BUILDING TECHNOLOGIES PROGRAM

Energy Efficiency & Renewable Energy



U.S. DEPARTMENT OF

ENERG

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: Devoted Builders, LLC

Mediterranean Villas | Pasco, WA

Devoted Builders of Kennewick, Washington, worked with Building America's BIRA team to achieve the 50% Federal tax credit level energy savings on 81 homes at its Mediterranean Villas community in eastern Washington.

BUILDER PROFILE

Builder: Devoted Builders, LLC www.mvtownhomes.com

Where: Kennewick, WA

Founded: 2002

Development: Mediterranean Villas

Size: 230 homes

Square Footage: 1, 1.5, and 2-story, duplexes and triplexes, 2- and 3-bdrm, 1,140 to 2,100 ft²

Price Range: \$145,000 to \$300,000

Energy-Efficiency Commitment: All Northwest ENERGY STAR since 2006, all Built Green since 2007



Builder Fred Giacci's decision to "raise the bar" led him into a collaboration with the U.S. Department of Energy's Building America program that has resulted in homes with HERS scores of less than 60 and calculated energy savings to homeowners of over \$1,300 a year compared to the Building America Benchmark (a home built to the 1993 Model Energy Code). Working with Building America's Building Industry Research Alliance team through its local research partner Washington State University (WSU) Extension Energy Program, Giacci built 81 homes to achieve the 50% energy savings level required for the Federal tax credit. Although the Federal tax credit ended in December 2009, Giacci has committed to building the remaining 31 homes in his 230-unit Mediterranean Villas community in Pasco, Washington, to achieve these exceptional energy savings and he continues to look for ways to raise the bar even higher.

Since 1988 Giacci has built 300 homes in southeastern Washington. In 2002 Giacci became the first production builder in his area to use insulated concrete form (ICF) walls. In 2006 he committed to building all of his homes to qualify for Northwest ENERGY STAR. Devoted Builders was named a Northwest ENERGY STAR builder of the year in 2008-09. In 2008 Giacci helped the local home builders' association start a Built Green program and since then has achieved a 3-star rating on all his homes (the local program does not have a 4-star level yet).

In 2006, David Hales of the WSU Extension Energy Program approached Giacci about working on a demonstration project for DOE's Building America program. "We got involved with Giacci because he was the first production builder in Washington state that was taking advantage of the Federal tax credit. With ICF, heat recovery ventilators, and good windows, Devoted Builders was fairly easily qualifying for the tax credit," said Hales.

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(left) Spray foam is used to insulate and air seal the "lid" or ceiling deck and any ducts located in the attic in Devoted Builders' homes in Pasco, Washington. The spray foam is covered with more than 12 inches of blown cellulose for the equivalent of R-49 of attic insulation.

(right) Insulated concrete form walls provide superior insulating, air sealing, and sound proofing capabilities.

"The kind of building they're doing has set Devoted apart from other builders in the area."

David Hales, project manager, Washington State University Extension Energy Program, a Building America research partner

Energy-Efficiency Features

Devoted Builder's exceptional energy performance starts with insulated concrete form wall construction. Giacci first looked at ICFs in 2002 during the planning stages of Mediterranean Villas. "I wasn't happy with sticks. I analyzed many different methods—brick, blocks, etc. Then I zeroed in on ICF and found a contractor who could put them together," said Giacci.

Giacci chose an ICF product consisting of 16-inch by 4-foot rigid expanded polystyrene (EPS) foam blocks separated at 4 or 6 inches by plastic spacers, which are connected to heavy plastic studs set vertically in the foam every 6 inches. The location of these studs is marked on the outside of the foam blocks making it easy to locate them for screwing in drywall on the interior or siding on the exterior side of the finished wall. The foam blocks are stacked, like Legos[™], to form the home's exterior walls. Vertical and horizontal rebar is set in the spacers and concrete is poured between the two 2 and 5/8-inch-thick layers of rigid foam to fill the gap.

The ICF walls provide an insulation value of R-25. The exterior of the walls is covered with a gray coat of cement and polymer, which provides some waterproofing. Stucco is applied directly to the gray coat. The ICF foundation wall goes down into the ground 30 inches so it provides adequate frost protection as well as R-25 of perimeter slab insulation.

Any ducts in the attic are mastic sealed, then the ducts and the lid of the ceiling deck are covered with an inch of spray foam. This is topped with more than a foot of blown cellulose to achieve R-49 attic insulation.

Spray foam ceiling insulation and ICF walls have helped Giacci achieve very low air leakage rates of below 2.0 air changes per hour at 50 Pascals on all homes. All homes are blower door tested. Some are as low as 0.8 ACH at 50 Pa.

With such low infiltration rates, fresh air must be brought in through intentional means to maintain healthy indoor air quality. Each home has an energy-recovery ventilator (ERV) to distribute tempered air throughout the home via small ducts located in conditioned space. The ERV is located either in conditioned space or in the garage.

With input from WSU, Devoted Builders transitioned from gas furnaces to standard heat pumps with a gas furnace backup in 2007. In 2009, Devoted stopped installing gas furnaces and upgraded to advanced heat pumps that are rated at 8.5 HSPF for heating and 14 SEER for cooling. The Sanyo heat pumps extract heat from the air down to 10°F; backup heat is provided by in-line electric resistance heaters. While this system can be mounted to the wall as a ductless unit, concerns about buyer reactions to the look of the wall-mounted inside units led Giacci to install the inside units in a distribution box located in conditioned space in a closet with a fan to distribute conditioned air through ducts, some of which are located in the attic.

The homes come equipped with ENERGY STAR dishwashers and 70% of the fixtures are hardwired with compact fluorescent lighting.

As part of its strong commitment to quality assurance, Devoted has 100% of its homes third-party tested and inspected. Since 2007, all of Devoted Builder's homes have met the Federal tax credit level of 50% savings over the 2004 IECC. These homes also are calculated to save 43% over the Building America benchmark.

Anticipated future improvements include solar hot water or heat pump water heaters, PV-ready designs, ductless heat pumps, 100% CFLS, and BuiltGreen community layout, with a goal of reaching net zero energy homes. Because Devoted Builders is already meeting the Building America and the Federal tax credit savings levels, Giacci does not anticipate any difficulty in implementing the 2009 IECC code.

Dollars and Sense

The table below compares calculated energy usage and energy savings for one of Devoted Builders' house plans and the Building America benchmark home (a home built to the 1993 Model Energy Code). The usage and savings were calculated by Building America research partner WSU Extension Energy. WSU calculated that the Devoted Builders' home would have 25% energy savings over the 2006 Washington State energy code and 43% energy savings over the Building America benchmark home. The home would save \$1,333 in energy costs each year. After subtracting out the increased mortgage costs to cover the increased initial cost of the energy-efficiency measures, the homeowner would net \$524 per year over the 30 years of the mortgage.



(top) Every home is equipped with an energy-recovery ventilator to provide conditioned fresh air throughout the home.

Energy-Efficient Features

- HERS scores 54-68
- R-25 insulated concrete form (ICF) exterior walls
- R-49 blown cellulose in attic
- 0.29 U-value windows
- Whole house air leakage 3.0 ACH or less at 50 Pa
- Duct leakage less than 6 cfm at 50 Pa to exterior
- 8.5-HSPF, 14-SEER heat pump with backup 93% AFUE gas furnace
- 70% hardwired CFL lighting
- ENERGY STAR refrigerator, dishwasher, clothes washer
- Energy-recovery ventilator, 75% total efficiency
- 3-star Built Green certified
- ENERGY STAR certified
- 50-year, 110-mph, composition roof

"We showed a positive cash flow for the homeowner from day 1. There is no question there is some added expense for the ICF. But the homeowner is coming out ahead," said Hales.

Devoted Builders offers a 2-year warranty on craftsmanship and materials and a 10-year structural warranty. Homes sell for \$145,000 to \$300,000. Most homes are sold through presales.

Giacci has seen competition from builders willing to build inexpensive models that just meet code. Although their energy performance is so exceptional, Giacci markets the Mediterranean-style duplex condominiums based on their location, design, and ease of maintenance.

Table 1. Added Costs and Savings of Energy-Efficient Measures for Devoted Builders

Total Energy Savings	54%
Total Added Builder Costs*	\$10,132
Annual Mortgage Payment Increase**	\$809
Annual Utility Savings	\$1,333
Annual Net Cash Flow to the Homeowner	\$524
*Costs are based on builder estimates, and manufacturers' data. These costs do not reflect rebates, incentives, and subsidies.	

**The annual mortgage payment is an estimate calculated by CARB and is based on a 30-year mortgage with a 7% fixed interest rate.

"We sell a lot of homes to engineers; they are all over our product. But the general public needs more education on the value of energy efficiency," said Giacci. Giacci commented that in the Seattle and Denver areas, green homes sell for more and realtors are more aware of the differences because the multiple listing sheets list the home's green and energy-efficient features, but that is not the case in eastern Washington

The Bottom Line

According to Hales, Giacci is positioning his company well for the future. "Energy is just going to get more expensive. Fred has always been open to new technologies and new ways to produce a high-performance home. He is very committed to the idea that it's the right thing to do. He's consistently building the highest performing homes in the state that I've seen and I expect he will continue to lead in energy-efficient home building," said Hales.

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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