



Building America Best Practices Series

Volume 15. Builders Challenge Guide to 40% Whole-House Energy Savings in the Hot-Humid Climate

Case Study: David Weekley Homes

Eagle Springs & Waterhaven | Houston, TX

This home is one of nearly 1,500 homes built by David Weekley Homes, Houston Division, that qualifies for the U.S. Department of Energy Builders Challenge.

BUILDER PROFILE

Builder: David Weekley Homes
Houston Division
(281) 249-7777
www.davidweekleyhomes.com

Founded: 1976

Employees: 620 in U.S.

Development: Eagle Springs and Waterhaven communities, Humble, Texas
55 production homes, 1780 - 3350 ft²
\$189,990 - \$306,990; 1, 1½, 2 story;
2-5 bedrooms; 2-4 bathrooms

David Weekley Homes' Houston, Texas, division began partnering with Building America in 2008 to evaluate the costs and benefits of building high-performance homes in the hot, humid southeast Texas climate. David Weekley Homes is the largest privately held homebuilder in the United States, constructing homes in more than 14 cities and six states.

The company's Houston division has been working with Building Science Corporation, a Building America research partner, to test advanced framing and air sealing techniques on 55 homes in the division's Eagle Springs and Waterhaven developments.

"It's a win-win for both our customers and David Weekley Homes," said Mike Funk, David Weekley's Texas quality coach. "The energy-efficiency features help close the deal for customers who are comparing Weekley homes with others in the area."

The company has since expanded its Building America construction practices beyond these two developments to its entire Houston division, resulting in nearly 1,500 new homes that are Builder's Challenge certified. These homes achieve HERS scores between 59 and 68 and qualify for ENERGY STAR certification as well.

Now the company's Dallas, San Antonio, and Austin divisions are considering the adoption of Building America's high-performance practices.



(Top) Rigid foam exterior sheathing is taped to provide an air seal and moisture barrier as well as additional insulation value.

(Bottom) DOE Building America team lead Building Science Corporation worked with David Weekley Homes to train site supervisors and subcontractors in advanced framing techniques, including open headers over windows, 2x6 24-inch on-center framing with framing member alignment, and 2-stud corners. This provides more room for wall insulation and less thermal bridging at studs. The techniques save lumber as well.

Atascocita Springs Elementary School, located in the Eagle Springs development, opened in August 2010 and offers students innovative instruction in environmental and energy conservation.

Energy-Efficiency Features

The company's Houston division worked with Building Science Corporation (BSC) to implement advanced framing, air sealing and the installation of high-efficiency HVAC components and windows. BSC provided training for coaches, site supervisors, and subcontractors and performed site visits. BSC also monitored third-party evaluators who performed air-tightness tests on the 55 Eagle Springs and Waterhaven homes. These homes are located in the Houston suburb of Humble, Texas, and have 2 to 5 bedrooms and 2 to 4 bathrooms. Ranging from 1,780 to 3,350 ft², they have 1, 1½, or 2 stories and sell for \$189,990 to \$306,990.

The team used advanced framing techniques, which include open headers over windows, 2x6 24-inch on-center framing with framing member alignment, and two-stud corners. These techniques allow room for more wall insulation and require fewer studs, which reduces thermal bridging. The techniques save lumber as well. On one David Weekley model, BSC found that switching from 2x4 16-inch on-center to 2x6 24-inch on-center framing reduced the board feet by 40%, cutting costs 40%, from \$2,749 to \$1,632. The savings more than offset the cost of additional insulation.

The use of advanced framing required some additional supervision. Subcontractors tended to revert to standard framing techniques when monitors were absent, installing unnecessary framing pieces. When David Weekley Homes started making them take out the unnecessary pieces, subcontractors began implementing the advanced framing correctly.

To insulate the homes, the exterior walls were filled with R-20 damp-sprayed cellulose, then covered on the outside with one inch of R-5 XPS rigid foam sheathing. The XPS foam, Funk said, "is really important" as insulation and as a rain barrier, because it resists liquid moisture penetration.

Brick cladding is affixed to the homes' exterior. A 1-inch air space separates the brick from the foam sheathing, further preventing solar-driven vapor diffusion through the brick and into the wall cavities. Any moisture that penetrates through the bricks can drain through vents at the bottom of the brick cladding. Additionally, each lot is graded to ensure positive drainage away from the foundation.

The vented attic has a radiant barrier to reduce solar heat gain. Sloped ceilings are insulated with R-19 unfaced fiberglass batts, and flat ceilings with R-38 unfaced batts or blown insulation. The contractor installs 1-inch R-5 rigid foam as interior insulation on garage walls, on attic walls abutting conditioned spaces, and on the attic side of knee walls.

To further tighten the building envelope, sill seal serves as a gasket, keeping air, moisture, and bugs from entering between the foundation slab and the sill plate. Caulking is applied at all openings, wall corners, and the top and bottom plates. Sheetrock is glued to the framing

(meeting a new criterion in ENERGY STAR Version 3). Draftstopping is applied in the building chases and behind the bathtubs and showers. Tests show whole-house air-tightness of 3.0 air changes per hour at 50 Pascals of pressure.

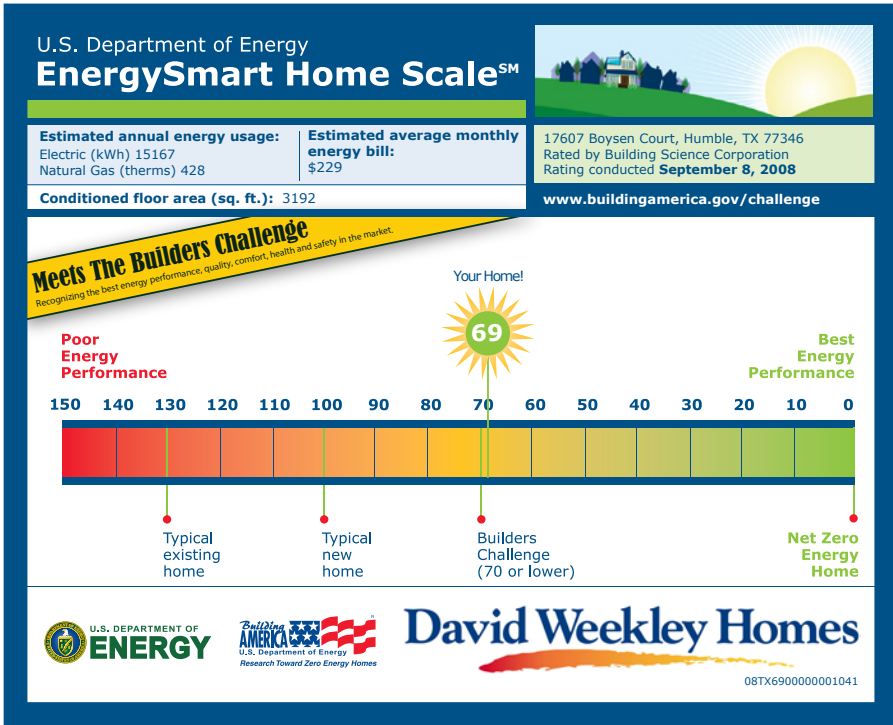
A right-sized air conditioner is key to reducing indoor humidity during the summer. An overly large system will cool the home rapidly and cycle off too quickly, allowing humidity to build up. The team used ACCA Manual J to right-size the 15 SEER air conditioner. A 95% AFUE natural gas furnace warms the home in winter. Ventilation is supplied by a central-fan-integrated supply with fresh air intake, variable speed fan cycling, and a motorized damper.

The R-6 flex ducts are mastic sealed and located in the unconditioned attic, as is the air handler. Duct tests showed a low leakage rate of 2.8 ft³/min/100 ft² at 25 Pascals. Jump ducts are installed to equalize air pressure among rooms when doors are closed. A jump duct is a piece of flex duct connecting ceiling registers in an enclosed room and an open area of the house. The equalized pressure improves energy efficiency, comfort, and air quality.

High-performance windows complete the energy-efficiency package. The double-paned vinyl-framed windows are spectrally selective. This means they have a low-emissivity coating that filters out 40% to 70% of the heat normally transmitted through insulated window glass or glazing, while allowing the full amount of light to be transmitted. The windows are U=0.34-0.35 and SHGC=0.30-0.34.

Energy-Efficient Features

- HERS Score: 59-68
- Attic: Vented, with radiant barrier
- Ceiling insulation: Unfaced fiberglass batts on sloped ceilings; R-38 unfaced batt or R-38 blown-in cellulose on flat ceilings
- Walls: 2x6 24-inch on-center advanced framing
- Wall insulation: R-20 cellulose and 1 inch R-5 XPS
- Windows: Vinyl-framed, low-e, spectrally selective, U=0.34-0.35, SHGC=0.30-0.34
- HVAC: 15 SEER AC; 95% AFUE gas furnace
- Air handler: Variable-speed, in unconditioned attic
- Ducts: R-6 flex, mastic sealed, in unconditioned attic; jump ducts in bedrooms
- Duct leakage: 2.8 cfm/100 ft² @ 25 Pa
- Ventilation: Central-fan-integrated supply with fan cycling and motorized damper
- Water heating: 0.62 EF gas
- Blower door test: 3.0 ACH 50
- Appliances: ENERGY STAR dishwasher, refrigerator
- Lighting: 80% CFLs



David Weekley Homes, Houston Division has certified nearly 1,500 homes to DOE's Builders Challenge (as of September 2011). That's more than any other builder in the country. Every home scores a 70 or lower on the Home Energy Rating System index.



With recommendations from DOE's Building America, David Weekley Homes, Houston Division, was able to cut energy use by 41% to 48% compared to a home built to the 1993 Model Energy Code, saving homeowners an estimated \$2,756 annually on their utility bills.

Exceeding 2012 IECC

David Weekley Homes has exceeded these requirements of the 2012 International Energy Conservation Code (IECC) on all of its homes since 2010.

Features	2012 IECC/CZ 2	David Weekley Homes
Walls	R-13	R-20 cavity + R-5 insulated sheathing
Infiltration	5.0 ACH	3.0 ACH
Duct Leakage	4 cfm per 100 sf	2.8 cfm per 100 sf
Lighting	75% high-efficacy fixtures	80% compact fluorescents

For More Information

www.buildingamerica.gov
EERE Information Center
1-877-EERE-INF (1-877-337-3463)
eere.energy.gov/informationcenter



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Health, Durability, Sustainability

The moisture-control design of the exterior walls, the tight thermal envelope, and the high-performing HVAC system contribute to the homes' health and durability. Together they maintain comfortable temperatures, control humidity, and create good indoor air quality. In addition, the homes have carbon monoxide detectors and MERV 11 pleated air filters designed to filter out 70% of pollen, mold, and dust. Pretreated framing lumber and an in-wall pest defense system reduce the risk of termite and insect damage.

Dollars and Sense

The energy-efficient upgrades in the Eagle Springs and Waterhaven developments, when compared to a code-minimum home in Houston, are estimated to cost the homeowner about \$400 a year when financed as part of a 30-year mortgage at 7% interest. But this leaves the buyer far ahead, since the annual reduction in energy bills is estimated at \$2,756 a year.

Table 1. Calculated Costs and Savings of Energy-Efficiency Features for David Weekley Homes, Houston, Texas

Total Energy Savings ¹	48%
Total Added Builder Costs ²	\$3,314
Annual Utility Savings	\$2,756
Annual Mortgage Payment Increase ^{2,3}	\$400
Annual Net Cash Flow to the Homeowner	\$2,356
¹ Savings are in comparison to the Building America benchmark (a home built to the 1993 Model Energy Code)	
² Builder costs were estimated by builders and Building America team. Costs include a 10% markup. Incentives and rebates are not included.	
³ Mortgage costs are based on a 30-yr fixed mortgage at 7% interest; inflation is not considered.	

The Bottom Line

Building high-performance homes is a challenge, Weekley said.

"This isn't something that a builder can do just by flipping a switch or spending more money," he said. "You have to fail a lot of blower door tests and duct blaster tests first. It took us awhile to get to where we could build our homes as tightly as we needed to, to train our air conditioning contractors to where their ductwork was as tight as it needed to be, and to train our insulation contractors to air seal in the way they needed to."