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Our annual Awards Issue features our Editors' Choice "Hot 50 Products," plus our latest Readers' Choice brand survey. Together they carry a mixed message. Construction is going high tech, yes—but big brands still dominate the mental landscape.

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**GREEN BUILDER**  
**HOT50**  
**PRODUCTS**  
 2016 Editors' Choice



PAGE 12

# TABLE OF CONTENTS

HERE'S A SAMPLE OF WHAT'S INSIDE:

**“In this country, increased demand for mass timber products hold the potential for reviving rural economies, especially if communities can create value-added products close to the harvest site.”**  
 (p.52)

**ON THE COVER**  
**VISUALIZING CHANGE**

Artist: Liza Kelley  
 The image depicts the DAQRI Smart Helmet:  
 Details on page 11.

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**EDITOR'S NOTE**

The Inside Scoop

02

**GREEN BUILDING NEWS**

Innovations, Research and Tips on Sustainable Building

04

**LOOKING AHEAD**

It's important to celebrate success. In this special awards issue, *Green Builder* showcases 50 products that contribute to smarter, more sustainable homes. Our professional readers also weigh in, as we present the results of our annual sustainable brands survey.

10

**THE HOT 50 GREEN PRODUCTS**

12

**STAYING POWER: 2016 READERS' CHOICE BRAND SURVEY**

39

**DESIGN IDEAS**

Design for a Sustainable Future

52

**INNOVATION UPDATE**

Breakthroughs in Sustainable Technology

54

**ENERGY SOLUTIONS**

Sustainable Power From This Day Forward

56

**BUILDING SCIENCE**

Innovative Solutions for High-Performance Homes

58

**CODEWATCH**

The Latest on Green-Related Construction Rules and Regulations

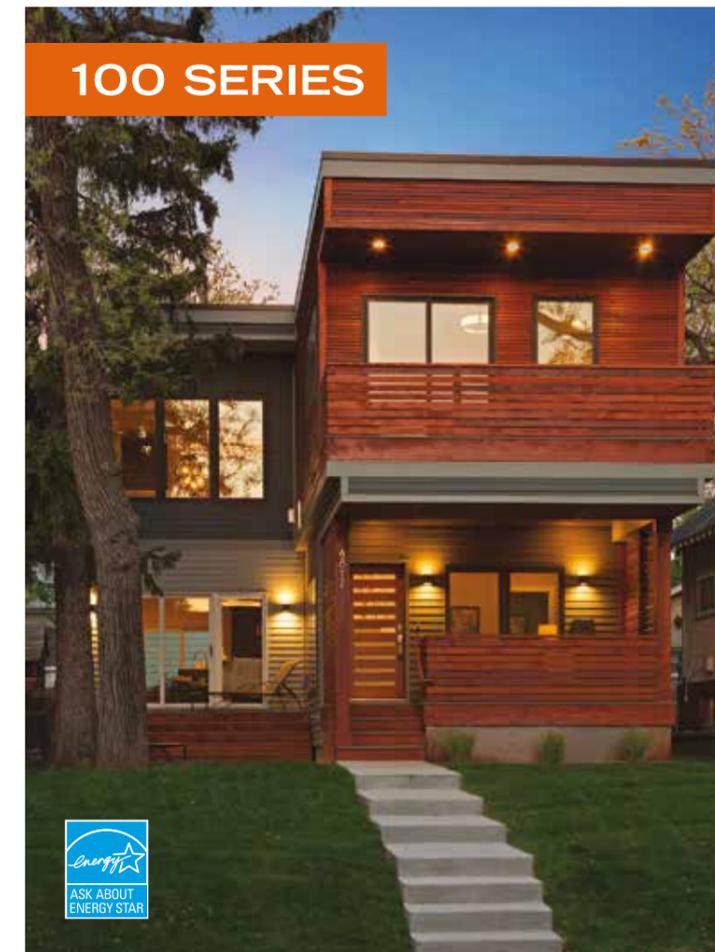
60

**FROM THE TAILGATE**

New Offerings for the Sustainable Minded

64

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# ENERGY SOLUTIONS

## Sustainable Power From This Day Forward

## Eight Technical Wonders for the (Near) Future

These technologies, being developed by the DOE's national laboratories and their partners, will transform the energy landscape.

BY GREEN BUILDER STAFF

**W**E'D LIKE TO KICK OFF the new year with a glimpse at some promising energy-saving technologies. Most are still in the R&D phase, but our friends at the Department of Energy are joining forces with manufacturers, energy providers and other partners and to bring these technologies to market. Here's a compilation of some of the most promising innovations on the horizon.

### 1. SMARTER SENSORS

Smart home technology improves energy efficiency by responding to feedback: temperature and humidity, changing light levels, etc. But until recently, collecting this data required wired sensors or expensive wireless ones. Researchers at the Oakridge National Laboratory (ORNL) are developing wireless sensors that are exponentially cheaper, by utilizing a process called "additive roll-to-roll" manufacturing. This allows electronic components such as solar PV cells and sensors to be printed on plastic. These "peel and stick" sensors will enable improved control of lighting, appliances and HVAC equipment, resulting in a 20 to 30 percent reduction in whole-building energy usage.

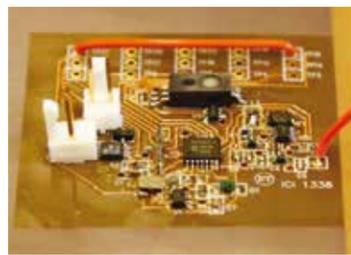


IMAGE CREDIT: ORNL

### 2. IMPROVED HEAT PUMPS

Next-generation heat pumps are a promising HVAC solution, and DOE partners are working on several prototypes. One is a heat pump based on the Vuilleumier cycle, which requires few moving mechanical parts. ThermoLift, Inc. ([www.tm-lift.com](http://www.tm-lift.com)) and several partners are working on a gas-fired unit that provides space heating and cooling and water heating; it utilizes an ultra-low combustion

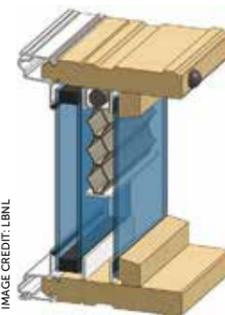


IMAGE CREDIT: LBML

burner and requires no refrigerants. Once all the kinks are worked out, this technology will deliver a grid-independent HVAC system that lowers energy use by 30 to 50 percent and slashes greenhouse gas emissions.

### 3. ULTRASONIC CLOTHES DRYERS

GE and the ORNL have worked together on a heat pump clothes dryer, and the Whirlpool Corporation released its first heat pump clothes dryer last year. These hold the potential to lower energy use by 60 percent, while eliminating the problem of moisture disposal. GE and ORNL are also developing an "ultrasonic clothes dryer" that uses high-frequency mechanical vibration to extract moisture out of clothes. It can dry a load in about 20 minutes, and it's easier on the clothes than heat-based drying technology.

### 4. MAGNETIC REFRIGERATORS

A magnetic refrigerator uses water instead of refrigerants and magnets in the place of a compressor. Turning the magnetic field on and off heats or cools the "refrigerant," which then flows to a heat exchanger. GE is working with the ORNL to develop the technology, which could potentially reduce energy use by 25 percent and eliminate refrigerants, which contribute to global warming. Magnetic refrigerators should hit the market within five years.

### 5. ADVANCED WINDOW CONTROLS

High-performance windows have a high solar heating gain coefficient, which is great for cold winter days. Motorized shades can limit solar gain, but they rely on people to operate them. Pella Windows and the Lawrence Berkeley National Laboratory are developing a super-smart window that utilizes a sensor/microprocessor package to refine shading control. The goal? A

highly insulating window with a high solar heat gain (when not shaded) that includes a motorized shade between glass panes, which responds automatically to changing conditions. It will work within or independent of whole-home automation systems.

### 6. NEXT-GENERATION INSULATION

No insulation product has yet broken the "R-5 per inch barrier," and the ones with the highest insulating values (i.e., XPS) rely on ozone-depleting blowing agents. But the Industrial Science and Technology Network is developing a high R-value foam insulation that relies on a carbon dioxide blowing agent, rather than hydrofluorocarbons. Their ultimate goal is to develop a cost-competitive polymer-blend spray foam, enhanced by nano-technology, that achieves R-9 to R-10 per inch and relies on a benign CO<sub>2</sub> blowing agent.

### 7. COOL ROOFS IN DARK COLORS

Lighter-colored roofs are "cooler" because they reflect more sunlight and absorb less heat. But not everyone wants a light-colored roof. PPG Industries and the Lawrence Berkeley National Laboratory are developing dark-colored fluorescent pigments that reflect up to four times the sunlight compared to standard pigments. These metal coatings will come in dark red and near-black colors, will

have "unprecedented" effective solar reflectance values of 0.50 to 0.70, which means they will reflect between 50 and 70 percent of sunlight. In contrast, the ESF of standard dark coatings ranges between 0.10 and 0.30.



IMAGE CREDIT: DOE

### 8. SUPERCHARGED LEDs

The cost of LEDs has dropped 90 percent since 2008, and sales have skyrocketed. But research and development is continuing, in search of even higher efficiencies and improved quality. On the horizon is LED lighting that produce 235 lumens per watt—nearly twice the efficiency of today's LEDs.

Source: DOE

## EXACTITUDE

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