



Building America Best Practices Series

Volume 16. 40% Whole-House Energy Savings in the
Mixed-Humid Climate

Case Study: Pine Mountain Builders

Pine Mountain, Georgia

Pine Mountain Builders worked with IBACOS, a DOE Building America research partner, to come up with designs that use off-the-shelf parts to build homes that look conventional but are both environmentally sustainable and energy efficient.

BUILDER PROFILE

Builder: Pine Mountain Builders

Contact: Mike Guinan, Manager
(706) 663-8443

www.callawaygardensliving.com/pine-mountain-builders.html

Founded: 2004

Where: Pine Mountain, Georgia

Employees: 5

Development: Callaway Gardens
(140 lots) and Blalock Lakes

Square Footage: 1,192 to 3,124 ft²

Size: 2-4 bedrooms

Price Range: \$300,000 to \$450,000

Pine Mountain Builders, a partnership between the owners of Fortress Construction and Cousins Properties, has teamed up with the U.S. Department of Energy's Building America program to build homes that achieve HERS scores as low as 59. (A typical new American home has a score of 100.)

Since 2005, Pine Mountain Builders has been working with Integrated Building and Construction Solutions (IBACOS) and Southface Energy Institute, both Building America research partners, to improve the energy efficiency of their homes. With the help of IBACOS and Southface, Pine Mountain Builders has used innovation to overcome technical challenges to meet and exceed the high standards of Callaway Gardens' Lingleaf sustainable resort community. Located in western Georgia near the non-profit Callaway Gardens Wetlands Preserve, this community was designed to serve as an example of sustainable development practices that are energy efficient and protect area wilderness.

With help from Building America, Pine Mountain Builders completed its first 11 homes of 140 at Callaway Gardens in 2007. "We love the program," said co-owner Mike Guinan. "We learn and improve every day. With IBACOS we can experiment with new systems and products," explains Guinan.

Although homebuyers may initially be drawn by the development's proximity to nature, they soon find that their homes perform extraordinarily well and can reduce their electricity bills to as little as \$50 a month, or about half of the state average.



Unvented attics insulated with R-30 low-density spray foam provide a semi-conditioned space for the high-efficiency heat pump and ducts.



Framing is covered with XPS foam structural insulated sheathing instead of OSB. The foam sheathing provides R-3 of insulation and protection against moisture. The wall cavities are filled with an additional R-13 low-density spray foam insulation, which provides air sealing as well as insulation.

Energy-Efficiency Measures

The homes are located in western Georgia's mixed-humid climate, approximately 70 miles southwest of Atlanta, and range from one story, 3 bedrooms, and 1,929 ft² at approximately \$355,000 to two stories, 4 bedrooms, and 3,124 ft², at a cost of up to \$450,000.

Pine Mountain Builders first worked with IBACOS to design homes that used 30% less energy than the Building America Benchmark (a home built to the 1993 Model Energy Code). These designs became their standard homes. Now further work with IBACOS has enabled them to reach the 40% savings mark. Using off-the-shelf technologies, Pine Mountain offers a suite of energy-saving features designed for high-performance in Georgia's mixed-humid climate. These features include low-emissivity windows, passive design to reduce heat gain, tightly sealed thermal envelope, an efficient HVAC equipment and duct system design, efficient appliances, and independent testing.

Because the mixed-humid climate requires a great deal of cooling, the builders chose low-emissivity, wood-framed, double-glazed windows filled with argon and rated $U=0.38$ and $SGHC=0.35$. Solar gain is also mitigated through the use of architectural shading, such as low overhangs, and the preservation of mature trees to provide shade.

The thermal envelopes of Pine Mountain's homes are built to be airtight. Blower-door tests show 1.0 to 1.8 air changes per hour at 50 Pascals of air pressure. A cathedralized, sealed attic with R-30 low-density spray foam insulation is indirectly conditioned by the HVAC system. The walls are 2x4 16-inch on-center and the cavities are filled with R-13 low-density spray foam. Above grade, 75% of the exterior walls are covered with a 1/2-inch R-3 extruded polystyrene (XPS) rigid foam insulation. Instead of oriented strand board sheathing, the builders recently began using structural XPS foam insulated sheathing panels. The structural panels provide extra insulation and resist moisture to protect the home from the humid climate.

The HVAC system is designed to achieve ASHRAE 62.2 whole house ventilation requirements by placing the ventilation, heat pump, and ducts within the semi-conditioned space of the sealed attic. An air cyclor provides fresh air to the house at an average of 20 cfm, while a 14 SEER/HPSF 8.0 heat pump provides cooling and heating. All air ducts are sealed with mastic at the joints. Some homes employ a ground source heat pump for heating, cooling, and water heating, pushing overall home energy savings to the 50% savings level compared to the Building America benchmark (a home built to the 1993 Model Energy Code). The homes achieve 30% energy savings compared to homes built to the Georgia construction code.

The builder installed only ENERGY STAR appliances, and 75% of the light fixtures are CFL.

Health, Durability, Sustainability

Pine Mountain Builders has set aggressive environmental performance measures that go beyond energy efficiency. The builder uses low-VOC paints and installs carbon-monoxide monitors and low-VOC carpets in each home. Pest controls are applied externally around the perimeter of the home to reduce human exposure. Garages are detached, which keeps fumes out of the house. The slab-on-grade foundation is raised to protect the home from water damage and sits on 4-ft-deep stemwalls that extend below the frostline.

To improve water efficiency, the builders have included low-flow showerheads, dual-flush toilets, high-efficiency washing machines, and rainwater harvesting for drip irrigation.

The builder grinds organic construction debris on site to use for mulch blankets that absorb rainfall to minimize runoff. Other erosion control measures include silt fences, permeable driveways and walkways, planting native species, and preservation of existing trees. The builder is registered in the NAHB's Building With Trees program. Each home is framed with sustainably harvested lumber.

Innovation

The company works with EarthCraft House, a regional program developed by the Southface Energy Institute that grades and certifies homes based on energy efficiency, indoor air quality, water efficiency, and other metrics for sustainability throughout the construction process. The builder also works with Callaway Gardens' Design Review Committee to ensure that the construction of its homes causes minimal impact to area habitat and water resources. Beyond providing third-party testing for energy efficiency, homes earning an EarthCraft House certification are also built to ENERGY STAR levels of efficiency. Certification requires builders to provide documentation of design goals and third-party verification before, during, and after the construction process to ensure overall building performance is as designed. This arduous process ensures that the finished building performs as it was designed. Furthermore, the builders take each home's alignment with the sun into consideration, both to adjust the amount and location of windows and doors and to properly determine the home's heating and cooling loads.

Pine Mountain Builders has worked with IBACOS and Southface over the past few years to reach both the 30% and 40% targets. Pine Mountain Builders have also begun working toward the 50% energy savings level in future designs. With more than 10 years of experience in building homes, Pine Mountain Builders has longstanding relationships with its trade partners that ensure its performance standards are met with the use of conventional building materials.

Key Features

- HERS scores: 59 to 85
- Foundation: Slab on grade, perimeter slab-edge insulation
- Siding: Wood shake cladding with R-3 XPS structural insulated foam sheathing
- Walls : 2x4 16-inch on center, R-13 low-density spray foam insulation
- Attic: Cathedralized, sealed, R-30 low-density spray foam insulation
- HVAC: ACCA Manual J-sized 14 SEER/HPSF 8.0 heat pump
- Ventilation: Air-cycler fresh-air supply with 20 cfm per hour
- Duct system: ACCA Manual D sized, located in semi-conditioned attic space, mastic sealed at joints
- Water heating: 40 gallon electric, 0.93 EF
- Windows: Low-E, double-pane, wood-framed windows, U=0.36, SHGC=0.30
- Lighting: 75% CFL
- Appliances: All ENERGY STAR



With help from IBACOS, Pine Mountain Builders has improved its energy efficiency from 30% to 40% savings over the Building America benchmark and HERS scores of 59. They are now working toward 50% energy savings in future designs.

“We like to build the most energy-efficient and best-performing home with off-the-shelf parts,” explains manager Mike Guinan of Pine Mountain Builders. “We don’t have any solar or PV arrays. It looks like an ordinary house but it performs way better.”

Dollars and Sense

The builders have calculated that their efficiency measures add \$917 per year (based on a 30-year mortgage at 7% interest), compared to a home built to Georgia code. IBACOS calculated the energy improvements can save homeowners up to \$1,180 per year on their utility bills for a net gain to the homeowners of \$263 per year.

Table 1. Calculated Costs and Savings of Energy-Efficiency Features for Pine Mountain Builders, Pine Mountain, Georgia

Total Energy Savings ¹	41%
Total Added Builder Costs ²	\$2,564
Annual Utility Savings	\$1,180
Annual Mortgage Payment Increases ^{2,3}	\$917
Annual Net Cash Flow to the Homeowner	\$263

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

With the downturn in the housing market, Pine Mountain Builders’ construction rate has dropped from 50-75 homes per year to 15 homes in 2010. Guinan sees a need for builders to help homebuyers understand the role efficient and sustainable design plays in the overall quality of their home. “The demand side, that’s where I think we need to put a lot of our attention,” he said.

Homebuyers may begin the process focusing on amenities such as garage size and swimming pools, according to Guinan but energy-efficient features really begin to shine after the home is built. “After they move in, they’re saying, ‘Wow, this is great! I can’t believe how well all this stuff works!’” explains Guinan.

“We try to do the extreme best with what is available to us today,” explains Guinan. “We think that our greatest success is our overall customer satisfaction. Our consumers are enjoying greater overall indoor air comfort and lower utility costs.”

For More Information

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

