Photo Credit: Stefano Paltera/U.S. Department of Energy Solar Decathlon

Solar House Innovation

Fresh ideas, sustainable materials, passive and active solar, green walls, expandability, and much more from the fertile minds of students competing at this year's Solar Decathlon.

Nineteen houses, designed, built, and lived in by college and university students...and all producing more energy than they consume. That was the spectacle in early October in Irvine, California, when the U.S. Department of Energy's Solar Decathlon came to town.

Since 2002, the contest has been inspiring and helping train the next generation of clean energy architects, engineers, and entrepreneurs. In the 2013 version, nineteen teams from colleges and universities around the world competed to design, build, and operate the most energy-efficient solar-powered house. There were ten contests over ten days that gauged each house's performance, livability, and affordability.

Team Austria, made up of students from the Vienna University of Technology, won top honors overall. University of Nevada Las Vegas took second place, followed by students from Czech Technical University. ▷

Photo Credit: Jason Flakes/U.S. Department of Energy Solar Decathlon.

Photos, counterclockwise from top left:

PV array and solar thermal systems on the roof of Team Ontario's *ECHO*, by Queen's University, Carleton University, and Algonquin College. The house was the winner of the engineering competition.

Arizona State University and The University of New Mexico's *SHADE* (Solar Homes Adapting for Desert Equilibrium).

Team Texas, by the University of Texas at El Paso and El Paso Community College, produced *ADAPT,* which reflects the nature of El Paso.

Santa Clara University's *Radiant House* is driven by three E's: efficiency, economics, and elegance.

Team Capitol DC's *HARVEST HOME* (Catholic University of America, George Washington University, American University, Washington, D.C.).

The 2013 Solar Decathlon Winner

Team Austria's winning entry (pictured right) is a simple, smart, and sustainable house. Powered by a rooftop solar photovoltaic system, *Living Inspired by Sustainable Innovation (LISI)* generates more power than it uses over the course of a year. The house adapts to a range of climate zones and flexes to meet a variety of lifestyles.

The designers view *LISI* as a "social creature" eager to find its place in a richly diverse community.

According to the project team and event organizers, features of the house include:

- Renewable and eco-friendly construction and insulation materials made of timber are easily transported and provide indoor climate comfort and carbon-neutrality.
- Changeable architectural elements create a variety of sensory conditions—closing to form a protective cocoon for occupants and opening to allow them to expand their space.
- Two patios create a balance between interior and exterior and public and semi-public spaces.
- The passive solar design, combined with an automated screen and awning system, provides shade to keep the living spaces cool and comfortable.
- A patio herb garden draws water from a rainwater reservoir.
- Generous storage, completely integrated into the walls, frees the primary indoor space from clutter.
- Photovoltaic modules provide an annual surplus, which can be used to power electric bikes or vehicles.
- A centralized utility room contains all the automated mechanical systems the house needs, including a photovoltaics monitor, ventilation, plumbing, and hot water supply.
- Two high-efficiency, air-water heat pumps supply cold and hot water for space heating and cooling as well as for domestic hot water.
- An energy-recovery ventilation unit acts as a heat and humidity exchanger between exhaust air and fresh intake air to keep the living spaces comfortable and healthy.
- A multifunctional subfloor system regulates the indoor climate using water, air, and active cubic capacity.
- A heat-recovering shower tray reduces the energy demand for hot water by almost one-third.
- Through a tablet application, the automated house control hub, energy performance history, and live data can be accessed in an intuitive way. ▷

Photo Credit: Jason Flakes/U.S. Department of Energy Solar Decathlon.

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Second Place Finisher Thrives in the Mojave Desert Sun

The University of Nevada Las Vegas designed its second-place *DesertSol* house (left) to reflect the spirit of the Mojave Desert. With reverence to the sun as both a source of harsh conditions and a solution for sustainable living, *DesertSol* harnesses abundant sunlight for solar electricity while capturing rain to provide evaporative cooling and irrigation.

DesertSol makes careful use of the desert's solar and water resources. Its design fuses modern architecture with a weathered aesthetic, the comfort of carefully selected materials, and the excitement of intriguing spaces to foster a spirit of openness and adventure.

The ultra-efficient house is envisioned as a vacation home or a seasonal retreat—a base camp for desert adventures that responds to its unique environment.

According to the project team and event organizers, features of the house include:

- The building is shaded by a weathered wood rain screen.
- Digitally fabricated retractable solar shade screens shield the hottest sides of the house in the summer and provide direct sun for warmth in the winter.
- A water feature captures water from the occasional desert downpour and uses it for irrigation and spot cooling on the outside deck.
- Folding doors open completely, allowing indoor activities to spill onto the outdoor deck space and doubling the square footage for entertaining.
- A home automation system ensures the house operates at peak efficiency and allows the lights, appliances, and thermostats to be controlled from an easy-to-use interface on a mobile device.
- Photovoltaic panels provide electricity and shade the outdoor living space.
- Solar thermal collectors provide radiant floor and water heating.
- Advanced structural design framing clad in reclaimed pre-weathered materials saves lumber and provides more insulation to the living spaces.
- Potable water is fed through the fire-protection sprinkler system and then into the house's cold water plumbing system; this contributes to a non-stagnant water sprinkler system.
- Layers of closed-cell, open-cell, and continuous rigid insulation ensure that the house is air-tight and highly heat-resistant and prevents thermal bridging.

▷

Third Place Goes to Energy Efficiency for Czech Retirees

Students from Czech Technical University designed their third-place finishing AIR House (right) for the generation of fifty-plus-year-olds who are empty-nesters and nearing retirement. Many of the team members' parents fall into this demographic, which inspired a compelling conversation about senior housing.

The *AIR House*, a prototype for an affordable (A), innovative (I), and recyclable (R) house, is designed for the Czech tradition of spending weekends in the countryside. Seniors can use it as a weekend getaway during their pre-retirement years and as a permanent residence at retirement. The house design features a "house within a house" principle, in which a minimum interior living area combines with a generous outdoor area.

According to the project team and event organizers, features of the house include:

- Natural wood fiber thermal insulation envelops a living area that features a wood façade, finishing, and furniture.
- A solar wooden canopy protects the enveloped area from sun and wind while generating electricity.
- A painted do-it-yourself wall façade enables occupants to write and erase messages.
- A charging station powers a pedelec (electric bicycle).
- A generous outside terrace expands the interior space for cooking, gardening, relaxation, and storage.
- An integrated edible natural garden mediates between the house and its surroundings.
- PV panels generate all the electricity needed to operate the house.
- Wood fiber insulating material regulates moisture levels and provides acoustic and thermal insulation.
- A solar water heating system ensures the preparation of hot water.
- A radiant chilled ceiling system provides comfort and stability to the interior environment.
- When needed, an air-conditioning unit with a direct evaporator conditions the interior air relative humidity and supplies fresh air.
- A greywater system collects water from the shower and wash basins, filters it, and reuses it to irrigate plants, thus reducing water consumption.

Learn More

Full competition results; photos, specs, and floorplans of all the houses; and details about the individual contests may be found at the website www.SolarDecathlon.gov. **- NL -**

Photo Credit: Jason Flakes/U.S. Department of Energy Solar Decathlon.