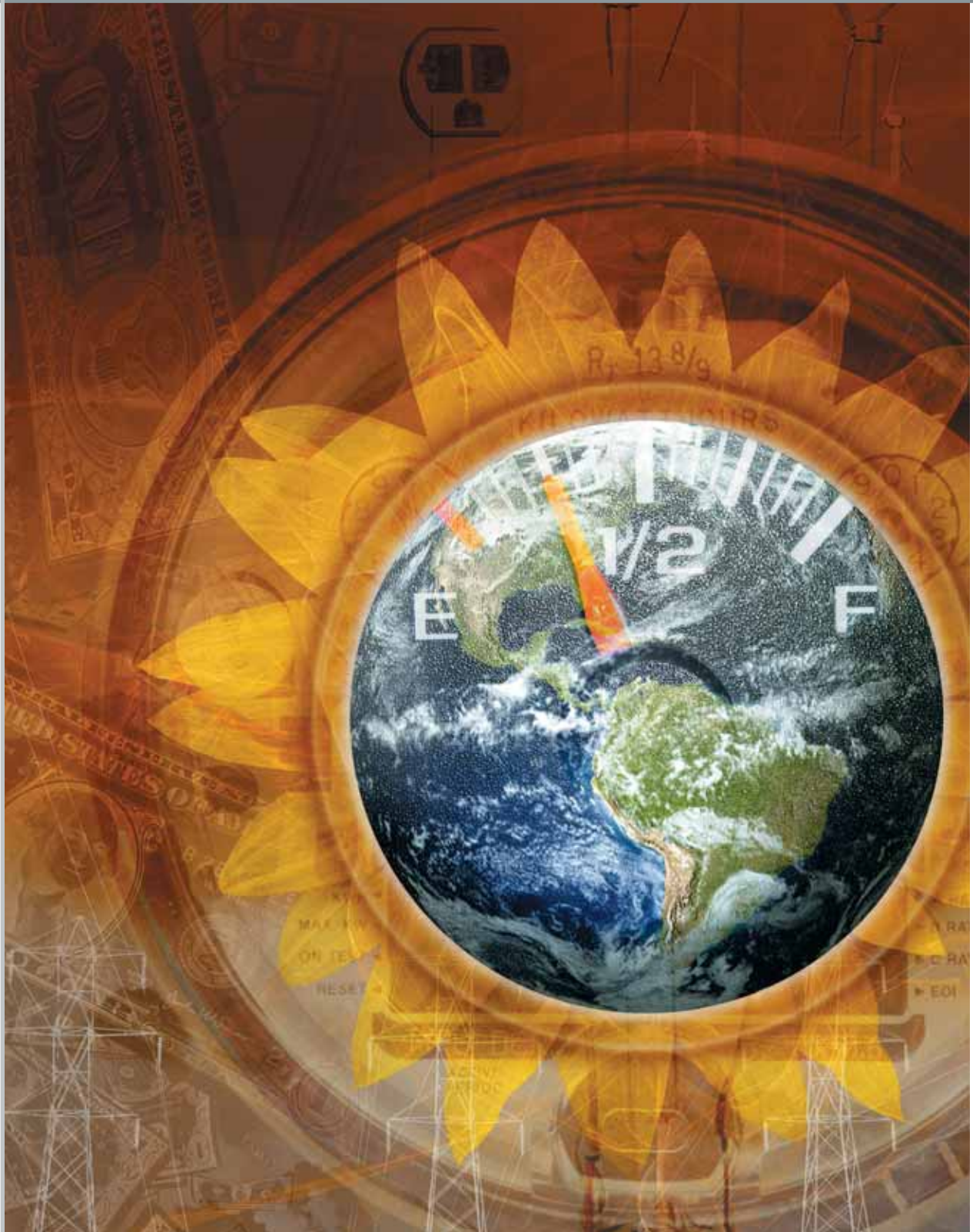


# INTELLIGENT



Smart Homes for a Sustainable Future

text by Robyn Linn Weinstein

# GREEN HOMES

Observations and climate models confirm that human-induced warming of the planet is having a pronounced affect on the atmosphere's total moisture content. Those are the findings of a new study appearing in the September 17, 2007 online edition of the *Proceedings of the National Academy of Sciences*. "When you heat the planet, you increase the ability of the atmosphere to hold moisture," says Benjamin Santer, lead author from Lawrence Livermore National Laboratory's Program for Climate Modeling and Intercomparison. "The atmosphere's water vapor content has increased by about 0.41 kilograms per square meter (kg/m<sup>2</sup>) per decade since 1988, and natural variability in climate just can't explain this moisture change. The most plausible explanation is that it's due to the human-caused increase in greenhouse gases." This is why the surge of sustainable, intelligent homes has prompted a movement toward the digital frontier. Cities around the globe are finally achieving advancements in the construction of intelligent green buildings that utilize renewable energy sources, like solar and wind, for single-family homes. Renewable energy is critical for reducing and offsetting our carbon (CO<sub>2</sub>) footprints; however, the key in creating an intelligent green home is automation—the use of integrated technologies and integrated systems, allowing the infrastructure to share data and information over one network.

The concept of integrated, sustainable technologies in homes has been circulating the industry for over 20 years. However, industry leaders have found it difficult—rather impossible—to implement the changes necessary when the industry's foundation is still acting on age-old principles. Nevertheless, one of the most important aspects of a smart green home is to understand the end-goal and have all key players on the same page toward achieving the goal. First, owners and/or developers must be aware of smart building technologies (or recommend using them), and second, they must see eye-to-eye with the electrical engineer, the integrator, and anyone else involved. Industry professionals believe there's no better time than now to bring smart, green technology into the home.

Albert E. Planas, Jr., Electrical Engineer and CEO of Simtra Cables, believes that an ecologically efficient intelligent home must be integrated under one common network supported by an electrical system, consisting of cable assembly; power and data; and a power server. Integrated systems do more than save money; they allow homes to

function without losing energy. People are ensured that energy is not wasted and used only when needed.

## EFFICIENCY AND SOLAR

"The solution is controlling your use and getting by with less, that way everyone can put back energy and help save the planet rather than taking what they don't need," Planas says.

The Second Law of Thermodynamics states that 100 percent efficiency is not attainable, but we can still demand the most sustainable infrastructures that our technology and innovations allow us. By working with local renewable energy contractors and staying aware of your electrical usage, getting close to 99 percent efficiency is very likely.

To reduce the carbon footprint of your home, you must be aware of the energy you are using on a daily basis and maximize efficiency by remaining conscious of your actions. Do you leave the refrigerator door open too long? Is your dishwasher full? Do you use a front-loading washer and dryer? By making subtle, conscious decisions, you can really make an impact.

"We need to start taking risks and move forward to the next phase of evolution toward sustainability by building and updating homes with intelligent green home technologies. Now that people are more conscious of global footprints, it's time to stop taking energy and give some back," Planas says.

Principal Engineer of The Hartman Company, Tom Hartman, believes that if the ultimate goal is to decrease the carbon footprint, the best place to begin is by creating a net-zero home. Using an array of photovoltaic panels to offset the electrical usage, you sell and buy electricity from the utility companies; a bartering arrangement that can lead to a net-zero balance.

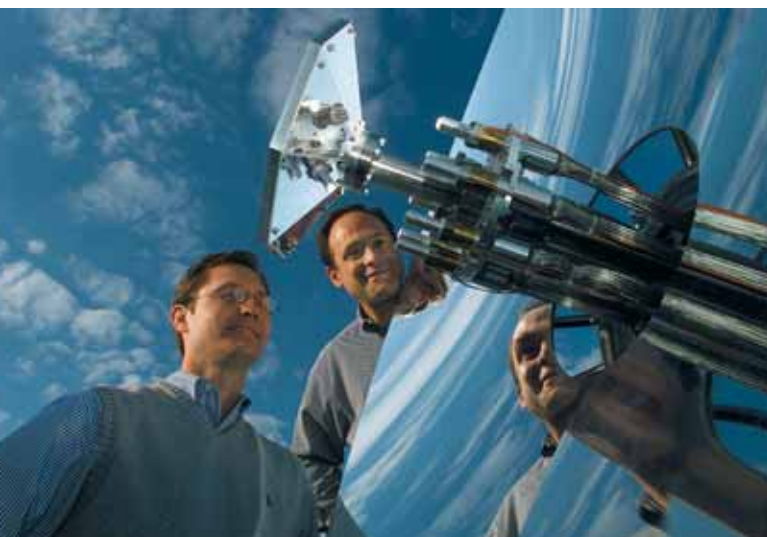
Through the use of solar cells, also called photovoltaic or PV, an array of solar collectors store energy from the sun throughout the day. When a surplus of power is created by the solar panels, the energy automatically feeds into the electric meter, establishing a credit with the utility company. Net-zero means that the renewable energy you are feeding into the home is equal to or less than the amount of energy you are using; it all depends on the

homes daily consumption of energy and the amount of solar panels one roof can handle. The goal is to end with a neutral read or net-zero balance; not having to pay the utility company for electricity and most importantly, a chance to backtrack on our energy consumption.

California is offering numerous tax incentives and rebates for homes with renewable energy systems installed. The California-based renewable energy supplier, Borrego Solar, is a major distributor of solar panels to the San Francisco Bay area, San Diego, and now in Charlestown, Massachusetts. The government is providing incentives for Connecticut and Massachusetts that pay for up to half the cost of a system. Borrego has installed over 500 panels in residences, businesses, and governments since 1980 using the Solar Elect System that feeds the electricity back into the grid using the same meter. Many of their clients immediately notice the price savings, as well as becoming more aware of their energy consumption.

“You can offset your usage depending on the size of the roof and size of panels. It offers great energy savings for homes with normally high energy costs, or for those who are morally conscious and want to do the right thing,” says Borrego Solar’s Andrew Keeper.

The market research firm Clean Edge, Inc. reported that the annual revenue for four clean-energy technologies—solar photovoltaics, wind power, biofuels, and fuel cells—rose from \$40 billion in 2005 to \$55 billion in 2006, projecting that by 2016, the market will skyrocket to \$226 billion. Solar photovoltaics alone are currently a \$15.6 billion industry and are forecasted to increase to \$69.3 billion by 2016.



From left, Alex Fischer, head of ORNL’s Technology Transfer Program, is shown with Jeff Muhs of ORNL’s Engineering Science and Technology Division, who developed the hybrid solar lighting technology. It allows the sun’s rays to light a room directly by using optical fibers to bring sunlight inside, and in the future, indirectly by harnessing the remaining portion of sunlight (mainly infrared energy) to generate electricity that can power a room’s light bulbs.

According to Borrego Solar, solar panels are so efficient that even a small 2.5kW solar system reduces CO2 emissions similar to the amount of planting one acre of trees and equal to the amount of CO2 emitted from a car that drives 7800 miles per year.

The integrated network can consist of products from solar panels to automated lighting; no matter what products you choose, the system will function as a holistic network.

“The key is to have very efficient heating and cooling energy usage with an efficient envelope, which are the walls and windows of a home. The two fundamental elements needed to achieve this are proper conduction (when it’s hot outside, it’s cool inside) and no infiltration (not allowing the outside air to seep in). It’s not difficult to do with today’s technology, and there’s not a huge cost implication,” says Hartman.

However, due to the lack of governmental support, as well as the utility companies’ fear of losing money, the trends have not gone mainstream. It is currently up to homeowners to demand that the changes be implemented.

“It’s up to the engineering community to tell the utility world things have changed, but we need public policy to make it work effectively. An important role is getting the attention of regulators,” says Hartman.

Hartman has written several articles on the benefits of using photovoltaic energy for homes and buildings, but has faced many setbacks along the way.

“The electric utility companies are still operating in an electrified world. They just keep going, selling more electricity to make more money, but it’s a different world in the 21st century. The utility world falls short of what is truly needed; they must change their objectives and business models in order to adapt to a sustainable future,” says Hartman.

As the industry continues to find ways to create a sustainable future, new technological advancements are finding their way into the market. One product has proven to be the powerhouse solution to network integration. As structured cabling and low-cost networking play major roles in integrating systems for smart technology, the Simtra Cable has been able to integrate all electrical and data units together—including Internet, computer, telephone, television, stereo systems, lighting control, air conditioning, security systems, automation, and more—while saving time, energy, and money for homeowners.

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The Simtra Cable combines power and data under one conduit using a magnetic barrier that insulates the power conductors from the data segments of the cable. Rather than running power, data/Internet, and telephone cables through your home with two or three different conduits or raceways (using thousands of feet of cable), Simtra distributes through the entire home in one conduit or raceway, resulting in less cable, less time, and less labor. The cable is made specifically for integration and intelligent wiring solutions; a smart bet for intelligent, sustainable homes.

“Through research, we have found that 70 percent of electricity usage for lighting alone goes to heat and only 30 percent goes to light. This process actually causes excess heat to enter the home, triggering the air conditioning. It is a continual process that causes a loss of energy,” says Ron Zimmer, President and CEO of the Continental Automated Building Association (CABA). “The home is integrated to reduce energy and operating costs.”

The use of energy-efficient equipment allows for ultimate comfort in the home. Automation is used for many services, including lighting control, window blinds, a complete security system, and much more, which can be accessed through the Internet, cell phone, or touch screen computer. With the help of industry professionals such as integrators, electrical engineers, electrical contractors, and local utility companies, you can take control of the energy coming in and through your home.

#### **ECO-CELEBRITIES**

And even though they're busy making films and posing for the paparazzi, celebrities like Cameron Diaz and Cate Blanchett to George Clooney and Brad Pitt are taking action and promoting awareness, hoping to lead by example. Actor Morgan Freeman sits on the board for alternative fuel supplier Earth Biofuels, Inc. to aid in the production and distribution of biodiesel fuel. Scarlett Johansson, Gwyneth Paltrow, and Julia Roberts purchased the Toyota Prius as part of their commitment to lower their CO2 footprints. Daryl Hannah and Edward Norton use solar panels to power their homes off the grid —meaning they are independent from the utility company's electricity and only use the sun's energy.

Actress and comedian Julia Louis-Dreyfus believes in environmental independence. She and husband, Brad Hall, transformed their northern Santa Barbara home into an eco-friendly haven, which features a retractable roof that acts as a “thermal chimney” to constantly circulate air in and out of the home, reducing the use of air

conditioning. Solar panels are built on the roof and are net-metered, so when the house is empty, the meter is credited from the utility company. The home uses a large amount of glass laminated with a “heat mirror” to reduce the use of electric lighting, keeping the home cool in the summer and warm in the winter. She also purchased Energy-Star certified appliances and drives a hybrid car.

Other smart technologies that are new to the market may delightfully impress snowbirds: the Digifire is an automatic and electronically controlled chimney-less fireplace used with eco-friendly Fanola fuel. The company is based in Poland and Germany with offices in New Jersey.

And the way to deter thieves may just be a touch—or rather a touch screen away. The Korean company, Seoul Commtech, a spin-off from China's Samsung Electronics, offers a sleek touch screen door lock for the home—the EZON Digital Door Lock, \$180. The company's switch from simple home automation products to network systems will feature many new products in the near future, including automated security network systems and many intelligent and digital home products.

The Davis Energy Group offers efficient cooling and heating systems. SunCache is incorporated into the roof and captures the sun's rays to heat water; NightBreeze controls the indoor air temperature for homes; and Formulate is a leave-in-place concrete slab form board with integral R-10 insulation using termite-resistant foam. Its purpose is to insulate the exterior edges of a slab foundation and eliminate the need for secondary application of insulating foam. The insulation provides an average savings of 60 therms/year with even greater savings for buildings with hydronic heat.

A technology developed at Pacific Northwest National Laboratory recently won a Federal Laboratory Consortium Award for its friendly approach to America's electrical grid. Aptly named the Grid Friendly Appliance Controller, the device senses conditions on a power grid by monitoring the frequency of the system and then provides an automatic response in times of disruption by reducing the demand. The response provides no disruption to the consumer's everyday life.

The controller is essentially a simple computer chip that can be installed in regular household appliances like dishwashers, washing machines, dryers, refrigerators, air conditioners, and water heaters. The chip senses when there is a disruption in the grid and turns the appliances off for a few seconds or minutes to allow the grid to

stabilize. The controllers also can be programmed to delay the restart of the appliances. The delay allows the appliances to be turned on one at a time rather than all at once to ease power restoration following an outage.

Consumers will not notice interruptions in the functioning of their appliances because the appliance will not shut down completely. For example, the heating element on a clothes dryer will turn off while the tumbler continues to run or the compressor on a refrigerator shuts down, but the light stays on.

Energy-consumption problems can also be addressed with simple tweaks to conventional home design, according to the founder of the eco-friendly home design company, Michelle Kaufmann Designs. “Windows and sliding glass doors placed on opposite walls allow the sun to more evenly wash a room with light and eliminate contrast, which reduces the need for electrical light during the day,” says Kaufmann. “Windows also allow for natural air circulation, which reduces demand for heating and air conditioning. Similarly, a glass wall can make a room seem bigger than it is, which cuts down on the need for McMansion-sized family rooms, and therefore, the amount of raw materials required for building the home in the first place,” she adds.

Kaufmann also explains that stone countertops are actually a hardened and highly polished material made from recycled paper and recommends bamboo wood floors for homes. Bamboo grows faster than most plants and is more ecologically friendly than more commonly used oak or fir.

New efficient products are constantly being introduced; the key is to keep an open relationship with your integrator and always research the products before you purchase them.

#### **IF OTHER COUNTRIES CAN DO IT...**

One way to stay ahead of the game is to do it (or create it) yourself. Spain is leading renewable energy efforts by establishing renewable energy resources with solar thermal power, also known as concentrating solar and wind power. In 2005, with 9000 megawatts (MW) of wind power, Spain ranked behind Germany (with 16,000 MW) but ahead of the United States (6,500 MW). Spain has been the largest producer of solar cells for the past decade thanks to Isofotón and BP Solar. The Renewable Energy Plan, backed by their government, will distribute five million solar collectors by 2010; a goal that will keep Spain on the forefront of sustainable technology. Spain is also committed to aiding renewable energies

for developing countries that may not have electricity in their homes today.

In 2006, Germany supplied 11.9 percent of renewable energy sources throughout the country. Germany is currently the largest solar thermal market in Europe. Wind power also provides five percent of the countries entire electrical consumption; the largest contribution to power generation from renewable energy sources. Germany also ranks second in installed capacity for solar water heating panels with 5.4 million square meters, totaling 1300 acres of productive space. By 2020, Germany vowed to cut their electricity usage by 11 percent and increase their renewable energies by 27 percent. In 2005, Germany was the fastest growing producer of photovoltaic solar power in the world, installing 837 megawatts of PV.

The United States is also seeing a rapid growth in wind power. Wind power will soon cost \$.02 per kilowatt-hour, making it one of the world’s most economical sources of electricity by 2010.

Japan is gaining an edge by utilizing solar panels on residential rooftops and anticipates gaining 10 percent of the country’s electricity from solar cells by 2030.

China is the world leader in solar water heating panels and is planning to quadruple its current 52 million square meters of collectors by 2015, according to *Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble*, by Lester R. Brown.

The trends are clearly moving to a more sustainable future as each country competes to be the largest, most efficient supplier of renewable energy by using integrated technologies. Scientists and environmental enthusiasts alike hope that the competition will stimulate a rapid growth for intelligent green technology and globally enhance the sustainability of our planet.

The U.S. government has promoted energy efficient products for homes and supports the formation of large corporate building integration, but has yet to mandate a policy for homeowners. Smart system integration will continue to flow into homes especially in the U.S. It’s only a matter of time — and morality.

For more information on system integration from leading professionals that are part of the intelligent building industry, as well as CABA members, visit [www.caba.org](http://www.caba.org). Visit [www.automatedbuildings.com](http://www.automatedbuildings.com) or call your local integrator or your local utility company for details on how to connect your home. ■