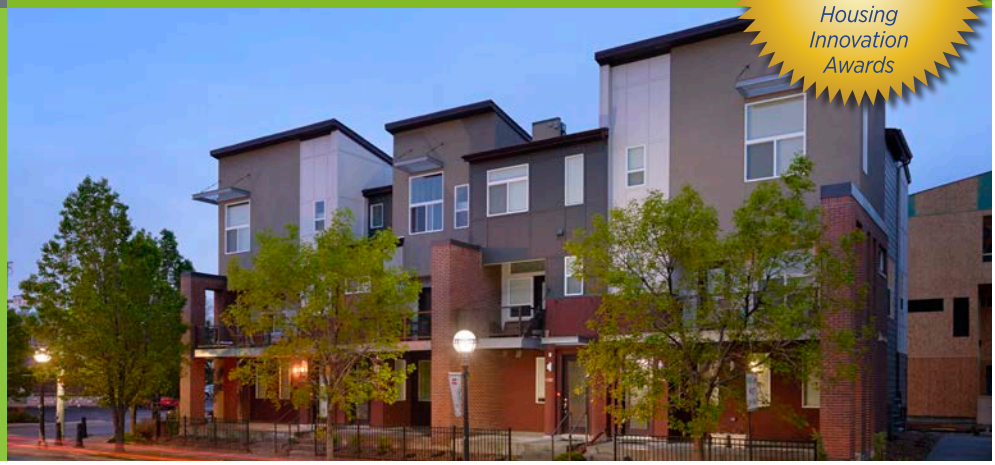
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2015 WINNER Housing Innovation Awards

New Town Builders

Town Homes at Perrin's Row Wheat Ridge, CO



BUILDER PROFILE

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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Town Homes at Perrin's Row
- Location: Wheat Ridge, CO
- Layout: 2 bedrooms, 2 baths, 3 floors
- Conditioned Space: 1,166-1,646 ft^2
- Climate Zone: IECC 5B, Cold
- Completion: December 2015
- Category: Multifamily

Modeled Performance Data:

- HERS Index: without PV 54, with PV 28
- Projected Annual Utility Costs: without PV $992, with PV $469
- Projected Annual Energy Cost Savings (compared to a home built to the 2009 IECC): without PV $171, with PV $682
- Builder's Added Cost Over 2009 IECC: without PV $7,937, with PV (no additional cost)
- Annual Energy Savings: with PV 116 kWh, 161.5 Therms; without PV 4,607 kWh, 161.5 Therms

New Town Builders' Perrin's Row town homes rise three stories above the street level in this 26-unit urban infill project along a busy corridor in the Denver suburb of Wheat Ridge. They also rise above the older one-and two-story homes in terms of energy efficiency. The town homes were built to the rigorous energy efficiency requirements of the U.S. Department of Energy's Zero Energy Ready Home program. "The DOE program has really helped us to differentiate in the marketplace. It is great third-party verification and DOE validation that we are standing above other builders around us," said Bill Rectanus, vice president of operations for New Town Builders.

This is New Town Builders' first town home project certified to the DOE Zero Energy Ready Home program, but the Denver-based production builder has certified more than 68 single-family homes to the DOE Zero Energy Ready Home program since joining the program in 2012. New Town Builders won DOE Housing Innovation Awards in 2013 and 2014 for homes constructed at Denver's Stapleton community.

The two-bedroom, two-bath, 1,457 ft^2 homes are expected to save their home owners nearly $700 per year in energy bills and should achieve Home Energy Rating System (HERS) scores of 54 without solar energy systems or 28 when the 3.0-kW solar photovoltaic system is installed on the roof of each unit.

Every unit will be certified to the DOE Zero Energy Ready Home program, which requires homes to meet all of the requirements of ENERGY STAR Certified Homes Version 3.0 and the U.S. Environmental Protection Agency's Indoor airPLUS, as well as the hot water distribution requirements of the EPA's WaterSense program and the insulation requirements of the 2012 International Energy Conservation Code. In addition, homes are required to have solar electric panels installed or have the conduit and electrical panel space in place for it.

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.

Roof-top solar panels help New Town Builders of Denver, Colorado, achieve average Home Energy Rating System (HERS) scores of 28 on this 26-unit town home community in the Denver suburb of Wheat Ridge. New Town specified fire retardant siding and shingles for Perrin's Row. In addition, the project was constructed to accommodate 100-pound-per-square-foot snow loads and wind resistance for 100 mile per hour gusts.

What makes a home a DOE ZERO ENERGY READY HOME?

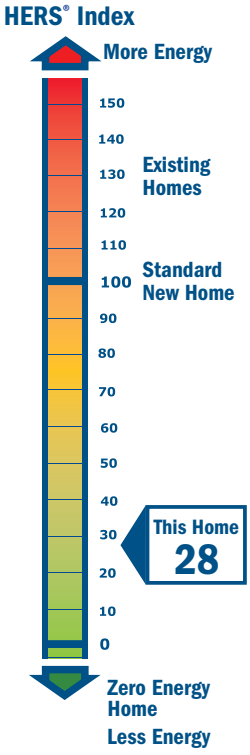
1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0

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.

New Town Builders started construction of the high-performance building envelope with a slab-on-grade foundation that is wrapped in R-10 rigid XPS foam slab edge insulation to provide an insulating barrier down to the footer.

The 2x6 framed walls were built using advanced framing techniques including 24-inch on center stacked framing with single-top plates, two-stud open corners, right-sized headers, and open-framed interior-exterior wall intersections. These techniques create a well-insulated thermal envelope with an R-value of R-23 by maximizing the space within the wall available for insulation while reducing both thermal bridging and lumber use. The lumber used for framing on this project was locally milled beetle kill lumber harvested from standing dead trees in the Colorado mountains.

Perrin's Row was New Town's first town home project to utilize a liquid-applied weather-resistant barrier. The asphalt emulsion product is applied to the OSB sheathing with a sprayer similar to a paint sprayer. To ensure the seams in the OSB are thoroughly air sealed, the installer applies 6-inch-wide felt strips over all seams then covers the strips with additional sprayer-applied coating, then coats the entire building. The same felt and spray can be used to make window pan flashing as an alternative to high butyl window wrap tape. A head flashing is integrated with the product above windows. The fluid-applied barrier, along with comprehensive counter flashings, ensures a continuous barrier against exterior bulk moisture while the vapor permeability allows the two-way drying important in the Denver climate.

Although the product is more expensive than traditional house wrap, New Town Builders felt that the advantages were worth it in terms of its consistent, seamless coverage and its durability both for the long term and during construction in Denver's challenging, changeable weather. New Town noted that the product is also easily inspected for proper installation.

In this project New Town also switched from blown cellulose insulation to loose-fill fiberglass, citing potential improved performance from less settling over the long term and the desire to offer a material manufactured from recycled glass bottles.

Perrin's Row has vented attics that are insulated with R-50 of blown fiberglass insulation. Truss heel heights are raised to 14 inches to maximize the insulation depths to the outside edge of the top plate. The top plates are air sealed using a

Blown fiberglass fills the wall cavities of the advanced framed home. Rigid metal HVAC ducts are installed between floors to keep them within the conditioned space of the home. New Town Builders selected windows that are ENERGY STAR qualified, double-pane, argon-filled, and vinyl-framed with a U-factor of 0.30 and a SHGC of 0.30.

long-lasting sprayer-applied gasketing caulk installed at all top plate-attic ceiling junctions. This step reduces air infiltration at one of the homes' most leak prone areas. All can lights are airtight and additionally sealed with caulking to the drywall air barrier.

The roof decks are protected with a self-adhering ice and water shield extending from the roof edge 3 feet in (a minimum of 24 inches past the wall line) and at all valleys. The deck is covered with a waterproof underlayment and 30-year asphalt shingles. In addition, all roof edges are protected with a metal drip edge.

New Town Builders' vigorous air sealing program, which included sealing of all top plates, closed-cell foam at all rim joist areas, detailed foam sealing at all penetrations, and the additive air sealing benefits of the sprayer-applied weather-resistant barrier, resulted in an average airtightness across all units of 2.48 air changes per hour at 50 Pascals pressure difference (ACH 50). Every unit was tested and showed individual airtightness numbers that were below 3.0 ACH 50, surpassing both the ENERGY STAR and 2012 IECC airtightness standards.

The ventilation strategy for this project included continuous exhaust ventilation using ENERGY STAR-labeled exhaust fans. Each unit was individually tested to insure compliance with ASHRAE 62.2 residential ventilation standards. The town home's 3-story designs lent themselves to natural ventilation with operable windows on all three levels taking advantage of the stack effect to bring in fresh air from the entry level through shaded windows and to allow warm air to escape from third-floor windows. First-floor patios and private second- and third-floor decks encourage this use of fresh air ventilation.

The HVAC systems include high-efficiency 92.1 AFUE gas furnaces and 13 SEER air conditioners with metal ducts and returns located within the conditioned space and sealed with mastic. A .95 efficient gas tankless water heater supplies continuous hot water. The unit is plumbed with a recirculation loop that employs intelligent technology that recognizes hot water use patterns and charges the main recirculation loop to save water while providing rapid hot water delivery to the home owner.

The design of the Perrin's Row buildings includes well-placed efficient expanses of windows to provide natural light while reducing the need for electronic lighting. The homes are equipped with 100% CFL lighting to minimize overall energy use. ENERGY STAR appliances and water-saving plumbing fixtures

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

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 black asphalt emulsion coating provides a seamless weather-resistant barrier on the exterior of the homes and windows.

labeled by the U.S. Environmental Protection Agency's WaterSense program add to energy and water savings in each unit.

To help offset electrical use, a 3.0-kW solar photovoltaic system is included on each town home. These units are leased through a solar leasing program with a national company. The renewable energy provides home owners with a substantial financial savings on their utility bills. Each resident received an internet-based live monitoring system that tracks their solar system production and the home's overall electric consumption. This information helps home owners better understand energy use and track how their behavioral changes can improve the home's overall efficiency while reducing energy costs.

The Perrin's Row town homes are built to meet the specifications of the EPA's Indoor airPLUS Program, which helps provide healthy indoor air. Each home is constructed with low-VOC paints, low-formaldehyde wood products, fresh air ventilation, sealed and cleaned air ducts, and a passive radon mitigation system. These features, among other IAP requirements, provide the residents in these town homes with comprehensive indoor air quality protection.

Perrin's Row is an urban pioneering project. No significant new residential construction had occurred in the vicinity within the last 40 years or more. Surrounding home prices were approximately $120 per square foot. In order to justify new construction, New Town needed the sales prices to be over $200 per square foot. Because of the density of the project, 26 units on 1.35 acres, New Town Builders was actually able to offer the homes at considerably less than many single-family detached homes in the area. "Our assumed value proposition for the project was that Perrin's could offer significantly less expensive homes (by almost $100,000), much more energy efficient homes (Zero Energy Ready standards), and a better school district than nearby areas in Denver," said Rectanus.

While meeting the DOE Zero Energy Ready Home specifications contributed significantly to the homes' performance, New Town estimated that the improvements added only $6 per square foot to the construction budget.

That modest added cost is just one of the reasons Rectanus is enthusiastic about the DOE program. "We think the DOE Zero Energy Ready Home program is the best program out there for residential construction. This program lends itself to the things that are most meaningful to home buyers and their families, in terms of energy efficiency, indoor air quality, and comfort."

Photos courtesy of New Town Builders

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance
- **Walls:** Advanced framing; 2x6; 24″ on center; single top plates; two-stud corners; insulated headers; blown-in fiberglass (R-23); asphalt spray-on weather-resistant barrier and seam sealer.
- **Roof:** 3′ ice and water shield; waterproof underlayment; 30-year shingles; metal drip edge.
- **Attic:** Vented; 14″ raised heel trusses; spray on gasket at top plates; blown-in fiberglass (R-50); closed-cell foam at rim joists.
- **Foundation:** Rigid foam under slab (R-10); XPS at slab edge.
- **Windows:** Double-pane; argon-filled; vinyl-framed; low-e; U=0.30; SHGC=0.30.
- **Air Sealing:** 2.48 ACH 50.
- **Ventilation:** Exhaust fan.
- **HVAC:** 92 AFUE furnace; 13 SEER AC.
- **Hot Water:** 95% efficient tankless water heater.
- **Lighting:** 100% CFL.
- **Appliances:** ENERGY STAR-rated refrigerator and dishwasher.
- **Solar:** 3.0 kWh.
- **Water Conservation:** All EPA WaterSense-rated fixtures; hot water recirculation pump; smart controls; drought-tolerant plants; drip irrigation.
- **Other:** Energy management system; low-VOC.

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