

# Mantell- Hecathorn Builders

Shenandoah Circle  
Durango, CO



## BUILDER PROFILE

Mantell-Hecathorn Builders, Durango, CO  
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## FEATURED HOME/DEVELOPMENT:

### Project Data:

- Name: Shenandoah Circle
- Location: Durango, CO
- Layout: 4 bedrooms, 4 baths, 2 floors, finished basement
- Conditioned Space: 3,841 ft<sup>2</sup>
- Climate Zone: IECC 5B, cold
- Completion: September 2014
- Category: Custom

### Modeled Performance Data:

- HERS Index: without PV 50, with PV 21
- Projected Annual Utility Costs: without PV \$4,343, with PV \$1,677
- Projected Annual Energy Cost Savings (compared to a home built to the 2003 IECC): without PV \$2,803, with PV \$5,519
- Builder's Added Cost Over 2003 IECC: without PV \$75,000, with PV \$100,000
- Annual Energy Savings: without PV 5,449 kWh, 118 MMBtu; with PV 16,139 kWh, 118 MMBtu

Colorado has not adopted a state-wide energy code since the 2003 International Energy Conservation Code (IECC) so, in small towns such as Durango, builders like Greg Mantell-Hecathorn who build to the criteria of the U.S. Department of Energy's Zero Energy Ready Home program are far beyond the competition.

Greg started constructing homes in Alaska in 1975, then moved to the highly regulated construction environment of California in 1987. After 19 successful years, Greg and his wife and business partner Tara moved their business, Mantell-Hecathorn Builders, to Durango. They continue to operate as a family-run business, now joined by son Hunter who worked his way up to become vice-president in 2010.

To show the local community what could be done in terms of energy efficiency, Mantell-Hecathorn built a \$1.8 million spec house that was certified to ENERGY STAR and Built Green Colorado, and earned Mantell-Hecathorn the title of custom home builder of the year for 2009 from the Colorado Built Green program.

"It sold within 3 months of going on the market, while many comparable homes sat for 3 years," said Greg. Greg became president of the local home builders association in 2009. He and Tara created a sustainable building program for local builders and hosted 35 events that year to promote building science. They invited Sam Rashkin, a chief architect for DOE's Building Technologies Office, to come and speak, along with other nationally known building scientists. "We hoped to raise the bar for the city, county, builders, appraisers, and the real estate community; to make them aware of benefits of energy-efficient housing."

In 2013 Greg, Tara, and Hunter heard Sam Rashkin speak about the DOE Zero Energy Ready Home program at the Energy and Environmental Building Alliance (EEBA) national conference in Phoenix. They had been building to ENERGY STAR since 2008 and realized they were already doing much of what



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.

Mantell-Hecathorn Builders built this 3,841-ft<sup>2</sup> mountain home in Durango, Colorado, to the criteria of the U.S. Department of Energy Zero Energy Ready Home program. The home's stone and stucco siding and metal roof fit into the natural setting and also provide a fire-resistant exterior.



## 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

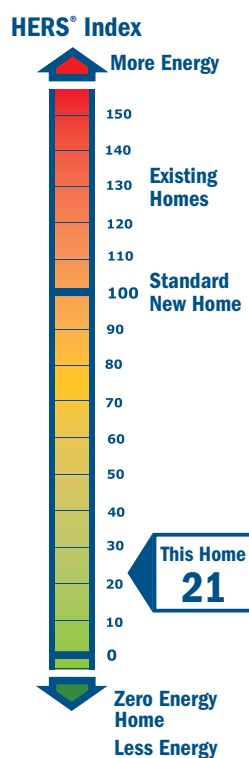
**3 DUCT SYSTEM**  
located within the  
home's thermal  
boundary

**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.



was required. They committed to building all of their custom homes to the DOE program. This home at Shenandoah Circle is their first DOE Zero Energy Ready Home. They have since completed two more and are working on a fourth.

The DOE Zero Energy Ready Home program 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 (IECC). In addition, homes are required to have solar electric panels installed or have the conduit and electrical panel space in place for it.

Greg said "We definitely recommend the DOE program to other builders. "We have a backlog of jobs. I think that puts some pressure on other builders to step up their game. Once we get word out of what we've done, it will hopefully bring other builders on board."

Local adoption by other builders has been slow. Only a handful of production builders construct to ENERGY STAR and custom builders have been reluctant to certify to it. There has been considerable resistance to adopting the 2009 or 2012 IECC at the city and county level, said Greg, who noted that the city is on the 2006 IECC and the county is on the 2003 code. Greg and Hunter are hoping more stringent codes are adopted because "it will force the subcontractors to raise the bar across the board. Everybody is forced to do a better job." They noted "Our subs know they will have an independent third-party inspection on everything they do."

While the local building community has been somewhat reluctant to adopt higher performance construction, customers are delighted. "They are often amazed at how comfortable they can be at 9,000 feet, even when they have a chair next to the window. The lack of utility bills is another surprise. Their neighbors are using 800 gallons a month of propane and our home owners are using next to none. All of a sudden, they have bragging rights," said Greg.

The award-winning home achieved a Home Energy Rating System (HERS) score of 50 without PV or 21 when a 6.3-kW PV system was added. This should provide estimated annual energy savings of \$5,519 compared to the local code (the 2003 IECC).





The 2x6 advanced framed walls were covered with a taped, coated sheathing and a mesh rain screen that provides a drainage plane and ventilation gap behind the stucco and stone exterior. Ice-and-water shield protects the edges and valleys of the roof while a three-layer vapor-permeable roof underlayment provides an air and water barrier. Standing seam metal roofing and 6.3 kW of solar panels were installed. The solar electric system should cut annual utility bills by \$2,600.

To achieve this performance level, Mantell-Hecathorn Builders starts with insulated concrete form (ICF) basement foundation walls. The ICFs consist of two layers of rigid expanded polystyrene (EPS) foam sandwiching an inner core of poured concrete for an R-value of 22. On the interior of the basement wall, they constructed a 2x4 24-inch on-center framed wall and insulated it with fiberglass batts for an additional R-13, resulting in a total below-grade wall insulation value of R-35. Under the basement slab, they laid 8 inches of washed rock then installed a passive radon mitigation system consisting of a perforated radon pipe set into the gravel and connected to vertical solid pipe risers installed in the interior walls. Over the gravel, they laid a 15-mil, sealed radon vapor barrier membrane, then for 4 inches (R-20) of rigid foam.

The walls are 2x6 24-inch on-center advanced framed walls with 2-stud corners, ladder blocking, and spray foam-insulated headers to allow more room in the walls for the 2 inches of closed-cell spray foam (R-13) and 3.5 inches of loose-fill blown-in fiberglass (R-13), which is held to the studs with netting. A bead of construction adhesive forms an airtight seal between the subfloor and the bottom plate. The walls are sheathed with a coated OSB product that is taped at the seams with a proprietary air sealing tape. The builders installed 2 inches of high-density rigid foam (R-10) over the sheathing then installed a 10-mil mesh rain screen over that. Metal flashing was installed at the foundation and weep screed was installed at the transition of stucco to stone.

The vented attic was framed with 16-inch raised-heel trusses and engineered joists. The attic is vented with continuous soffit strip vents and a continuous ridge vent. Vent baffles in each rafter bay direct ventilation air to flow up the underside of the roof line while keeping the loose-fill insulation from falling through the vents or being pushed away from the eaves by wind. The area where the baffles meet the top plates was insulated and air sealed with R-63 worth of spray foam. All penetrations through the ceiling drywall, for can lights, wires, and pipes, etc., were meticulously air sealed with canned spray foam and caulk. The flat parts of the ceiling, which included everything but the living room and breezeway, were insulated with R-60 of blown fiberglass. The vaulted ceilings were insulated with 8 inches of closed-cell spray foam and R-30 unfaced fiberglass batts snugly fitted against the spray foam.

The home's American-made triple-pane casement windows have an aluminum-clad exterior and prefinished interior pine jamb. The glass has an invisible low-

## HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

EPA WaterSense



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.



A heat recovery fresh air system runs 24/7 to help create an indoor environment that's almost as healthy as the setting.

emissivity metal coating to minimize heat transfer. There is no argon gas fill between the panes due to the home's high altitude. The windows have an insulating U-factor of 0.24 and a solar heat gain coefficient (SHGC) of 0.38.

The attention to air sealing helped the builders to achieve an airtight home. Third-party blower door testing confirmed that the home had only 1.11 air changes per hour at 50 Pascals (ACH 50). To bring in fresh air the builder installed a heat recovery ventilator (HRV). The HRV was installed as a stand-alone system with its own ducting system to provide fresh air to the bedrooms and living areas while removing stale, moist air from the bathrooms and kitchen. The unit has a MERV 13 filter and operates 24/7 to satisfy ASHRAE 62.2 whole house ventilation rates.

A 96% efficient propane furnace and 13 SEER air conditioner were installed. All ducting is R-8 insulated, mastic-sealed rigid metal ducting that is installed in conditioned space, except some return ducts, which are encapsulated in 2 inches of closed-cell spray foam and buried in blown-in fiberglass in the attic.

The home's hot water is provided by an 80-gallon electric tank water heater with an energy factor rating of 95. A hot water recirculation pump minimizes the amount of stored water in the line. The pump is occupant-controlled and has a timer. All of the bathroom fixtures carry an EPA WaterSense label indicating water efficiency.

To add to energy and water savings all of the home's appliances are ENERGY STAR certified. Mantell-Hecathorn installed all energy-efficient lighting: 80% of the fixtures are LED based and 20% are CFL based.

Mantell-Hecathorn takes indoor air quality seriously, for the home's occupants and for the workers themselves. "Back in 1999 I had hairy-cell leukemia. I have no doubt it was due to the chemicals I was exposing myself to as a young builder in Alaska," said Greg. All construction materials are low VOC, with no added urea-formaldehyde. Non-toxic building products are specified, from glues and mastics to cabinets, finishes, and paints. Mantell-Hecathorn began certifying homes under the EPA Indoor AirPLUS program even before they joined the DOE Zero Energy Ready Home program. They seal off the new HVAC and HRV systems until the home is professionally cleaned of construction dust and final debris prior to starting the HVAC systems. They use a separate job site furnace and supplemental heaters if needed during construction. After cleaning, the HRV is run for a month to completely air out the home before occupancy. They also spray closed-cell foam at the wall interface of the house and garage and install an ENERGY STAR exhaust fan in the garage with a motion sensor to remove car exhaust.

*Photos courtesy of Mantell-Hecathorn Builders*

## KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 2x6; 24" on center; 2 stud corners; ladder blocking; foam-insulated headers; 2" closed-cell spray foam (R-13); 3.5" blown-in fiberglass; coated OSB sheathing; 2" exterior rigid foam (R-10); rain screen; stucco and stone.
- **Roof:** Standing seam metal; ice and water shield at valleys; breathable underlayment.
- **Attic:** Vented; 16" raised heel trusses; spray foam sealed baffles; baffles; 24" loose-fill fiberglass at attic floor (R-65); 7" closed-cell spray foam; unfaced fiberglass batts at vaulted ceiling (R-30); all penetrations sealed with caulk or spray foam.
- **Foundation:** ICF below-grade walls (R-22); interior stud framing; fiberglass batt (R-13); rigid foam under slab (R-20); 15-mil vapor barrier under foam; 8" rock with passive radon pipe.
- **Windows:** Triple-pane; aluminum-clad; low-e; U=0.24; SHGC=0.38.
- **Air Sealing:** 1.11 ACH 50.
- **Ventilation:** Continuous HRV; MERV 13 filter.
- **HVAC:** Rigid metal ducting; 96 AFUE furnace; 13 SEER AC.
- **Hot Water:** 95% efficient electric tank; recirculating pump.
- **Lighting:** 80% LED, 20% CFL.
- **Appliances:** ENERGY STAR-rated refrigerator and dishwasher.
- **Solar:** 6.3 kW.
- **Water Conservation:** Low-flow fixtures.
- **Other:** No formaldehyde; pre-wired for electric car charging; low-VOCs. iPad-based controller for HVAC.