

BY JENNIFER WEEKS

PHOTOGRAPHS BY PRESTON-SCHLEBUSCH

# Sun city

## YOU DON'T NEED TO BUILD

a house from scratch to take advantage of smart new solar technology, but that's exactly what 18 college and university teams did for the Solar Decathlon, a competition sponsored by the U.S. Department of Energy.

The students spent three years designing houses powered exclusively by solar energy, and this past October transported them to the National Mall in Washington, D.C., where the doors were thrown open to the public.

Weather during the two-week Decathlon ranged from cloudy to stormy, which put rooftop photovoltaic (PV) systems to the test. Despite the inclement conditions, more than 120,000 spectators waited in line to see inside the roughly 800-sq.-ft. houses. With

average winter fuel costs projected to be 33 percent higher this year than last, many people were there to glean ideas for tightening up their own homes' building envelopes with triple-glazed windows, structural insulated panels and other energy-efficient features. But perhaps the most surprising lesson was that comfort and style don't have to be sacrificed in the pursuit of alternative energy.

Here are four of PM's favorite entries.

**WHEN 18 TEAMS OF STUDENTS BUILT A SOLAR NEIGHBORHOOD** in the nation's capital, they created a showcase of the best new technology for conserving energy and harnessing the power of the sun.

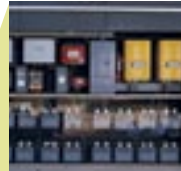
Cleverly designed roofs, such as the one on Virginia Tech's house, maximize photovoltaic panels' exposure to the sun. "Drawing that fancy curve was a lot easier than building it," says student Bryan Atwood.

VIRGINIA TECH

## Keeping It Light

The house built by Virginia Tech needs no electric lights from sunrise to sunset. Translucent walls that transmit daylight can be tuned with motorized shades to control indoor air temperature; a stretched-fabric ceiling reflects and redistributes light pouring in from windows just above the walls. At night, low-energy LEDs illuminate the house like a colorful lantern.

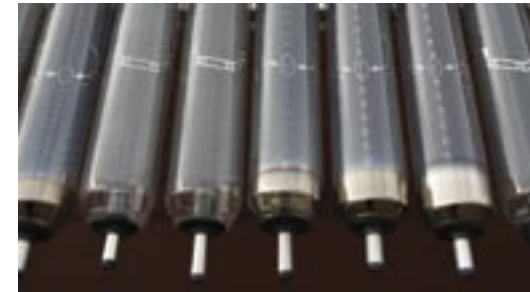
**TRANSLUCENT THERMOCLICK PANELS:** gelexan.com  
**NANOSEL:** cabot-corp.com  
**SOLAR PANELS:** sunpowercorp.com  
**ELECTRO/2 MOTORIZED SHADES:** mechoshade.com  
**LYPTUS FLOOR:** weyerhaeuser.com  
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**Power Center** The north wall of the house (top left), made of insulated steel panels, slides on a track to provide access to the electrical system. When fully charged, 20 sealed lead-acid batteries (inset) can power the home for five days. **Colorful Touch** The south, east and west walls (below) are double layers of translucent polycarbonate panels filled with Nanogel, an aerogel that diffuses light and sound, and provides insulation values up to R22. **High Standards** The roof—which appears to float above the house—holds 36 200-watt SunPower PV panels, and is angled to capture sunlight and to direct rainwater to cisterns beneath the deck. **Inner Beauty** The team chose laminate flooring made of sustainably harvested Lyptus (bottom left), low-flow faucets, and appliances rated Energy Star for superior efficiency.



UNIVERSITY OF COLORADO



## Natural Genius

Students dubbed Colorado's house the BioS(h)IP, playing on a key component—structural panels made of wastepaper and soy. The recycled theme continues throughout the building, which produces more energy than it consumes—clinching for the school its second straight Decathlon championship.

**SONOBOARD:** sonoco.com  
**INSULATING FOAM:** biobased.net  
**SOLAR THERMAL COLLECTORS:** thermomax.com  
**RADIANT FLOOR:** warmboard.com  
**HEAT MIRROR:** alpeninc.com  
**E4 ELECTRIC CAR:** gemcar.com

**Framework** The home's walls (above) are a twist on standard structural insulated panels (SIPs), sandwiching soy-based insulation between lightweight fiberboard made of recycled paper. These BioSIPs have an insulating value of about R7 per inch—twice that of loose-fill cellulose. **Heat Magnet** The roof of the house has 34 200-watt SunPower PV panels. On the southwest wall are 80 vacuum tubes (top right), or solar thermal collectors, which heat water for domestic use and for a radiant floor system. **Surplus Power** Excess energy generated during the Decathlon powered an electric vehicle (bottom right) for 319 miles.



## Built to Scale

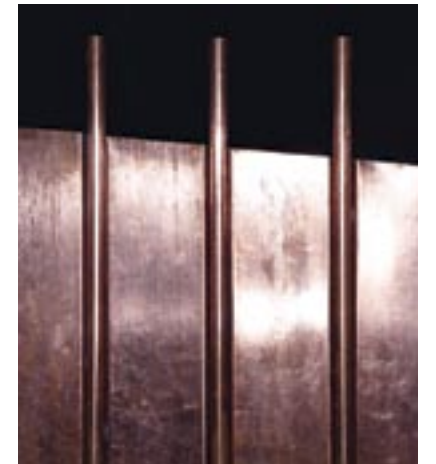
Cornell's team used a simple rectangular design to create a tight thermal envelope. And because the wall panels are load bearing, several units can be combined. "They are basically building blocks," says student Josh Bonaventura-Sparagna. The team is now developing a business plan to build 2000-sq.-ft. homes.



**SOLAR MODULE:**  
gepower.com  
**BAMBOO CABINETS:**  
teragren.com  
**ULTRATOUCH INSULATION:**  
bondedlogic.com  
**CUSTOM SILICA GEL WHEEL:**  
www.rotor  
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standardair.com  
**FOLDING GLASS DOOR:**  
nanawall.com  
**INDUCTION COOKTOP:**  
divainduction.com  
**ADVANTIUM OVEN:**  
geappliances.com



**Powering Up** The angle of the 56 110-watt PV panels on the rooftop array (above) can be adjusted to maximize sun exposure in a range of climates. **Fresh Air** A custom energy recovery ventilator draws outside air through a wheel of silica gel, transferring heat and humidity from the intake to the exhaust. This greatly reduces the amount of energy required to heat and cool the interior (left). **Cotton Buffer** The team chose floor insulation made primarily of recycled blue jeans (right)—easier and safer than fiberglass to install, and just as effective.



UNIVERSITY OF MISSOURI-ROLLA  
ROLLA TECHNICAL INSTITUTE

## Prairie Home

The Missouri team's goal was to build a solar house that produced ample power, but could blend easily into a typical suburban neighborhood. To do so, the team drew on two influences: the architecture of Frank Lloyd Wright and a mathematical ratio that appears repeatedly in nature.

**By the Numbers** Many features—from the window placement to the curve of the kitchen island (left)—are designed around the aesthetically pleasing "golden ratio" of 1:1.62, which has influenced architects for millennia. **First STEP** In the Solar Thermal/Electric Panel system, thin-film amorphous PV panels are integrated with copper piping (above) to produce hot water and electricity in the same roof area. **Aesthetics** As an added bonus, the STEP system is subtle (top left). "Another team asked when we were going to put up our solar panels," says student Allison Arnn. "And we said, 'They're up there.'" **PM**

**SOLAR PANELS (PVL-SERIES):**  
www.uni-solar.com  
**CUSTOM COPPER ROOF PANELS:**  
atas.com  
**SEALED INVERTER (FX SERIES):**  
outbackpower.com  
**6-IN.-THICK SIPs:**  
thermocore.com  
**KENMORE ELITE REFRIGERATOR:**  
sears.com



FOR MORE ON THE SOLAR DECATHLON, INCLUDING A VIDEO TOUR OF THE WINNING HOUSE, VISIT [popularmechanics.com/solar](http://popularmechanics.com/solar)