U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

# Students Build Solar Homes

***By Michael Tinnesand***

Every 4 years, the summer Olympics awards a gold medal for the decathlon. The winner becomes "the world's greatest athlete." After facing 2 days of grueling athletic competition in 10 events—which includes sprint races, jumps, as well as throwing a heavy disc and a long spear called a javelin—the winners have proven themselves to be "the world's greatest."

Every other year, another competition challenges college students to build the world's best solar homes. The students don't have to run, jump, or throw a disc, but they have to show that their solar home can outdo other homes in 10 contests. This international event, called the Solar Decathlon, is organized by the U.S. Department of Energy (DOE ) and is supported with in-kind donations from organizations such as Dow Corning, Lowe's, M.C. Dean Inc., Pepco, and Schneider Electric.

New this year is the sustaining level sponsorship from Dow Corning, a global leader in silicones and silicon-based technology. Dow Corning is sponsoring the educational partnership of this year's event by overseeing the creation of educational resources that will strengthen understanding of solar energy and sustainability and of the importance of science, technology, engineering, and mathematics.

"There has never been a more important time to further develop viable, renewable, clean, domestically generated energy sources, and there is no better way to achieve that goal than by challenging great minds from universities all over the world," says Robert D. Hansen, President and Chief Executive Officer of Dow Corning. "The students' hard work is a testament to the endless possibilities attainable through math and science education."

The Solar Decathlon puts 20 teams of college students from around the world in head-to-head competition across the 10 contests (see sidebar). DOE helps get things started by giving each school a $100,000 grant. The completed house is transported to the decathlon site in Washington, D.C., and reassembled for judging and public viewing. The houses must be between 600 square feet and 1,000 square feet in size.

The contests are both clever and demanding. Some are evaluated by a jury, as in gymnastics or ice skating. Other contests are determined by specific measurements, such as power consumption or total energy produced. In the remaining contests, points are awarded for the satisfactory completion of a task.

In the most recent Decathlon, which was held in 2009, the winner was Team Germany, a group of students from the University of Darmstadt. Their house looked like a huge black box that intrigued the judges and the public, and drew long lines of people seeking a look inside. One of the reasons this solar house was so successful was that nearly every bit of its outside surface was coated with solar panels. Team Germany placed first in the Net Metering and Comfort Zone contests.

**Team Illinois poses in front of their house.**

Many of the solar house designs have a futuristic, spaceship look. But the team from the University of Illinois at Urbana-Champaign took a different approach: They used reclaimed barn boards to cover their house. But underneath this traditional exterior was cutting-edge construction. The house featured 12 inches of insulation in the wall, ceiling, and floors, which allowed it to use 90% less energy than a typical construction. The team won three individual contests, including Hot Water, Appliances, and Home Entertainment. All this led to a second-place finish overall.

PHOTOS BY STEFANO PALTERA/U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON

**Team Germany's solar house looked like a huge black box.**

**The 20 teams who participated in the 2010 Solar Decathlon (distinguished by the color of their shirts) spent 2 years designing and building houses powered exclusively by the sun.**

Team California, from Santa Clara University and the California College of the Arts, finished in third place with a house made of windows, walls, and floors that collected, stored, and distributed solar energy in the form of heat in the winter and rejected solar heat in the summer. Team California placed first in the Architecture and Communications contests.

The 2011 contest entries are also packed with innovative technology. An increasing number of teams are incorporating phase-change materials, which can store and release large amounts of energy. Heat is absorbed or released when the material goes from liquid to solid, solid to liquid, or other phase changes.

One of the homes that use phase-change materials was designed by the team from Appalachian State University, Boone, N.C. It is made with interior walls that contain microscopic capsules filled with high-purity paraffin wax. The wax is a phase-change material that melts when enough energy is absorbed. Then, as the house cools, the wax releases its heat as it changes from liquid back to solid.

Another original design comes from Team China. The team members, who are students from Tongji University in Shanghai, designed and assembled a Y-shaped house by using six recycled shipping containers. These cheap building materials compensate for the cost of solar cells, which cover the roof of the house. The "Y Container" house—as it is called—may score high in the "Affordability" contest, which was introduced this year and that focuses on the potential cost of the solar houses.

**Visitors toured Team California's solar-powered house on Oct. 11, 2009. Team California won first place in the Architecture contest in 2009.**

Also, this year, all the competing houses will be connected to an extension of the electric grid—the network of power lines that delivers electricity to homes and buildings. In addition to producing electricity from solar energy, the houses will be challenged to release any electricity surplus that they produce to the grid and, as a result, to District of Columbia customers. With this new challenge, the students participating in the Solar Decathlon will push the limits of what is possible with solar energy and may pave the way for the solar house of the future. The winners of this year's decathlon will clearly be the champions in this field, and only time will tell whether we can indeed call them "the world's greatest." CM

## The 10 Contests of 2009

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**Appliances:** Using only solar power, ensuring that a refrigerator stays cold, a freezer keeps food frozen, and clothes are washed and dried.

**Architecture:** Look and style of the house, including size and arrangement of the various rooms in the house.

**Comfort Zone:** Inside temperature and humidity (maximum score if inside temperature between 71 °F (22.2 °C) and 76 °F (24.4 °C) and relative humidity below 60%).

**Communications:** Presence of displays, Web sites, videos, or photos that inform the public about major features of the house and how they work.

**Engineering:** Functionality and efficiency of basic systems of the house, such as heating, ventilation, and air conditioning.

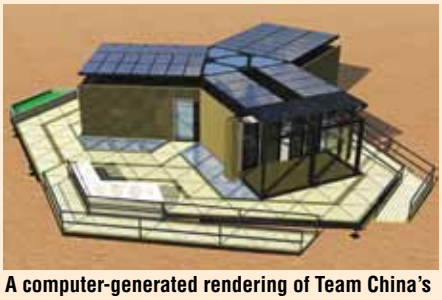
**Home Entertainment:** Ability to hold two dinner parties and one movie night for neighbors.

**Hot Water:** Ability to deliver 15 gallons (56.8 liters) of hot water (110 °F /43.3 °C) in 10 minutes or less.

**Lighting Design:** Presence of functional, energy-efficient, and aesthetically pleasing lighting systems

**Market Viability:** How attractive the home might be for buyers.

**Net Metering:** How much energy the house produces and consumes.



COURTESY OF TEAM CHINA

**A computer-generated rendering of Team China's Y-shaped house**


**SELECTED REFERENCES**

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