The Sunny Side of the Street

by Angie Morfeld

Bob Phelan/ Missouri University of Science & Technology photo

An aerial view of Solar Village, located on the Missouri S&T campus, showcases homes built in previous Solar Decathlon competitions. Clockwise, starting from front center, the 2007 home, the 2009 home, the 2002 home and the 2005 home.

I arrived at the Solar Village – a collection of four small homes situated on the outskirts of the Missouri University of Science and Technology (Missouri S&T) campus in Rolla – on a stormy Tuesday morning in May. The storm was of the typical late spring variety, cloudy with bursts of heavy rain and a little lightning and thunder mixed in for good measure. But walking into the homes on this unique piece of real estate, you wouldn't have known there was a cloud in the sky. Inside the homes, the power of the sun was in full effect.

That is because all four homes are completely powered by the energy of the sun.

Each home was designed and constructed over the past decade by the Missouri S&T Solar House Team, composed of undergraduate students, in order to compete in the Solar Decathlon. The biennial event is a collegiate competition sponsored by the U.S. Department of Energy (DOE).

"This area is literally one of a kind," said Emily Vandivert, project manager for the 2013 Solar House Team. "Missouri S&T is the only university in the world with a community of student-designed-and-constructed solar homes."

The Solar Decathlon challenges each college team to design, fund, build and operate solar-powered houses that are cost-effective, energy-efficient and attractive. The competing teams spend nearly two years creating their homes.

"The challenge is to not only design and construct a sustainable, net-zero solar house, but to market it as a viable residential option," Vandivert said. "It has to be appealing to those in the market for a home."

Getting In

Just getting into the decathlon is no easy feat, Vandivert says. Colleges, universities and other post-secondary educational institutions worldwide are invited to submit proposals for the competition. Each proposal is reviewed, scored and ranked by representatives of DOE and the National Renewable Energy Laboratory. Only 20 schools are selected to participate.

Missouri S&T's Solar House Team competed in the 2002, 2005, 2007 and 2009 Solar Decathlons, building an 800-square-foot home in each of those competition years. The Solar Village showcases the products of those competitions.

"We narrowly missed the 2011 competition," Vandivert said. "We were selected as number 21, or first runner-up."

The team is currently preparing for the 2013 competition, their fifth, scheduled for Oct. 3-13 at Orange County Great Park in Irvine, Calif. Missouri S&T is the only school to have been accepted into five of six Solar Decathlons.

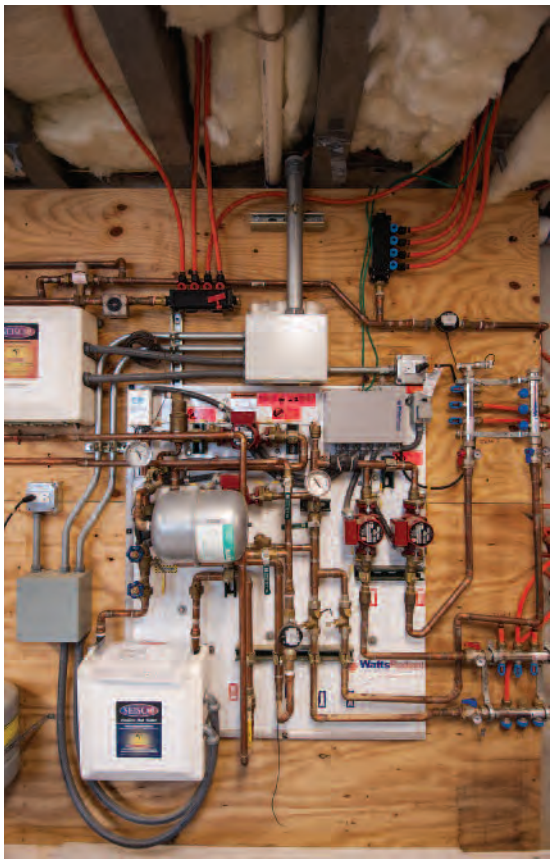
This year's project is known as the Chameleon House, a 1,000-square-foot adaptable living environment. The square footage requirement was increased from 800 to 1,000 during the 2011 competition.

"Much like a chameleon, the home will feature several innovative aspects that can transform to suit the needs of the occupant," Vandivert said.

One such innovation is an advanced, Web-connected automation system that provides an unprecedented level of control over the living space. A similar prototype automation system was used in the 2009 house, but with technological advancements, the size and price of the system being used for the 2013 solar house have dropped tremendously.

"Whereas the price of the system in 2009 was about $20,000, the price for the system in the Chameleon House is an affordable $1,400," Vandivert said. "And it doesn't require as much wiring and wall space. The 2013 system is comparable to the size of a pack of gum."

That reduction in price for the system is a bonus for the team. An affordability com-



DNR photo by Scott Myers

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(Left) The mechanical systems of the home built for the 2009 competition are located in the basement. Technological advancements since then have caused tremendous drops in both the price and size of these systems. (Bottom) An interior view of the competition home built in 2005. This design was based on Frank Lloyd Wright's style of architecture and the Golden Ratio.

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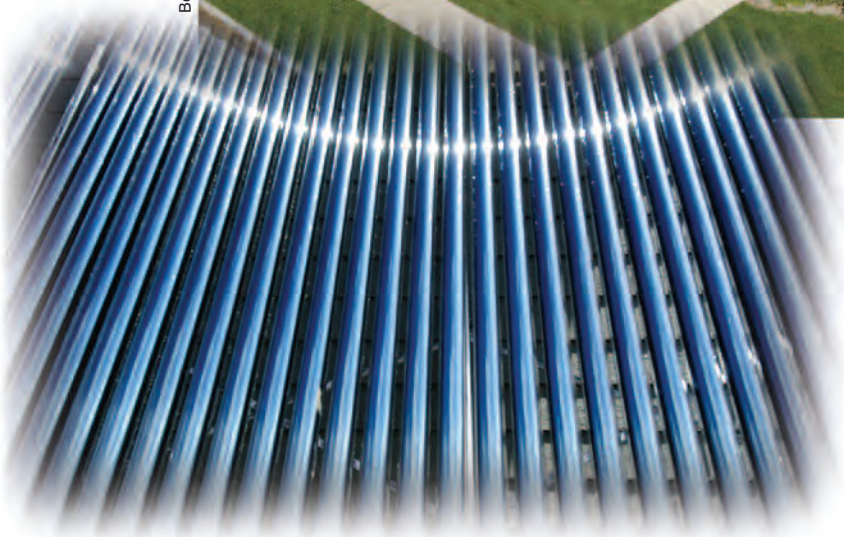

DNR photo by Scott Myers

(Top) With four homes, the team has outgrown the available space at Solar Village, so Chameleon House will be installed in a new, renewable-energy space on campus after the 2013 competition. (Above) A close-up of a solar panel from a home in the Solar Village.

ponent also was added to the competition in 2011 – all teams must stay at or below $250,000 in construction costs.

Preparing for the Contest

There is a lot of work leading up to the competition, including fundraising. Qualifying teams must raise money to cover construction and expenses. Each selected team receives $100,000 from the U.S. Department of Energy. The rest of the money is raised through donations, special events and grants, such as an $8,000 grant from the Missouri Department of Natural Resources' Division of Energy. The division recently was reassigned to the Missouri Department of Economic Development.

"We have to get creative with our fundraising," Vandivert said. "We have a winning team of students, advisers and sponsors, but experience has taught us that we can never have enough help. The great things we do would not be possible without donations from generous people."

When the funds start coming in, the construction can start. The team must fully construct their home on campus prior to the contest. Then just before the start of the decathlon, the house is meticulously disassembled into large pieces, put on trucks and transported to the event site. The team then has nine days to reassemble it.

"Once we get to the competition, we are working at break-neck speed to get the house back up and in working order," Vandivert said. "After it is reassembled, it stays up for judging and public exhibition over a two-weekend period."

The team then has only five days to disassemble it, at which time it is shipped back to its permanent home on the Missouri S&T campus. That is how Solar Village was born, and how it grows. Once reconstructed on campus, the homes not only serve as campus housing, but help educate the public and provide research opportunities.

Vandivert says the team sees their work and the competition as a way to showcase and help market solar energy, what it is and what it can do.

Into the Future

Future plans for the Solar Village include installing a microgrid, which will tie the existing four solar homes together in order to share power. It's another step forward in sustainability, according to Vandivert.

"If one home doesn't have enough power, but the neighboring house has extra, it can pull from the microgrid and continue running as normal," Vandivert added.

The team has outgrown the available space in the Solar Village, so once the 2013 competition is over, the university plans to allow space for the Chameleon House in a renewable-energy site being developed on campus. The new location is known as the E3 Commons.

"The competitors are extraordinarily excited to see the Chameleon House transition from blueprints and specifications into an actual building," Vandivert said.

The group completed its first-round assembly of the home in August, which was marked with a ribbon-cutting ceremony on the Missouri S&T campus.

Now, it's on to California.

For more information about the Solar Village or the Solar House Team, visit experiencethis.mst.edu or solarhouse.mst.edu. For a virtual walk-through of the Chameleon House, visit youtube.com/watch?v=udLvgUwcHCs.

Angie Morfeld is a public information coordinator for the Missouri Department of Economic Development's Division of Energy. The division was transferred from the Department of Natural Resources to the Department of Economic Development in August 2013.

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Categories of Competition

Much like the Olympic decathlon, the Solar Decathlon consists of 10 contests:

- Architecture
- Market Appeal
- Engineering
- Communications
- Affordability
- Comfort Zone
- Hot Water
- Appliances
- Home Entertainment
- Energy Balance

Each contest is worth a maximum of 100 points, for a competition total of 1,000 points. The winning team produces a house that is affordable, attractive and easy to live in; maintains comfortable and healthy indoor environmental conditions; supplies energy to household appliances for cooking, cleaning and entertainment; provides adequate hot water; and produces as much or more energy than it consumes.

(Top) Emily Vandivert and Chris Bowe stand inside the Chameleon House. Emily and Chris are members of the Solar Decathlon team for Missouri S&T, and will compete in the decathlon in the fall of 2013.
(Right) The Chameleon House is currently being built on the Missouri S&T campus. Once completed, it will be dismantled and shipped to California to compete in the U.S. Department of Energy's Solar Decathlon 2013 in fall 2013.
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