BUILDING AMERICA TOP INNOVATIONS HALL OF FAME PROFILE

INNOVATIONS CATEGORY:

2. House-as-a-System Solutions
2.1 New Homes with Whole-House Packages

High Performance Without Increased Cost:

Urbane Homes, Louisville, KY

Urbane's first home, built for $36 per ft^2 in 2008, incorporated both energy efficiency and strategies to reduce building costs. The home won two EnergyValue Housing Awards, and homebuyers began seeking out the builder for energy-efficient, high-quality homes.

By effectively demonstrating cost-neutral solutions for high-performance homes, Building America has directly impacted 3,000 homes constructed by builders working with research partners. This innovation indirectly influenced many related programs to gain traction, including over 1.3 million ENERGY STAR-certified homes and over 14,000 DOE Challenge Homes.

BUILDING AMERICA TOP INNOVATIONS

Recognizing Top Innovations in Building Science – The U.S. Department of Energy's Building America program was started in 1995 to provide research and development to the residential new construction and remodeling industry. As a national center for world-class research, Building America funds integrated research in market-ready technology solutions through collaborative partnerships between building and remodeling industry leaders, nationally recognized building scientists, and the national laboratories. Building America Top Innovation Awards recognize those projects that have had a profound or transforming impact on the new and retrofit housing industries on the road to high-performance homes.

Building America field projects that demonstrated minimal or cost-neutral impacts for high-performance homes have significantly influenced the housing industry to apply advanced technologies and best practices.

In 2006, the U.S. Department of Energy's Building America program set a goal of proving that cost-neutral energy savings of 40% over code were possible at a production scale for new home builders in every U.S. climate zone. Between 2005 and 2010, Building America research partners worked with 34 builders to construct nearly 3,000 homes in communities of at least 10 homes (and often more than 100 homes). Each home achieved a Home Energy Rating Score (HERS) of 70 or better while ensuring the resulting utility bill savings would more than make up for any increased first cost. In every field study, homeowners made a net profit from the first year.

One example of exceptional cost savings is Urbane Homes of Louisville, Kentucky. In 2008, Urbane Homes worked with the National Association of Home Builders Research Center (NAHBRC), a Building America research partner, to build its first home. The high-performance home cost $36 per ft^2, well below the local average of $55 to $85 per ft^2 (not counting the lot), and won three major building awards in 2009, including an EnergyValue Housing Award for affordability. In 2009 and 2010, the company built 14 homes ranging in size from 1,484 to 2,996 ft^2 that achieved energy savings of 40% over code and sold at or below market rate at prices ranging from $150,000 to $450,000. All the homes received third-party inspections for ENERGY STAR® certification. Their HERS scores ranged from 57 to 62. A typical new minimum code home has a HERS score of 100.

Researchers at the NAHBRC showed Urbane the technical details of building a frost-protected shallow foundation, which reduces the cost of excavation. They also ran computer simulations to calculate the cost-effectiveness and energy efficiency of potential home components.

"Every house sold within 3 weeks. We just listed the houses about 2 weeks before they were done so people could come and see it. The last one we sold was on the market for just 2 weeks."

Abe Gilbert, Co-owner, Urbane Homes

Urbane hired an architect who specialized in energy-efficient designs and worked closely with its subcontractors to ensure that efficiency details were carefully implemented.

A number of energy-saving measures that provide other construction cost savings were applied in this project. Advanced framing techniques were used including 2x6 studs at 24-inch on-center and two-stud corners. Advanced framing saves lumber cost while allowing more room for R-19 fiberglass batt wall insulation, with less thermal bridging. The builders also used extruded polystyrene (XPS) rigid foam sheathing for exterior walls. The sheathing was taped at the seams, braced at the corners, and then covered with a water-resistant barrier. This saved the cost of installing oriented strand board while minimizing thermal bridging and providing more moisture absorption capabilities that were desirable in Louisville's humid climate.

Frost-protected shallow foundations with footings placed just 12 to 16 inches below grade were used instead of more costly traditional foundation construction below the frost line. The cost savings were applied to installing one inch of R-5 XPS rigid insulation under the slab and on both sides of the foundation walls.

Ducts were installed within conditioned space between the floors in the open-web floor trusses, and tests showed less than 5% duct leakage to outside. Cost savings were also invested in energy-efficient components: efficient heating, ventilation, and air-conditioning equipment, a 0.92 energy factor (EF) electric tank hot water heater, 100% hardwired compact fluorescent lighting, ENERGY STAR® appliances, and high-performance windows (vinyl-framed, double-glazed, and low-emissivity with argon fill).

Urbane Homes sold every house in less than three weeks, without any formal advertising. Although Urbane now focuses on homes for affluent buyers, the builder keeps looking for energy efficiencies. Recent changes include switching to blown cellulose insulation in walls instead of fiberglass batts and using spray foam for more detailed air sealing and insulation in attic eaves and soffits, around fireplaces, and in garage ceilings.

Key Lessons Learned

- The key elements to cost savings were strict control of the construction process, advanced framing, and the frost-protected shallow foundation, according to the builder.
- Urbane achieved better than cost-neutral energy savings with homeowners actually making a profit each year. For Urbane's 2,184-ft^2 home, energy-efficiency upgrades added about $1,465 to the cost of the home. This only added $129 per year to the annual mortgage cost with a 30-year term and 7% interest rate while providing an estimated annual energy cost savings of $713. This allows the homeowner to pocket $584 per year.
- Energy efficiency helped Urbane Homes stand out in the market and sell new homes. When Urbane first started building, prospective buyers were only concerned about price and location. As more buyers have learned how much money they can save in energy costs, the builders have become more sought out because of their reputation for energy efficiency and quality.

To save both money and energy, Urbane Homes used advanced 2x6 framing at 24-inch on-center, and sheathed exterior walls with XPS rigid foam instead of OSB.

KEY ENERGY-EFFICIENCY MEASURES

Envelope:

- 2x6 advanced framing
- Attic insulation: R-50 blown fiberglass
- Wall insulation: R-19 batts; 1-inch R-5 XPS exterior foam sheathing
- Foundation: 1-inch XPS R-5 below slab, R-5 exterior and R-13 batts in basement
- Airtightness: less than 3.6 ACH@50PA (~0.15 ACHnat infiltration)
- Windows: Low-e, vinyl-framed, doubled-glazed, argon-filled (U=0.32, SHGC=0.31)

HVAC:

- Heat pump 8.4 HSPF, 14.5 SEER
- Ducts in conditioned space with less than 5% leakage to outside

Lighting, Appliances:

- Electric 0.92 EF water heater with tank
- 100% hardwired CFLs
- ENERGY STAR® appliances

REFERENCES

IBACOS. 2010. *Building America Stage Gate 3 Mixed-Humid 40% 2010 Project Management Milestone Report.* Prepared by IBACOS for the U.S. Department of Energy Building America. www.buildingamerica.gov

U.S. DEPARTMENT OF ENERGY
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DOE Building Technologies Program
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