



## Building America Best Practices Series

Volume 12. Builders Challenge Guide to 40% Whole-House Energy Savings in the Cold and Very Cold Climates

# Case Study: S&A Homes

East Liberty | Pittsburgh, PA

S&A Homes worked with Building America's IBACOS and architects Pfaffmann & Associates and Moss Associates to design energy-efficient homes for urban in-fill lots. This is a new market for S&A Homes, which builds over 500 homes a year using suburban designs.

### BUILDER PROFILE

**Builder:** S&A Homes

**Where:** State College, PA

**Founded:** 1980s

**Employees:** 150

**Development:** East Liberty

**Size:** 3 bedroom, 3 baths

**Square Footage:** 3,108 ft<sup>2</sup>, includes 1,004 ft<sup>2</sup> basement

**Price Range:** \$216,000 to \$305,000

East Liberty Development, Inc., worked with the U.S. Department of Energy's Building America team lead IBACOS and builder S&A Homes to build six homes in Pittsburgh's East End that achieved Home Energy Rating Scale (HERS) scores of 51 to 55.

"We literally designed the house around the HVAC system," said Eric Jester, a project manager with East Liberty Development, Inc.

"In standard building, the mechanical systems are an afterthought," said Kevin Brozyna, an IBACOS building performance specialist. "Your typical builder will frame the house and then the mechanical contractor will figure out how to route the ductwork around the framing. From the start, we wanted to design an integrated solution."

IBACOS worked with the architects Pfaffmann & Associates and Moss Architects to help them meet the project requirements: designs that could fit on narrow in-fill lots 25 to 40 feet by 110 feet deep, incorporating Building America-recommended energy-efficiency specifications, while using S&A Home's typical procedures and material suppliers where possible.

East Liberty Development, Inc., is a non-profit community development corporation focused on neighborhood renewal, whose efforts sparked a renaissance in this older Pittsburgh neighborhood. Now employers like Google, new retail stores like Whole Foods and Target, and new restaurants join a growing number of new homeowners and investors in this previously forgotten part of the city.

"Real estate is perception. These homes give a strong perception that investing in East Liberty is a good idea, and people are following that cue," said Jester. "We have seen a plummeting crime rate (down 60%) and an increase in single-family house values across the neighborhood of 100% or more."



(top) In a market where the median house price is \$100,000, East Liberty Development, Inc., has sold three of its super-energy-efficient homes at prices starting at \$216,000.

(bottom) The HVAC equipment is located in conditioned space in the basement, which is thoroughly insulated and air sealed with precast concrete walls that come to the site with 2.5 inches of foam insulation and steel-reinforced insulated concrete studs already installed.

“Codes are improving. Trades are aware that things are becoming more strict, and they are going to be required to be more diligent in their work. Have a discussion with the trades to let them know what you expect and make sure they are committed to pulling it off.”

Kevin Brozyna, IBACOS

## Energy-Efficiency Features

The first step in designing the homes was to put all of the HVAC equipment and ductwork within the highly insulated and air-sealed thermal envelope. The completed homes blower door tested at 3.0 air changes per hour (ACH) at 50 Pascals, compared to 9 ACH at 50 Pa for a typical home.

The tight building shell consists of 2x6 24-inch-on-center stud wall cavities filled with R-24 blown-in fiberglass. The walls are sheathed with ½-inch OSB and housewrap and clad with LP SmartSiding®, a compressed wood product impregnated with a zinc borate preservative. “Every single stud was air sealed. Every single penetration was air sealed with a low-expansion foam,” said Todd Winnor, the project manager for S&A Homes. Double-pane windows with a low U-value of 0.33 and a low SHGC of 0.30 complete the wall assembly.

The unconditioned attic contains R-49 blown-in fiberglass insulation. “We used raised-heel trusses to get the full depth of insulation over the exterior wall,” said Winnor.

All of the HVAC equipment is located in the basement. The insulated, precast-concrete wall system (Superior Wall xi™) includes 2½-inch Dow® extruded polystyrene insulation (R-12.5) within a 1¾-inch concrete exterior. This insulated wall panel comes factory-assembled with steel-reinforced steel-faced concrete studs at 24 inches on center.

“Originally, we looked at enhancing the stud cavities with an R-13 batt,” said Winnor, “but when we tried this with the first home, we had a very cold winter and got some condensation. So we ended up pulling out the batts, and now it works just fine.”

In the basement and first-floor ceilings, open-web floor trusses contain the ducts. Brozyna, the building scientist with IBACOS, notes, “The open-web floor trusses were not selected primarily as an energy feature, but they allowed us to more efficiently route the mechanical systems.”

Two-stage, 96% AFUE natural gas-fired furnaces with a multi-speed blower are located in the basement. A SEER-14 system provides air conditioning. Fresh air is provided through a 6-inch supply-air duct connected to the return plenum, and a fan-cycler provides ASHRAE 62.2 rates for fresh air at a 50% run time. The natural-gas-fired tankless water heater supplies heated water with a 0.82 energy-efficiency rate.

IBACOS prepared mockups of field assemblies at its warehouse for hands-on training sessions for the subcontractor crews. “If they had any questions or suggestions for improving the process, we could work this out before we got into the field,” said Brozyna.

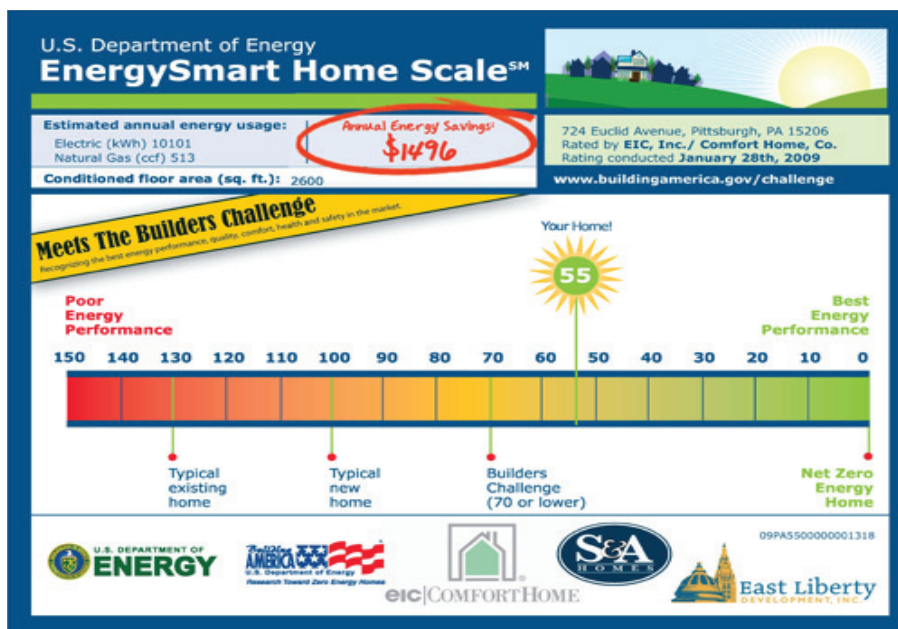
## Community Development

East Liberty Development, Inc., bought lots in a challenged east end neighborhood in Pittsburgh where “gangs, absentee landlords, trash and drug raids stained the scenery” (*Pittsburgh Post-Gazette*, December 22, 2008). The non-profit demolished blighted properties and built the six new Building America homes. East Liberty Development, Inc., currently has control of 60 properties in a 10-block area and plans to build and rehabilitate additional houses as these homes sell. It has committed to building all of its new homes to the Building America energy savings target of 40% or higher.

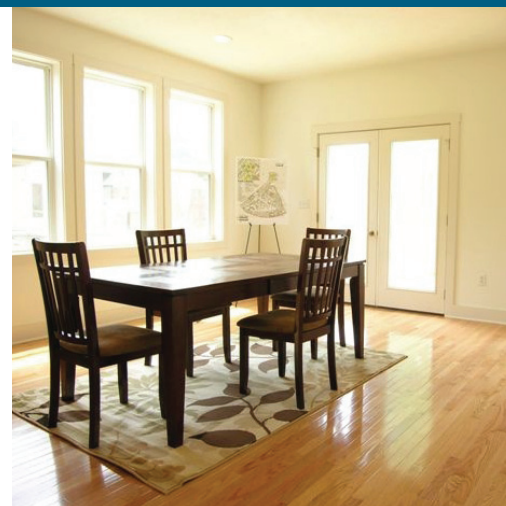
“In 2005, single-family home values in the neighborhood ranged from \$40,000 to \$50,000,” said Jester. “Our highest sale was \$315,000, nearly 630% higher.” In the first half of 2010, average prices for existing single-family homes in East Liberty climbed to \$145,000 as prices dropped citywide, thanks in part to East Liberty Development, Inc.’s community development efforts.

## Dollars and Sense

Building America analysis shows the estimated cost above code for the energy-efficient improvements to be about \$9,900 per house (or \$3.42/ft<sup>2</sup>), assuming a 30-year loan with 7% interest (Table 1). However, the energy-efficiency measures can result in an annual utility bill savings of \$1,699 compared to the Building America benchmark (a home built to code requirements of the mid-1990s), which results in a return on investment in less than 5 years.



East Liberty Development, Inc., uses a modified Builders Challenge label in its marketing efforts.



High-performance windows and 100% fluorescent lighting add to the energy savings in these craftsman-style homes.

## Energy-Efficient Features

- HERS 51-55
- 2x6, 24-inch-on-center advanced framing
- Wall insulation: R-24 blown-in fiberglass
- Attic insulation: R-49 blown-in fiberglass insulation
- Foundation insulation: Superior Wall xi™ includes 2½-inch Dow® extruded polystyrene insulation (R-12.5)
- Windows: Double-pane, U = 0.33 and SHGC = 0.30
- Air sealing tightness: blower door testing of 3.0 ACH at 50 Pa
- 96%-AFUE natural gas-fired furnace with a multi-speed blower
- 14-SEER cooling system
- 0.82 EF (energy factor) tankless gas-fired hot water heater
- Ducts in conditioned space
- 100% CFL lighting
- ENERGY STAR appliances

Table 1. Added Costs and Savings of Energy-Efficient Measures for S&A Homes

Total Energy Savings	49%
Total Added Builder Costs*	\$9,419
Annual Mortgage Payment Increase**	\$752
Annual Utility Savings	\$1,651
Annual Net Cash Flow to the Homeowner	\$899

\*Costs are based on builder estimates, RS Means, DEER, and manufacturers' data. These costs do not reflect rebates, incentives, and subsidies.

\*\*The annual mortgage payment is an estimate calculated by CARB for comparison purposes and is based on a 30-year mortgage with a 7% fixed interest rate and a 10% builder markup over added first cost.

## Overcoming Challenges

Training the subs was difficult,” said Winnor. “We have subcontractors who have been doing things the same way for 20 years, and they needed to start thinking differently about this. Every single person building the house, even the painter, plays a role in energy efficiency.”

IBACOS took an active role in subcontractor training by preparing mockups of field assemblies at its warehouse and providing hands-on training sessions. “We had the actual crew, who would be performing the work in the field, come to participate in the build-outs at the mockup site [for learning and practicing]. If they had any questions or suggestions for improving the process, we tried to work this out before we got into the field,” said Brozyna.

“My advice to other builders,” says Winnor, “is to take it slow. Get your best subcontractors and get them involved early in the process because you want their feedback. Create partnerships with them to move forward. Make sure it is a guy who will be around awhile because you are making a huge investment in your subcontractors when you do something like this.”

## The Bottom Line

“My experience working with the Building America program has been a great one. I have learned more things about energy efficiency in a year than a typical home builder would in several years. This project has provided us a road map to achieve the high-performance house of today and the net-zero energy home of tomorrow,” said Winnor.

And tomorrow is now. S&A Homes is working with IBACOS to build a “lab home” that tests the materials and construction practices needed to reach net-zero energy in a cold climate. “The lab house pushes us even further into tomorrow so we understand now what we need to do for 10 to 15 years ahead when the code changes,” said Winnor.

### For More Information

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

