

**DOE CHALLENGE HOME
CASE STUDY****Nexus
EnergyHomes**

Frederick, MD

**BUILDER PROFILE****Nexus EnergyHomes**

Frederick, MD

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www.nexusenergyhomes.com**FEATURED HOME/DEVELOPMENT:****Project Data:**

- Name: North Pointe Lot 5
- Location: Frederick MD
- Layout: 3 bedrooms, 3 baths w/bsmt
- Conditioned Space: 4,516 ft², w/o bsmt
- Completion: Dec. 2012
- Climate Zone: IECC 4A
- Category: Custom

Performance Data:

- HERS Index without solar PV: 43
- HERS Index with solar PV: 28
- Projected annual utility costs: without solar \$1,464
- Projected annual energy cost savings: without solar \$607 (compared to a house built to the 2009 IECC)
- Builder's added cost: 10% (compared to a house built to the 2009 IECC)
- Annual energy savings: without solar 22,759 kWh, 51 therms (compared to a house built to the 2009 IECC)

When Nexus EnergyHomes' founder Paul Zanecki partnered with Mike Murphy, formerly of Toll Brothers, to start a home construction company in Maryland, some might have questioned his timing. After all, it was 2008 and the country's building industry was on a steep downward trajectory. But Zanecki, a land use lawyer, had a clear vision in mind—to revolutionize the home building industry by implementing the energy-efficient technologies already available to build net zero energy homes at a cost average consumers could afford. His research told him there was a market for energy-efficient homes if he could come up with the right suite of high-performance measures that would make sense from a building science and cost-competitive perspective.

The impressive package the builder has developed includes SIP walls, geothermal heat pumps, solar PV, and a proprietary energy management system, among other things. What sets Nexus EnergyHomes apart is that these high-powered features aren't optional upgrades; they are part of the standard package, integrated into a whole building approach that is implemented on every home. Nexus EnergyHomes charges about 10% more for their zero energy homes than a similar sized home built to code and they are selling twice as fast. This consistent approach has helped Nexus gain the distinction of having built the most emerald-level certified homes in the country to the National Green Building Standard (ANSI ICC 700).

Nexus implemented this impressive suite of measures at its North Pointe community in Frederick, Maryland, and it was there that Nexus built its first house certified to the U.S. Department of Energy's Challenge Home program. This urban infill community includes 24 duplex units, 19 townhomes, and 7 single-family homes. North Pointe is also the largest concentration of National Green Building Standard emerald-level certified homes in the United States.



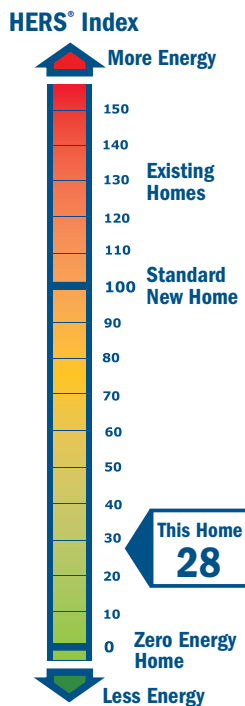
DOE Challenge Home builders are in the top 1% of builders in the country meeting the extraordinary levels of excellence and quality specified by the U.S. Department of Energy. Every DOE Challenge Home starts with ENERGY STAR for Homes Version 3 for an energy-efficient home built on a solid foundation of building science research. Then, even more advanced technologies are designed in for a home that goes above and beyond current code to give you the superior quality construction, HVAC, appliances, indoor air quality, safety, durability, comfort, and solar-ready components along with ultra-low or no utility bills. This provides homeowners with a quality home that will last for generations to come.

Nexus EnergyHome uses SIP walls as part of a package of high-performance technologies that includes geothermal heat pumps and solar panels. SIPs provide exceptional insulation and air sealing performance.



CHALLENGE HOME CERTIFIED:

- 1 BASELINE**
certified ENERGY STAR for Homes Version 3.0
- 2 ENVELOPE**
meets or exceeds 2012 IECC levels
- 3 DUCT SYSTEM**
located with 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.



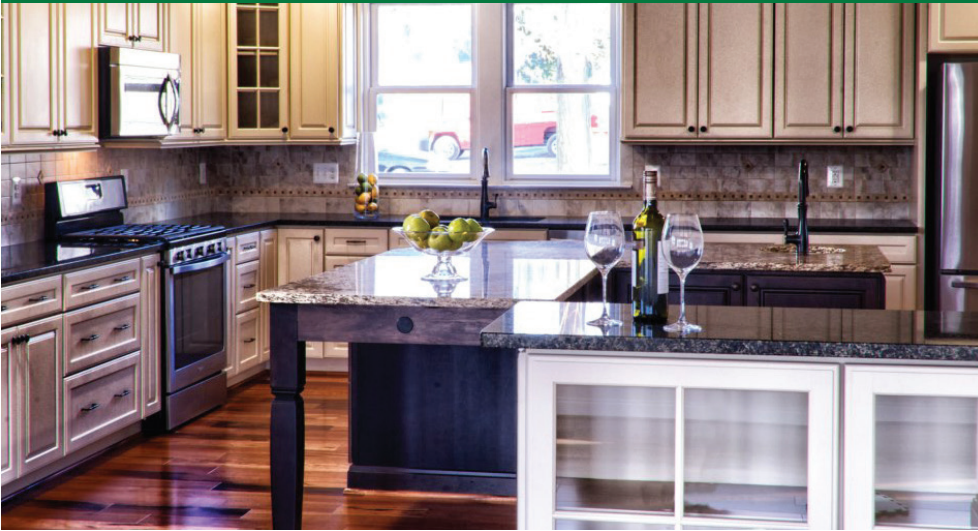
The North Pointe homes start with a high-performance building shell constructed of structural insulated panels (SIPs). The SIPs consist of a 5-5/8-inch-thick expanded polystyrene (EPS) rigid foam core glued to two layers of oriented strand board for an insulation value of R-24. Laboratory testing has shown that SIPs provide superior shear strength to stick-framed walls, meaning they are better able to withstand hurricane-force winds. SIPs also provide superior air sealing, sound proofing, and insulating qualities. Because there are no studs in a SIP wall, the foam insulation provides a continuous layer along the entire length of the wall, minimizing thermal bridging (the transfer of heat from the inside to the outside of the wall via wood framing members). SIPs can cost more, but because each wall section is precision cut at the factory, assembly on site is a relatively quick process, reducing labor costs.

The exterior walls are covered with house wrap, which serves as the drainage plane. The walls are clad with durable, insect- and rot-resistant fiber cement siding.

The attic is an unvented assembly that is insulated along the underside of the roof deck with 10.5 inches of an open-cell, soy-based spray foam that provides an insulation value of R-50 to 55 depending on foam thickness. The roof is topped with 30-year architectural shingles. Many of the house designs at North Pointe have a loft room on the third floor so spray foaming along the underside of the roof is a simpler and more consistent method for installing insulation than insulating the attic kneewalls. The insulated attic also provides protected, insulated storage space. In these homes, the HVAC equipment is not installed in the attic.

The basement or floating slab foundations are insulated beneath the entire length of the slab with R-4.5 of rigid insulation. Perimeter drain pipes are installed along the footings of the 10-inch-thick poured concrete exterior foundation walls. The exterior walls are covered with a waterproof coating. The slab is separated from the foundation wall with a capillary break. The basement walls are coated on the inside with a low-permeability coating, then finished with a 2x4 framed wall filled with R-11 interior faced batt insulation and covered with drywall.

Wood-framed windows were selected to meet historical preservation society requirements. The high-performance double pane windows have an insulation U factor of 0.31, a solar heat gain coefficient of 0.27, and low-emissivity coatings to prevent heat loss in the winter and to minimize heat gain in the summer.



An energy recovery ventilator provides continuous fresh air to the house while ENERGY STAR appliances and lighting and low-flow faucets reduce energy and water consumption. An innovative home energy management system allows homeowners to track their home's energy usage and production.

A ground-source heat pump provides the home's heating and some of its hot water. A ground source heat pump is an electric heat pump that exchanges heat with the ground or ground water, instead of air. Because heat is exchanged with the ground rather than the outside air, which has more erratic temperatures, ground-source heat pumps are a very efficient source of heating and cooling all year, achieving efficiencies of up to 300%+ year round. Hot water is provided by a desuperheater connected to the geothermal heat pump. Additional back-up water heating is provided by a power-vented gas storage tank water heater.

Nexus EnergyHomes has its own proprietary electronic energy management system, the NexusVision Smart System, which gives the homeowner the latest in home electronics integration. Traditional home management technologies such as security, climate control, audio/visual equipment, and lighting are combined with Nexus' exclusive whole-house energy usage, solar energy production, and air quality monitoring capabilities. Homeowners can see how their activities impact energy usage and track their energy consumption as well as their home's energy production. The air quality monitor tracks particulates in the indoor air and alerts homeowners to any significant degradation of air quality. NexusVision's user-friendly application is accessible from a desktop computer, laptop, tablet, or smart phone, making it remotely accessible anywhere the internet is available.

ENERGY STAR appliances were installed including a dishwasher and a refrigerator. All of the lighting in the homes is LED or fluorescent based. Sustainably produced materials like local brick and bamboo flooring and recycled materials like recycled-content carpet and recycled-glass countertops are used throughout the home.

Nexus takes several steps to ensure good air quality in the home. Ventilation is provided by an energy recovery ventilator that operates at low air flow continuously 24/7 to provide complete mixing and refreshing of the home's indoor air. The ERV brings in fresh outside air that is passed through a heat exchanger to capture heat from outgoing air before being distributed throughout the home. The ERV can also transfer humidity from incoming air to the outgoing air stream in the summer.

HOME CERTIFICATIONS:

DOE Challenge Home

NAHB National Green Building Standard
— Emerald

ENERGY STAR Version 3

EPA Indoor airPLUS



Every DOE Challenge Home combines building science specified by ENERGY STAR for Homes and advanced technologies and practices from DOE's Building America research program.

All of the materials used in the homes are certified as low- or no-VOC, including the spray foam insulation, all adhesives (including the SIP adhesive), waterproofing products, the carpets, the plywood used for the subflooring and roof sheathing, indoor paints and finishes, and drywall. Every home is equipped with a central vacuum system. Unlike conventional vacuums, which can recirculate dust, a central vacuum removes 100% of the contacted dirt, dust mites, pollen, pet dander, and other allergens and carries it outside the home for disposal. Every home also comes with a high-efficiency particulate air (HEPA) filter, which is installed on the return side of the central air handler to clean air that will be circulated throughout the home. The HEPA filters installed have minimum efficiency reporting values (MERVs) of 17 to 20, meaning they can filter out mold, pollen, dust mites, tobacco smoke, bacteria, and even most viruses.

All plumbing fixtures are low flow. Drought-tolerant and non-invasive plants were utilized in the landscaping and the home was equipped with a high-efficiency irrigation system as well as a rainwater collection cistern to offset potable water use.

Quality management practices are crucial to ensure high-performance homes are constructed as designed. Nexus has a pre-construction team meeting and prepares comprehensive construction documents for its contractors. Third-party verification through testing and inspections is required for Challenge Home. Nexus is so confident of the quality of its homes that it offers a 10-year limited warranty on each home it builds.

The model home at North Pointe has been turned into a showcase of the high-performance technologies in each home. The home has displays of each of the technologies to help potential homebuyers understand the Nexus EnergyHomes package. In addition, Nexus developed educational materials including a “Dare to Compare” home buyer guide and a “Builder and Product Warranty Guide.”

“Home buyers do want to talk about money, but that seems to be a later conversation. Our buyers ask a lot of questions about health and comfort. Allergies are an issue. We’ve had homeowners anecdotally say they’ve thrown away their allergy meds, after moving into one of our homes,” said Amber Wood, director of research, development, and innovation for Nexus EnergyHomes.

There has been significant media interest in the Nexus net-zero energy homes. Articles on Nexus EnergyHomes have appeared in the *Wall Street Journal*, the *Washington Post*, and *USA Today*. Nexus EnergyHomes was also mentioned in Maryland Governor O’Malley’s State of the State address.

KEY FEATURES

- **Path:** performance
- **Walls:** 6.5-inch (R-24) SIP panels with EPS foam core; housewrap; fiber cement siding.
- **Roof:** unvented roof insulated along underside of roofline with 10.5 in. (R-50) open-cell, soy-based spray foam
- **Foundation:** cast-in-place concrete basement walls with R-11 interior batt insulation
- **Windows:** double-pane, argon-filled, low-e, wood-frame windows, U=0.31, SHGC=0.27
- **Air Sealing:** 1.12 ACH50
- **Ventilation:** ERV with MERV 17 to 20 HEPA filters
- **HVAC:** ground-source heat pump, 26.8 EER, 4.7 COP, all ducts in conditioned space
- **Hot water:** desuperheater with power-vented gas water heater
- **Lighting:** 100% CFL
- **Appliances:** ENERGY STAR lighting, dishwasher, refrigerator
- **Solar:** 5-kW PV
- **Water Conservation:** drought-tolerant, non-invasive plants; high-efficiency irrigation system; rainwater collection cistern
- **EPA WaterSense:** showerheads, faucets, toilets
- **Energy Management System:** NexusVision Home Communication System for energy monitoring and home automation
- **Other:** low-VOC paints and no-VOC SIP panels, bamboo flooring, recycled content carpet, urban infill location

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

For more information on the **DOE Challenge Home**,
go to www.buildingamerica.gov/challenge

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www.BuildingAmerica.gov