

# Dwell Development

Emerald Star  
Seattle, WA



## BUILDER PROFILE

Dwell Development, Seattle, WA  
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Rater: Evergreen Certified  
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## FEATURED HOME/DEVELOPMENT:

### Project Data:

- Name: Emerald Star
- Location: Seattle, WA
- Layout: 3 bdrm, 3 bath, 3 fl, 2,117 ft<sup>2</sup>
- Climate Zone: IECC 4C, marine
- Completion: October 2015
- Category: custom spec

### Modeled Performance Data:

- HERS Index: without PV 45, with PV 0
- Projected Annual Energy Costs: without PV \$472, with PV \$51
- Projected Annual Energy Cost Savings (vs home built to 2012 IECC): without PV \$888, with PV savings \$1,628
- Projected Annual Energy Savings: without PV 9,896 kWh, with PV 18,090 kWh
- Added Construction Cost: without PV 10%

Dwell Development of Seattle has built the “Emerald City’s” first Emerald Star home. Emerald Star is the highest honor given by the regional Built Green program, and an impressive achievement for the home which was also designated a 2016 U.S. Department of Energy Zero Energy Ready Home Housing Innovation Award winner. The home is Dwell’s third home to be certified to the DOE program although, according to founder Anthony Maschmedt, Dwell has built over 100 homes, duplexes, or townhomes that meet the program criteria.

DOE’s Zero Energy Ready Home program requires every home to be certified to ENERGY STAR Certified Homes Version 3.0 and the U.S. Environmental Protection Agency’s Indoor airPLUS program. Each home must meet the hot water distribution requirements of the EPA’s WaterSense program and the insulation requirements of the 2012 International Energy Conservation Code. The program also requires homes to have solar electric panels installed or at a minimum to have the conduit and electrical panel space in place for future PV installation.

Dwell’s 2016 award winner met all of these criteria as well as the rigorous criteria of Built Green, a program conducted by the Master Builders Association, in partnership with King and Snohomish counties of Washington state. The home was Dwell’s 100<sup>th</sup> to achieve a 5-Star Built Green rating and the first in the state to achieve the Emerald Star, which requires homes to achieve net zero energy usage, implement high indoor air quality measures, meet a 70% reduction in water usage versus the King County average home’s water consumption, and verify that 90% of the wood used is reclaimed or FSC-certified.

This last requirement helps to account for the home’s unique appearance. Settled in the old Seattle neighborhood amidst 100-year-old craftsman style homes, the 3-story, 2,117 ft<sup>2</sup> contemporary home stands out as a testament to maximum efficiency.



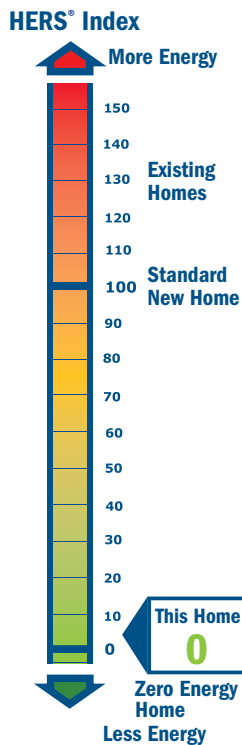
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE’s Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0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

Dwell Development built this 2,117-ft<sup>2</sup> home in Seattle, Washington to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. All of the interior and exterior lamps use energy-efficient LED lighting.



### 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.

Abbey Maschmedt, Dwell’s Director of Design, led the charge to meet the Emerald Star 90% reclaimed or FSC-certified wood by sourcing reclaimed Douglas Fir and naturally weathered steel roofing panels from a cannery in Oregon’s Willamette Valley for the siding. This protective rain screen adds visual interest and will never need painting. The home’s framing package is FSC-certified wood, which is rarely done in residential construction because of the challenges of finding a local supplier and the expense. Inside, the floors, stairs, and treads were built out of 100-year-old hand-hewn mixed hardwoods from Montana. Countertops, cabinets, and tile were made locally from high-recycled-content materials.

“The project was designed and constructed to reflect the neighborhood’s rich historic roots while merging modern design and the contemporary living habits of today’s residents,” said Maschmedt.

The simple rectangular design encompasses a smaller footprint. The project team, which included local firm Caron Architects, carefully configured the roof and window placement to maximize solar gain for passive heating, natural daylight, and cross ventilation. The double height interior space at the dining area and open floor plan help the interior feel light and spacious despite the weight of the exterior facade. Large south-facing overhangs help keep the house cool in summer.

The home is constructed on a slab-on-grade with 4 inches (R-16) of rigid foam EPS insulation under the slab and a full perimeter thermal break separating the slab from the poured concrete foundation stem walls.

For the above-grade walls, Dwell employed a double 2x4 stud wall (inside wall is partition, outside wall is structural). The two walls are set 7 inches apart to provide a 12-inch-deep wall cavity, which was dense-packed with R-46 of cellulose insulation. The studs were sheathed with ½ inch of plywood sheathing, which was covered with a fluid-applied membrane that replaces house wrap as the weather-resistive barrier under the cladding of reclaimed barn wood and reclaimed standing seam metal.

The home has no attic; instead, the third floor is topped with 5/8-inch drywall-faced cathedral ceilings. The unvented roof structure consists of 16-inch-deep, parallel-chord open-web roof trusses with R-64 of blown-in fiberglass insulation, ½ inch of plywood roof sheathing topped with 3 inches (R-20) of polyiso exterior insulation, ¼ inch of protection board, and a TPO membrane roofing surface. The roof assembly provides a total insulation value of R-84.



All of the home's plumbing fixtures comply with the EPA WaterSense program requirements. The builder used reclaimed wood inside and out, and all of the home's paints and finishes are low- or no-VOC products for fewer contaminants in the indoor air.

Although this house was not certified to Passive House, Maschmedt is familiar with the standard and it inspired some of his design and equipment choices, including the European triple-paned, solid wood-framed windows, with low-emissivity coatings, an insulating argon gas fill between the panes, an average whole-window insulating value of  $U=0.14$ , and an  $SHGC=0.50$ .

The home uses a CO<sub>2</sub> heat pump water heater with an 83-gallon storage tank to heat water for in-floor radiant heating and potable hot water. The unit is 450% efficient, meaning it uses 1 kW of energy to generate 4.5 kW of heat, which is approximately 78% less energy than traditional hot water systems. The heat pump uses a CO<sub>2</sub> refrigerant with a very low global warming potential compared to other refrigerants.

Whole-house ventilation for the tightly sealed home (1.17 air changes per hour at 50 Pascals pressure [ACH 50]) is provided by a heat recovery ventilator (HRV), which consistently brings in fresh air while efficiently recovering heat from the exhaust air stream. The system also helps to maintain a comfortable temperature inside the home by continuously mixing the air.

The home is equipped with 100% LED lighting and has an ENERGY STAR qualified refrigerator, dishwasher, and clothes washer.

All of the home's plumbing fixtures are WaterSense low-flow fixtures. The structured plumbing loop had a recirculation pump on a timer. To help meet the Emerald Star requirement of 70% reduction in water use over a code-built home, the builder also installed a 420-gallon storage cistern to harvest rainwater from the roof. The rainwater is twice filtered and used in the clothes washer, toilets, and hose bibs.

The home meets all of the criteria of the U.S. Environmental Protection Agency's Indoor airPLUS program including the use of all no-VOC finishes and site water management practices.

The home's roof-mounted 8.1-kW of photovoltaic panels provide enough electricity over the course of the year to meet the home's electric needs, cutting electric utility costs to about \$50 per year in service charges for this net zero energy home. The home is also equipped with an electric car charging station. To help track and manage electric usage and PV production, the home is equipped with an adaptive internet-connected home energy management system that was actually invented by another Dwell home owner.

## HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program

ENERGY STAR Certified Homes  
Version 3.0

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 home's high-performance windows are low-e, argon gas filled, and triple paned. Together with the double-stud walls they help maintain quiet, comfortable interiors.

Dwell has racked up an impressive list of awards and Maschmedt attributes this success to the quality control management practices put in place throughout the entire construction process, with the help of project manager and site superintendent Aaron Yankauskas, who was their Passive House Consultant before being hired on.

“Our team’s involvement from pre-design through approved building permits is where we attribute our success. The details are the difference. Pre-construction meetings with the City (Seattle) and all our subs set the tone and expectations,” said Maschmedt. First and foremost, we build energy-efficient homes because it’s the right thing to do. Every project we do, every home we design, every decision we make, every material we choose, and every system we install, is always approached in the same way, and with this mission in mind. What can we do to be better each and every time.”

The philosophy has paid off for Dwell which is able to sell its homes at a price premium compared to standard code construction builders in the area. Although Dwell sells all of its homes on spec most are sold before completed.

“Zero days on the market and selling at the highest price per foot at the time for this neighborhood proved that what we are doing is working,” said Maschmedt. “Our goal and mission now is to have every home we build be Net Zero Energy. We get a ton of press and media coverage because what we are doing is good in so many ways. Good for the environment, good for the community, good for the economy, good for the built environment, and good for knowing and showing to everyone that you can design and build a Net Zero Home and be profitable!”

*Photos courtesy of Dwell Development*

## KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** Double 2x4 stud wall, 12" cavity dense-packed with R-46 cellulose, ½" OSB sheathing, fluid-applied weather-resistant barrier, reclaimed barn wood and standing seam metal siding.
- **Roof:** R-84: unvented 16-inch cathedral roof with R-64 blown fiberglass, ½" OSB sheathing, 3" R-20 polyiso, ¼" protection board, standing seam metal roof.
- **Attic:** No attic.
- **Foundation:** Poured concrete foundation stem walls; slab-on-grade with 4" R-16 EPS under slab, and full perimeter thermal break R-8 slab edge.
- **Windows:** Triple-pane, low-e, argon-filled, wood-framed, U=0.09, SHGC=0.50.
- **Air Sealing:** 1.17 ACH 50.
- **Ventilation:** HRV, MERV 7 filters.
- **HVAC:** 83-gal CO2 heat pump water heater, 450% efficient, for radiant floor heat and hot water.
- **Hot Water:** CO2 heat pump water heater.
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, clothes washer, dryer, induction range.
- **Solar:** 8.1-kW PV.
- **Water Conservation:** All WaterSense low-flow fixtures, 420-gallon rainwater cistern.
- **Energy Management System:** Adaptive use home management system.
- **Other:** Electric car charging station, no-/low-VOC finishes, 100% reclaimed siding, 90% FSC or reclaimed wood, recycled content tile and countertops; Passive House inspired.