



Building America Best Practices Series

Volume 14. Builders Challenge Guide to 40% Whole-House Energy Savings in the Hot-Humid Climate

Case Study: Imagine Homes

Stillwater Ranch | San Antonio, TX

Imagine Homes worked with DOE's IBACOS Building America research team to achieve HERS scores of 52-65 that allow ducts and HVAC to be installed in conditioned attics.

BUILDER PROFILE

Builder: Imagine Homes
San Antonio, TX
www.imaginehomessa.com

Founded: 2006

Employees: 16

Development:
Stillwater Ranch
87 homes, 1,751 - 3,668 ft²
\$181,000 - \$289,000

Construction Date: 2006-2015

When San Antonio builders John Friesenhahn and Jim Bastoni couldn't find an insulation contractor who would install to their specifications, they started their own insulation company. This kind of dedication to doing things right led Friesenhahn and Bastoni, in 2006, to form a construction company, Imagine Homes, and to enter into a partnership with the U.S. Department of Energy's Building America program. The builders have since sold the insulation company, but they are still building houses. Working with the DOE Building America research team IBACOS (Integrated Building and Construction Solutions), Imagine Homes has exceeded the target of 40% whole-house energy savings over the Building America benchmark on nearly 300 homes completed as of December 2010.

Imagine Homes was also the first San Antonio builder to certify all of its homes to both the federal ENERGY STAR program and the Build San Antonio Green program. According to that program's website, 75% of the homes certified in San Antonio were built by Imagine Homes, making it San Antonio's "greenest" volume home builder. As of December 2010, Imagine had certified 251 homes to Build San Antonio Green's Level 1 (which is 15% more energy efficient than the current local energy code [equivalent to the 2009 IECC]), and 43 homes to Level 2 (30% more energy efficient than the current code and "solar-ready").

These efforts have helped the local company distinguish itself from the competition and sell 77 homes per year over the last four years in a market flooded with just-to-code homes by national builders.

"We just feel it [building green] is the right way to go, and we want to demonstrate it can be done affordably," said Friesenhahn, who is president of Imagine Homes. Imagine has several house plans available in high-



(Top) Attics and walls are insulated with spray foam for superior insulation and air sealing to achieve house leakage of less than 2.5 air changes per hour at 50 Pascals.

(Bottom) [Interior view] The home is sheathed with rigid foam insulation and all seams and holes are taped to provide a continuous air barrier.

Committed to Energy Efficiency

All Stillwater Ranch homes are ENERGY STAR and Build San Antonio Green certified, all are performance tested, and all exceed 40% energy savings over the Building America benchmark.

growth neighborhoods around San Antonio, with homes ranging in size from 1,751 to 3,668 ft² and prices ranging from \$181,000 to \$289,000.

IBACOS helped Imagine Homes develop specifications to build homes that achieve Home Energy Rating System (HERS) scores of 52 to 65 and source energy savings of 45% to 54% over the Building America benchmark (a home built to the 1993 Model Energy Code). Research and modeling by IBACOS helped the company make choices regarding insulation methods, windows, sheathings, HVAC systems and design, water heating systems, and air sealing techniques. “IBACOS and the Building America program provided us with the resources to help us validate our ideas,” said Friesenhahn.

Energy-Efficiency Features

Since working with Building America, the biggest change Imagine Homes has made in design and construction has been the sealed attic, which provides conditioned space for the ducts and air handler. The roofs have unvented, sealed attic assemblies that have R-19 low-density foam sprayed on the underside of the roof decks creating an insulated space for the ducts and air handler.

“We were already testing and getting a tight duct system, but now it is all inside the building envelope, and in a hot, humid climate this makes a tremendous difference,” said Friesenhahn. Because the attic environment is cooler and less humid, the HVAC system doesn’t need to work as hard.

The air conditioning ducts are sealed with mastic and every home’s duct system is duct blaster tested by a third party energy rater to ensure minimal leakage. The sealed ducts typically test at less than 3.5% total system leakage inside and less than 1% leakage to the exterior. The whole house air leakage is also tested and results show air leakage of 2.5 air changes per hour at 50 Pascals.

The 2x4, 16-inch on-center wall cavities are filled with low-density foam which provides R-13 insulation and excellent air sealing properties. “The key is to have a good relationship with contractors who believe in what we are doing,” said Friesenhahn. In this case, that’s not hard to do, since Friesenhahn and Bastoni started the insulation company.

Due to improvements in the thermal enclosure, Imagine Homes was able to downsize the air conditioning equipment and use the savings to install higher performing equipment at no added cost. They downsized from a 3.5-ton to a 3.0-ton 15 SEER (Seasonal Energy Efficiency Ratio) air conditioner with a sealed-combustion 92% AFUE furnace.

Every house is equipped with a tankless gas water heater with an energy factor (EF) of 0.82. Every house also comes with a whole house energy usage monitor so homeowners can track their electricity usage and dollars spent in real time. The homes have ENERGY STAR dishwashers, and ENERGY STAR clothes washers and refrigerators are offered. More than 90% of the hard-wired lighting fixtures are fluorescent. The low-emissivity, double-pane windows have a U value of 0.35.

Health, Durability, Sustainability

The homes have uninsulated slab-on-grade foundations, which is typical in hot-humid climates where heavy rains and termite infestations are common. Windows are installed using water-proof flexible sill wrap, corner shields, and adhesive flashing tape to protect against water intrusion and reduce air infiltration. Building exteriors use fiber-cement siding and soffit materials that resist termites, rot, and deterioration.

To ensure indoor air quality, a fresh air duct brings fresh air from outside to the return side of the airhandler where it is filtered through a MERV 10 (minimum efficiency reporting value) pleated air filter and conditioned before being distributed by the air handler to provide filtered fresh air to the home. This fresh air intake keeps the home slightly positively pressurized to keep hot, humid air from being pulled into the home. There is a central return on each floor and returns in each bedroom to provide additional paths for air flow. Low-VOC paints are used and all carpet options carry the Carpet and Rug Institute (CRI) Green Label. Carbon monoxide detectors are installed in every home.

Dollars and Sense

With San Antonio's median household income around \$42,000, home ownership is a major investment. The builder estimated that construction costs to incorporate the above-code energy-efficiency features in its Stillwater Ranch community are \$4,800. When the costs of the energy-efficiency upgrades are added to a home mortgage (at 7% interest over 30 years) this adds \$383 to the annual mortgage costs. But, annual utility bill savings are estimated at \$2,067, according to IBACOS analysis. When the added cost of \$746 is subtracted from the annual savings, homeowners still see a cost savings or net cash flow of \$1,321 annually, as shown in Table 1 on the following page.

Energy-Efficient Features

- HERS Index: 52-65
- Walls: 2x4, 16-inch on-center framing
- Attic Insulation: R-19 low-density spray-foam insulation
- Wall Insulation: R-13 low-density spray-foam insulation
- Foundation: Uninsulated slab-on-grade
- Ducts: Sheet metal trunk and R-6 flex duct branches
- Air Sealing: 2.5 ACH50 or less
- HVAC: 92% AFUE natural gas-fired furnace; 15 SEER split-system AC unit; central fan-integrated supply ventilation and spot ventilation; ASHRAE 62.2 compliant
- Windows: Double-glazed vinyl, low-E; U=0.35, SHGC=0.23
- Water Heating: Tankless gas water heater (EF = 0.82); central manifold plumbing, PEX piping
- Ventilation: Fresh-air intake ducted to return side of airhandler through a MERV 10 filter; return air vents or transfer grilles in each bedroom; central fan integrated supply ventilation and spot ventilation
- Lighting and Appliances: 90+% CFLs, ENERGY STAR appliances
- Commissioning/Certification: Third-party inspections, duct-blasters and blower door performance testing are performed on every home to verify the high performance specifications for each home are executed as planned.



[Exterior view] A fresh air intake ducted to return side of airhandler through a MERV 10 filter, provides filtered fresh conditioned air that is distributed throughout the home.

Commitment to Energy Efficiency Nets Builder Regional and National Awards:

2008 NAHB Green Building Award Winner

2009 NAHB Green Building Award Winner

2009 and 2010 City of San Antonio Green Building Awards

2010 Energy Value Housing Silver Award Winner, NAHB Research Center

2011 Energy Value Housing Silver Award Winner, NAHB Research Center

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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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Table 1. Calculated Costs and Savings of Energy-Efficiency Features for Imagine Homes, San Antonio, Texas (Lilac Model)

Total Energy Savings ¹	54%
Total Added Builder Costs ²	\$4,800
Annual Utility Savings	\$2,067
Annual Mortgage Payment Increase ^{2,3}	\$746
Annual Net Cash Flow to the Homeowner	\$1,321

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

Imagine Homes uses quality control protocols at every stage of construction to ensure compliance with the company's commitment to meeting the green building guidelines. Three performance tests are conducted on each home constructed—a duct-blast test, a blower-door test, and a combustion safety test. A 500-point quality assurance walk-through is completed for each home by the builder prior to close. The process begins on the exterior of the home and includes the garage and all rooms and hallways on the interior. At every stage of construction, systems are in place to assess building techniques used to ensure compliance with the company's commitment to building green and to provide peace of mind to the homeowner. With over 200 homes under warranty, the company averages less than \$1,500 per month in warranty costs. "Our warranty costs are almost nothing. We have happy homeowners," said Friesenhahn. Building with energy efficiency in mind is just "the right thing to do" for Imagine Homes.

Where They're Headed

Working with the Building America team IBACOS, Imagine Homes developed specifications to build and monitor the performance of a concept home that incorporates additional energy-efficiency features. This home, which was completed in July 2010 in the Cibolo Canyons neighborhood, incorporates advanced framing techniques using 2x6 construction at 24 inches on-center, a half-inch (R-4) layer of rigid foam sheathing, R-20 blown cellulose wall insulation, an R-19 low-density foam-sealed roof, high-efficiency HVAC with a 17-SEER air-conditioning system and a sealed combustion 95% AFUE furnace, thermal solar water heating, and a 2-kW photovoltaic solar system. The home achieved a HERS index of 40 with the benefit of PV power production included (the home would achieve a HERS index of 49 without the PV panels). The concept home demonstrates a 50% overall energy-use reduction, but most importantly it shows that the additional cost to include the advanced system is more than offset by the energy savings.