

# Mandalay Homes

Pronghorn Ranch  
Prescott Valley, AZ



## BUILDER PROFILE

Mandalay Homes Inc.  
Phoenix, AZ  
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## FEATURED HOME/DEVELOPMENT:

### Project Data:

- Name: Pronghorn Ranch
- Location: Prescott Valley, AZ
- Layout: 3 bedrooms; 2 baths; 1 floor
- Conditioned Space: 2,469 ft<sup>2</sup>
- Completion: May 2014
- Climate Zone: IECC 4B, mixed-dry
- Category: Production

### Modeled Performance Data:

- HERS Index: without PV 48, with PV 25
- Projected Annual Utility Costs: without PV \$1,666, with PV \$1,078
- Projected Total Annual Energy Cost Savings (compared to a home built to the 2006 IECC): without PV \$1,127, with PV \$1,849
- Builders Added Cost Over 2006 IECC: \$7,400
- Annual Energy Savings: without PV 4,407 kWh, 490 therms, with PV 10,454 kWh, 490 therms

In 2013, production home builder, Dave Everson of Mandalay Homes built his first home to meet the rigorous energy-efficiency requirements of the U.S. Department of Energy's Zero Energy Ready Home program. Since then, he has certified 20 homes and plans to certify 50 more in six developments around the state of Arizona. In addition to being DOE Zero Energy Ready Home certified, every home will have a Home Energy Rating System (HERS) score of 50 or less.

Everson first heard about the DOE Zero Energy Ready Home program while working on an affordable housing project for the city of Phoenix, building 14 homes in a development that had been foreclosed by a previous builder. The city awarded Everson the contract with the stipulation that he showcase energy efficiency. An energy consultant introduced him to the DOE program and the HERS score. Everson, who had been building to ENERGY STAR, decided to aim for the stricter DOE specifications. When Everson's Phoenix homes achieved HERS scores in the low to mid 50's, he was so impressed he stopped construction at the Pronghorn Ranch development and retooled his processes to meet the DOE Zero Energy Ready Home specifications.

Mandalay plans to build 100 homes at the Pronghorn Ranch Development in sizes ranging from 1,700 to 3,000 ft<sup>2</sup> and prices ranging from \$240,000 to \$315,000. "They will be all DOE Zero Energy Ready, all ENERGY STAR, all Indoor airPLUS, and all WaterSense. Everything we have built since last year and from here on out will be DOE Zero Energy Ready Home certified. We made that commitment at Pronghorn just over a year ago," said Mandalay's construction supervisor and energy expert Geoff Ferrell.



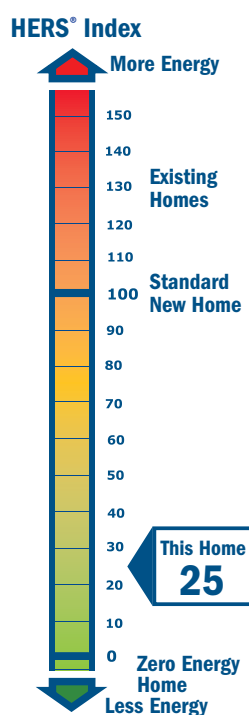
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 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.

Mandalay Homes uses open-cell spray foam to fill the wall cavities of its homes, providing insulation, air sealing, and sound proofing. Spray foam also covers the underside of the roof, providing a cooler, insulated attic space to house the home's HVAC equipment and ducts.



## 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.



One home recently completed at the Pronghorn Ranch development scored a HERS 48. The 2,469 ft<sup>2</sup>, 3-bedroom, 2-bath, single-story home is built on a post-tension slab assembly. A 20-mil polyethylene vapor barrier extends under the length of the slab, including the 30-in.-deep footings. Mandalay does not install foam under the slab because of the little impact it makes in the hot-dry/mixed-dry climate. A heavy plastic vapor barrier is installed under the slab and wraps up the sides to prevent moisture migration from the expansive clay soil into the slab. The edge of the slab is wrapped in a 2-inch-thick, R-10 layer of rigid extruded polystyrene foam insulation that extends 24 inches from the top of the slab to a few inches below grade. Metal flashing protects the top of the foam and serves as a termite barrier; it also diverts water away from the slab. The exterior surface of the foam is covered with a protective coating of lathe and stucco. A waterproof foam gasket between the slab and the sill plate prevents moisture transfer and air seals the seam between the wood and the concrete.

The above-grade walls consist of 2x6 framing set 16 inches on center. The walls are filled with 3.5-in. (R-13) of open-cell spray foam and are sheathed with plywood, then house wrap, then a 1-in. layer of rigid foam, then lathe and a two-coat layer of stucco as an exterior finish. Mandalay trains its insulation contractors to caulk all wiring and plumbing holes through the top and bottom plates, exterior walls, and roof prior to filling the walls with spray foam. The rigid foam provides a continuous layer of insulation around the outside of the house and serves as a thermal break to prevent heat transfer between the inside and outside of the home. Mandalay uses advanced framing details, including open or insulated rather than solid wood headers over doors and windows, two-stud rather than three-stud corners, and ladder blocking where interior walls intersect exterior walls, to reduce the amount of lumber in the walls and increase the wall cavity space for insulation.

Mandalay also uses open-cell spray foam to insulate the attic, spraying along the underside of the roof deck to a thickness of at least 5.5 inches for an R-20 insulation value. In recent homes, Mandalay has increased the attic foam to 7.5 inches to increase the R-value to R-27. By sealing the attic and insulating it along the roof deck, Mandalay creates a cool, semi-conditioned space to locate the home's heating and cooling system ducts, rather than the very hot and cold conditions typically found in vented attics in northern Arizona. The engineered roof trusses provide extended heel height at exterior walls to allow for adequate insulation over the exterior wall sill plates. Above the roof deck, Mandalay





Two inches of rigid foam insulates the sides of the post-tensioned slab foundation. A 20-mil-thick plastic vapor barrier wraps the bottom and sides of the slab, preventing moisture from migrating from the ground into the concrete.

installs a continuous moisture barrier under the asphalt shingles. Mandalay minimizes penetrations through the roof by grouping vents where possible and routing some vents through the walls instead of through the roof.

Because most windows have an insulation value of R-2, they can be a significant source of heat loss. Mandalay selected triple-pane, R-5 windows from a local company that uses a patented extruded PVC frame designed with insulating air pockets, aluminum reinforcements, built-in weather stripping, interlocking meeting rails, and a pocketed sill with a sloped drainage path for superior insulation and water resistance. The glass panes have low-emissivity glass coatings to reduce heat transfer and the space between the panes is filled with an inert argon-gas fill, adding insulation value.

Mandalay achieved a remarkable airtightness of 0.3 air changes per hour at 50 Pascals pressure difference (ACH 50). That is half the airtightness limit of the 0.6 ACH 50 set by the Passive House Standard and far below the 7 ACH 50 set by the 2009 International Energy Conservation Code (IECC). This level of performance is the result of considerable attention to air sealing details. “We conduct multiple in-house quality assurance inspections as well as third-party inspections at pre-slab, pre-drywall, and upon final completion,” said Ferrell.

To provide healthy indoor air, Mandalay installed an energy recovery ventilator (ERV), which has two ducts to the outside—one to bring in fresh air and one to exhaust stale air. The two air paths cross in a heat exchanger allowing heat to transfer from the hotter path to the cooler path, cooling the incoming air in the summer and warming it in the winter. Unlike a heat recovery ventilator (HRV), ERVs also allow some moisture transfer in the air. The incoming fresh air duct is connected to the central HVAC system to distribute fresh air throughout the home. The ERV is electronically controlled to come on for 20 minutes every hour on a low fan speed. The home is equipped with a 95% efficient sealed-combustion gas furnace and central air conditioner. In very hot Phoenix, Mandalay installs 15 SEER air conditioners. In cooler northern Arizona, Mandalay installs 13 SEER air conditioners. According to Ferrell, “Even in our 90 degree (summer) climate, it’s rare that the AC comes on more than one or two times a day,” because the homes are so airtight and so well insulated.

High-performance lighting with LED recessed can fixtures and CFL wall and ceiling fixtures add to the savings, as do the ENERGY STAR-rated dishwasher

## HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

EPA WaterSense

RESNET Energy Smart Builder



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.



Interactive displays and a knowledgeable sales staff help home buyers understand the special features of these high-performance homes and that has helped more buyers to choose Mandalay Homes.

The HERS score of 48 at Pronghorn Ranch is a typical HERS score for a Mandalay home without photovoltaic panels on the roof. With approximately 3.5 kW of PV panels installed, the home would score HERS 25. In accordance with DOE requirements, Mandalay pre-wires all of its homes for future solar installation and offers PV systems as an upgrade, ranging from 3.5 kW to 7 kW. Each home is engineered to achieve HERS scores of 25 or 0, depending on the amount of PV panels chosen.

As part of the Indoor airPLUS requirements, all paints, finishes, and cabinets are certified as low- or no-VOC-emitting products. All carpets and carpets pads are Green Label or Green Label Plus certified.

Ferrell likes the DOE Zero Energy Ready Home program's comprehensive approach, and he credits it with helping Mandalay sell houses. "It has absolutely helped us market. Our list of features practically sells itself; it's hard to pass up."

"It's great to do walk-throughs with homeowners and when they ask questions like 'why is this home different from the house across the street built 5 years ago?' I can show them the HERS score and show them the tangible reasons that really reaffirm to the homeowners that they are getting a much better product."

Mandalay educates potential home buyers with hands-on interactive exhibits, ceiling cut-aways, and an energy-efficiency wall display describing the HERS score and energy-saving features. An "energy-trained" sales team conducts realtor events with informative walk-throughs and demonstrations of building processes.

"The best measure of results is the feedback and testimonials we receive from our customers, touting their low energy bills, how much they enjoy their homes, and how proud they are of the energy performance. Many share their enthusiasm for their homes' energy efficiency with friends, guests, and visitors. What better way to spread the word about healthy, energy-efficient living than through happy, satisfied customers!" said Ferrell.

*Photos courtesy of Mandalay Home, Inc.*

and microwave that are included in all Mandalay homes. Mandalay also offers ENERGY STAR refrigerators and clothes washers and solar water heating, although Ferrell said no home buyers have selected the solar water heaters, probably because they perceive the 95% efficient tankless gas water heaters that come standard on the homes to be an energy-efficient water heating choice. The water heater is centrally located to minimize water waste.

## KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance
- **Walls:** 2x4, 16 in. on center; 3.5 in., R-13 open-cell spray foam; plywood sheathing; house wrap; 1-in. rigid foam; lathe; two-coat stucco; total wall R-15
- **Roof:** Sealed attic; insulated roof deck with R-20 5.5 in. open-cell spray foam; moisture barrier; asphalt shingles.
- **Foundation:** Post-tensioned slab on grade; with 20-mil plastic vapor barrier; R-10 rigid foam slab edge insulation
- **Windows:** 3-pane; thermally insulated; extruded PVC frame; low-e coatings; argon gas fill; U=0.28; SHGC=0.30
- **Air Sealing:** 0.3 ACH 50
- **Ventilation:** ERV set for 20 min on every hour; central fan supply; exhaust fans in bathrooms
- **HVAC:** 95% efficient direct vent gas furnace; 13-16 SEER AC; duct in cond. space
- **Hot Water:** 95% efficient gas tankless water heater
- **Lighting:** 100% LED and CFL
- **Appliances:** ENERGY STAR dishwasher; microwave
- **Solar:** None
- **Water Conservation:** EPA WaterSense fixtures, centrally located water heater; irrigation on timers w/rain sensors
- **eMonitor Management System:** Home automation system