critical life-support conditions if services such as power, heating fuel, or water are lost, and suggested that it should become a standard design criterion for houses, apartment buildings, schools, and certain other building types (*EBN* Vol. 14, No. 12). Since then, the term has begun creeping into the lexicon of green building, though we have a long way to go before the mainstream building industry takes notice.

In this article we examine the concept of passive survivability in greater detail and address some specific strategies that can be employed in adopting this design criterion for buildings.

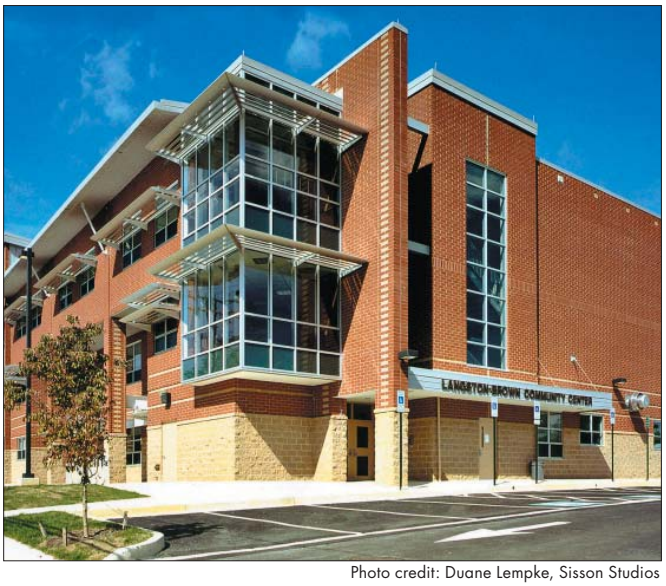

Photo credit: Duane Lempke, Sisson Studios

Cooling-load avoidance strategies, like the shades on the southwestern windows of the combined Langston High School and Langston-Brown Community Center in Arlington, Virginia, help maintain livable thermal conditions in a building even when the power goes out.

The Vulnerability of Buildings

While Hurricane Katrina wasn't the first natural disaster to affect an entire city, and it certainly won't be the last to cause widespread power outages and damage to buildings, it may have been a turning point—both in our acceptance that global warming is real and in our awareness of the vulnerability we face in the years and decades ahead. Visionary thinker Gil Friend suggested in a recent essay that someday we will look back at 2005 as a tipping point. "The fact- and science-averse among us may still claim to not be persuaded about global warming, but I'll wager that everyone else got the message in 2005," he wrote in "Sustainability—At the Tipping Point?" in his online newsletter, *The New Bottom Line* (www.natlogic.com).

As the storm track images on page 11 clearly convey, both the frequency and the magnitude of tropical storms affecting the Gulf Coast and coastal Atlantic states increased dramatically in the decade 1995 to 2004 compared with the previous decade. Other, longer-term, scientific studies have demonstrated that at least the *severity* of tropical storms has been increasing as an effect of global warming, even if the jury is still out on the *frequency* of storms.

The potential for rising sea levels has also been in the news a great deal recently.

(continued on p. 10)

In This Issue

Quote of the month:

"With a single ganglion for a brain, using no electricity or fossil fuels, termites construct dwellings that maintain temperature, humidity, and ventilation better than most buildings."

Terry Brennan

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What's Happening

Humanity Overshoots Biological Capacity by 39%—Humanity's ecological footprint exceeds the planet's capacity by 39%, according to Redefining Progress, a nonprofit policy organization based in Oakland, California. The ecological footprint is a measure of the amount of "nature" it takes to sustain a given population over the course of a year; comparing this footprint to the same area's biological capacity shows the degree to which the population is living sustainably, or within its ecological means. The new report finds humanity's current footprint to be an average of 57 acres (23 ha) per person, while Earth's biological capacity is just 41 (17 ha). It identifies overfishing, industrial agriculture, urban sprawl, and carbon emissions as the chief culprits driving the overshoot. The U.S. has the world's third highest ecological deficit, coming in well behind the United Arab Emirates and Kuwait. The entire report is online at www.ecologicalfootprint.org.

U.S. Homes Continue to Grow—The average new, single-family home built in the U.S. in 2004 came in at 2,349 ft² (218 m²)—13% larger than the average in 1990 and 2.4 times as big as the average in 1950—according to the National Association of Home Builders' newest "Housing Facts, Figures, and Trends" report, released in March 2006. Of new homes in 2004, 95% had two full bathrooms or more, compared with 87% in 1990 and only 4% in 1950; and 91% had a garage or carport, compared with 84% in 1900 and 47% in 1950. The complete report is available at www.nahb.org (search for "figures").

Petroleum Net Imports Reach a New High—Although the U.S. used slightly (0.5%) less petroleum in 2005 than it did in record-breaking 2004, the percentage of that petroleum that was imported reached a new high in 2005, according to the U.S. Department of Energy's Energy Information Administration. Of the 99.84 quadrillion Btus used, a net 59.8% was imported. Of those imports, 17.0% came from the Persian Gulf and 40.7% came from OPEC countries. More information is online at www.eia.doe.gov/emeu/mer/.

Norton Claims Increase in Wetlands—Gale Norton, outgoing secretary of the interior, announced in March 2006 an increase in the nation's area of wetlands. Although more than 500,000 acres (202,000 ha) of swamps and tidal marshes were lost between 1998 and 2004, the U.S. Fish and Wildlife Service found a 200,000-acre (81,000 ha) *net increase* in wetlands, due to the fact that it counted golf course water hazards, ornamental ponds, stormwater systems, and mine reclamation ponds.

Photo: Lynn Betts, USDA Natural Resources Conservation Service

The U.S. Fish and Wildlife Service counted golf course water hazards as wetlands in its most recent survey.

"Open water systems do not have the same biological diversity or functions and values as wetlands," says Julie Sibbing, National Wildlife Federation wetlands specialist. Calling Norton's report "pure spin," Sibbing notes that "the majority opinion is that the nation is still hemorrhaging wetlands."

Landowner to Pay for Clean Water Act Violations—The U.S. Environmental Protection Agency (EPA) has ordered James Pflueger to pay $7.5 million for construction activities on 380 acres (150 ha) of coastal property on Kaua'i, Hawaii. Pflueger's transgressions include cutting away a hillside to create a vertical road cut, grading a coastal plateau, creating new access roads to the coast, and disposing of dirt and rock fill in perennial streams, according to EPA. The largest settlement ever for Clean Water Act violations at a single site, the agreement requires Pflueger to pay $2 million in penalties to the state of Hawaii and the U.S.; $5.3 million to prevent erosion and restore streams at areas damaged by his construction activities; and $200,000 to replace cesspools with improved wastewater systems at homes in a nearby coastal community. Details are online at www.epa.gov/compliance/resources/cases/civil/cwa/pflueger.html.

New Jersey Meadowlands Commission Plans 5 MW Photovoltaic System—The New Jersey Meadowlands Commission (NJMC) has announced plans to install a 5 MW solar photovoltaic system (the largest system in North America). NJMC plans to harness space atop roofs, parking lots, and remediated landfills to accommodate the system, which will require 1.3 million ft², or approximately 30 acres (121,000 m²; 12 ha) of space. NJMC also plans to develop a strategy for creating 20 MW of renewable energy in the Meadowlands District by 2020. "We're serious about becoming a global leader in renewable energy," says NJMC's executive director, Robert Ceberio. "The time to pursue these resources is now." NJMC is online at www.njmeadowlands.gov.

Wisconsin Commits to Green Building—Wisconsin Governor Jim Doyle signed an executive order in April 2006 supporting green building. The order calls for new State facilities to be 30% more efficient than required by commercial code, and it calls for a 10% reduction of energy usage in all State buildings by fiscal year 2008 and a 20% reduction by fiscal year 2010. The order also calls on the Department of Administration to establish standards based on the U.S. Green Building Council's LEED® Rating System. The text of the order is online at www.wisgov.state.wi.us (search for "145").

Florida Partnership Promotes Green Affordable Housing—The Florida Home Builders Association (FHBA) and the Florida Green Building Coalition (FGBC) have announced a partnership designed to promote green affordable housing. The partnership will jointly advocate use of the FGBC Green Home Designation Standard and Green Development Designation Standard, advocate incentives for builders and developers whose projects are certified under these standards, and develop resources to educate and encourage the public to consider green building. FHBA is online at www.fhba.com, and FGBC is at www.floridagreenbuilding.org. For more information about green affordable housing, see *EBN* Vol. 14, No. 3.

Green Roof Industry Reports 80% Growth—The area of green roofs in the U.S. grew by 80%—from 27 acres (11 ha) to 49 acres (20 ha)—from 2004 to 2005, according to the nonprofit Green Roofs for Healthy Cities (GRHC). The area of green roofs in all of North America grew 72%—from 30 acres (12 ha) to 57 acres (23 ha). Chicago is leading the pack with a total of 183,000 ft² (17,000 m²) of green roofs, more than 63,000 ft² (5,800 m²) *more* than runner-up Ottawa. The figures are based on a survey of GRHC corporate members, who were recently asked to report on their activities in both years. Because not all members returned surveys and because GRHC members do not represent the entire green roof industry, the figures are lower than the real area. (Chicago's Department of Environment Commissioner Sadhu Johnston told *EBN* that over 200 green roofs totaling 2.5 million ft² [230,000 m²] are under construction in the city.) The full results are online at www.greenroofs.org.

The green roof on the Silva, a high-rise residential building in North Vancouver, British Columbia, is part of the 27 acres (11 ha) of green roofs built in North America in 2005. Photo: David Sprague

Toronto Commits to Green Roofs—The City of Toronto, Ontario, has committed to installing green roofs on new and existing buildings owned by the City "whenever practical to do so." The City recommends considering green roofs for existing buildings when roofs are due to be replaced. For new construction, the City has set a target of covering 50% to 75% of each building's footprint. Called "Making Green Roofs Happen," the policy also includes incentives for the private sector to install green roofs. "Torontonians have told us that they

want the City to do more to promote green roofs," says Deputy Mayor Joe Pantalone, who chairs the City's Roundtable on the Environment. "In response, City Council has approved a comprehensive approach—from establishing standards and building our capacity to support green roofs at the City level to offering education, funding, expert advice, and promotion." Details are at www.toronto.ca/greenroofs/roundtable.htm.

WBCSD Aims for Climate-Neutral Buildings by 2050—"By 2050 new buildings will consume zero net energy from external power supplies and produce zero net carbon dioxide emissions while being economically viable to construct and operate." That is the goal of an effort led by the World Business Council for Sustainable Development (WBCSD), United Technologies Corporation, and Lafarge Group. The project, announced in March 2006, includes three phases: documenting existing green building successes and setbacks, identifying present and future opportunities, and presenting a unified industry strategy for realizing those opportunities. Each phase will take one year to complete, according to WBCSD. More information is online at www.wbcsd.org.

FSC to Develop Risk Registry Program—Thanks to a $380,000 grant from the Home Depot Foundation, the Forest Stewardship Council (FSC) plans to develop a Controlled Wood Global Risk Registry. This program addresses one of the more challenging aspects of FSC's recently revised chain-of-custody labeling rules—a requirement that any noncertified wood in a labeled product be "controlled" to ensure that it meets certain standards (see *EBN* Vol. 14, No. 2). A joint project of FSC-U.S. and FSC International Center, the Registry will screen all sources of wood entering the certification supply stream to ensure that it did not originate from: forests where traditional or civil rights are violated, forests where high conservation values are threatened, genetically modified trees, illegal sources, or natural forests that have been harvested for the purpose of converting the land to plantations or other non-forest use. "This effort will help all manufacturers, retailers, and consumers of wood products positively verify that their dollars are not aiding the illegal or harmful actions of others," says Roger Dower, president of FSC-U.S. More information is online at www.fscus.org.

Rose Starts Smart Growth Investment Fund—Jonathan Rose Companies, LLC, has announced the formation of the Rose Smart Growth Investment Fund I, LP, the first national real estate investment fund that acquires buildings exclusively in Smart Growth locations and improves them to enhance the quality of life for tenants and the livability of the communities. The company announced its first acquisition, the historic Joseph Vance and Sterling buildings in downtown Seattle, in April 2006. "We aim to create one of the greenest and healthiest buildings in the Seattle marketplace, says Jonathan Rose, president of Jonathan Rose Companies. "This effort will not only improve the quality of life for our tenants; we hope it will also continue to advance understanding of how to meld older sites with the necessities of this century—reduced energy use and the appreciation for environmental protection. Jonathan Rose Companies is online at www.rosecompanies.com.

CTG Opens Northeast Regional Office—Energy and sustainability consultant CTG Energetics, Inc., has announced the opening of its northeast regional office in Providence, Rhode Island. The office is led by Stephen Turner, P.E., a consulting engineer who specializes in mechanical, electrical, and energy systems for buildings and campuses. The northeast office will focus on commissioning and high-performance buildings. CTG is online at www.ctg-net.com.

PBS to Air "design: e²"—The Public Broadcasting Service (PBS) plans to air "design: e²," a six-part television series about "the economies of being environmentally conscious," beginning in June 2006. Narrated by Brad Pitt, the series will delve into eight topics: design, water, energy, food, textiles, transportation, botanicals, and health. More information and a preview are available at www.design-e2.com.

SBIC Releases New Version of Energy-10—The Sustainable Buildings Industry Council (SBIC) has released version 1.8 of its Energy-10™ modeling software, compatible with PC computers. The new version features the ability to model the performance of stand-alone or building-integrated photovoltaic systems as well as solar domestic or service water heaters. For more information, visit www.energy-10.com.

BOMA Launches BEEP—In partnership with the U.S. Environmental Protection Agency (EPA) ENERGY STAR® program, the Building Owners and Managers Association (BOMA) Foundation has launched the BOMA Energy Efficiency Program (BEEP), designed to educate BOMA members about energy conservation and reduce the industry's annual $24 billion energy bill. BEEP has initially scheduled six audio-conference seminars, which run through mid-November 2006; additional seminars may be scheduled. Details are at www.boma.org/trainingandeducation/beep/.

Awards & Competitions

AIA Awards 2006 Top Ten Green Projects

The American Institute of Architects (AIA) Committee on the Environment has selected this year's Top Ten Green Projects. The 2006 jury included Kevin Burke, AIA, of William McDonough + Partners; David Miller, FAIA, of the Miller Hull Partnership, LLP; Kath Williams, Ph.D., of Kath Williams + Associates; Kevin Hydes, P.E., of Stantec Consulting, Ltd.; R. K. Stewart, FAIA, of Gensler; and Catriona Campbell Winter, of the Clark Construction Group, LLC. Full project descriptions are online at www.aiatopten.org and in *BuildingGreen Suite*.

Alberici Corporate Headquarters

Overland, Missouri
Mackey Mitchell Associates

This 109,000 ft² (10,100 m²) LEED® Platinum adaptive reuse project includes an open office environment, training rooms, exercise and dining facilities, and structured parking. Although the original manufacturing plant faced southwest, the addition of south-facing "saw-tooth" clerestory windows in effect reoriented the building due south and provided ample glazing while blocking western sunlight. The interior is organized around three large atria and receives abundant light and fresh air. In addition to visually uniting the two floors, the atria act as thermal flues to induce ventilation. The open-plan environment fosters teamwork and collaboration while affording 90% of building occupants direct views to the outdoors. The project earned 60 LEED points, more than any other project to date.

Photo: Alise O'Brien

The Animal Foundation Dog Adoption Park

Las Vegas, Nevada
Tate Snyder Kimsey Architects

Photo: Tom Bonner

The 18,700 ft² (1,740 m²) Dog Adoption Park consists of bungalows arranged in a park-like setting shaded by freestanding photovoltaic canopies. Given southern Nevada's climate, the team decided to focus on eliminating the cooling load and reducing water use. The bungalow's form and orientation were governed by daylighting and wind-powered ventilation, and the project is expected to use 81% less energy than baseline models. A Living Machine treats wastewater for reuse on site.

Ballard Branch Library and Neighborhood Service Center

Seattle, Washington
Bohlin Cywinski Jackson

This project consists of the 15,000 ft² (1,400 m²) Ballard branch of the Seattle Public Library, a 3,600 ft² (330 m²) neighborhood service center, and 18,000 ft² (1,670 m²) of below-grade parking. The main entry is pulled back from the street, allowing for a deep front porch that joins the library and the service center under a large canopy. The gently curving green roof reduces stormwater runoff. Daylighting studies allowed the team to maximize the use of varying intensities of natural light. Electricity is generated onsite using photovoltaics in stand-alone panels on the roof and integrated into the glazing.

Photo: Nic Lehoux

Ben Franklin Elementary School

Kirkland, Washington
Mahlum Architects

Photo: Benjamin Benschneider

The Ben Franklin Elementary School serves 450 students in kindergarten through grade six. The 56,000 ft² (5,280 m²) school was designed to preserve and harness the environment as a teaching tool. Two-story classroom wings reach like fingers toward the large wooded area along the north end of the school. Between these wings, courtyards landscaped with native plants serve as classrooms. The interior was designed to maximize natural ventilation and daylighting, enhancing students' ability to learn and reducing the building's energy use.

Immaculate Heart of Mary Motherhouse

Monroe, Michigan

Susan Maxman & Partners, Architects

Photo: Barry Halkin Photography

Because respecting the Earth and promoting environmental justice are among their missions, the Sisters of the Immaculate Heart of Mary wanted to renovate their 380,000 ft² (35,300 m²) motherhouse in a way that would exemplify those ideals. All shower and lavatory water is treated in a constructed wetland and reused for flushing toilets. Daylighting and a ground-source heating and cooling system contribute to an expected 20% reduction in energy use, compared to a conventional building. Materials were selected for their durability and environmental responsibility.

Philadelphia Forensic Science Center

Philadelphia, Pennsylvania

Croxton Collaborative Architects, P.C., and Cecil Baker & Associates

Photo: Croxton Collaborative Architects, P.C.

The Philadelphia Forensic Science Center is housed in a former school that had been abandoned for many years. The 58,700 (5,450 m²) concrete-frame building with brick infill was originally constructed in 1929. The project's energy-efficiency features include load separation of lab areas, which require 100% outside air; envelope upgrades resulting in a superinsulated building; and extensive daylighting. The project also substantially increased the perviousness of the site, with vegetated swales filtering runoff and reducing input into city sewers.

Skaaren Environmental Learning Center at Westcave Preserve

Dripping Springs, Texas

Jackson & McElhaney Architects

Photo: Greg Hursley

The 3,030 ft² (281 m²) Warren Skaaren Environmental Learning Center functions as a wilderness classroom at the Westcave Preserve, a 30-acre (12 ha) nature preserve and canyon in southern Texas. The design of the structure was conceived as a three-dimensional textbook. A rainwater collection and filtration system demonstrates water quality and water cycles. A constructed wetland and composting toilets show recycling of materials in nature. Natural ventilation, the building's orientation, and a weather station illustrate air currents and air quality. Systems that reduce the project's use of nonrenewable energy include a photovoltaic array, ground-source heat pumps, daylighting, high levels of insulation, overhangs, attic fans, and efficient lighting.

Solar Umbrella House

Venice, California

Pugh + Scarpa

Photo: Marvin Rand

The 1,790 ft² (166 m²) Solar Umbrella House is an adaptive reuse of a home originally built in 1923. The home's major design feature is a solar canopy that provides 95% of the residence's electricity while screening large portions of the structure from the sun. A solar heating system supplies heat through the concrete floors of the new addition. Three solar panels preheat the domestic hot water, and a fourth heats the swimming pool. The home's daylit interior requires no electric lighting on sunny days. Materials were selected based on their effects on the environment and indoor air quality.

University of Texas Health Science Center and Student Community Center

Houston, Texas

BNIM Architects and Lake|Flato Architects

The University of Texas School of Nursing and Student Community Center is situated on a small, urban site within the heart of the Texas

Photo: Hester + Hardaway

Medical Center campus. The 194,000 (18,000 m²) building is expected to use 41% less energy than a conventional, baseline building. Three vertical atria, a horizontal atrium, and perimeter operable windows provide occupants with natural light and ventilation. Underfloor air distribution increases energy efficiency and thermal comfort. Low-emitting materials were selected to protect indoor air quality. Rainwater harvesting, waterless urinals, and efficient fixtures contribute to a 63% reduction in potable water use.

World Birding Center Headquarters

Mission, Texas
Lake|Flato Architects

Photo: Hester + Hardaway, Paul Hester

The 13,000 ft² (1,210 m²) World Birding Center Headquarters is adjacent to more then 1,700 acres (690 ha) of remnant native habitat that is being reclaimed and established as a habitat preserve. Landscape plantings were strictly limited to native species. A 47,000 gallon (180,000 l) rainwater storage system is used for irrigation and as a wildlife watering trough. Water-efficient fixtures and waterless urinals minimize potable water use in the building. Energy-efficiency strategies include variable-speed mechanical cooling equipment, demand water heaters, and efficient lighting. Shielded exterior lighting protects this important night sky and migration flyway.

Award Briefs

McLennan Named Among "40 Under 40"—Jason McLennan, founder and director of Elements, BNIM Architects' sustainable design and consulting division, was named among *Building Design & Construction*'s first annual "40 Under 40" architects, engineers, contractors, designers, and AEC business developers. The full list is at www.bdcnetwork.com/article/CA6316252.html.

AIA Broad Knowledge Committee Seeks Submissions—The American Institute of Architects (AIA) Broad Knowledge Committee seeks proposals for research projects. AIA will award $7,000 each to ten winning projects "that advance professional knowledge and practice" in a range of areas, including sustainability. Entries are due May 15, 2006. For more information, contact Barbara Sido at bsido@aia.org.

CoreNet Global Announces 2006 Sustainable Leadership Awards—In partnership with the International Interior Design Association and The American Institute of Architects (AIA) Committees on the Environment and Interior Architecture, CoreNet Global has announced the 2006 winners of the Sustainable Leadership Awards. **HOK** won the category for architecture and interior architecture or interior design firms; **Texas Instruments, Inc.**, won for for-profit companies with sales over $5 billion per year; and **Herman Miller, Inc.**, won for for-profit companies with sales under $5 billion per year. No award was given in the nonprofit category. "Although sustainability is not a new concern, it is one that has often been uncoupled from an organization's best practices and design excellence," according to CoreNet Global. "The Sustainable Leadership Awards unite these distinct issues into one: best practices, design and development excellence, and sustainable leadership." More information is online at www.corenetglobal.org.

Then & Now: 1996-2006

Unvented Gas Heaters Still Gaining Ground

Ten years ago, we expressed concern over the increase in sales of unvented gas heaters (see *EBN* Vol. 5, No. 3). At that time, sales totaled about 520,000 units per year. In the intervening decade, sales have risen to over one million units per year.

As the name suggests, these heaters do not require chimneys or other exterior ventilation; rather, they vent directly into the room where they are installed. Proponents of the heaters claim that high combustion efficiency and oxygen depletion sensors (devices that shut off the gas supply if oxygen levels fall below 18%) make the heaters safe when they are properly installed and operated as supplemental heaters. However, most indoor air quality (IAQ) experts argue that even with proper installation and operation, unvented gas heaters release water vapor and such hazardous gases as carbon monoxide and nitrogen dioxide into a home's living space.

"The chemistry of combustion does not change—if you burn hydrocarbon fuel you get at least water and carbon dioxide, neither of them wanted in excess indoors," says Michael Apte, Ph.D., of the Indoor Environment Department at Lawrence Berkeley National Laboratory. He notes that even the best-designed products sometimes fail; if one in 1,000 of the roughly five million unvented gas heaters installed to date is out of spec, that's 5,000 units

potentially putting as many as 20,000 family members at risk of exposure to deadly carbon monoxide. "It's just not prudent to put unvented appliances in our homes," he told *EBN*.

A 2004 study in eighteen Australian schools published in the *International Journal of Epidemiology* linked unvented gas heaters with increased difficulty breathing, chest tightness, and asthma attacks. But despite these results and the concerns of IAQ experts, unvented gas heaters continue to gain ground.

In our 1996 article, we listed six states that prohibited the residential use of unvented gas heaters. Today, only California still prohibits the appliances, and that prohibition may soon be repealed—the legislation allows the appliances but requires that they be installed as regulated by the state, and the state has not yet written guidelines for installation. Some municipalities across the country do still prohibit the heaters.

Fewer localities prohibit unvented gas heaters now in part because of their inclusion in the codes of the International Code Council (ICC) and the International Association of Plumbing and Mechanical Officials (IAPMO). When the 2006 version of IAMPO's Unified Mechanical Code goes into effect, both of the United States' major codes will allow the use of unvented gas heaters. – *RA*

For more information:

Vent-Free Gas Products Alliance
Gas Appliance Manufacturers Assoc.
Arlington, Virginia
703-525-7060 x240
www.ventfreealliance.org

Product News & Reviews

New Delta Showerhead Advances State of the Art

A new product introduced at the 2006 Kitchen and Bath Show in Chicago demonstrates how sophisticated engineering can dramatically improve the performance of a seemingly mundane product: the showerhead. In late April, the Delta Faucet Company introduced a water-efficient showerhead with H_2Okinetic Technology™ that uses only 1.6 gallons per minute (gpm; 6 lpm) at 80 pounds per square inch (psi; 550 kPa) of water pressure yet delivers a forceful, satisfying shower. This represents a 36% water savings over standard 2.5 gpm (9.5 lpm) showerheads. Reducing water use in showers saves both water and energy.

Delta has achieved this performance by partnering with Bowles Fluidics Corporation. The technology that makes this performance possible comes from the automotive industry, where it was developed for windshield sprayers, according to Paul Patton, senior product development manager at Delta. An oscillation process controls the water droplets. "We tell the water how big the droplet should be and how fast it should come out," said Patton. The water leaves the showerhead through four openings, and the droplets are fairly large, resulting in good heat retention and excellent body wetting.

By comparison, most low-flow showerheads either create very small droplets or aerate the water. In the former case, according to Patton, the water cools off quickly after leaving the showerhead; in the latter case, some cooling happens, and the showerhead is noisier. The H_2Okinetics technology retains the same amount of heat 12 inches (300 mm) farther into the shower than most low-flow showerheads, according to Patton. This may result in moderate energy savings—beyond the energy savings achieved by using less water—by enabling users to shower at a cooler water mix.

Photo: Delta Faucet Company

Delta's advanced new H_2Okinetic showerhead uses just 1.6 gallons (6 l) of water per minute (36% less than the 2.5 gallon [9 l] standard), yet delivers a remarkably satisfying shower.

Delta has been working with the H_2Okinetic Technology for several years and in 2004 introduced several body-spray heads using this technology that are rated at as little as 0.75 gpm (2.8 lpm). (Body-spray heads are used in multi-spray shower systems that result in an end-run around the federal 2.5 gpm limit for showerheads by using multiple spray heads; some use as many as a dozen spray heads that, combined, consume well over 10 gpm [38 lpm].)

The new Delta H_2Okinetic showerhead is not cheap, carrying a list price of $50 (with typical discounting through plumbing supply distribution channels). In the third quarter of 2006, Delta plans to introduce a consumer version of the showerhead that will be sold through big-box retailers, such as Home Depot and Lowe's.

EBN editors tested two prototypes of the H_2Okinetic showerhead and found the product to be quite satisfying. When standing right next to the showerhead, one feels a pulsating flow, but the pulsating is unnoticeable a foot away. The showerhead is very quiet. Even when used in a rural home with a well and pressure tank that maintains only 40 to 45 psi (280–310 kPa) of water pressure, performance was adequate—with measured water consumption of only 1.4 gpm (5.3 lpm). – *AW*

For more information:

Delta Faucet Company
Indianapolis, Indiana
800-345-3358
www.deltafaucet.com

Kohler Enters the Waterless Urinal Market

The Kohler Company became the largest company to enter the waterless urinal market when it introduced two vitreous china models in April 2006. The company, which unveiled the models at the annual Kitchen and Bath Show in Chicago, joins at least four other manufacturers of waterless urinals.

Kohler's Steward™ and Steward S urinals are the end-product of a two-year development cycle in which the company essentially reinvented the urinal, according to Shane Judd, product manager for toilets and commercial products at Kohler. "We started by asking 'how would you make the best urinal possible?'," recounted Judd. They identified splash as the biggest problem with today's urinals and realized that a conical bowl is the best shape to prevent splash—but that you can't have a conical bowl with a flush urinal. "We completely redesigned the shape," Judd told *EBN*.

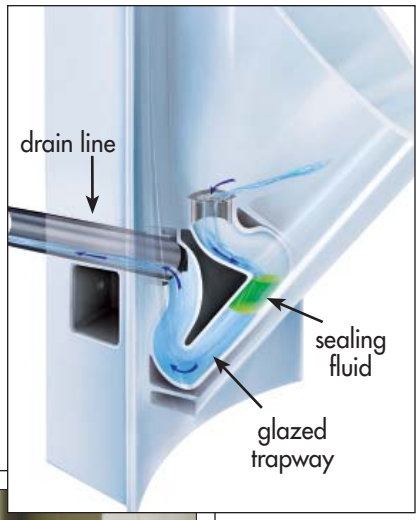
In terms of the sanitary trap, Kohler decided to forgo the more typical cartridge design. Instead, the Steward urinal uses a fully glazed vitreous trapway in which the seal is provided by a proprietary sealing liquid (see schematic inset at right). The liquid was specially developed for Kohler and, according to Judd, has low permeability to odors. Made primarily from vegetable oil, the sealing liquid is fully biodegradable.

Like other waterless urinals, each Steward should save up to 40,000 gallons (150,000 l) of water per year, according to Kohler, though water savings is dependent on usage. Conventional urinals today can use no more than 1.0 gallon per flush (gpf; 3.7 lpf); at least three manufacturers produce 0.5 gpf urinals.

Kohler's maintenance manual recommends rinsing the urinal bowl daily with a proprietary biodegradable cleaning fluid the company sells. Additional sealing fluid has to be added approximately monthly, though the frequency depends on usage patterns. When the sealing fluid is added, Kohler recommends first adding one ounce of the cleaning fluid to the urinal to dissolve deposits, including uric acid crystals, then flushing out the urinal trapway with a couple buckets of water.

The Steward urinal includes a rectangular backplate that enables this model to easily replace existing urinals in retrofit applications—it completely covers the footprint of a standard wall-mounted urinal. The model also works well in new installations. The much smaller, sleeker Steward S does not include the backplate and is appropriate only for new installations.

Kohler has been testing the urinal at its own headquarters for about a year, and employees have remarked that the urinal could make its way into residential applications. That is "absolutely" a market the company will be pursuing, according to Judd, though acceptance of a residential urinal will not be rapid.



Kohler, one of North America's largest plumbing fixture manufacturers, has entered the growing waterless urinal field with its sleek, cartridgeless Steward line. Photo: Kohler Company

The Steward carries a list price of $525, and the Steward S $475, though based on the typical distribution-channel discounting, the actual selling price for most commercial-building buyers is likely to be about half that, according to Judd—who calls the price "very competitive" with other non-water urinals. The urinals are manufactured in Kohler's Sanimex, Mexico, plant and began shipping at the end of April. The sealant fluid carries a list price of $130 for a one-gallon (3.7 l) bottle, but Judd says the typical cost to a company will be $70 to $75.

With the first production urinals installed in late March 2006, *EBN* was not able to obtain user experience yet but will report on the performance of this—and other recently introduced waterless urinals—in a future issue. – *AW*

For more information:

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www.kohler.com

Another Green Panel Manufacturer Calls it Quits

Rodman Industries, manufacturer of ResinCore1™—an FSC-certified, recycled-content particleboard made with phenolic resin—has announced that it will shut its doors by the end of May 2006. Rodman has been

producing particleboard since 1965. The shutdown comes on the heels of last November's unexpected folding of Dow BioProducts, which manufactured Woodstalk™ straw particleboard panels (see *EBN* Vol. 14, No. 12). Like Woodstalk, ResinCore1 leaves the market despite growing sales. "Sales were going up, especially since Dow Bio closed," according to Norman Chambers, national sales manager for Fiberesin Industries, Inc., Rodman's parent company. Employees who were anticipating a strong year were surprised in February when the board of directors gave its workforce and customer base 60 days' notice. "After the announcement, we booked about four months' worth of business in about three days," Chambers says.

So what drove these businesses to pack it in? Very simply: rising production costs. For starters, wood fiber has become more expensive. A report from Weyerhaeuser Company indicates that the 2005 industrial prices for softwoods and hardwoods were up about 5% and 30%, respectively, since 1999. Transportation costs have risen even faster. "In the last couple years we've had to go farther afield looking for wood, especially FSC-certified materials," Chambers told *EBN*, while the costs per mile have risen dramatically. Because the company has to buy more wet product, the energy costs for drying have also increased, reports Chambers. Finally, rising energy costs also affect the resins used in panel manufacturing; the phenol used in ResinCore1's binder is derived from petroleum, which has been skyrocketing in price. The overall cost to produce and deliver a wood-based composite panel, according to Jack Winterowd, senior scientific specialist for Weyerhaeuser, has gone up more then 60% since 2002, with the sharpest rise occurring over the last several months.

The costs of constituent materials, transportation, and process energy are unlikely to decrease. The wood panel industry will either have to raise prices (and get the market to accept higher prices), develop new methods and materials, or face ever-dwindling margins. Weyerhaeuser, the nation's largest timber products company, announced last year that it's getting out of the wood panel game altogether—its medium-density fiberboard (MDF) and particleboard mills in the U.S. and Ireland are for sale. Like Weyerhaeuser, Rodman is hoping a buyer will emerge—soon. In the meantime, the company has been trying to maximize operations during its remaining days to meet as much demand from its existing customers as possible, and it is working with them to line up replacement product from other manufacturers and suppliers.

"Clearly, green engineered panels are a growing market," Brian McLeod, senior vice president of Panel Source International, Inc., told *EBN*. He does not believe that the recent closures were caused by lack of demand for environmentally preferable sheet goods, but he anticipates that some opponents of FSC and LEED® in the forest products industry will spin the closings to appear that way. "Every time you have something like a Dow BioProducts situation, a Rodman situation, those interests will jump up and say 'I told you so.' But that's not the truth." Chambers agrees that there's a strong and growing market for green engineered wood products—but notes that the costs of producing them have to be borne and that the market will accommodate only so much. He cites Chinese agrifiber-board plants that haven't entered the U.S. market yet. "Eventually," he says, "it's going to come from somewhere." – *MP*

For more information:

Fiberesin Industries, Inc.
Oconomowoc, Wisconsin
262-567-4427
www.fiberesin.com

Passive Survivability *(from page 1)*

New evidence shows that the Greenland ice sheet is melting far faster than expected. This and the calving of large ice sheets in Antarctica (some as large as small states) raise the specter of significantly higher sea levels. With 53% of the U.S. population living on land defined as the coastal zone, rising sea level is a major concern. The University of Arizona Department of Geosciences Environmental Studies Laboratory website dramatically illustrates rising sea level: www.geo.arizona.edu/dgesl/ (click on "Dynamic maps of areas susceptible to sea level rise . . . ").

Low-lying areas prone to tropical storms and flooding are not alone in being vulnerable. An extensive ice storm in eastern Canada in 1998 left 4 million people without power for an extended period and forced 600,000 people from their homes—which could not be heated without electricity. A heat wave in Chicago killed more then 700 people in their homes or apartments in 1995; a more severe heat spell in 2003 killed 30,000 people in Europe. A widespread power outage in the eastern U.S. and Canada in 2003 left 50 million people—one-seventh of the U.S. population and one-third of the Canadian population—without power; fortunately, weather conditions were moderate.

Adding to these risks is terrorism. Following the 9/11 attacks in the U.S., Americans will forever be aware of their vulnerability to terrorism. Power and natural gas distribution systems are particularly exposed and susceptible to interruption, with large centralized trunk lines running through remote areas. The extensive power outage in 2003, caused by a circuit overload or malfunction, demonstrated this risk; well-placed explosives could even more effectively cut off power to large areas.

"The blackout in the Northeast in the summer of 2003 and Katrina should be enough to make it clear that we have a serious problem," notes David Eisenberg, of the Development Center for Appropriate Technology (DCAT) in Tucson, Arizona.

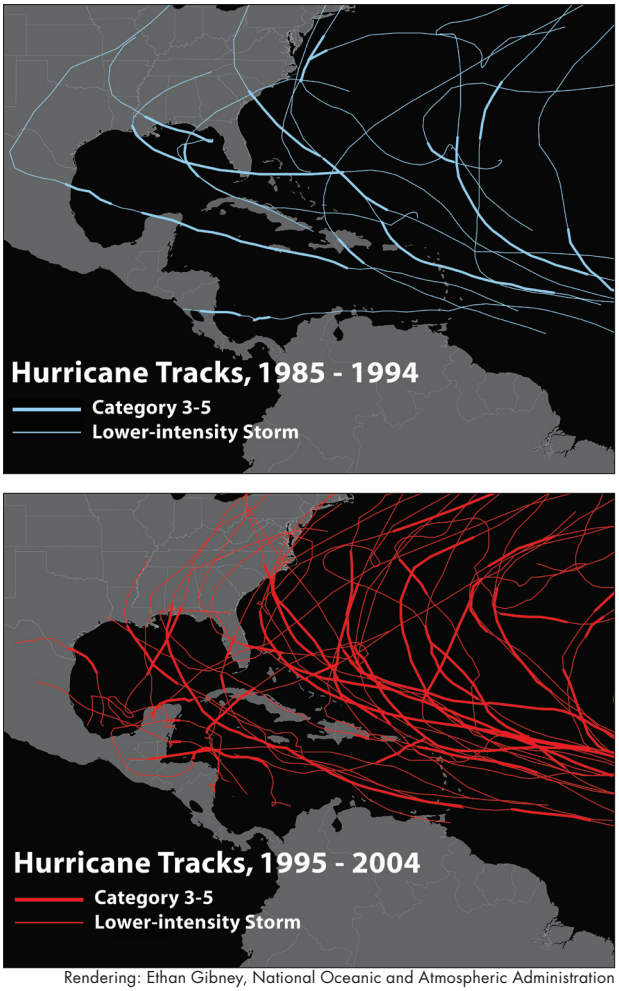
Often neglected in discussions about terrorism is the risk of *cyberterrorism*. "By hacking into control systems of the utility grid," according to Joel Gordes, of Environmental Energy Solutions in West Hartford, Connecticut, "it is possible to incapacitate the system for as long as a week with lingering effects remaining for as long as 18 months."

Finally, we are vulnerable to energy supply shortages. The petroleum age will effectively end well within the expected lifetimes of buildings being designed and built today. Most resource experts and policy makers assume that by the time petroleum "runs out," alternative energy sources will be available to replace that lost energy. However, during the period of transition to next-generation fuels, or if replacement fuels do not become available quickly enough to displace dwindling supplies of fossil fuel, there may be significant energy shortages. Natural gas, heating oil, and electricity derived from fossil fuels could all become scarce or prohibitively expensive.

Defining Passive Survivability

In preparing for a series of charrettes on Gulf Coast reconstruction for the Greenbuild conference in November 2005, the term passive survivability emerged as an umbrella concept to convey the idea of buildings that maintain livable conditions in the event of extended power outages, interruptions of fuel supply, or loss of water and sewer services. High temperatures in the Superdome—the city's emergency shelter—had put evacuees at risk, contributing to uproar across the country.

This made us wonder about the schools around the country that are commonly designated as shelters, as well as our houses and apartment buildings. If storms are becoming more intense and more common, and if our energy distribution systems or energy supplies are becoming more vulnerable, shouldn't we be designing our buildings to be able to function—at least minimally to provide basic livability—in the event of power outages or interruptions in fuel or water supply? Shouldn't passive survivability, we asked ourselves, be a basic design criterion of buildings in this day and age?



Rendering: Ethan Gibney, National Oceanic and Atmospheric Administration

A dramatic increase in the frequency and severity of tropical storms affected the Gulf Coast in the decade from 1995 to 2004 compared with the previous ten-year period. Ocean surface temperatures in the most recent period were 1°F to 2°F (0.5°C to 1.1°C) warmer, driving this increase in storm activity.

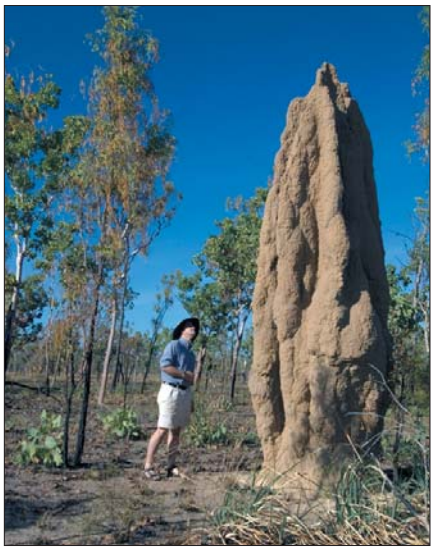
Achieving Passive Survivability

In some ways, the failure of conventional buildings to maintain survivable conditions can be thought of as a failure of design. "If they lose only electricity," notes building researcher Terry Brennan, of Camroden Associates, Inc., in Westmoreland, New York, "few buildings in the U.S. can provide as much comfort as my backpacking tent; if the gas lines and water lines go, the situation is even worse."

Some strategies for passive survivability can be found by looking back at our building heritage—vernacular designs that were in place before electricity and readily transportable fuels became available. The wide-open and well-ventilated "dog-trot" homes of the Deep South are examples, as are the high-mass adobe buildings of the American Southwest.

The house designs of some animals display even better examples of passive survivability. Among the best are termite mounds of Africa and Australia (see photo, page 12). "With a single ganglion for a brain, using no electricity or fossil fuels, termites construct dwellings that maintain temperature, humidity, and ventilation better than most buildings," says Brennan.

Marc Rosenbaum, P.E., of Energysmiths in Meriden, New Hampshire,



Termites maintain remarkably constant thermal conditions in their mounds, such as this one in Australia. Photo: Dreamstime

says generators are the survivability focus in large buildings, but these are really designed for short-term power outages. "It's rare that anyone is looking for 24 hours of continuous operation." With typical buildings, Rosenbaum hasn't seen any planning for longer outages, which are among his arguments for incorporating daylighting and operable windows.

Fortunately, we are beginning to pay attention. "Disaster tolerance is of growing interest to many groups," says John Straub, Ph.D., an engineer and building science expert at the University of Waterloo in Ontario. "I like the term 'robust designs,' since this encompasses weather, energy, extreme people, changing times, etc." Straub argues, for example, that stairwells should be built with windows, and offices should be daylit and have the potential for natural ventilation. "High insulation and high mass with some passive solar gain and summer shading will dramatically improve survivability," Straub told *EBN*.

A 21,000 ft² (2,000 m²), five-story apartment building that Straub helped design, and lives in, incorporates a wide range of passive survivability measures, including high levels of insulation, passive solar features, and natural ventilation. The design team specified the heating system to have a very low electrical draw—just 250 watts operate the pumps and fans for the entire building—so that they can use a photovoltaic-charged battery pack to operate the natural-gas heating system in the event of a power outage.

While maintaining livable thermal conditions generally gets the most attention relative to passive survivability, water is also very important. "We can live without many things," notes New York City developer Jonathan Rose, "but water is essential." A good start, suggests Brennan, is to install composting toilets and waterless urinals, neither of which require water to operate.

While passive survivability features can be incorporated into virtually any building, these features are most important for buildings that are lived in or likely to be used as emergency shelters: houses, apartment buildings, schools, hospitals, emergency-service buildings, and government buildings. The strategies differ somewhat by building type; the need for a high-performance building envelope, for example, is greater in smaller buildings that are skin-dominated (where heating and cooling loads are determined primarily by energy flow through the building envelope) than it is in large, load-dominated buildings.

A number of the most important design and construction strategies for achieving passive survivability in new buildings are addressed in the checklist on page 13.

Passive Survivability and Building Codes

David Eisenberg, whose organization, DCAT, has been working to integrate aspects of sustainability into building codes for the past ten years, points out that the purpose statement in the International Building Code states that codes should "safeguard public health, safety, and general welfare from hazards attributed to the built environment." "When a building is unable to provide a safe and habitable environment," says Eisenberg, "it fails to meet this standard of responsibility." He believes that this should apply whether all of

Marc Rosenbaum on passive survivability at his own house

EBN Advisory Board member Marc Rosenbaum shared with us how he has addressed passive survivability in his New Hampshire home:

On my own house, I wanted a highly robust product. I have a drilled well and a submersible pump, but I also ran a second pipe into the basement that can be used with a hand pump. Because the static level of the well is close to the ground level, I can have water without electric power. The house is heated by a woodstove, and water is heated by either a passive solar water heater (thermosiphon) or a passive heat exchanger in the woodstove. Daylight illuminates all rooms. I use an electric range for air quality reasons, but I have a single-burner gas cooker that I can use in a power outage. A root cellar in the basement provides some level of food storage.

One challenge I haven't solved yet is power. I have a grid-tied photovoltaic system, but when the grid goes down I can't get power from the system. I want to set things up so I don't have a battery bank but could use the power when the sun shines regardless of the grid being operational. This feature doesn't need to be automated—it could be a manual changeover. I think that having power a few hours every other day would allow much of life to be fairly uninterrupted. In many places around the world, electricity is not available at all times, but provided for a known period each day. One could pump water, operate tools and computers, freeze ice, etc. during those times.

Then there is the matter of where food comes from after the first few days . . .

Passive Survivability: A Checklist for Action

Create storm-resilient buildings.	Design and construct buildings to withstand reasonably expected storm events and flooding. One should assume that storm events will become more common and more intense in the future, and that regions prone to severe storms will expand in area. More stringent design and construction standards, such as the Miami – Dade County Building Code, should be adopted widely.
Limit building height.	Most tall buildings, with their dependence on electrically powered elevators and their reliance on air conditioning, usually cannot be used in the event of power outages. The occupant density in tall buildings generally precludes providing a significant fraction of power requirements with onsite renewable sources, and in a development pattern with a lot of tall buildings, blocking solar access of other buildings is a significant concern. In *Adapting Buildings and Cities for Climate Change*, the authors recommend six to eight stories as a reasonable height limit.
Create a high-performance envelope.	High levels of insulation, high-performance glazings (with multiple low-emissivity coatings and low-conductivity gas fill), and airtight construction are critical in achieving passive survivability in buildings. High levels of energy performance of the envelope (superinsulation) are particularly important with smaller, skin-dominated buildings.
Minimize cooling loads.	Reduce unwanted solar heat gain by paying careful attention to building orientation (situating buildings on an east-west axis with the long façades facing south and north), minimizing east- and west-facing glazings, specifying glazings "tuned" to the orientation (using low solar-heat-gain-coefficient glazings on the east and west, for example), using overhangs and other building geometry features to shade glazings, and selecting vegetative plantings that will shade the buildings (particularly the east and west façades).
Provide for natural ventilation.	In addition to reducing unwanted solar gain, design buildings to provide for natural ventilation. Even if the building is designed to operate with conventional air conditioning, provide operable windows, natural stack-effect cooling towers, and other features that can provide passive ventilation and cooling when necessary—even if using such strategies will result in higher-than-desired humidity levels in the building.
Incorporate passive solar heating.	Particularly with smaller, skin-dominated buildings, provide passive solar design features, such as direct solar gain with interior thermal mass, thermal storage walls (Trombe walls), and sunspaces or other *isolated-gain* solar systems.
Provide natural daylighting.	The following strategies can optimize daylighting design while minimizing unwanted heat gain: provide windows high on exterior walls; specify glazings with high visible-light transmission and a low solar-heat-gain coefficient; install lightshelves to reflect light deep into the space; install skylights with provisions to prevent overheating; paint ceilings and walls with high-reflectance paints; consider clerestory windows and light monitors to bring light deep into buildings; utilize light wells and atria to extend daylighting to lower floors of larger buildings; in buildings with very deep floorplates, consider light-scoop and mirror systems to improve daylight distribution in the interior space.
Provide solar water heating.	To provide hot water during power outages or fuel supply interruptions, install solar water heating systems that can operate passively (thermosiphoning or batch/integral-collector-storage) or that operate with DC pumps powered by integrated photovoltaic (PV) modules.
Provide photovoltaic power.	Capability to power a building with PVs is invaluable during outages. To be able to rely on PV power during a power outage for nighttime electricity necessitates battery storage, which increases system cost substantially (but may be justified for the value provided). Be sure to mount PV modules in a manner that will protect them during storms. Wire the building to isolate critical loads so that they can be PV powered when the rest are cut off.
Configure heating equipment to operate on PV power.	The vast majority of gas- and oil-fired heating equipment cannot operate without electricity. Providing the capability to operate that equipment during a power outage—using either a generator or a PV power system—is clearly beneficial. To simplify switching over to PV operation during an outage, equipment should be redesigned to operate on DC power; even without battery storage, some operation of heating equipment would be possible during a 24-hour period.
Where appropriate, consider wood heat.	In more rural areas, install low-pollution-emitting wood stoves, masonry heaters, or pellet stoves (with back-up power for fan) to provide space heating in the event of an extended power outage or fuel-supply interruption.
Store water on site; consider using rainwater to maintain a cistern.	Provide water storage to serve the building during an extended loss of water. Ideally, store this water high in the building, such as on the rooftop, to facilitate gravity delivery. In cohousing communities and planned neighborhoods, shared water systems can be developed with gravity-feed to dwellings. Cisterns can be fed with rainwater and used during normal building operation for landscape irrigation and, depending on local permitting, for toilet flushing—as long as an adequate reservoir is maintained for emergency use. Such cisterns can also serve fire suppression needs.
Install composting toilets and waterless urinals.	Composting toilets and waterless urinals can be used in the event of water loss, and composting toilets can function even if the municipal sewage treatment plant shuts down. In a large building with conventional toilets, such as an apartment building, consider installing one or two high-capacity composting toilets in a common area for use if water supply is cut off or the sewer system fails.
Provide for food production in the site plan.	Whenever possible, provide for local food production in the site planning for a building or development. Consider setting aside the best land for agricultural uses and planting food-bearing trees and shrubs in the landscaping mix.

the building's assumed utilities are functioning or not. "We should not be designing, approving, and constructing buildings that kill people when they are disconnected from their external utilities," Eisenberg told *EBN*.

Eisenberg is not aware of any building codes that address passive survivability. He expects that the same forces that opposed energy codes and indoor air quality standards will oppose anything like this getting into the codes. "At the very least," he argues, "the code organizations should be working to make it easier, rather than more difficult, to gain code approval for such designs."

"Codes are very reactive and so have not been doing anything about this as far as I know," says Straub. When codes do address survivability, they go about it the wrong way, in his opinion. "Codes prefer active systems that routinely fail and need lots of ongoing maintenance," he says, "like back-up generators to run lights in windowless stairwells."

A few elements of passive survivability are beginning to find their way into building codes and related regulations. The City of Chicago, for example, has passed an ordinance requiring all buildings to have reflective roofs, according to Sadhu Johnston, commissioner of the City's Department of the Environment. "Our progress toward greener buildings continues to grow, which, by default, has passive survivability gains," Johnston told *EBN*.

Gordes notes that in general the only passive survivability measures that have been incorporated into building codes are those providing storm resilience—such as the Miami – Dade County hurricane codes. He suggests that demand for such codes may come from another major player. "I believe we may find support for some aspects of green or survivable buildings within the insurance industry, which has an interest in mitigating losses and protecting lives," he says. "Just as they have been champions in fire-suppression sprinklers, they may support code upgrades for many green building attributes."

Photo: Mark Littrell, Wilcox Group Architects

This 700-gallon (2,600 l) cistern stores rainwater for the Camp Aldersgate Commons Building in Little Rock, Arkansas.

Final Thoughts

When one looks through the collection of passive survivability strategies addressed in this article, it becomes immediately obvious how closely they match a general list of green building strategies. Indeed, most of the measures that make our buildings more passively survivable also make the buildings more environmentally responsible.

Passive survivability strengthens the case for green buildings. Most of us in the green building community probably don't need another reason; we seek to create green buildings because we know that they are better for the people living in them and better for the Earth. But getting them designed and built isn't always easy in the face of financial and regulatory obstacles and just plain inertia. To overcome these barriers, it may help to make the case that these buildings are more resilient and better able to protect the well-being of Americans in the aftermath of natural disasters or terrorist actions. Sometimes it's useful to respond to people's fears as well as their aspirations, and passive survivability does just that, without an antisocial survivalist agenda.

The next step in advancing the agenda of passive survivability should be a collaborative effort that involves the design community, code organizations, the insurance industry, and nonprofit social welfare organizations. The sustainability community could play a lead role in convening such an initiative. "Life safety should be the bottom line in this, and it would be gratifying to see a collaborative effort develop to address this issue," says Eisenberg.

– Alex Wilson

Photo: Cody Andresen, Arup

Classrooms at the Kirsch Center for Environmental Studies in Cupertino, California, feature ceiling fans and operable windows to maximize daylighting and natural ventilation.

From the Library

Design Essentials
ASHRAE's Most Referenced Standards and Guidelines

January 2006. CD-ROM, $499, $429 for ASHRAE members, with an annual updating fee of $290 for nonmembers and $220 for members. A network version also is available. Runs only on Microsoft Windows® operating systems. To order, call 800-527-4723 or 404-636-8400, or visit www.ashrae.org/bookstore.

In January 2006 the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., (ASHRAE) released a CD-ROM containing the 12 standards and guidelines most widely used in the design of mechanical systems. While not inexpensive, the CD is a bargain compared to purchasing each one separately and less than half the cost of a CD-ROM containing all ASHRAE standards.

Although they are distributed on a CD, the standards are set up to be installed on a hard drive. Activation is required via the Internet to prevent unauthorized copies. Once the standards are installed and registered, users can view, print, and cut-and-paste from them freely. The standards included on the CD are:

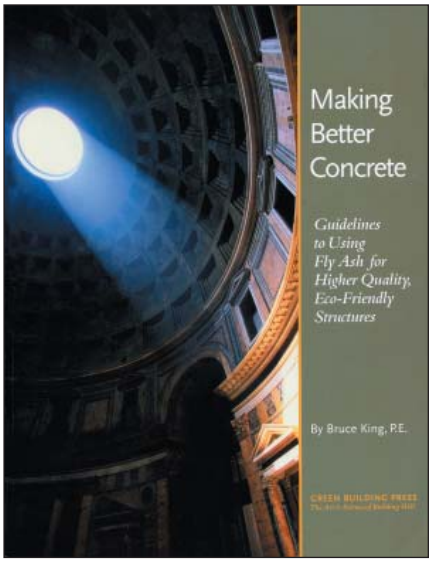
- ANSI/ASHRAE Standard 15-2004, Safety Standard for Refrigeration Systems
- ANSI/ASHRAE Standard 34-2004, Designation and Safety Classification of Refrigerants
- ANSI/ASHRAE Standard 52.2-1999, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
- ANSI/ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy
- ANSI/ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality
- ANSI/ASHRAE Standard 62.2-2004, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
- ANSI/ASHRAE/IESNA Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P edition)
- ANSI/ASHRAE Standard 90.2-2004, Energy-Efficient Design of Low-Rise Residential Buildings
- ANSI/ASHRAE Standard 135-2004, BACnet®: A Data Communication Protocol for Building Automation and Control Networks
- ASHRAE Guideline 0-2005, The Commissioning Process
- ASHRAE Guideline 1-1996, The HVAC Commissioning Process
- ASHRAE Guideline 13-2000, Specifying Direct Digital Control Systems – *NM*

Making Better Concrete
Guidelines to Using Fly Ash for Higher Quality, Eco-Friendly Structures

by Bruce King, P.E. 2005, Green Building Press. San Rafael, California. Paperback, 52 pages, $20.

Using coal flyash to replace 50% or more of the portland cement in concrete mixes is a huge opportunity for designers and builders—a way to get better concrete with a significantly smaller ecological footprint (see *EBN* Vol. 8, No. 6). But designing concrete mixes well isn't a simple matter, and using large amounts of flyash increases the importance of properly designing and pouring the concrete. *Making Better Concrete* argues for using lots of flyash, but it does so with the precautions and warnings of an engineer who has been doing it long enough to have learned some lessons. "If you don't plan to control water content and cure the concrete well, throw this book away; it will do you no good," cautions King in a typical statement.

Making Better Concrete covers all the basics, beginning with a history of flyash and pozzolans and descriptions of all the common (and some not-so-common) materials with pozzolanic properties. King then explains how they work, how to specify them, and how to work with the resulting mix on the jobsite. The book wraps up with a summary of the performance and environmental benefits of using flyash and a series of appendices containing sample mixes and listings of useful resources. Best of all, the entire text has King's friendly, self-effacing, and humorous voice, which makes it as easy to read as anything this technical could be.



Making Better Concrete will be of great value to architects who are trying to figure out whether and how to use high-flyash concrete and need just enough of an understanding to ask their engineers good questions. Especially useful is a summary of the applications in which high flyash mixes are a no-brainer (mostly those in which early strength gain is not important and curing conditions are not challenging), when they are possible but require special attention, and when they are not a good fit. Engineers, in turn, will find this book a useful introduction—though before they actually start specifying high-flyash mixes, they'll need some of the more technical documents listed in the appendix. – *NM*

Calendar

MAY

4-7 • The Architecture of Sustainability, Shepherdstown, WV. *Organizer:* The American Institute of Architects. *Information:* www.aia.org/ev_cod_may06.

11-12 • 4th Annual Greening Rooftops for Sustainable Communities Conference, Boston, MA. *Organizer:* Green Roofs for Healthy Cities. *Information:* 416-971-4494; www.greenroofs.org/boston/.

16 • Negotiating a Green Mindset, Boston, MA. *Organizer:* Green Roundtable, Haworth. *Information:* 617-374-3740; www.greenroundtable.org/Trainings/Green Mindset.html.

16-17 • 4th Annual SUNY-ESF Green Building Conference, Syracuse, NY. *Organizer:* U.S. Green Building Council New York Chapter. *Information:* 315-470-6888; www.esf.edu/outreach/pd/2006/gbc/default.htm.

16-17 • Restoration 2006: Community and Economic Recovery After a Disaster, New Orleans, LA. *Organizer:* International City/County Management Association. *Info:* 202-962-3539; www.restoration2006.org.

17-19 • Greening the Heartland 2006: Advancing Sustainable Practices, Kansas City, MO. *Sponsor:* U.S. Green Building Council Greater Kansas City and Regional Heartland Chapters. *Info:* 215-295-2725; tkarleen@rdinc.net; www.greeningtheheartland.org.

22-26 • 2006 ACI Home Performance Conference, Austin, TX. *Organizer:* Affordable Comfort, Inc. *Info:* 724-627-5200; lindawig@affordablecomfort.org; www.affordablecomfort.org.

30-June 3 • Natural Home Building, Jessup, MD. *Organizer:* Green Building Institute. *Information:* 443-733-1234; www.greenbuildinginstitute.org.

JUNE

1-4 • Congress for the New Urbanism XIV, Providence, RI. *Organizer*: Congress for the New Urbanism. *Info:* www.cnuxiv.org.

8-10 • AIA 2006 National Convention and Design Expo, Los Angeles, CA. *Organizer*: The American Institute of Architects. *Information:* www.aia.org.

9-11 • Eco Show 2006 and Greenbuild Australia, Sydney, Australia. *Organizer*: WSB Media Group. *Information:* www.ecoshow.com.au.

12-14 • NeoCon World's Trade Fair, Chicago, IL. *Organizer*: Merchandise Mart Properties, Inc. *Information:* www.merchandisemart.com/neocon/.

4-16 • Eco-Architecture 2006: First International Conference on Harmonisation Between Architecture & Nature, The New Forest, UK. *Organizer*: Wessex Institute of Technology, UK. *Information:* www.wessex.ac.uk.

26-29 • Ecobuild America and AEC - Science & Technology, Chicago, IL. *Organizer*: Sustainable Buildings Industry Council. *Information:* www.ecobuildamerica.com.

JULY

8-11 • The Campus of the Future: A Meeting of the Minds, Honolulu, HI. *Organizer*: Society for College and University Planners. *Information:* 734-998-6595; betty.cobb@scup.org; www.campusofthefuture.org.

8-13 • SOLAR 2006: Renewable Energy, Key to Climate Recovery, Denver, CO. *Organizer*: The American Solar Energy Society. *Information:* www.ases.org.

AUGUST

13-18 • 2006 ACEEE Summer Study on Energy Efficiency in Building, Pacific Grove, CA. *Organizer*: American Council for an Energy-Efficient Economy. *Information:* www.aceee.org.

SEPTEMBER

18-19 • Engineering Green Buildings Conference and Expo, Austin, TX. *Sponsor:* HPAC Engineering. *Information:* 800-438-6720; gsmith@penton.com; www.egbregistration.com.

19-22 • Rethinking Sustainable Construction 2006, Sarasota, FL. *Organizer:* University of Florida. *Information:* 352-273-1172; www.treeo.ufl.edu/rsc06.

28-30 • West Coast Green, San Francisco, CA. *Organizer:* West Coast Green, LLC. *Information:* 800-419-1282; www.westcoastgreen.com.

More complete information and additional listings are online at www.BuildingGreen.com.

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