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 for Homes Version 3 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.
against natural disasters. All of these features are confirmed through testing and inspection by an independent verifier and the home’s performance is modeled to calculate a Home Energy Rating System (HERS) score. New Town’s first DOE Zero Energy Ready Home received an impressive score of HERS 41; in comparison, a new home built to the 2006 IECC would score 100 and most existing homes score above 120. With photovoltaic panels added to the roof, New Town’s Zero Energy Ready Home scores a HERS 3, with annual energy costs of negative $89.

To achieve these impressive scores, New Town focused first on the building envelope—the home’s walls, roof, and foundation. “The envelope is key. You need to build the tightest, most well insulated envelope that you can get,” said Rectanus. One notable thing about New Town’s construction is that they were able to achieve extraordinary performance levels with fairly ordinary construction materials. “I think the remarkable thing about our envelope is that it is simple. It is built with standard construction materials that are used onsite every day. We are not having to retrain our subcontractors to use some new, high-tech product. These are standard building materials that are used every day that the contractors are familiar with,” said Rectanus. He estimated that the envelope costs only added about $3 per square foot over costs for a home built to the builder’s standard, which exceeds code.

The builder chose 2x4 stick frame construction but instead of building one wall, they built two. The second 2x4 walls sits 2.5 inches in from the first wall, a technique known as double-wall construction. The outside wall is sheathed with OSB and the interior side of the inside wall is covered with netting forming a 9.5-inch wall cavity that was filled with blown-in fiberglass insulation providing an R-36 wall. The studs are separated by insulation and further separated by staggering their locations along each wall to prevent the thermal bridging that can happen when heat is transferred from inside to outside through the studs in a standard stud wall. The studs were spaced 24 inches apart and other advanced framing techniques including two-stud corners, open headers, and reduced framing at windows were employed to reduce lumber costs while allowing more space for insulation. The OSB sheathing is covered with housewrap and lapped fiber-cement siding. “This wall works well for our climate zone,” said Rectanus, “And every framer in town knows how to frame a 2x4 wall, so it helped us reach a competitive price point.”

New Town uses a standard vented attic with the insulation laid on the ceiling deck; however, they employ a raised heel truss, which raises the roof slightly above the
walls so that in the critical area at the eaves there is more space to pile insulation above the top of the outside walls. New Town has been using a 10-inch raised-heel truss for years. For the DOE Zero Energy Ready Home, they increased the heel height to 14 inches, allowing room for a full R-50 of blown-in fiberglass insulation to completely cover the attic floor all the way to the edges of the attic space.

The 9-foot-ceiling basement, within the conditioned space, is constructed with standard 8-inch poured concrete with damp-proofing sprayed onto the exterior of the wall and a capillary break between the footer and the foundation wall. Unfinished walls are insulated on the inside with an interior R-19 perforated vinyl drape, which New Town has had success with for several years in Denver’s dry climate. The finished areas are framed with 2x4 wood studs and insulated with R-19 fiberglass batt insulation, then finished with drywall.

The windows are double-pane, argon-filled, and vinyl-framed, with an insulation U factor of 0.28 and a solar heat gain coefficient (SHGC) of 0.22. The windows have a low-emissivity coating that reduces heat loss during the cold Colorado winters and helps control heat gain during the sun-intense summers.

Blower door testing was conducted by an independent HERS rater to determine how much air leaks in and out of the building envelope (which is one measure of its energy performance). The DOE Zero Energy Ready Home tested at 2.11 air changes per hour at 50 Pascals pressure (ACH50), well within the 4 ACH50 required by code.

Although New Town came up with a fairly simple wall design, some sophisticated building science went into the decision making process. New Town Builders ran WUFI modeling analyses on several potential wall designs to look for potential moisture issues and determine insulation effectiveness.

This building science sophistication applied to the whole house design. “The lesson we learned is that you really need to concentrate on the house as a whole system,” said Rectanus. “You need to start from the beginning with the integrated design process. This is crucial to being able to build the most effective energy-efficient home and to most easily meet the specifications of DOE Zero Energy Ready Home program.” New Town worked with several consultants who ultimately ran nine different scenarios through HERS software as well as 27 separate scenarios through the Passive House Planning Package design tool.

The building science center within the company’s sales office compares New Town’s advanced framing techniques, raised heel trusses, insulation, and air sealing with a typical Denver resale home. The buyer can actually see the difference between a high-performing zero-energy home and a typical existing home.

**HOME CERTIFICATIONS:**

- DOE Zero Energy Ready Home
- ENERGY STAR Version 3
- EPA Indoor airPLUS

New Town Builders won two prestigious awards in 2012: the Green Home of the Year from Green Builder Magazine and the Denver Home Builders Association’s Major Achievements in Marketing Excellence (MAME) award for Green Home of the Year.
New Town chose a conventional gas furnace and central air conditioner but selected high-efficiency models – a 97.4% AFUE furnace and a 16 SEER air conditioner – that are well above the minimum standard levels of 80% AFUE and 13 SEER. The furnace and air conditioner are located in the basement and are right-sized using the Air Conditioning Contractors of America’s Manual J sizing calculations. All ducts are sized according to ACCA Manual D. The ducts are located in conditioned space and are air sealed to ENERGY STAR specifications. Testing shows these ducts leak less than 4 cfm/100ft² of conditioned floor area.

Over two decades of experience have taught New Town the value of considering duct layout early in the design process so that duct runs can be integrated into framing plans while there is an opportunity to make modifications if needed to allow for the shortest, most direct ducting possible. This, together with right sizing of the system, helps ensure the most efficiency and best performance in terms of comfort from the HVAC equipment. “It is essential to complete detailed duct planning and layouts in advance. It goes back to the integrated design process,” said Rectanus.

The tankless water heater (0.94 EF) provides hot water. The builder chose PEX (cross-linked polyethylene) piping for the water distribution system, citing its noise dampening, corrosion resistance, and condensation prevention properties. An on-demand recirculation feature installed in the furthest upstairs bath allows the homeowner to get nearly instantaneous hot water at the fixtures with the push of a button.

For ventilation, a continuously operating exhaust fan in a first-floor hallway meets the residential ventilation criteria of ASHRAE 62.2 as it pulls stagnant air and moisture out of the house. This and other features ensure that the home meets the indoor air quality requirements of the EPA’s Indoor airPLUS Verification Checklist.

New Town installed a 9.5-kW solar photovoltaic panel system on the roof of the Zero Energy Ready Home, which covers nearly all of the home’s remaining electric use, bringing the home’s HERS score down to 3.

Several homebuyers at Stapleton have already selected the zero energy package. New Town is building two series of homes at Stapleton. The Solaris II series comes standard with a 2.75-kW solar system and earns HERS scores in the low 40s to high 30s. They offer a zero energy option on this series with increased envelope specs and a 9.5-kW solar system to bring the designed HERS score down to zero. The winning Zero Energy Ready Home was one of these. New Town also offers their Z.E.N. (zero energy now) series homes, which have HERS scores of 40 with no solar. Adding 7 to 8 kW of solar to these homes brings the HERS scores down to zero. New Town has committed to 100% Zero Energy Ready Home for both series moving forward.

“One thing we are really proud of is the way that we have been able to put together this package where we can offer zero energy on every home in a production atmosphere at an affordable cost,” said Rectanus.