Building America Case Study
Whole-House Solutions for New Homes

Hood River Passive House

Hood River, Oregon

PROJECT INFORMATION

Construction: New Home

Type: Single-family, custom

Builder:
Root Design Build of Hood River, Oregon
www.rootdesignbuild.com/

Size: 2,004 ft^2

Price Range: $320,000

Date completed: August 2012

Climate Zone: 5–Dry

PERFORMANCE DATA

HERS index: 40

Projected annual energy use reduction of 62% below benchmark saving: $943/year

Billing data based on 9 months shows a 69% reduction in energy use, resulting in annual savings of $1,140

Incremental cost of energy efficiency measures: $50,000

Incremental annual mortgage: $2,500

Annual cash flow: -$1,360

Project Description

The Washington State University (WSU) Energy Program—a member of the Building America Partnership for Improved Residential Construction (BA-PIRC)—has worked with builders in the cold and maritime climates of the Pacific Northwest for more than 30 years to develop exceptionally efficient residential construction practices.

BA-PIRC and the WSU Energy Program approached this project as an opportunity to:

- Evaluate the Passive House design approach and process outcomes.
- Document home performance.
- Track costs and determine obstacles to moving the Passive House into a cost-effective production environment.

The Hood River Passive Project, developed by Root Design Build of Hood River, Oregon, incorporates all features of the Passive House Planning Package (PHPP) and meets all of the requirements for certification under the European Passive House standards.

The Passive House design approach has been gaining momentum among residential designers for custom homes. BEoptE+ modeling indicates that these designs may actually exceed the goal of the Building America program to reduce home energy use by 30%–50% (compared to 2009 energy codes for new homes).

The Hood River project was initiated in 2009, but market conditions delayed completion until August 2012.

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Key Energy Efficiency Measures

HVAC

- Ductless mini-split heat pump with electric resistance baseboards as backup
- Heating season performance factor/ seasonal energy efficiency ratio = 11/22
- Ventilation: Heat recovery ventilator that meets ASHRAE 62.2 2010
- Shading: movable exterior panels

ENVELOPE

- Wall R-value = 50.5*
- Slab-on-grade R-value = 43.5*
- Ceiling R-value 76.6*
- Windows U-value = 0.09*
- Doors U-value = 0.13*
- Air sealing, ACH50 = 0.4 (tested)

*Values as derived in the PHPP

LIGHTING, APPLIANCES, AND WATER HEATING:

- Domestic hot water: solar thermal with electric resistance backup
- 100% compact fluorescent lamps and light-emitting diodes

For more Information, please see the Building America report titled, *Hood River Passive House,* at *www.buildingamerica.gov*

Image credit: All images were created by the BA-PIRC team.

The Shift House, built by Root Design Build in Hood River, Oregon, meets all requirements for certification under European Passive House standards.

Lessons Learned

- Incremental costs of building enclosure enhancements (air sealing, insulation, and fenestration) were $50,687.
- The total package of energy performance enhancements implemented in this project did not meet the Building America standard for cost neutrality.
- Individually ductless mini-split heat pump, lighting, and advanced air leakage control were the most cost-effective measures.
- The single-point source space conditioning from the mini-split heat pump did require some zonal resistance heat to maintain comfort in extreme conditions (6.5% of heat load).
- Overheating has not been a problem because the house has adequate shading.
- Comparisons between Passive House design development using PHPP and modeling with BEoptE+ indicates sizable differences. Monitored energy use was higher than modeled by PHPP but significantly lower than modeled by BEoptE+.
- Monitored energy use was 43.9% lower than modeled in BEoptE+.
- Measure costs, nontraditional building practices, space conditioning systems, and the design process are all obstacles to adoption by production builders.
- The process as seen here doesn't ensure the cost benefit goals of Building America are met; rather, it appears to be driven by noneconomic forces (desire to do the right thing, etc.).

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Energy Efficiency & Renewable Energy

For more information, visit:
www.buildingamerica.gov

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The U.S. Department of Energy's Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.

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