

# Mandalay Homes

Cathedral Point at The Dells  
Prescott, AZ



## BUILDER PROFILE

Mandalay Homes, Prescott, AZ  
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## FEATURED HOME/DEVELOPMENT:

### Project Data:

- Name: The Dells at Cathedral Point
- Location: Prescott, AZ
- Layout: 3 bdrm, 3 bath, 1 fl, 2,207 ft<sup>2</sup>
- Climate Zone: IECC 4B, mixed-dry
- Completion: March 2016
- Category: production

### Modeled Performance Data:

- HERS Index: without PV 47, with PV -2
- Projected Annual Energy Costs: without PV \$1,473, with PV -\$234
- Projected Annual Energy Cost Savings (vs home built to 2012 IECC) without PV \$897, with PV \$2,334
- Projected Annual Energy Savings: without PV 4,206 kWh, 392 therms, with PV 16,081 kWh, 404 therms
- Added Construction Cost: without PV \$2-3/ft<sup>2</sup>, with PV \$6-9/ft<sup>2</sup>

Most people aren't that happy about hitting 50. Geoff Ferrell is looking forward to it. In fact you could say it's a professional goal. Ferrell is the chief technology officer for Mandalay Homes of Phoenix, Arizona, and his company's goal is to build homes that are so energy efficient that every home will get to 50 or lower on the Home Energy Rating System (HERS) index, even without photovoltaic panels on the roof. For comparison a typical new home just built to code would score about a HERS 80 to 100.

Mandalay Homes has actually hit 50 many times in the past three years, since they began constructing homes to the high performance requirements of the U.S. Department of Energy's Zero Energy Ready Home program. In 2015-16, Mandalay certified more homes to the program than any other builder. They certified 89 homes and all of them hit HERS scores of 50 or below.

Mandalay plans to start between 120 and 150 new homes in 2016, all of them certified to DOE ZERH. "Everything we build will be a DOE ZERH compliant home," said Ferrell. Mandalay has certified 161 homes since joining the program in 2013. Four of these homes have been recognized with DOE Housing Innovation Awards, three in the production home category and one in the affordable home category in partnership with the City of Phoenix.

Innovation is a key element for Mandalay. "We are constantly seeking to improve our homes," said Ferrell. "We constantly re-evaluate products and processes. If a new product comes along that can improve performance, comfort, or durability, we are quick to begin an evaluation process to see if it is right for our homes. If so, our internal policies allow for fast transitions into these products," said Ferrell.



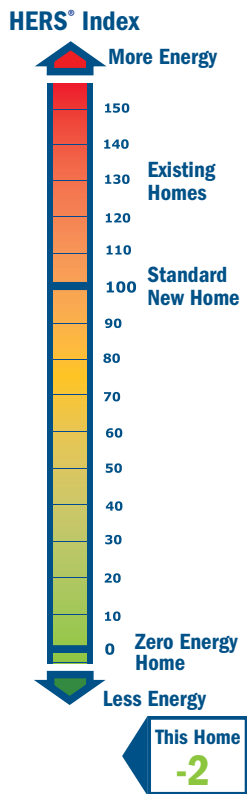
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 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 built this 2,207-ft<sup>2</sup> home in Prescott, Arizona, 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- and no-VOC wood products, primer, paint, cabinets, and flooring that limit the release of air contaminants. LED and compact fluorescent lighting and ENERGY STAR appliances add to energy savings.



### 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.



The 2016 award-winning home is a 2,200 ft<sup>2</sup> single-story home built at The Dells, an 1,100-acre planned community in Prescott, Arizona. The 3-bedroom, 2-bathroom “Summit” model is one of four floor plans for the 42 homes that Mandalay Homes will offer in its Cathedral Point community at The Dells. All of the homes feature Southwest architectural details and outdoor living spaces that take advantage of the sunny and mild Northern Arizona climate. “The large covered patios shade direct sunlight from the house, which allows us to install more glass—a desired buyer feature—while maintaining efficiency,” said Ferrell.

Every home is constructed to the DOE Zero Energy Ready Home program criteria, which require 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 The Dells is built on a conventional slab with 2 inches of R-10 rigid foam installed at the slab edge on the interior side of the stem wall which runs to 24 inches deep.

This home is constructed with 2x6 exterior walls, with studs spaced 24 inches on center. The wall cavities are filled with R-17 of open-cell spray foam in the cavities then R-4 of continuous rigid foam is installed on the exterior of the walls for an R-21 total. This foam is covered with a coated 7/16" OSB sheathing that is taped at all seams and penetrations to provide a moisture barrier and air barrier. House wrap is not needed because the taped coating on the OSB provides a drainage plane behind the finished stucco system cladding.

“We have worked relentlessly with our architects and engineers to reduce the amount of lumber needed in our homes through advanced framing techniques and some value engineering. We work with our trade partners to make sure they understand our priorities and we help them find ways to reduce waste and reuse bits that would otherwise go to the local dump. A marked reduction in the amount of material delivered to our sites is a great indicator of our efforts,” said Ferrell who noted that the dollars saved in lumber and labor costs can be applied to other innovative technologies in their homes.



Advanced framing techniques allow more room for insulation and use less building materials. Spray foam insulation with an insulation value of R-17 is used in the walls and under the roof deck to form a continuous thermal blanket around the house. On the exterior of the walls, continuous rigid foam insulation is installed beneath the siding.

The roof consists of a ½-inch coated OSB sheathing that is taped at the seams with a product-specific tape to provide a comprehensive air and water barrier. Underlayment and battens were installed over this to provide a ventilation gap under the roof tiles. Mandalay Homes has gone to great lengths to eliminate roof penetrations by determining how to make use of side-wall venting. “Having a roof deck completely devoid of holes or breaks in the roofing material not only makes for a much cleaner looking roof, but also greatly reduces our risk as the builder of future roof leaks,” said Ferrell.

Inside, the unvented attic is insulated with R-25 of spray foam installed along the underside of the roof deck. “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, the attic will only be 5 degrees hotter than the main house,” said Ferrell. In addition, the conditioned attic can be used as a temperature-controlled storage space for the home.

All of the homes have double-pane windows with low-emissivity coatings and an argon gas fill between the panes to achieve an insulation U-factor of 0.29 and a solar heat gain coefficient (SHGC) of 0.23.

Once the framing is complete and the windows are installed, Mandalay has a dedicated team of employees who perform a complete air sealing procedure and quality assurance check. This team tapes the exterior sheathing, seals any penetrations, and air seals on the inside along the sill plates. Mandalay’s in-house quality assurance inspector does a thorough visual inspection of the home. They spray the walls and windows with water to make sure they are watertight before roofing or exterior cladding is applied.

These envelope measures help Mandalay routinely achieve total house air leakage rates of under 1.0 air changes per hour at 50 Pascals of pressure (ACH 50). This is far lower than the air leakage limit of 3.0 ACH 50 set by the 2012 International Energy Conservation Code for the northern Arizona climate. The award-winning home actually tested at 0.83 ACH 50.

The insulated attic provides a mild environment for the home’s high-efficiency (95 AFUE) gas furnace, 18 SEER two-stage air conditioner, and R-6-insulated flex ducts. Ventilation for the air-tight home is provided by an energy recovery ventilator (ERV), which operates continuously to bring in fresh air and exhaust

## HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.1

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.



The plumbing fixtures are EPA WaterSense certified and a centrally located tankless water heater speeds hot water to the tap to reduce energy and water use.

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 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. All appliances are ENERGY STAR certified.

Although the model home does not have photovoltaics installed, the Mandalay plans to operate the home for 1 year without renewables and then install a 7-kW system, which is estimated to shift the home's HERS rating from a 47 to a -2. Mandalay Homes is exploring different approaches to renewable integration in partnership with the local electric utility, including solar photovoltaics accompanied by battery storage and/or solar accompanied by a charging station in the garage. All homes are prewired for the charger as part of the ZERH program.

Mandalay Homes uses a web-based construction management software that allows them to plan and manage all their construction projects quickly and efficiently with trade partners. "Since introducing this system we have seen marked improvements in efficiency and trade communications which has greatly reduced construction errors and mistakes," said Ferrell. "We also conduct multiple in-home quality assurance inspections as well as third-party inspections at pre-slab, pre-drywall, and completion. Quality construction really comes down to quality team members," said Ferrell. "The greatest reward would have to be pride in what we have chosen to do."

For Mandalay choosing DOE ZERH is the right way to hit 50. "DOE ZERH represents the way to build homes to us. Anyone not moving towards this program is behind the curve," said Ferrell.

*Photos courtesy of Mandalay Homes*

stale air. The ERV's heat exchanger captures heat with a 79% effective recovery rate to transfer heat to the outgoing air on warm days and to the incoming air on cold days. The ERV has its own dedicated supply and return ducts to help move fresh air throughout the home. Ferrell noted that by mixing the air the ERV helps to reduce HVAC cycling.

The HVAC system is managed with an energy management system, which includes a programmable "smart" thermostat and controller that manages all the HVAC, ventilation, and lighting functions of the home. The system uses location and seasonal data to operate the home's LED and CFL lights more efficiently.

## KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 2x6 24" o.c. studs, advanced framing, R-17 spray foam in cavities, R-4 continuous rigid foam exterior, coated 7/16" OSB taped at seams for moisture barrier, stucco siding.
- **Roof:** 1/2" coated OSB decking taped at seams, felt, battens, tile roofing.
- **Attic:** Unvented attic, raised heel trusses, R-25 open-cell foam on underside of roof deck.
- **Foundation:** 2" R-10 foam at slab edge to 24" deep, on interior of stem wall on conventional slab.
- **Windows:** Vinyl-framed, dual-pane, argon-filled, low-e, U=0.29, SHGC=0.23.
- **Air Sealing:** 0.83 ACH 50.
- **Ventilation:** ERV.
- **HVAC:** 2-stage 95% AFUE gas furnace, 18 SEER AC, in conditioned attic.
- **Hot Water:** 95% efficient, natural gas tankless water heater.
- **Lighting:** 90% LED, 10% CFL, motion sensors, ENERGY STAR ceiling fans.
- **Appliances:** All ENERGY STAR.
- **Solar:** Wired for solar.
- **Water Conservation:** All WaterSense fixtures, smart-timed drip irrigation.
- **Energy Management System:** Automatic controls of HVAC, ventilation, and lighting.
- **Other:** EPA indoor airPLUS certified, no-/low-VOC paints, stains, adhesives, and flooring.