Building America Case Study
Whole-House Solutions for New Homes

Nexus EnergyHomes

Frederick, Maryland

PROJECT INFORMATION

Construction: New home

Type: Duplex, affordable

Builder: Nexus EnergyHomes
www.nexusenergyhomes.com

Size: 1,830 ft² above grade; 2,550 ft² conditioned area

Price Range: High $200,000s

Date completed: June 2011

Climate Zone: Mixed-humid

PERFORMANCE DATA

HERS index:
- With renewables = 28
- Without renewables = 51

Projected annual energy cost savings:
- 36% (62% with photovoltaics)
- $810 ($1,441 with photovoltaics)

Incremental cost of energy efficiency measures: $15,210 ($34,910 with photovoltaics)

Incremental annual mortgage:
- $820 ($1,881 with photovoltaics)
- $385 ($1,163 with photovoltaics) + incentives

Annual cash flow: $425 ($278 photovoltaics)

It's a common misconception that green homes are expensive. With this new home—which achieved the highest rating possible under the National Green Building Standard—Nexus EnergyHomes demonstrated that green and affordable can go hand in hand. The mixed-humid climate builder, along with the U.S. Department of Energy Building America team Partnership for Home Innovation, embraced the challenge to create a new duplex home in downtown Frederick, Maryland, that successfully combines affordability with state-of-the-art efficiency and indoor environmental quality. To limit costs, the builder designed a simple rectangular shape and kept interesting architectural features such as porches outside the building's structure. This strategy avoided the common pitfall of creating potential air leakage where architectural features are connected to the structure before the building is sealed against air infiltration. To speed construction and limit costs, the company chose factory-assembled components such as structural insulated panel (SIP) walls and floor and roof trusses. Factory-built elements were key in achieving continuous insulation around the entire structure. Open-cell spray foam (ocSPF) at the rim joist and attic roofline completed the insulation package, and kept the heating, ventilating, and air-conditioning (HVAC) system in conditioned space.

Nexus EnergyHomes' infill project was a result of years of development with the community and the Housing Authority of the City of Frederick. The techniques employed at this first home will help improve affordability for owners of all 55 homes in the neighborhood, 85% of which were sold in the first four months they were offered. The completed home earned Nexus EnergyHomes a 2012 Gold EnergyValue Housing Award, and the builder was honored as 2012 EVHA Builder of the Year.

Building AMERICA SM
U.S. Department of Energy

Key Energy Efficiency Measures

HVAC

- Ground source heat pump with forced air distribution
- Entire heating, ventilation, and air conditioning and distribution system in conditioned space
- Well-sealed ducts in open-webbed floor trusses. Duct leakage to outside = 0 cfm @ 25 Pa
- Energy recovery ventilation with bypass HEPA filtration

ENVELOPE

- R-22 structural insulated panels with tray-type roof trusses and open-webbed floor trusses
- R-38 ocSPF in unvented attic
- R-44 ocSPF in rim joist area
- R-15 fiberglass batt insulation in conditioned basement
- Double-pane, low-e, vinyl windows. U = 0.31, solar heat gain coefficient = 0.27
- Tightly sealed house, ACH50 = 1.1

LIGHTING, APPLIANCES, AND WATER HEATING

- 4.4-kW photovoltaics system
- 100% compact fluorescent lighting
- Whole-house energy monitoring system
- 64% energy factor natural gas water heater

Image credit: All images were created by the PHI team.

Nexus EnergyHomes used spray foam insulation to seal and insulate the attic as well as elastomeric sealant at key framing junctures to keep HVAC in conditioned space, add living space affordably, and tighten the building.

SIP walls and open-webbed floor trusses expedited on-site construction. Floor trusses, however, increased potential leakage areas at the rim joist, and were carefully air sealed with spray foam.

Lessons Learned

- SIP walls with combination spray foam and elastomeric sealant produce a tight envelope (1.1 ACH50). Redundant sealing systems were effective, but may result in unnecessary costs that could be avoided in future homes.
- The thermal and air sealing package is scalable to higher R-values without considerable redesign or added labor.
- Structural system allows conclusive air leakage testing before interior finishing, when mitigation is still relatively inexpensive.
- Open-webbed floor trusses and unvented attic made it easy to keep the HVAC system in conditioned space.
- Spray foam for sealing the attic and the rim joist was key to adding living space affordably.
- Due to the use of factory-assembled structural components (roof, walls, and floors), construction time was shortened by about two days compared to stick-framed construction.
- With federal and state incentives, the ground source heat pump was competitive with traditional systems while providing 13% energy savings compared with a high efficiency gas furnace and air conditioner.
- Without incentives, photovoltaic system economics were lackluster. Purchase incentives and renewable energy credits dramatically improve economics.
- The added cost of the indoor environmental quality features can be easily offset by omitting an attached garage.

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For more information, visit:
www.buildingamerica.gov

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.

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

DOE/GO-102014-4073 • February 2014