

# University of Cincinnati

The University of Cincinnati Solar Decathlon team describes its home as a model of the marriage of technological innovation and design excellence. The house was constructed with intentional seams that enhance its modularity and flexibility, but the integration of energy and space is truly seamless. Of greatest note is the striking array of evacuated tubes that screen the south side of the house while providing all of its thermal energy needs.

## What's Different?

- The house is cooled using hot water produced by the sun in evacuated tubes that is sent through an absorption chiller.
- The south side of the house is faced with an array of 120 evacuated tubes.
- The house is built on four separate trailers that are bolted together in parallel.

## Architecture, Interior Comfort

- The majority of the house is a very large main room containing the kitchen, laundry, and dining and living spaces.
- A central threshold runs perpendicular to the trailers and functions as a rain gutter, PV wiring conduit, HVAC duct, and spatial divider.
- Almost all of the major energy management and consumption happens in one trailer, providing greater flexibility and expansion capability for the rest of the house
- All interior finishes (flooring, countertops, cabinet doors, bedding) were chosen with their environmental properties in mind.

## Heating and Cooling Systems

- All heating and cooling is accomplished using hot water produced by evacuated tubes.
- The fan coil unit includes a heat exchanger that transfers heat from exhaust air to incoming air, providing an energy savings when conditioning the space.
- An absorption chiller takes hot water from the evacuated tubes, runs an environmentally harmless compression/evaporation process, and produces cold water that is sent through the fan coil unit to create cool air.
- The house uses both a rapid-response, forced-air system and an energy-saving radiant floor system.

## Lighting (including Daylighting)

- Large clerestory windows wrap the perimeter of the house, providing ample natural light for normal daytime lighting needs.
- The interior is wrapped with translucent cabinets that are illuminated from behind with efficient fluorescent lights at night.

## Appliances

- All appliances have been donated and are ENERGY STAR rated, providing important energy savings for the house.

## PV and Solar Thermal

- The team's initial energy analysis showed that about 65% of the energy used in a typical house is thermal in nature, versus only 35% electrical. This led team members to focus most on the solar thermal system.
- The design gains higher efficiency by not having to transfer electrical to thermal or vice versa.
- The 7.7-kW Sunpower PV system is mounted as another layer of roof construction. The modules are lifted a couple of inches from the waterproof membrane, shading and protecting it while providing ventilation to the undersides of the modules.
- An array of 120 evacuated tubes produce hot water that is then stored in two 350-gallon tanks under the kitchen counter. Those tanks basically function as thermal batteries.

## **Communications**

- Visitors to the house will be greeted by the DOE family, three fictional cartoon characters who tell the story of the house from their individual perspectives on technology, economics, and design.

## **Budget**

- The entire project cost is approximately \$500,000, but the expected market cost of the house would be closer to \$240,000.

## **Future Plans**

- A number of options are currently being explored, including keeping the house on campus or in a nearby neighborhood and retaining its use for sustainability research.

## **Kid's Corner**

- This team is really making the sun cool! Their air conditioner turns hot water made from the sun into cold air to make the inside of the house nice and comfortable.
- All these big glass tubes make hot water that the team uses to heat and cool the house.
- It's amazing what you can do with trash these days. The flooring in this house is made with recycled rubber tires, the decking with recycled plastic bags, and the countertops with recycled paper!
- The name of this house "[re]form" means "sun form." Re is another name for Ra, the Egyptian Sun God.

## **Team Information**

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