

Clifton View Homes

Marine Drive and
Port Hadlock
Coupeville, WA
Port Hadlock, WA



BUILDER PROFILE

Clifton View Homes Inc., Coupeville, WA
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Marine Drive and Port Hadlock
- Location: Coupeville and Port Hadlock, WA
- Layout: MD - 2 bdr, 2.5 bth, 2 fl + bsmt
PH - 2 bdr, 2 bth, 1 fl
- Cond. Space: MD - 2,408 ft²; PH - 1,784 ft²
- Climate Zone: IECC 4C, cold
- Completion: MD - March; PH - May 2015
- Category: Custom

Modeled Performance Data:

- HERS Index: MD - w/o PV 39, w/PV -12;
PH - w/o PV 38, w/PV -9
- Projected Annual Utility Costs:
MD - w/o PV \$862, w/PV \$-4;
PH - w/o PV \$759, w/PV \$-35
- Projected Annual Energy Cost Savings
(compared to home built to 2012 WSEC):
MD - w/o PV \$866, w/PV \$1,728;
PH - w/o PV \$1,518, w/PV \$2,300
- Builder's Added Cost Over 2012 WSEC:
MD - w/o PV \$24,000, w/PV \$53,530;
PH - w/o PV \$29,000, w/PV \$62,500
- Annual Energy Savings: MD - w/o PV
10,501 kWh, 35.83 MMBtu; w/PV 20,589
kWh, 70.25 MMBtu; PH - w/o PV 7,901
kWh; w/PV 17,367 kWh, 59.26 MMBtu

Builder Ted Clifton, who constructs custom zero energy homes on Whidbey Island in western Washington state, has two homes recognized with U.S. Department of Energy 2015 Housing Innovation Awards. While the houses are unique, they share an important common denominator, both have been certified to DOE's Zero Energy Ready Home program.

The DOE Zero Energy Ready Home program requires homes to meet all of the requirements of 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 a solar electric system installed or have the conduit and electrical panel space in place for it.

Clifton worked with his home buyers to install solar panels at construction, taking advantage of Washington state's generous solar subsidies to provide true net zero energy homes—homes that produce as much or more energy than they consume in a year. In fact, the homes are so energy efficient that, with the addition of solar electric panels, both homes produce enough electricity to power the home and an electric car with zero annual electric bills.

Clifton's two winning homes, one located on Marine Drive in Coupeville on Whidbey Island and one located in nearby Port Hadlock, achieved Home Energy Rating System (HERS) scores of 39 and 38 without solar photovoltaics or -12 and -9, respectively, when solar systems were added. Clifton achieves these high levels of energy efficiency by building to the DOE Zero Energy Ready Home criteria. Clifton has built homes to DOE's labeling criteria since 2011.



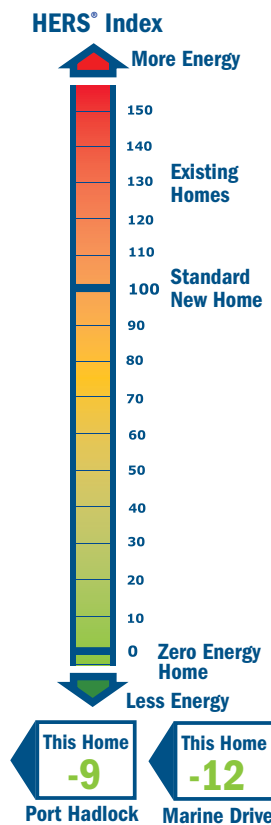
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0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

Clifton View Homes constructed this home on Marine Drive in Coupeville and a second home in Port Hadlock in 2015 to the strict performance criteria of the DOE Zero Energy Ready Home program. Both homes enjoy views of Puget Sound while producing enough solar electricity to power the home and an electric car charging station.



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.



Clifton has been a lifelong innovator in home construction. A high school graduate at age 16, he was accepted into the University of California Berkeley’s School of Design but dropped out after one quarter to go into construction, a trade he’d learned from his father, a high school teacher who also built and renovated houses and apartment buildings. Clifton moved his family to Alaska and then to Whidbey Island in Washington state in 1989 where he founded Clifton View Homes. Clifton’s reputation as a zero energy builder grew through grateful customers and through participation in local and state builders associations and national conferences. By 2008, he was getting more requests to build homes than he could handle, so he founded Zero-Energy Plans, LLC. Through this company, Clifton sells plans and consults on zero energy home projects throughout the country. All of Clifton’s homes meet the criteria of the DOE Zero Energy Ready Home program. Clifton also certifies local homes through the Skagit-Island County Builders Association (SICBA) Built Green® program; he has certified more homes to their five-star level than all other builders in the Skagit-Island County area combined.

Both sets of home owners of the 2015 award-winning homes were referred to Clifton by their realtors. The owners of the Port Hadlock home had a beautiful piece of property overlooking a marina on Puget Sound, west of Seattle. An architect had already drawn up plans with most of the window area facing north for the view. Clifton was hired as the builder. The home owners did not come asking for a zero energy home, but the husband, a diesel mechanic for a German auto maker, wanted the structural insulated panel (SIP) construction that Clifton uses. “Once I told them that we could do zero energy construction in their price range, they knew that is what they wanted,” said Clifton.

Clifton had to tweak the floor plan a bit and created a whole new roof line with a larger south-facing expanse to accommodate the solar panels. The roof peak is asymmetrical and a row of south-facing clerestory windows brings light into the home’s interior.

Clifton typically builds with concrete floor slabs that he stains and seals to serve as the finished flooring as well as thermal mass. The Port Hadlock home owners wanted wood, carpet, and tile flooring, which Clifton installed but he put a dense slip sheet under it so it became part of the thermal mass of the concrete floors, which also had 4 inches (R-20) of rigid foam underneath. Insulated concrete form (ICF), concrete-filled foam block walls formed the foundation walls down to the footer, providing R-23 of insulation and a thermal break around the slab, which



Natural light fills the kitchen of this Clifton View home in Port Hadlock. An ultra-efficient air-to-water heat pump provides hot water for domestic use and for the home's radiant floor heating, while ENERGY STAR appliances, LED lighting, and EPA WaterSense-rated plumbing fixtures add to water and energy savings. Outside, rain gardens help to infiltrate storm water back into the aquifer while reducing watering requirements. Plants were chosen that need no extra watering after the first season.

held the radiant floor heating coils. Clifton noted that concrete has a thermal resistance of R-1 per foot so it transfers heat fairly quickly, a principal he used for passive solar heating within the home. The thermal mass also provides a heat sink for cooling during the day. Clifton said the home had no air conditioning but on a recent 87-degree day, the interiors stayed 71 degrees at 3 pm.

The home has 6.5-inch SIP walls that provide an R-25 insulation value with no thermal bridging. The walls are wrapped in wrinkled house wrap to provide a slight air gap and drainage plane behind the fiber cement plank and shingle siding. The roof is composed of 10.25-inch SIP panels for an R-40 assembly. The main house is all cathedral ceilings, with a small mechanical attic above the master closet and master bath, and another small attic over the guest bath, all within the building envelope.

One of Clifton's "12 Essential Steps to Net Zero Energy" is to have balanced insulation levels throughout the home with high-R windows. The windows in the Port Hadlock home are triple-paned, with an argon-gas fill between the panes and low-emissivity coatings on three of the glass layers. The U-factors range from 0.14 to 0.17, and the solar heat gain coefficients also vary depending on which direction the window is facing, with values ranging from 0.22 to 0.51. The triple-low-e, low-SHGC windows on the north side reflect most of the winter sun back into the north-facing rooms. Total glazing area was kept to just 15%, mostly by reducing east- and west-facing glass to near zero.

The SIP construction provided an airtight structure for the Port Hadlock home, which tested at 1.7 air changes per hour at 50 Pascals pressure (ACH 50). For ventilation, Clifton devised a balanced approach that he considers to be more economical than a heat or energy recovery ventilator. Clifton installed a 240-cfm fan with a HEPA filter (MERV 19) that is directed to bring air into the home via a fresh air duct. This air flow is balanced with a matching 240-cfm range hood fan. A damper on the fresh air intake allows air in but not out. A 24-hour programmable timer allows the fan combination to operate in the early morning hours during periods of hot weather to cool off the home at a very low cost of operation. The system will replace all the air in the home in less than 1½ hours, at a cost of about 2¢ per day. When the system is not actively running, it provides a filtered passive pathway for fresh air to enter the home when a bath fan runs. The guest bath fan is set to run continuously at 40 cfm to meet the ASHRAE 62.2 requirement. The in-coming air is distributed through ducts (all within the conditioned space) to each bedroom and to the main living area.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

Built Green® Washington, four-star



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 stained concrete floors provide thermal mass while triple-pane windows let in sun for passive solar heating.

The owners of the home on Marine Drive on Whidbey Island also heard about Clifton through their realtor. They actually made appointments with three builders but after meeting with Clifton and finding out they could get a zero energy house at the size they wanted within their budget, they canceled the other appointments.

The Marine Drive house also has a slab floor with 4 inches (R-20) of rigid foam underneath and ICF foundation walls that provide slab edge insulation. The home owners chose to seal and stain the concrete floor slab and use that as the finished flooring. Clifton noted this helped save about \$15 per square foot compared to hardwood flooring and made a significant dent in the 7% cost increase over to-code construction.

The Marine Drive home has a daylight basement; below-grade walls are made of 11.75-inch R-23 ICF. Like the Port Hadlock home, the Marine Drive home has 6.5-inch (R-25) SIP walls and a 10.25 (R-40) SIP roof. The Marine Drive home had a near Passive House airtightness of 0.7 ACH 50 and used a ventilation strategy similar to that used in the Port Hadlock home. The Marine Drive home also used an air-to-water heat pump for the in-floor radiant heating system and hot water. The 2.5-ton heat pump has a COP of 4.5 and an HSPF of 15.5.

The Marine Drive home had a 7.84-kW solar electric system installed while the Port Hadlock home had a 7.56-kW PV system installed. All of the components were made in Washington to capture the Washington state production credits. Although the initial cost of the system was slightly higher, both systems will have an approximately 6-year payback due to the state production credits. Electric car-charging circuits were installed in the garages of both homes.

Both homes were engineered to withstand up to an 8.0 magnitude earthquake. Clifton ties the floors to the walls using ICF hangers that embed in the ICF concrete, rim joists that are connected to the floor joists, and an ICF wall design that has less bendable wall for less likelihood of breakage under stress. At a building conference, Clifton heard that, in tornadoes and earthquakes, the risk is not shingles flying off the roof but walls getting pulled apart. "About \$600 worth of hardware can prevent that," said Clifton who now uses screws at every 6 inches rather than every 12 to 24 inches to tie the walls to the roof.

The Port Hadlock home is heated with a highly efficient air-to-water heat pump (COP of 4.1), using in-floor radiant heat. No active cooling is required, except for the night ventilation cooling described above. Clifton has used ground source heat pumps on past projects but chose the air-to-water heat pump on this house because of the smaller house and lot size.

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KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 6.5" SIPs (R-25); corrugated house wrap; fiber cement siding.
- **Roof:** 40-year composition shingles.
- **Attic:** 10.25" SIPs (R-40); two-part polyiso spray-foam seals rim joists.
- **Foundation:** 11.75" ICF walls extending 12" below slab base (R-23); 4" rigid foam under floor slab (R-20).
- **Windows:** Triple-pane; argon-filled; triple low-e; U=0.14-0.17; SHGC=0.22-0.51.
- **Air Sealing:** 1.7 ACH 50.
- **Ventilation:** Fresh air intake fan; fans set on programmable timer; continuous bath exhaust fan; 240 cfm; MERV 19 HEPA filter.
- **HVAC:** Air-to-water heat pump (COP 4.1, 4.4); radiant floor heat; ventilation cooling.
- **Hot Water:** Air-to-water heat pump.
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR-rated refrigerator, dishwasher, clothes washer, and 2 ceiling fans.
- **Solar:** 7.56 kW PV system; WA-made for incentives.
- **Water Conservation:** All EPA WaterSense-rated fixtures; xeroscaped landscaping.
- **Other:** Electric car-charging circuit in garage; no-VOC paints; low-VOC caulks and adhesives; natural disaster resistance.

Photos courtesy of Clifton View Homes