

# Mandalay Homes

Vision Hill Lot 1  
Glendale, AZ



## BUILDER PROFILE

Mandalay Communities Inc., Prescott, AZ  
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## FEATURED HOME/DEVELOPMENT:

### Project Data:

- Name: Vision Hill Lot 1
- Location: Glendale, AZ
- Layout: 4 bedrooms, 4 baths, 1 floor
- Conditioned Space: 3,181 ft<sup>2</sup>
- Climate Zone: IECC 2B, hot-dry
- Completion: January 2015
- Category: Production

### Modeled Performance Data:

- HERS Index: without PV 52, with PV -2
- Projected Annual Utility Costs: without PV \$1,748, with PV \$117
- Projected Annual Energy Cost Savings (compared to a home built to the 2012 IECC): without PV \$800, with PV \$2,431
- Builder's Added Cost Over 2012 IECC: without PV \$3-4/ft<sup>2</sup>, with PV \$4-5/ft<sup>2</sup>
- Annual Energy Savings: without PV 13,591 kWh, 341 Therms; with PV 24,322 kWh, 187 Therms

Mandalay Homes's first energy-efficient homes were constructed for the city of Phoenix as part of an urban-infill affordable housing project that required energy efficiency, but when Mandalay owner Dave Everson saw what was possible at that price point, he said "we should be doing this everywhere."

The affordable housing project introduced Mandalay Homes to the U.S. Department of Energy's Zero Energy Ready Home program and Mandalay ended up winning a 2013 Housing Innovation Award for the 14 homes, which achieved average Home Energy Rating System (HERS) scores of 58 without solar panels. Mandalay has indeed gone on to incorporate energy efficiency into all of its homes and now builds to the strict requirements of the DOE Zero Energy Ready Home program in all of its communities.

In 2014, Mandalay won a DOE Housing Innovation Award for the Pronghorn Ranch development in Prescott Valley, Arizona, where Mandalay built over 100 certified DOE Zero Energy Ready homes with an average HERS score of 48.

The 2015 award-winning home is the first completed at Mandalay's Vision Hills community in Glendale, Arizona, and scored a HERS 52. (The second house scored HERS 50 and scores of 50 or less are anticipated on future homes.)

The builder, who is currently building in 12 communities in northern Arizona and the Phoenix area will complete about 90 homes in 2015 and anticipates completing 120 homes in 2016. This includes two developments in Phoenix selling in the upper \$400,000s like the Vision Hills community, Pronghorn Ranch in Prescott with homes starting in the mid \$300,000s, and some basic homes in Chino Valley selling in the mid \$200,000s.



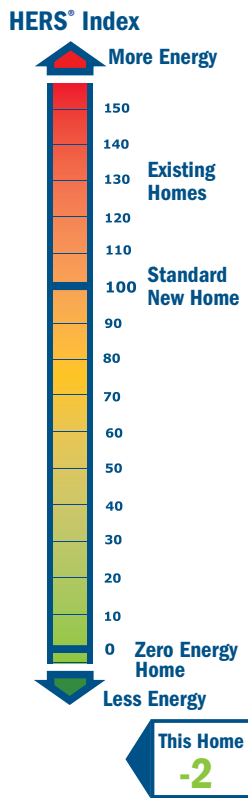
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 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 built this 3,181-ft<sup>2</sup> home in Glendale, Arizona, to the performance criteria of the DOE Zero Energy Ready Home Program. Mandalay Homes used zeriscaping, drip irrigation, rain sensors, drought-tolerant species, and 100% EPA WaterSense-certified plumbing fixtures for water savings outside and inside the home.



### 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.



“Now, no matter where you go, no matter what price point, they all have the core construction value, energy efficiency, and health aspects,” said Geoff Ferrell, a construction manager responsible for energy efficiency development and new technologies for Mandalay Homes.

Mandalay’s goal is to achieve a HERS 50 or less, without PV, on every home they build. Ferrell notes “We have been working on perfecting this for 3 years now. Most of our homes are coming in at 46 to 47, whereas a year ago it was 48 and 49.” Ferrell attributes the improvement to better craftsmanship as the trades understand better how to get the most out of the products and technologies Mandalay is using.

According to Ferrell, owner Dave Everson’s goal is to offer Mandalay Homes at the lowest added cost possible. “You should see Dave’s spread sheet. He is constantly working with our vendors looking for new and better products that will work in a production setting, and working with the options to get the costs down.” Ferrell said their high-performance improvements might add \$3 or 4 per square foot, but not \$50 or \$60 per square foot, compared to homes that just meet code.

Every home is constructed to the DOE Zero Energy Ready Home program criteria, which requires homes to meet 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.

The award-winning home at Vision Hills is built on a post-tensioned slab foundation with R-8 perimeter rigid foam insulation. The builder chose not to install a vapor barrier or insulation under the slab due to the hot-dry climate.

This home is constructed with 2x6 exterior walls, with studs spaced 16 inches on center. The wall cavities are filled with 3.5 inches (R-14) of open-cell spray foam, which provides superior insulation and air infiltration characteristics. A stucco house wrap covers the walls to provide an added air barrier and protective layer between the framing and the exterior siding, which is stucco installed over an additional R-4 continuous foam and lath system.



Low- and zero-VOC paints and finishes and Green Label Plus-rated flooring help contribute to the home's indoor air quality as does the energy recovery ventilator, which is separately ducted and operates continuously to bring in fresh air and remove stale air from the home. An upgraded suite of high-end ENERGY STAR-labeled appliances add to energy savings.

Mandalay Homes has adopted a sealed attic. The winning home has R-31 open-cell spray foam applied to the underside of the roof deck to completely seal the attic from the outside air. "We have found that sealed and semi-conditioned attic spaces vastly improve the efficiency of our homes by creating a secondary air space between the livable home and the roof. Even if it's 115 degrees outside in Phoenix, the attic will only be 5 degrees hotter than the main house," said Ferrell. The home's concrete tile roofing sits on a plywood roof deck with a breathable fabric membrane underlayment.

The insulated attic provides a much less harsh environment for the home's high-efficiency (92 AFUE) gas furnace and 15 SEER air conditioning coil. Any losses from the R-6-insulated and sealed flex ducts stays in the attic to temper that space and buffer losses within the living space. The HVAC system is managed via a programmable, internet-accessible thermostat.

The spray foam insulation, together with extensive air sealing of top and bottom plates, door and windows openings, electrical boxes, and other holes in the building envelope, helped Mandalay to achieve a total house air leakage rate of 1.66 air changes per hour at 50 Pascals of pressure.

Ventilation to the home is provided by an energy recovery ventilator (ERV), which brings fresh air into the house and exhausts stale air. The incoming air is warmed and cooled by the outgoing air for energy savings and increased comfort. Mandalay installs ERVs as a standard feature in every home they build and has transitioned from installing ERVs that are connected to the furnace to separately ducted ERVs. The ERV has supply registers located in two bedrooms and a third corner of the house that is far from the ERV's centrally located return register. The ERV is set to run continuously and creates a consistent overpressure situation in the home that not only keeps out allergens and pollutants, but also has the added benefit of reducing dust in the home. "Our owners love that part the most," said Ferrell. The ERV can be manually controlled to activate the high-speed fan should an owner require additional ventilation.

Hot water is provided via a 95% efficient tankless water heater. The water heater is located close to plumbing uses and all hot water piping runs are made as direct as possible via a homerun to a central manifold just below the water heater with direct lines to each individual fixture, to minimize the time it takes for hot water to arrive at a fixture.

## HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

EPA WaterSense

LEED for Homes, platinum level



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 master bath in Mandalay Home's award-winning home features water-saving fixtures, ultra-efficient LED lighting, and high-efficiency windows.

maintenance is almost nothing," said Ferrell. He noted that LED and CFL lighting is standard on all of Mandalay's homes and they are moving toward 100% LED on all homes.

An 8-kW photovoltaic system has been installed on the home, which brings the home's overall HERS score down to a -2 or zero energy, meaning the home is expected to produce as much power as it uses in a year. "Arizona has the perfect climate for PV with tons of clear sunshine-filled days so we are excited to encourage its use to all our home buyers," said Ferrell. Mandalay offers two levels of solar electric upgrades: a HERS 25 upgrade with the addition of 3 to 4.25 kW of PV (depending on the size of the home) and a HERS 0 upgrade with the addition of 4.75 kW to 7 kW PV. According to Ferrell, about 10% of Mandalay home buyers are going for the HERS 25 package. Ferrell noted that utility companies are starting to charge a surcharge to home owners for connecting their PV systems to the grid. Mandalay currently offers only grid-tied solar systems but is looking at battery storage of solar.

Mandalay prewires all of its homes with a 240-volt, 40-amp car charging circuit. This circuit allows the buyer to install any brand of home car charging station when they are ready to. "One home owner told me they went out and bought an electric car because we had the higher amperage 240-volt wiring in place, which allows you to install a much faster car charger," said Ferrell.

The landscape design of the winning home was carefully executed to minimize water needs. All landscape plants are on an automatic drip irrigation system with automatic rain-sensing delay. Plants were selected for their drought tolerance and applicability to the hot-dry climate zone. Plumbing fixtures are 100% WaterSense certified and the home's plumbing system was designed for maximum efficiency as well. "Water is a hot topic here," said Ferrell. "Some buyers are doing rain barrels and water cisterns. In a future project, we hope to offer an underground tank, maybe under the driveway, so anytime there is surplus water we can store it for irrigation. We've looked at grey water recycling and are considering partnering with land developers to do community-scale water reclamation."

For Mandalay Homes, the path toward energy efficiency may have started as a city contract requirement, but said Ferrell, "now we do it for the fun of it."

The award-winning home features 100% low-voltage LED lighting throughout. All lighting and fixtures in the home are ENERGY STAR certified. Mandalay installed a low-voltage hard-wired system for the home to maximize the energy advantages of using 100% LED lighting. It uses transformers installed in a central location and all power is transmitted over low-voltage lines. "It is very simple to add additional fixtures to this system and, with the LED bulbs,

## KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 2x6; 16" on center; 3.5" spray foam (R-14); exterior rigid foam (R-4); house wrap; stucco.
- **Roof:** Concrete tile.
- **Attic:** Unvented; open-cell spray foam on underside of roof (R-31).
- **Foundation:** Post tensioned slab; rigid foam slab insulation (R-8).
- **Windows:** Double-pane; U=0.3; SHGC=0.22.
- **Air Sealing:** 1.66 ACH 50.
- **Ventilation:** Continuous ERV.
- **HVAC:** 92 AFUE furnace; 15 SEER AC.
- **Hot Water:** 95% efficient tankless water heater.
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR-rated refrigerator and dishwasher.
- **Solar:** 8 kW PV.
- **Water Conservation:** All EPA WaterSense-rated fixtures; central manifold hot water distribution; drought-tolerant plants; drip irrigation with rain sensors.
- **Other:** Energy management system; pre-wired for electric car charger; low-VOC.

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"The best measure of results is the home owner testimonials we receive on a regular basis, touting their low energy bills and their enjoyment of their home. What better way to spread the word about healthy, energy-efficient living than through happy, satisfied customers!"  
— Geoff Ferrell

*Photos courtesy of Mandalay Homes*