



## Builders Challenge

Recognizing Energy Leadership in Homebuilding

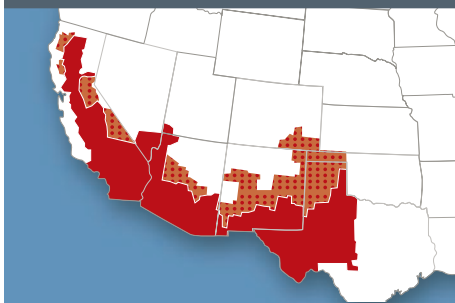
## High Performance Builder Spotlight

# Yavapai College

Chino Valley, Arizona

Yavapai college students built a Builders Challenge home for Habitat for Humanity of Prescott, Arizona, that scored a -3 on the HERS index.

### HOT-DRY & MIXED-DRY CLIMATES



## BUILDER PROFILE

**Builder:** Yavapai College  
Residential Building Technology Program

**Founded:** late 1970s

**Employees:** Two full-time instructors

**Development:**  
Prescott Habitat for Humanity

**Size:** 1,207 sq. ft.

**Price Range:** \$92 per sq. ft. cost to build

**When:** Construction started August 2008;  
completed May 2009

## Students Build Net-Zero-Energy Home

College students in Chino Valley, Arizona, accomplished a feat shared by only two production builders in the country in 2009. They built a Building America Builders Challenge house that achieved the remarkably low HERS score of -3. The 1,207-square-foot net-zero energy home, built by students in the Yavapai College Residential Building Technology Program for Prescott Habitat for Humanity, also achieved a remarkably tight building envelope. A blower door test showed air leakage of 0.25 air changes per hour at 50 Pascals. The students were able to accomplish all of this and still reach a sales price of \$140,000, or \$92 per square foot (student and homebuyer labor was volunteered).

The super energy-efficient building enclosure starts with an R-21 insulated concrete form stem wall with an additional R-10 of extruded polystyrene rigid insulation on the slab perimeter and extending perpendicular to the wall 2 feet beneath the slab. Walls have two 1-inch layers of XPS rigid exterior insulation wrapped around 2x6, 24-inch-on-center stud framing that holds an additional R-21 of blown cellulose insulation. The attic is insulated with 8 inches of low-density foam sprayed against the under side of the roof decking to provide a sealed, conditioned attic. Windows are high-performance double-pane, low-emissivity glass with vinyl-clad frames. Underneath the 35-year shingles, the students installed roofing underlayment as a vapor barrier.

The home's 2-ton HVAC system is an air-source electric heat pump with a 9.0 HSPF for heating and 19-SEER for cooling. Mastic-sealed ducts and HVAC equipment are inside the conditioned space. Duct blaster testing measured leakage at 27 cfm at 25 Pascals. A filtered whole-house heat-recovery ventilation system is located in the conditioned attic. Jump ducts provide pressure balancing throughout the home.

"The houses we build today will be around for at least 100 years, so put in now what you can't put in later."

**TONY GRAHAME**, program director  
of the Yavapai College Residential  
Building Technology Program

(photo at right) Yavapai College professor Tony Grahame and student Tommy Nester properly flash and install a window.



The students conducted a solar survey of the site to properly orient the house for active and passive solar benefit. A 4.6- kW grid-tied photovoltaic array is mounted on the south-facing roof. Also, a solar thermal 40-square-foot closed-loop collector transfers heat to an 80-gallon storage tank for domestic hot water. A solar light tube provides natural light to the hall bathroom.

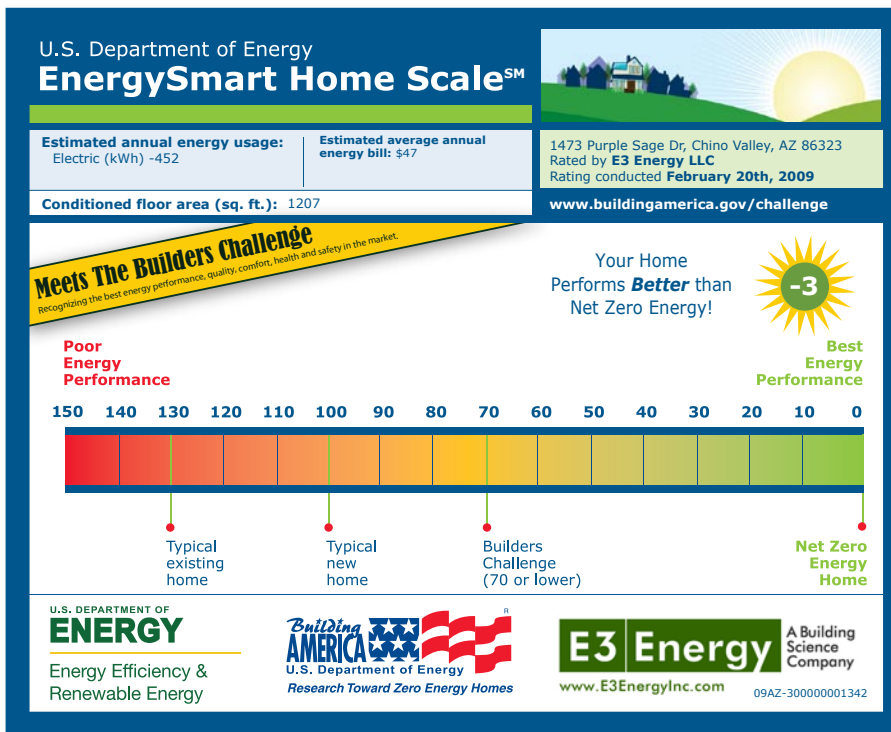
Lighting and appliances are ENERGY STAR. Permaculture landscaping captures all rainwater that lands on the lot and roof; this water is channeled through trenches and ponds to provide irrigation to native plants and the vegetable garden areas. “In a desert climate, water efficiency and renewable energy are the next big challenges after energy efficiency,” said Tony Grahame, program director of the Yavapai College Residential Building Technology Program.

**Energy-Efficient Features**

- HERS: -3
- Walls: 2x6 24-inch o.c. advanced framing
- Attic Insulation: R-34 spray foam on underside of roof deck
- Wall insulation: R-21 blown cellulose + two 1-inch layers of XPS rigid insulation
- Roofing: Shingle with titanium vapor barrier
- Foundation: R-21 ICF stem wall; R-10 slab-edge rigid insulation
- Ducts: 100% in conditioned space; Duct leakage 27 cfm @ 25 Pa; jump ducts in bedrooms
- Air Handler: In conditioned attic
- Air Sealing: OSB glued to studs, housewrap seams taped and caulked to OSB; all wall penetrations sealed; ductwork sealed with mastic
- HVAC: Heat pump; 9.0 HSPF for heating 19 SEER cooling
- Windows: Double-pane, low-e vinyl frames, south facing SHGC=0.31, U=0.34; north, east, west facing SHGC=0.23, U=0.30
- Water Heating: Solar thermal with electric tank backup
- Ventilation: HRV with HEPA filter
- Lighting and Appliances: 100% CFL lighting; ENERGY STAR refrigerator, stove/range top, dishwasher
- Solar: 4.6- kW grid-tied PV
- Commissioning/Certification: DOE Builders Challenge, ENERGY STAR, MASCO Environments for Living Certified Green, LEED for Homes Platinum, EPA IAQ Plus

**U.S. Department of Energy Builders Challenge**

DOE seeks to give every consumer the opportunity to buy a cost-neutral, net-zero energy home anywhere in the U.S. by 2030. Homes that qualify for this Builders Challenge must achieve a 70 or less on the EnergySmart Home Scale (E-Scale) which is based on the Home Energy Rating System (HERS) index (www.natresnet.org). The E-Scale allows homebuyers to understand—at a glance—how the energy performance of a particular home compares with others.



To learn more about the Builders Challenge and find tools to help market your homes, visit [www.buildingamerica.gov/challenge](http://www.buildingamerica.gov/challenge).