U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2014 WINNER Housing Innovation Awards

New Town Builders

The ArtiZEN Plan
Denver, CO

BUILDER PROFILE

New Town Builders, Denver, CO
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: The ArtiZEN Plan
- Location: Denver, CO
- Layout: 3 bedrooms, 2.5 baths, 2 floors
- Conditioned Space: 2,115 ft^2
- Climate Zone: IECC 5B, cold
- Completion: September 2013
- Category: Production

Modeled Performance Data:

- HERS Index: without PV 38, with PV -3
- Projected Annual Utility Costs: without PV $1,414, with PV $5
- Projected Annual Energy Cost Savings (compared to a home built to the 2009 IECC): without PV $493, with PV $1,902
- Builder's Added Cost Over 2009 IECC: without PV $22,000, with PV $35,000
- Annual Energy Savings: without PV 8 MMBtu/yr, 2,588 kWh, 203 therms; with PV 48.5 MMBtu/yr, 14,476 kWh, 203 therms

New Town Builders has committed to a new way of building. The Denver area production builder hopes to convert all of its product lines to zero energy-ready construction by the end of next year.

"Our goal is to be 100% U.S. Department of Energy (DOE) Zero Energy Ready certified on all of our single-family homes," said Bill Rectanus, vice president of New Town Builders, which plans to build 150 single-family homes in the Denver metro area next year.

The builder constructed its first home to DOE's Zero Energy Ready Home program criteria in 2013 and has been gradually moving toward certification across the board since then. New Town was in the process of building 29 homes in its Solaris community when it learned about the DOE program. Most of the 29 homes in the first phase of Solaris are certified and all 34 homes in the next phase of Solaris will be certified. All of the homes come with at least a 2.75-kW photovoltaic system on the roof. In phase 2 the goal is to install 5-kW systems and homebuyers will have the option to add more PV to achieve a true net zero energy home, a home that produces as much power as it uses in a year.

In New Town's Z.E.N. (Zero Energy Now) community, which has 30 homes at or near completion and 33 more homes scheduled for a second phase, all of the homes are true zero energy. New Town is in the planning stages on two additional projects—Hyland Village, a development of 75 single-family detached homes, and Perrin's Row, a development of 26 attached homes. Both communities will be 100% DOE Zero Energy Ready.

ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY

The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

Raised heel energy trusses ensure that there will be plenty of room in the attic for a full R-50 layer of blown fiberglass insulation over the walls. The home's exterior walls consist of 9.5-inch-thick double-stud walls that are filled with R-40 worth of blown fiberglass insulation.

What makes a home a DOE ZERO ENERGY READY HOME?

1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0

2 **ENVELOPE**
meets or exceeds 2012 IECC levels

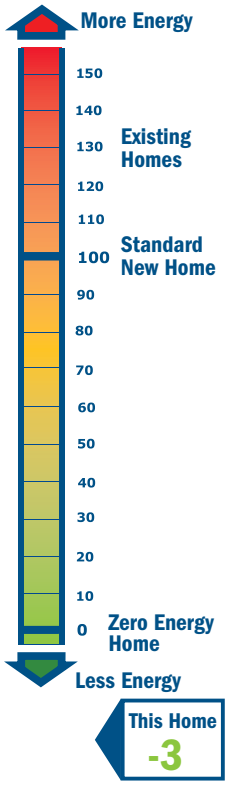
3 **DUCT SYSTEM**
located within the home's thermal boundary

4 **WATER EFFICIENCY**
meets or exceeds the EPA WaterSense Section 3.3 specs

5 **LIGHTING AND APPLIANCES**
ENERGY STAR qualified

6 **INDOOR AIR QUALITY**
meets or exceeds the EPA Indoor airPLUS Verification Checklist

7 **RENEWABLE READY**
meets EPA Renewable Energy-Ready Home.



To be certified as a DOE Zero Energy Ready Home, a builder must meet the requirements of ENERGY STAR Certified Homes Version 3.0, the U.S. Environmental Protection Agency's Indoor airPLUS and WaterSense programs, and the insulation requirements of the 2012 International Energy Conservation Code. In addition, DOE Zero Energy Ready certified homes have ducts in conditioned space, meet higher window criteria, and have renewables or "renewable-ready" measures installed that ensure the home is ready for solar photovoltaic and water heating when the homeowner is ready to purchase them.

The ArtiZEN plan, in New Town's Z.E.N. product line, provides a good example of how New Town achieves the DOE Zero Energy Ready Home certification. The home is built with double walls consisting of two 2x4 framed walls separated by 2.5 inches. After the exterior wall is sheathed with OSB, netting is stapled to the face of the inside studs creating a 9.5-inch-deep wall cavity that is filled with blown fiberglass insulation. Because the insulation runs as a continuous layer through the wall, there is no thermal bridging (the heat transfer through the studs that can happen between the home's interior and exterior).

Advanced framing techniques were employed on both walls to reduce the amount of lumber used and leave more room for insulation. These techniques included single rather than double top and bottom plates, 2-stud rather than 3-stud corners, 24-inch rather than 16-inch on-center stud spacing, insulated rather than solid wood headers over windows, and ladder blocking at interior-exterior wall intersections.

The attic is constructed with 14-inch-high raised heel "energy trusses" to ensure plenty of space for insulation at the eaves, just above the outer walls. A full R-50 of blown fiberglass blankets the floor of the vented attic. The home's conditioned basement was insulated to R-19 along the interior walls.

New Town paid extra attention to air sealing the home's building envelope. Spray foam was used to seal around windows, behind outlets, at bottom plates, and at any holes for wiring or plumbing. For extra assurance of airtightness, New Town applied a bead of pliable sealant product along the top plates of all walls bordering the attic and the garage before installing drywall. This nonhardening sealant spreads out when the drywall is screwed in place, forming an air-tight gasket. On the second floor, any exhaust fans, can lights, etc., that might typically be installed in the ceiling were installed in dropped soffits below the ceiling

All of the homes in New Town Builders' communities at the Stapleton development in Denver feature solar panels along with the energy-saving features specified in DOE's Zero Energy Ready Home program. The 8-kW PV system provides more than enough power to meet the annual energy needs of this energy-efficient home, making this a true net zero energy home.

drywall instead so that the ceiling drywall, which serves as the primary air barrier separating the house from the attic, could be kept intact and hole-free. Blower door testing of the home showed air leakage of only 2.11 air changes per hour at 50 Pascals pressure difference (ACH 50) between the inside and outside.

All of the home's windows are double-pane, vinyl framed, with low-emissivity coatings to reduce heat transfer. The windows have high insulation values of U-0.25 and low solar heat gain coefficients (SHGC) of 0.27. Generous roof overhangs minimize summer solar heat gain.

The home's heating system consists of a highly efficient ducted heat pump with a heating efficiency of 12.7 HSPF and a cooling efficiency of 19.8 SEER, high above the minimum federal standards of 7.7 HSPF and 13 SEER. On the rare days when the temperature drops below 5°F, a high-efficiency gas furnace is available to kick in.

A tankless water heater with an energy efficiency factor of 0.947 provides hot water. The tankless water heater employs a "smart" recirculating system that learns the occupants' behavior and initiates the pump at times of high use throughout the day. A drip irrigation system minimizes water use outside.

All of the home's lighting uses energy-efficient compact fluorescent lamps and all of the appliances are ENERGY STAR rated.

The 2,115 ft^2, 3-bedroom, 2.5-bath, 2-story home achieves a Home Energy Rating System (HERS) score of 38 without PV panels and would save its homeowners about $493 in energy bills compared to a home built to the 2009 IECC. When 8.0 kW of PV panels are added to the roof, the home achieves a HERS score of -3 and saves its homeowners a whopping $1,902. For comparison, a home built to the 2009 IEEC code would score about a HERS 85.

The home also meets all of the healthy indoor air requirements of the EPA's Indoor airPLUS program, including moisture-management measures, ventilation requirements, and low- or no-VOC criteria.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

ENERGY STAR

Building America U.S. Department of Energy

Every DOE Zero Energy Ready Home combines a building science baseline specified by ENERGY STAR Certified Homes with advanced technologies and practices from DOE's Building America research program.

The high-efficiency double-pane, vinyl-framed windows have low-emissivity coatings and low solar heat gain coefficient ratings and are protected by generous overhangs to reduce unwanted heat gain.

The home is a poster child for the green slogan "recycle, reuse, reduce," starting with its location in the Stapleton area of Denver. Once home of the old Denver International Airport, the 6,500-acre site has been recycled into a planned community of schools, shopping, and over 8,000 homes. Developers have crushed over 6 million tons of run-way concrete to reuse as roadways, bridges, and bike paths. The eight home builders at Stapleton have committed to meeting at least ENERGY STAR 3.0 certification, which means their homes will reduce energy use at least 30% compared to a typical new home in Denver. New Town's homes will reduce energy use by 85% compared to typical homes.

New Town Builders has gone further, committing to framing all of its homes with Colorado beetle kill lumber, which is wood harvested from trees that have been killed by beetles, leaving a blue fungus that stains the wood. "It's actually a great framing material because it's been dried in the Colorado sun before going to a local mill for cutting, so it stays very straight and true after installation," said Rectanus.

New Town Builders works closely with all its trade partners to negotiate fair prices with partners while keeping home costs competitive for homebuyers. To help its subcontractors, New Town provides detailed scopes of work and project specifications. Energy-efficiency details are included on each plan set and New Town is committed to providing continued training to its staff and trade partners. Every home also receives two third-party inspections—from the energy rater and from an additional construction quality assurance company.

"Building to DOE's Zero Energy Ready Home certification drives us to pay attention to the details that enable us to provide a more durable, high-quality home. Moving forward, New Town is positioning itself as the area's leading zero energy home builder. "100% compliance with the DOE Zero Energy Ready Home program helps us to achieve that consistency across all of our projects and product types. We appreciate the third-party validation that comes from partnering with DOE," said Rectanus.

Photos courtesy of New Town Builders.

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance
- **Walls:** Double walls 2x4 advanced-framed with 9.5 inches blown fiberglass (R-40.7)
- **Roof:** Vented attic with R-50 blown fiberglass attic insulation, 14-in. raised heel energy truss
- **Foundation:** Conditioned basement with R-19 interior wall insulation
- **Windows:** Dual-pane, low-e, vinyl framed, U=0.25, SHGC=0.27
- **Air Sealing:** 2.11 ACH 50
- **Ventilation:** Exhaust only: 71 cfm, 15 watts
- **HVAC:** Ducted heat pump 12.7 HSPF, 19.8 SEER, 97.3 AFUE backup gas furnace
- **Hot Water:** 0.947 EF tankless water heater
- **Lighting:** 100% CFL
- **Appliances:** All ENERGY STAR
- **Solar:** 8.0-kW PV
- **Water Conservation:** WaterSense compliant fixtures, recirculation pump
- **Other:** Beetle kill wood

PNNL-SA-105477 September 2014