

## Achieving 40% Whole-House Energy Savings in the Hot-Dry and Mixed-Dry Climate

# Case Study: Artistic Homes

ALBUQUERQUE, NM



Artistic Homes of Albuquerque, New Mexico, is the first home builder in the United States to offer true net zero energy construction to the average home buyer on every home it builds. The New Mexico production builder signed a contract for its first true net zero energy upgrade package December 20, 2008. The price tag for the 2,157-square-foot upgraded home, which qualifies for U.S. Department of Energy Builders Challenge, LEED platinum, and ENERGY STAR Indoor Air Quality certifications, is just over \$294,000.

Since joining DOE's Building America program a decade ago, Artistic Homes has continually sought to refine and improve its home building craft. In September 2008 Artistic became one of the first builders in the country to build a true net zero home. The 1,666-square-foot home completed in Rio Rancho, New Mexico, will produce and conserve more energy than it uses throughout the year for heating, cooling, and plug load. The home's tight construction ensures that, even without the 5.3-kilowatt solar photovoltaic power system and solar thermal water heating system, the home would still achieve a HERS index score of less than 60.

In November 2008 Artistic committed to building all of its homes to meet the Builders Challenge criteria. While Builders Challenge requires a HERS index score of 70 or lower, starting in 2008, Artistic committed to building all of its homes to a HERS score of 60 or lower and LEED silver level or better. The production builder has built more than 5,300 high-performance homes since 1998 and hopes to build 500 to 800 houses per year in the years ahead.

"We build all over New Mexico, from the southwest, which gets very hot, to the Four Corners area in the north with its extreme cold. We have a wide spectrum of climate conditions so we have to really apply our building science knowledge to get LEED silver or better and HERS 60 or below," said Tom Wade, co-owner of Artistic Homes. "We've worked with Building America for 10 years," said Wade, adding the DOE program helped encourage Artistic's cultural shift toward a greater emphasis on building science. "We continually look at what we are doing to see how we can improve our product. Everything we do is geared toward improving energy efficiency, indoor air quality, and affordability."

Artistic Homes, a New Mexico production builder, completed this true net zero energy home in summer 2008. The home qualifies for the U.S. Department of Energy Builders Challenge and LEED platinum level, and is the first in the nation to meet the ENERGY STAR Indoor Air Quality certifications.

### BUILDER PROFILE

---

**Builder's Name:**

Artistic Homes

---

**Where:**

Albuquerque, NM

---

**Founded:**

1986

---

**Employees:**

13, not counting subs

---

**Square footage:**

1,305-2,905 sq. ft.

---

Dollars and Sense

KEY FEATURES

- Air handler in sealed utility closet
- Ducts in conditioned space
- R-21 blown insulation in walls, R-38 blown insulation with wind baffles at soffit vents in attics
- Advanced framing techniques
- Gasketing, foam sealing, and caulking of all envelope penetration to minimize air leakage
- Fresh air inlet, positive pressure in home, and jump ducts
- 3<sup>rd</sup> party HERS rater blower door and duct blaster testing of every house
- 15 SEER AC and 9.0 HSPF electric furnace
- Heating and cooling energy usage and comfort are guaranteed
- Low-emissivity, dual pane, fibrex frame windows
- Borate treatment of studs and bottom plate
- Low and no VOC products
- Job-site recycling
- True net zero upgrade package includes:
  - Roof-mounted photo-voltaic power system ( from 4.2 to 7.0 kWh depending on home’s square feet)
  - Solar thermal hot water heating
  - R-50 attic insulation
  - Heat recovery ventilator for constant conditioned fresh air circulation

Artistic’s price for a Builders Challenge home without the zero energy upgrade averages \$222,000. Its homes range in size from 1,305 to 2,905 square feet and are geared to first-time home buyers and retirees on fixed incomes. Artistic charges about \$20,000 more for a Builders Challenge home than its competitors charge for code-built homes, but found that energy efficiency is helping it to outsell competitors two to one (Figure 1).

The slowing of the market has had a positive side for Artistic. “When money was easy, people didn’t care about energy efficiency. Some buyers were more interested in big foyers and vaulted ceilings, which we don’t do. Now 100% of our buyers are coming to us for the energy efficiency,” said Wade.

Figure 1. Number of Homes Sold in One Month (July 2009)

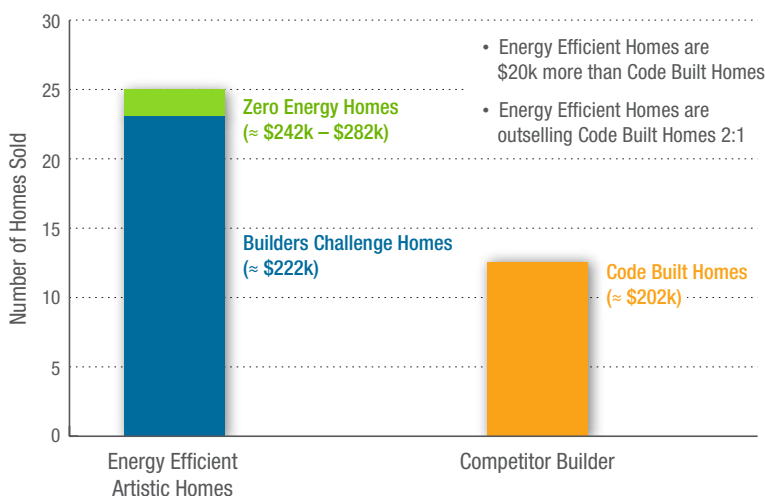


Chart compares data from three Artistic communities in Albuquerque to similar sized new communities by two competing builders [a large local builder and a national builder with a local division] who are building code-built home.

Artistic sold its very first zero energy home, a prototype built on speculation, for \$240,000. The builder signed its first contract on a home with the zero energy upgrade package in December 2008 for \$294,086 (which, included \$19,000 in cosmetic upgrades).

Artistic sells the zero energy upgrade package for \$40,000 to \$60,000 depending on the size of the home and the size of the PV system. Local, state, and federal incentives combine to make the zero energy home package much more affordable. Artistic estimates that after applied incentives, homeowners could be paying less than \$1,000 for the zero energy home package, and this is not including the ongoing savings homeowners will accumulate by eliminating their utility costs. In addition to the existing federal and state tax credits, the local utility company pays homeowners 13 cents per kWh for 12 years. After applying for all available incentives, homeowners will have close to 99% of the incremental cost covered.

Incentives cover 99% of the cost of a ZEH upgrade

Cost of Zero Energy Home Upgrade	\$49,550.00
Incentives	
Xcel Energy - Solar Rewards Program	\$15,840.00
New Mexico Sustainable Building Tax Credit	\$18,698.65
Federal PV Tax Credit	\$12,000.00
Federal Solar Thermal Tax Credit	\$2,200.00
INCENTIVES TOTAL:	\$48,738.65
Actual Cost of Zero Energy Home Upgrade	\$811.35

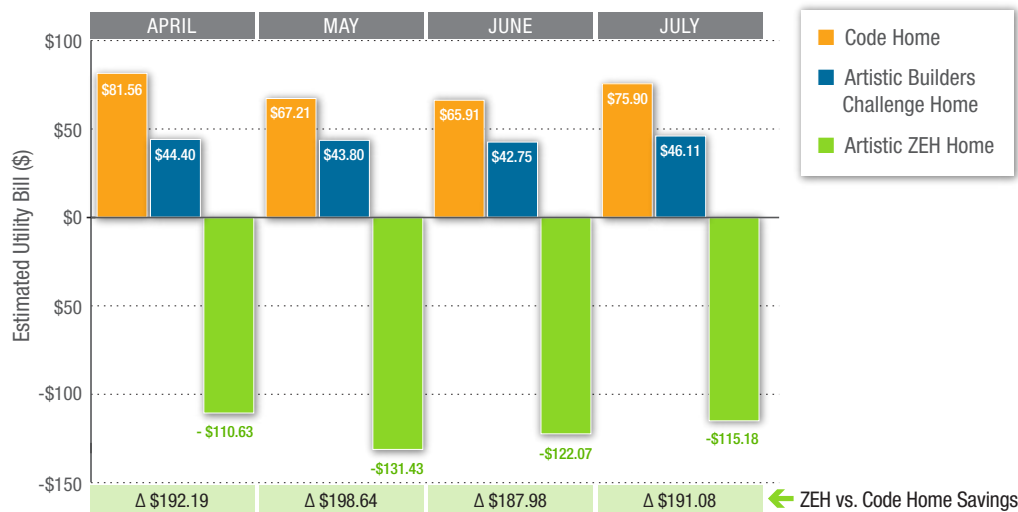


Artistic asked its first zero energy home owners for utility bill data. During the first four months the homeowners had been in the home, they received a check each month from the utility company averaging \$100 per month. The chart below compares the homeowners' electric bills to those of homeowners in Artistic's Builders Challenge homes, and to owners of a code-built home. When compared to a code-built home, the zero energy home owner can expect to save about \$200/month in avoided utility costs plus reimbursements.

(left) Advanced framing with 2x6 24-inch on-center stud walls, 3-stud corners, and open headers, which use less lumber and provide more space for the R-21 blown insulation in the wall cavity.

(top right) Artistic increases the efficiency of its heating and cooling systems by putting ducts in conditioned space in a central chase down the main hallway.

Figure 2. Comparison of Utility Bill Data for a Code-Built Home, an Artistic Builders Challenge Home, and an Artistic Zero Energy Home



(bottom right) Techniques like the location of the air handler and furnace in the home's conditioned space, timed ventilation with a fresh air intake, extensive envelope air sealing, jumper ducts to balance indoor air pressure, and testing of each house for duct and whole house air leakage help to ensure a comfortable and healthy indoor air environment.

## Energy Efficiency

Wade noted that Artistic doesn't need to rely on esoteric or avant-garde gadgetry to achieve its high efficiency ratings. "We use off-the-shelf products. We are a production builder so what we build has to be reproducible and maintainable."

Energy efficiency features include R-21 blown insulation in the walls, R-38 blown insulation in the ceiling with wind baffles installed at the soffits vents (R-50 in zero energy home package), and high-efficiency windows. Artistic uses slab-on-grade construction with R-10 rigid foam insulation under the slab and R-5 rigid foam vertical insulation on the edges of the slab. Advanced framing techniques include 2x6 24-inch on center walls, California (3-stud) corners, and open headers, which use less lumber and provide more space for insulation in the wall cavity. Air sealing details include gasketing the sill plate and caulking or foam sealing all wiring and piping holes to minimize air leakage. Every home is tested by an independent HERS rater for whole house and duct leakage.

The biggest energy savings probably come from locating the ducts in conditioned space. Most of the home's heating and cooling registers come directly off a main duct trunk line that runs through a dropped ceiling in the hallway. The airhandler is located inside conditioned space in a utility room.

The zero energy package includes Schüco roof-mounted solar photovoltaic panels, a roof-mounted solar thermal water heater and 80-gallon storage tank, a 15-SEER air conditioning unit, a 9.0-HSPF heat pump, and R-50 ceiling insulation. The zero energy upgrade package yields a house that is 68% to 75% more energy efficient than a home built to code. The zero energy home upgrade also includes an energy recovery ventilator which provides steady circulation of fresh conditioned air through the home. The fresh air is cleaned by a HEPA filter and preheated or cooled by the energy recovery ventilator before sending it through the ducts. The energy recovery ventilator system helped Artistic's model zero energy home become the first home in New Mexico and one of the first in the country to meet the requirements of ENERGY STAR's new Indoor Air Quality certification.

Artistic is considering making energy recovery ventilators standard on every new Artistic home because Artistic's goal is to have every home it builds meet the ENERGY STAR Indoor Air Quality certification. Artistic also hopes to get its new homes to achieve EnergySmart Home Scale scores down to a HERS index of 40 to 48 in the upcoming year.

"The HERS index is the very best measuring stick we could use to see if we are improving. We use it for ourselves and we'd like to see other builders use it so homebuyers can compare," said Wade.

## The Bottom Line

Artistic is determined that net zero will not be an idealistic dream but a realistic possibility within the grasp of the average home buyer. Artistic is now offering a zero energy package to home buyers on any home it builds, with a net zero energy guarantee for heating, cooling, and plug load. Wade hopes in 3 to 5 years Artistic will be building only zero-energy homes.

"We are constantly looking at different technologies and making changes to make the homes more energy efficient and healthy. It's part of the evolution of our internal culture; we just want to be better than we were yesterday," said Wade.

**For additional information, contact:**

Theresa Gilbride  
theresa.gilbride@pnl.gov