



Mandalay Homes

Foothills Lot 8
Prescott, AZ



BUILDER PROFILE

Mandalay Homes

Prescott, AZ; mandalayhomes.com

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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Foothills Lot 8
- Location: Prescott, Arizona
- Layout: 2 bdrm, 2 bath, 1 fl, 1,872 ft²
- Climate: IECC 4B, mixed-dry
- Completed: June 2020
- Category: Production

Modeled Performance Data:

- HERS Index: without PV: 45; with PV: 34
- Annual Energy Costs: without PV: \$1,300; with PV: \$950
- Annual Energy Cost Savings: (vs typical new homes) without PV: \$1,000; with PV: \$1,400
- Annual Energy Savings: without PV: 8,200 kWh; with PV: 11,100 kWh
- Savings in the First 30 Years: without PV: \$41,200; with PV: \$55,900

Not very many builders have said they had to cut back on their social media to *reduce* the number of potential buyers through their sales office, but that has been the case for Mandalay Homes. This production builder who constructs high-performance homes in and around Prescott, Arizona, has experienced such an unprecedented increase in visitors to its communities over the past year, it's had to cap sales and sell from a waiting list. "Despite cutting back on social media and online advertising to better control demand, our organic website traffic has more than doubled, and lead acquisition is four times higher than 2019 numbers," said company president Dave Everson. Every home Mandalay builds is constructed to the U.S. Department of Energy's Zero Energy Ready Home program criteria. Everson is convinced that the emphasis on energy efficiency, quality, comfort, and health this designation provides are key to Mandalay's success and the numbers prove it. "Our DOE Zero Energy Ready homes sold for \$15,000 to \$20,000 more with less square footage on smaller lots against the competition's code-built offering. These sales numbers align with customer feedback in the sales office, confirming that customers are seeing value in the features of the DOE Zero Energy Ready homes," said Everson.

From the moment visitors step into Mandalay's sales offices and model homes, they are greeted with the message that "Mandalay Homes is the industry leader in energy efficiency and indoor air quality." The numerous certifications and awards from DOE Zero Energy Ready Home, EPA Indoor airPLUS, ENERGY STAR, and others posted throughout the sales offices and model homes back up that statement. Several customers have noted that this recognized level of excellence is something that stuck with them after a long day of home shopping.

Everson noted that a recent innovation in Mandalay's sales offices was to go paperless by moving information about the homes to touch screen sales kiosks. With 40 or more groups going through the models daily, the sales kiosks allow customers to educate themselves until a sales rep is available. But Mandalay has found that return visitors, including realtors, home buyers, and even current Mandalay homeowners, are so



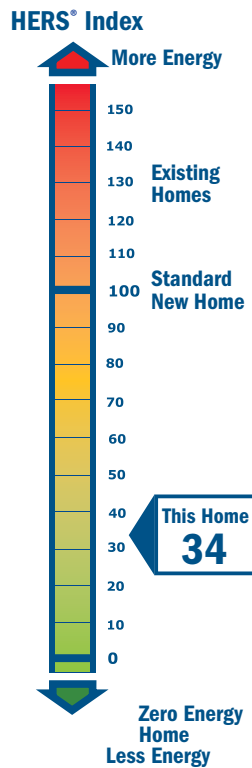
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program. Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0/3.1/3.2 for an energy-efficient home 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.

ENERGY STAR appliances and lighting and high-efficiency HVAC reduce energy usage. Most of the home's power is supplied by the 1.9-kW of photovoltaic panels and the 10-kWh battery, which stores any excess power produced by the rooftop PV panels. Mandalay has worked extensively with both the local utility and the battery manufacturer to optimize the PV and battery systems to maximize the return for home owners within the existing rate structure. Mandalay earned a special DOE Housing Innovation Award for "Grid-Interactive Efficient Building Innovation" for their efforts.



What makes a home a DOE ZERO ENERGY READY HOME?

- 1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0/3.1
- 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.



enthusiastic about the high-performance features of the homes that they will often jump in to guide new visitors through the model homes.

Mandalay makes sure its customers get what they've paid for. Every home design goes through an extensive review and departmental checks before being released for construction. During construction, weekly meetings are held with the superintendents, customer care, customer experience manager, and the sales team. In these meetings, the progress of the homes and the satisfaction level of the customers are discussed. The sales team also takes weekly photos of the home throughout the build. The photos are used to keep the home owner updated on progress and as an additional layer of quality control. Mandalay Homes also employs a comprehensive in-house quality assurance program with inspections performed at pre-slab, pre-drywall, post insulation, upon completion, and in the warranty process. Mandalay also uses a web-based collaborative construction management system. "This allows us to further improve efficiency and trade communications," said Everson.

All this is in addition to the third-party inspections required by the DOE Zero Energy Ready Home program. Every ZERH certified home must meet the requirements of the ENERGY STAR Certified Homes checklists. They must also be certified to the U.S. Environmental Protection Agency's Indoor airPLUS criteria and meet the hot water distribution requirements of the EPA's WaterSense program. DOE ZERH homes must also meet above-code insulation requirements, be blower door tested for air sealing, comply with moisture management guidelines, have ducts inside conditioned space, and use ENERGY STAR-labeled windows, lighting, and appliances. Homes must also have solar electric panels installed or have the conduit and electrical panel space in place for future installation of solar panels.

Mandalay offers solar standard on its 600 and 700 series homes and as an optional upgrade on its 500 series homes. This home has 1.9 kW of photovoltaics, which is only six panels. Although this seems like a meager amount, Mandalay also includes a 10-kWh battery storage system on the home. The local utility uses a time-of-use rate structure and offers incentives for residential solar power produced during the late afternoon/early evening peak demand period. The 10-kWh battery size is large enough to get most of Mandalay's homeowners through the daily peak period that the rate plan incentivizes. Mandalay has found that, for most of its homeowners, the battery covers about 8 hours of the homes' power needs each day and some homeowners are able to run on their own stored power all night until the sun comes up the next day and the battery starts re-charging.



The underside of the roof deck is covered with 7 inches (R-30) of open-cell spray foam providing an insulated, conditioned, unvented attic space, which protects the central heat pump's ducts from the Arizona sun and also provides a conditioned space for storage. Open-cell spray foam also fills the 2x6 walls, providing R-21 worth of wall insulation as well as air-sealing and sound-dampening benefits. An aerosol acrylic sealant process further reduces air leakage.

This home has a Home Energy Rating System (HERS) score of 45 without PV; when the 1.9 kW of PV is included, the energy modeling software brings the HERS score down to a 34. However, according to Everson that score doesn't quite tell the whole story as it doesn't accurately account for the battery storage and the impact of time-of-use rates. If the software were able to accurately account for the home's use of its own stored power during peak rate periods, the HERS score would look more like a 10 or 12. The system should save homeowners at least \$1,400 a year in energy costs compared to a home built to code.

Mandalay maximizes the power production from the PV panels it installs on each home by placing them at the ideal orientation toward the sun. To provide the builder with uninterrupted space for panel placement, Mandalay has taken pains to eliminate all pipes and stacks through its unvented roofs by moving exhaust fan vents to gable walls or soffits and employing Studor vents for plumbing stacks. A clean roof deck is less prone to leakage down the road, has better thermal properties, is easier to install, and is more appealing aesthetically.

The unvented roofs are insulated on the underside of the plywood roof deck with 7 inches of open-cell spray foam for an insulation value of R-30. Most of the ceilings are vaulted, providing a sense of spaciousness in homes with compact floor plans like the one-story 1,872-ft² 2021 award-winning home.

The exterior walls consist of 2x6 studs spaced 16 inches on center. The stud walls incorporate advanced framing techniques like three-stud insulated corners, open and insulated headers, and ladder blocking at interior wall intersections to increase the amount of space in the walls for insulation. The walls are filled with open-cell spray foam in the cavities then wrapped with taped house wrap and covered with a continuous 1-inch-thick layer of rigid EPS foam for an R-21 total wall insulation value. The walls are covered with stucco cladding.

Mandalay uses a post-tensioned-slab foundation with an interesting slab-to-wall detail. The 2x6 wall bottom plates are placed on the perimeter of the slab so that they extend beyond it by 2 inches including sheathing. The entire perimeter of the slab edge (to a depth of about 18 inches) is then covered with 1.5 inches of a dense 3-pound closed-cell spray foam, which adheres to both the slab edge and the bottom edge of the overhanging bottom plate forming an air- and water-tight seal over the plate-to-slab seam. This dense spray foam hardens to a durable surface that requires no additional covering other than a layer of UV paint.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Quality Management Guidelines

DOE Zero Energy Ready Home Program - 100% Commitment

ENERGY STAR Certified Homes Version 3.1

EPA Indoor airPLUS

National Green Building Standard

RESNET EnergySmart 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.



The heat pump water heater provides energy-saving hot water and helps to cool the garage.

that has a reported cooling efficiency of 17 SEER and heating efficiency of 9.6 HSPF, although Mandalay found that the actual heating performance was better than stated. The HVAC equipment will use up to 50% less power than a comparably sized standard heat pump in a code-built home of equal size.

Mandalay has recently switched from gas tankless water heaters to heat pump water heaters, making the homes all electric (unless the home buyer requests an optional gas stove or fireplace). The heat pump water heater has an energy factor rating of 3.42 EF and is located in the garage, which in Arizona typically provides a source of warm air year round. The water heater employs a central manifold with PEX piping and distant hot water faucets use a smart programmable recirculating pump to reduce wasted water. All plumbing fixtures are EPA WaterSense labeled for energy and water savings. Outside the home, the builder implemented WaterSense guidelines for irrigation and graded the lot to encourage onsite collection, retention, and percolation of storm water.

One other area that has caught the attention of Mandalay's home buyers is healthy homes. "Indoor air quality is as foundational to the Mandalay Homes brand as energy efficiency," said Everson. "To achieve the energy efficiency we do, our homes must be extremely airtight. As such, every home we build includes an ERV fresh air exchange and filtration system. In 2020 we added a hydrogen-peroxide ion, in-duct air purification system as a standard feature in our iON Series homes. The system works in conjunction with the ERV and HVAC to capture even more airborne particles and provide an additional layer of antimicrobial protection, killing up to 99% of bacteria, mold, and viruses. It can also help maintain IAQ in instances where the ERV has to be turned off, such as during a forest fire."

In addition to the air purification system, Mandalay meets all of the requirements of the EPA's Indoor airPLUS program including the use of low-emission products like low/no-VOC cabinets, carpets, flooring, paints, caulks, and glues.

Photos courtesy of Mandalay Homes

Mandalay's home designs feature large windows and sliding doors. To help complete the efficient building envelope, Mandalay installs ENERGY STAR-rated, double-pane, vinyl-framed, argon-filled windows with an insulation value of U-0.29 (R-3.57) and a solar heat gain coefficient of 0.23. To minimize unwanted solar heat gain, the sliding doors are protected by covered porches or deep overhangs and windows typically have two layers of low-emissivity coatings on the glass to limit heat transfer. Mandalay is also transitioning from sliding and single-hung window styles to more airtight casement and awning style windows.

For heating and cooling, the home is equipped with a properly sized, two-stage, heat pump with a fully variable ECM motor and smart home connected user controls

KEY FEATURES

- **Walls:** 2x6, 16" o.c., R-21 total: advance framed; R-21 open-cell spray foam in cavity, house wrap, exterior lath, stucco.
- **Roof:** Truss gabled roof: ¾" plywood, synthetic underlayment, asphalt shingles.
- **Attic:** Unvented attic: 7" R-30 open-cell spray foam on underside of roof deck.
- **Foundation:** Slab on grade.
- **Windows:** Double-pane, argon-filled, low-e2, vinyl frame, U=0.29, SHGC=0.23.
- **Air Sealing:** 0.63 ACH50, open-cell spray foam in walls and attic. Aerosol whole-house sealant.
- **Ventilation:** ERV w/MERV 12 filter. Exhaust fans in baths and laundry, master bath fan has humidity sensor. MERV 8 filters in returns in hall and bedrooms. 16 SRE, 73 CFM, 52 Watts.
- **HVAC:** Central air-source heat pump, 9.6 HSPF, 17 SEER, two-stage compressor.
- **Hot Water:** Heat pump, 50-gal, 3.42 EF.
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, exhaust fan.
- **Solar:** 1.9-kW PV rooftop panels, 10-kWh battery storage, rooftop panels.
- **Water Conservation:** Low-flow fixtures, central manifold PEX piping, recirculation pump, drip and predictive irrigation, stormwater management practices.
- **Energy Management System:** PV tracking, battery usage timed to avoid peak rates.
- **Other:** EV charging, low/no-VOC cabinets, carpets, flooring, paints, caulks, glues. In-duct hydrogen-peroxide air purifier.