Figure 1. University of Santa Clara's solar house

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Amidst an unceasingly intricate political agenda lies what many consider a grave and often ignored issue: global warming. It would be naïve to overlook the current international political and financial demands, but few can refute global warming's ever-increasing presence looming on the horizon.

Fortunately, technological developments have brought about more affordable alternative energy sources, though most still require a fairly steep investment. I stress the term investment because alternative energy sources aren't something you can purchase with those ten hours of overtime last week, but thinking in the long-term, imagine the benefits that will come from your green steps into the future.

The Basics

Solar panels convert sunlight into electricity through photovoltaic cells that use solar energy to free electrons, allowing them to flow through the cell to create electricity.[1] The sun offers enough daily energy to generate and meet global energy needs. Unfortunately, current technology generates a mere one-tenth of one percent of these energy needs.[1] This is not to say, however, that the technology available today won't contribute to a healthier environment tomorrow.

Though solar technology remains in the beginning phases of alternative energy developments, the products out today appear to be more attuned to environmental awareness than ever

before. Despite the slightly higher price tags and comparably fewer energy efficient products, green participation is far more attainable than most would think, which is the idea universities around the world have embraced through their design and construction of individualized solar houses.

Solar Houses: They're All The Rage

The Solar Decathlon, an annual competition held on the National Mall in Washington, D. C. where 20 universities vie to build the best solar-powered house, serves as a public venue that demonstrates not only effective use of solar energy but also creative structural design. Participants, aware that every aspect of their design must use solely solar power, face the challenge of integrating innovative ideas with high-tech materials to make "powerful, comfortable, and stylish" homes that waste neither space nor energy.[2] Simply put, the Solar Decathlon illustrates the amalgamation of nature and technology.

Figure 2. 3D Model of University of Maryland's solar house

This year's Solar Decathlon winner hails from Germany. The Technische Universitat Darmstadt, using strictly German-manufactured products, has created a solar house where the owner uses every nook and cranny, wasting little to no space. Not only does the Technische Universitat Darmstadt take the lead in student-constructed solar houses but they also serve as the lead architects in creating a solar-powered campus, known as Solare Lichtwiese. The university is in the process of installing solar panels atop each of its academic buildings that will then feed into the German power grid.[8] Outside of the university, Germany has implemented a "solar feed-in tariff," offering a 20-year flat rate contract that allows citizens to tap into the German power grid. This tariff will not only cover the initial cost of installing the solar panels but will also pay off in the long-run because of the contract's flat rate, further corroborating the investment aspect of solar energy.[8]

The University of Maryland's LEAFhouse placed second at this year's competition, combining not only energy efficiency but also sustainability. LEAFhouse's features include a curved roof with solar panels arranged in angles intended to mimic the change in the sun's altitude over a year; a raised elevation that allows for nature to reclaim the earth ("reducing its footprint, literally and figuratively, of the land") yet keeps the house anchored to the ground; and renewable construction materials, such as FSC-certified lumber and bamboo flooring.[6] LEAFhouse uses a photovoltaic power system, one of the most common features in solar-powered homes, that generates electricity through solar panels, charges batteries that then store electricity, and converts solar energy into traditional household alternating current. The house's plumbing features Aquatherm Fusiotherm polypropylene pipes fused together with fittings, reducing the likelihood of cracks and breaks.

The University of Santa Clara, ranked third at this year's event, believes that idealism drives their "design with purpose" mentality, as displayed in their Ripple House. Students from the School of Architecture and the School of Engineering featured energy-efficient materials in their design, such as integrated bamboo I-joists, which can hold up to 10,390 pounds before breaking or even bending. Bamboo is not only energy-efficient but also environmentally friendly, having a faster growth rate than wood and a root system that allows new shoots to grow from old stalks.[7] Like the University of Maryland's LEAFhouse, the Ripple House implements a 7.5 kilowatt photovoltaic system that has a battery reserve compiled of 2,500 pound lead-acid batteries that can run up to five days without sunshine. Perhaps one of the most innovative features of the Ripple House, however, lies in the NanaWall, a sliding glass door that serves as both a window and a wall. This eight-foot wide structure contains highly-insulated, triple-pane glass that allows the maximum natural light to enter into the home with minimal energy

lost through heat transfer.[7] Eco-friendly powder coat paints, water-based wood finishes and recyclable aluminum adorn this NanaWall, completing the environmentally conscious design.

The Virginia Tech team, who competed in the 2005 Solar Decathlon and received first place in the architecture competition, seeks to inform and educate on alternative energy through collaboration among students, faculty, and staff from the College of Architecture and Urban Studies and the College of Engineering. Tech's solar house has an energy-efficient V-shaped roof that holds 36 adjustable 200-watt SunPower solar panels, which not only produces energy but also collects rain, further contributing to another form of environmental friendliness—water conservation.[4] This rainwater then supplies the house's water-filtering system. Aside from using innovative technology, Tech's solar house pays fine-attention to aesthetics—"the emphasis was on environmentally friendly materials for sustainable living."[4] For instance, the floors consist of eucalyptus wood that expands and contracts as the room heats and cools, while the furniture consists of butcher block, which pieces together smaller chunks of wood rather than cutting large slabs from trees, thereby using more and wasting less.[4] Beyond solar panels and environmentally-friendly materials, Virginia Tech students also chose energy-efficient appliances, including low-flow faucets, as well as a dishwasher, washer, and dryer with energy star ratings. You can even decide the water level used when flushing the toilet. [4]

The walls are perhaps one of the most innovative features of Tech's solar house because they function as a light source within themselves, serving as the light and allowing you to select different colors. Three of the house's walls have two layers of panels filled with translucent insulation. Between these panels lie three systems: " a motorized shade that allows the user to control light and heat; linear, actuated vents at the top and bottom that provide ventilation for further thermal control; and dimmer-controlled LED lights that allow the user to make the wall and color, no paint required."[4]

Figure 3. Interior of the University of Santa Clara's solar house

Bring It Down a Notch

These energy efficient features aren't strictly intended for academic exploration—you really can integrate even the smallest of features into your everyday life. The technologies available today can and will meet your daily energy needs through solar power.

Bear in mind, though, that a solar electric system alone will likely cost upwards of $72,000. With that said, if you plan on building a solar-powered home, or even giving your current home a green facelift, understand that it may take a while for you to start reaping the financial benefits. Living in a solar-powered home isn't one of those instant gratification splurges, though some may say that saving the environment is pretty rewarding, with or without fiscal reward.

With that said, if building a solar house falls slightly outside of your designated budget, try a few of these energy saving tips offered by National Geographic:

1- Replace your 75-watt incandescent light bulbs with 19-watt compact fluorescents;
2- Take the train for those shorter distance trips;
3- Use a fan rather than an air conditioner;
4- Replace older refrigerators (10 years or older) with more energy-efficient Energy Star models;
5- Quit taking long showers! Limit yourself to 5 minutes. This is really all you need;
6- Dry your clothes outside whenever possible. They'll smell better anyway;
7- Eat more fish, eggs, and poultry—it exhausts fewer fossil fuels;
8- Use public transportation whenever possible. It can be fast, convenient, and often fairly cheap.[9]

Life has innumerable uncontrollable factors--energy conservation doesn't have to be one of them. For once, we each can take active steps towards eliminating, or at the very least reduc-

ing, energy consumption, thereby ameliorating the irreversible effects of global warming.

Go green. Live clean. You know you want to.

Further Resources

United States Green Building Council
www.usgbc.org
Ecological Home Ideas
www.ecologicalhomeideas.com
Ecobroker International
www.ecobroker.com
Alliance to Save Energy
www.ase.org
Partnership for Advancing Technology in Housing
www.pathnet.org

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[4] Virginia Tech Solar Home Homepage. Date Accessed: 18-Oct-2007. http://vtsolar.arch.vt.edu

[5] Virginia Tech Spotlight on Innovation. "When the solar revolution knocks, a Virginia Tech collaboration answers." 11-Jan-2007. http://www.vt.edu/spotlight/20061204_solar.php

[6] University of Maryland Solar Decathlon Homepage. Date Accessed: 29-Oct-2007. http://solarhouse.umd.edu/page.php?id=65

[7] University of Santa Clara Solar Decathlon Technology Page. Date Accessed: 30-Oct-2007. http://www.scusolar.org/technology

[8] Technische Universitat Darmstadt Solar Decathlon Homepage. Date Accessed: 13-Nov-2007. http://www.solardecathlon.org/2007/team_darmstadt.html

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About the Author

Jessica hails from Virginia Tech's English department, representing one of three English students to sit on JUMR's editorial board. She completed her undergraduate degree in May of 2007 during Volume 3's publication. She spent much of her time at Tech tutoring in The Writing Center and swing dancing with Solely Swing, the university's student-run swing dancing club. On most days, though, you could find her fulfilling her barista duties at the Daily Grind, serving the best cup of coffee in the world. Yeah!