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

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2016 WINNER *Housing Innovation Awards*

Garbett Homes

The Chandler at Little Cottonwood Canyon Sandy, UT

BUILDER PROFILE

Garbett Homes, Salt Lake City, UT
Damian Mora, damian@garbetthomes.com
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Rater: Provident Energy Inc.
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: The Chandler at Little Cottonwood Canyon
- Location: Sandy, UT
- Layout: 4 bdrm, 3 bath, 2 fl + bsmt, 5,226 ft²
- Climate Zone: IECC 5B, cold
- Completion: October 2015
- Category: custom spec

Modeled Performance Data:

- HERS Index: without PV 46
- Projected Annual Energy Costs: without PV $1,602
- Projected Annual Energy Cost Savings (vs home built to 2006 IECC): without PV $702
- Projected Annual Energy Savings: without PV 133 kWh
- Added Construction Cost: $15,000

Production home builder Garbett Homes won a 2016 Housing Innovation Award from the U. S. Department of Energy for this 5,226-ft² home constructed to the high performance requirements of the U.S. Department of Energy's Zero Energy Ready Home program. The home is Garbett's second DOE Housing Innovation Award winner and second home constructed to the DOE Zero Energy Ready Home program requirements. Garbett plans to build 14 more certified homes in its Treseder development located in Little Cottonwood Canyon, in Sandy, Utah, 25 miles southeast of Salt Lake City.

The builder, who has been constructing homes in the Salt Lake City area since 1983, began certifying all of its homes to the ENERGY STAR Certified Homes program criteria in 2008. ENERGY STAR certification is the first step in the DOE Zero Energy Ready Home program. DOE ZERH also requires that homes be certified to the U.S. Environmental Protection Agency's Indoor airPLUS program. In addition, homes must meet the hot water distribution requirements of the EPA's WaterSense program and the insulation requirements of the 2012 International Energy Conservation Code. Homes must also have solar electric panels installed or have the conduit and electrical panel space in place for future installation.

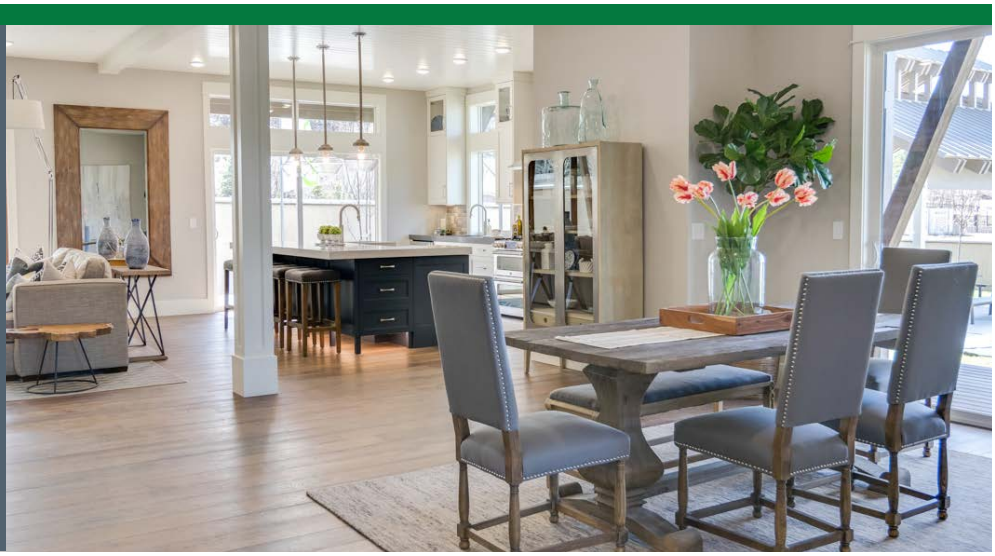
With its 2013 award winner, Garbett did install solar photovoltaic panels on the roof that produced enough power to meet all of that home's energy needs for the year, making that home the first net zero energy home in Utah. The 2016 home was prewired for solar panels and the roof was constructed to support their weight, although they have not yet been installed.

This house and all of the house sites in the development were situated so that the long axis of the homes will run east-west affording large south-facing roof areas for solar panel installation. The homes were designed with many south-facing

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.

Garbett Homes built this 5,226-ft² house at Little Cottonwood Canyon, Sandy, Utah, to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. The home meets the EPA Indoor airPLUS requirements, including the use of low- or no-VOC structural wood products, primer, paint, cabinets, and flooring. For further energy savings, all of the home's lighting is provided by LEDs. The home also has ENERGY STAR appliances and ceiling fans and a programmable thermostat.



What makes a home a DOE ZERO ENERGY READY HOME?

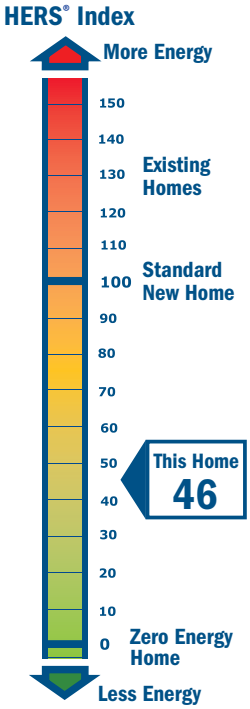
1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0

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.

windows to take advantage of daylighting. "The area is home to incredible views so we made sure to have plenty of outdoor viewing spaces and deck area to take advantage of those views year round," said Damian Mora, Garbett's energy-efficiency coordinator, referring to the development's mountain location at the mouth of Little Cottonwood Canyon, which is in easy driving distance from world-class ski resorts such as Alta, Snowbird, Brighton, and Solitude. Because of the expected snow fall, Garbett Homes installed an angled roof rather than the flat roof it tends to use in its modern designs. The sites were graded so that snowmelt and rain runoff will drain away from the homes and into a local retention area.

To meet the performance requirements of the DOE certification, Garbett used advanced framing techniques to pack insulation into the shell of this two-story, 4-bedroom, 3-bathroom home. The wood-framed homes were constructed with 2x6 studs placed 24 inches on center and the wall cavities were stuffed with R-23 of dense-packed blown fiberglass. Garbett uses single headers rather than solid wood headers, providing space to insulate above doors and windows. Garbett constructs corners with two studs and drywall clips, rather than three or four studs. According to Mora, this one advanced framing technique alone eliminated about three hundred 2x4 and 2x6 wood studs. The volume of space that would have been used by the backing studs has been replaced with an additional 120 ft³ of high-density fiberglass blown-in insulation. Fewer studs also means less points for thermal bridging or heat transfer through the walls.

"Our homes come with customized insulating and air sealing techniques as part of our package to reduce unwanted thermal gains and losses, creating a comfortable home and tight building envelope," said Mora. Garbett uses a sprayer-applied sealant to seal all bottom plates to the subfloor, which stops air leaks and also keeps out bugs. Garbett used the sealant as a drywall gasket where drywall meets top plates and bottom plates on exterior and interior walls. They used spray foam to seal all of the top plate-to-drywall seams from the attic side. Garbett used spray foam insulation to insulate and air seal all rim joists as well.

Garbett installs house wrap over the OSB sheathing to provide a weather-resistant barrier and drainage plane. The house wrap is also taped at all seams and sealed to the sheathing at the edges to provide an additional layer of air sealing.

The home is equipped with a hot water recirculation system to deliver hot water on demand to reduce water waste and conserve energy. A 93% efficient tankless condensing hot water heater located in a conditioned space provides hot water for the entire home. The home also includes low-flow fixtures for additional water savings.

The home has a full basement of poured concrete foundation walls and was insulated along the interior of the basement walls with R-22 (two R-11's) of continuous fiberglass blanket insulation. The rim joists were spray foamed to both insulate and air seal this difficult transition area from the basement to the above-grade walls.

Garbett used a vented attic and pitched roof designed to structurally support solar photovoltaics and solar thermal panels with plenty of south-facing roof area. It was also prewired for solar PV by running the wire from the panel to just inside the roof. Garbett also used trusses with raised energy heels (a measure employed in all its homes). This allows Garbett to spray foam above the top plates around the entire perimeter of the attic, which helps to prevent cold spots along the ceilings in the winter and also helps keep conditioned air from leaking into the attic along the eaves. This is an important step in helping to prevent the formation of ice dams on the roof. The raised heel trusses also provide more space along the attic eaves to install the blown insulation. The attic of this home was insulated with R-60 of blown fiberglass.

Garbett installed double-pane, vinyl-framed windows that have a nearly invisible low-emissivity coating that helps to prevent heat transfer. The windows have an insulation value of U-0.31 and a solar heat gain coefficient (SHGC) of 0.30, which far exceeds local codes. They were installed with proper flashing techniques to prevent air and water leaks.

Together all of the air-sealing measures Garbett incorporated helped the builder to achieve a tight home. When the home was tested for air leakage by an energy rater as required for the DOE program, it showed whole house air leakage of only 1.3 air changes per hour at 50 Pascals. This is well below the 3 ACH 50 required by the 2015 International Energy Conservation Code.

To provide fresh air to the tight home an energy recovery ventilator (ERV) was installed. The ERV is ducted to bring fresh air to the return side of the furnace's central air handler for distribution throughout the home. As on all Garbett homes, the air handler and ducts are located within the conditioned space. The rigid aluminum ducts are sealed with mastic at seams and bends. This home has a 96.5 AFUE natural gas, multi-stage furnace with an electronically commutated (ECM) motor. The ECM motor allows the air handler to run at a lower rate when the heating or cooling load of the home is lower, which contributes to less energy consumption. The home has a 13 SEER air conditioner.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program

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.

Spray foam insulates a cantilevered ceiling over the entry way.

The home is equipped with a 93% efficient tankless gas water heater. A hot water recirculation pump system is set up to speed hot water to the furthest fixtures, in the master bathroom, at the push of a button. Although not a DOE program requirement, Garbett also installed drip irrigation systems for plants and planters to cut water usage outside.

To help ensure a quality product, Garbett's construction team meets weekly to discuss quality control measures. Garbett also conducts pre-construction meetings with the construction team and trade partners to ensure everyone understands the ENERGY STAR and DOE ZERH standards. "We work closely with all trade partners and energy raters to ensure our vision of a high-performance home is met. This is crucial for maintaining quality construction," said Mora.

All of these efforts have paid off. The award-winning home achieved a HERS score of 46, well below the 80 to 100 of new homes just built to code. The winning home is expected to cost its home owners about $130 a month, very reasonable considering the size and cold climate location of this large family home.

Garbett also holds pre-construction meetings with its home owners to ensure they understand the high-performance goals. Garbett sees the sales process as a home buyer education process. "We have utilized model homes that are deconstructed and have exposed areas to highlight different building techniques. We use displays throughout the site to educate home buyers on the Home Energy Rating System (HERS) score and different energy-efficiency features. We also have a continuous loop television showing the advanced construction techniques," said Mora. Garbett has created YouTube videos that buyers can access for answers to questions about their high-performance homes. Garbett has also worked with the local realtors board to get HERS scores, ENERGY STAR certifications, and other energy-related certifications into the Multiple Listing Service.

"Garbett is known in the Salt Lake Valley as a major player in energy-efficient homes. One of the ways we measure this is by customer satisfaction surveys. It's very rewarding to see the excitement of our buyers when they let us know how much they enjoy their homes, how comfortable they are, and how low their low energy bills are," said Mora.

Photos courtesy of Garbett Homes

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 2x6 24″ o.c., advance-framed, drywall clips, dense-packed blown fiberglass, sprayer-applied sealant at top and bottom plates, house wrap.
- **Roof:** Asphalt shingles.
- **Attic:** Raised heel trusses, spray foam over top plates, R-60 blown fiberglass.
- **Foundation:** Basement, R-22 fiberglass blanket insulation on inside of walls, spray-foamed rim joists.
- **Windows:** Double-pane, low-e, vinyl-framed, U=0.31, SHGC=0.30.
- **Air Sealing:** 1.3 ACH 50.
- **Ventilation:** ERV.
- **HVAC:** 96.5 AFUE, natural gas, multi-stage furnace, 13 SEER AC.
- **Hot Water:** 93% efficient tankless gas water heater, push button hot water recirculation pump.
- **Lighting:** 100% LED lighting, ENERGY STAR ceiling fans.
- **Appliances:** ENERGY STAR refrigerator, dishwasher.
- **Solar:** Pre-wired and designed for solar PV.
- **Water Conservation:** Low-flow fixtures, hot water recirculation pump.
- **Energy Management System:** Programmable thermostat.
- **Other:** No-/low-VOC paints and adhesives, passive radon system.

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