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

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2020 WINNER Housing Innovation Awards

Insight Homes

The Nelson
Millsboro, DE

BUILDER PROFILE

Insight Homes
Bridgeville, Delaware; itsjustabetterhouse.com
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: The Nelson
- Location: Millsboro, DE
- Layout: 4 bdrm, 3.5 bath, 2 fls, 3,680 ft²
- Climate: IECC 4A, mixed-humid
- Completed: December 2019
- Category: Production

Modeled Performance Data:

- HERS Index: without PV 50
- Annual Energy Costs: without PV $2,400
- Annual Energy Cost Savings: (vs typical new homes) without PV $3,450
- Annual Energy Savings: without PV 7,300 kWh, 450 Therms
- Savings in the First 30 Years: without PV $161,200

They say practice makes perfect. In 2020, Insight Homes of Bridgeville, Delaware, constructed 244 homes to the high-performance requirements of the U.S. Department of Energy (DOE) Zero Energy Ready Home program, more homes than any other builder in the program. Insight Homes, which began building homes in Delaware and Maryland in 2007, only joined the DOE Zero Energy Ready Home program in 2018 and has already certified 370 homes to date. In 2018, they made a commitment to certify 100% of their current product line to the program requirements. Insight has been pushing the envelope of high-performance home construction since its inception by partnering with programs like DOE's Zero Energy Ready Home program. Through participation in programs like this and others, Insight has been able to identify and implement cost-effective strategies that allow them to achieve exceptional performance at little to no added cost compared to a home built to the state's energy code, which is equivalent to the 2012 International Energy Conservation Code.

“Insight started building new homes in Southern Delaware with the vision of making a better product and we’ve spent years perfecting the process. Insight’s entire business model evolved around high performance, efficiency, and a healthy indoor environment. “We believe so strongly in the benefits of the high-performance features we offer that we include all these features as standard in every home we build,” said Kevin Broznya, vice president of operations. This allows Insight Homes to negotiate volume purchases of high-end, higher performing products. Insight uses an integrated design process that includes team meetings with design partners and key trade partners (e.g., HVAC, structural, framing labor, and plumbing).

The DOE program requires that builders certify their homes to the program checklists of ENERGY STAR Certified Homes Version 3.1 and the U.S. Environmental Protection Agency’s Indoor airPLUS. Builders must also meet other efficiency requirements like the hot water distribution requirements of the EPA’s WaterSense program; the insulation requirements of the latest International Energy Conservation

ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY

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. Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0/3.1/3.2 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.

Insight Homes built this 3,680-ft² two-story home in Millsboro, Delaware, to the high-performance requirements of the U.S. Department of Energy's Zero Energy Ready Home program. ENERGY STAR labeled appliances, WaterSense labeled fixtures, and 100% LED lighting help this home save energy and water.

What makes a home a DOE ZERO ENERGY READY HOME?

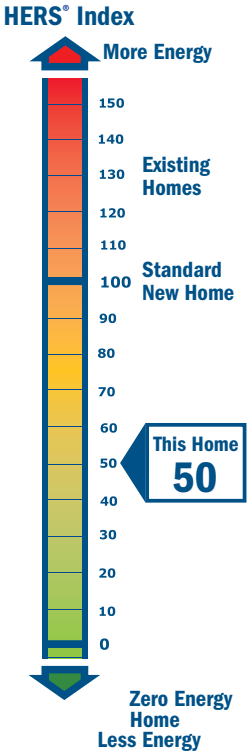
1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0/3.1

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.

Code; HVAC and water heating efficiencies; third-party-verified air sealing targets; installation of ENERGY STAR appliances, windows, and lighting; and ducts in conditioned space. In addition, DOE requires that homes have solar electric panels installed or have the conduit and electrical panel space in place for it.

Insight decided not to install PV at the time of sale, giving the buyer the option to add it later. Even without PV, this award-winning 3,680-ft² single-family production home achieved a Home Energy Rating System (HERS) score of HERS 50 and estimated energy savings of $3,450 per year compared to a home built to the state code.

Insight Homes employs a panelized wall system consisting of 2x6 framing at 24-inch on center stud spacing and other advanced framing techniques like insulated headers, two- and three-stud corners. The wall panels have a 7/16-inch coated OSB exterior sheathing, which saves time and money by serving as the structural sheathing and the primary weather barrier when all seams between panels are taped. The wall cavities are insulated with R-23 of netted and blown fiberglass. No plumbing or HVAC is installed in the exterior walls. The walls are clad with vinyl siding.

The exterior walls sit on an unvented conditioned crawl space consisting of poured concrete walls that are protected on the exterior with a liquid-applied water proofing. An interior perimeter drain is installed and connected to a sump pit. The ground of the crawl space consists of 4 inches of clean gravel for a capillary break, topped by a 10-mil fiber-reinforced poly vapor barrier that is taped and sealed at all penetrations and wrapped 18 inches up the foundation wall. The crawl space walls are insulated with 2 inches (R-10) of extruded polystyrene rigid foam board that is applied to the interior from the top of the wall to the top of the footer. The band joist is insulated with R-19 of open-cell spray polyurethane foam.

The vented attic is constructed with engineered roof trusses that include an 18-inch raised heel design to allow for full depth insulation over the top plates of the exterior walls. Cardboard insulation baffles are installed in each attic bay to prevent wind washing from the soffit vents and to provide a path for ventilation air to flow up to the ridge vent. In the mixed humid climate, this air flow helps to provide several benefits; it helps pull heat and humidity out of the attic in the summer and in the winter it keeps the deck surface cooler, which helps to prevent the ice dams that can occur when snow melts on a warm roof deck then refreezes at the roof's edge. The attic is insulated with 16.25 inches of loose blown fiberglass insulation to achieve R-49 across the full ceiling plane. For any vaulted ceiling areas, R-38 fiberglass batts were

Insight Homes employs a panelized wall system consisting of 2x6 framing and a coated OSB sheathing product that is taped at the seams to provide a continuous air barrier for the wall panels, which assemble quickly on site. Advanced framing features like 24-inch on-center stud spacing, insulated headers over doors and windows, and two- and three-stud corners help reduce lumber use while providing more space in the wall for the R-23 of netted and blown fiberglass insulation.

used. Attic hatches that are located in the side walls or the ceiling plane are insulated with multiple layers of extruded polystyrene rigid foam board and are gasketed for air sealing. No mechanical equipment or HVAC ductwork is permitted in the attic.

Every home certified through the DOE Zero Energy Ready Home program is inspected by a HERS rater and tested for air tightness. Insight's home achieved an air tightness of 1.9 air changes per hour at 50 Pascals (ACH50). Air sealing occurred in two stages. The first occurred before drywall was installed and after mechanical rough-in when all penetrations through the subfloor to the crawlspace, through the top plates and chases to the attic, and through the exterior walls were sealed using expanding foam sealant and rough openings around the windows and door frames were sealed with low-expansion foam sealant. The second stage occurred after drywall was installed when spray foam was used to seal the back side of the ceiling drywall, along the top plates of all interior partition walls, and any penetrations through the ceiling drywall and partition walls (e.g., light fixtures, exhaust fans, plumbing stacks, etc.).

The home is heated and cooled with a 97.5 AFUE modulating gas (propane) furnace and heat pump with a heating efficiency of 9.3 HSPF and a cooling efficiency of 18.8 SEER. The indoor equipment is located in the conditioned crawl space. The duct system trunk lines are rigid round metal ducts while branch takeoffs are insulated flex ducts with a manual balancing damper at each branch. Two dedicated 4-inch supply lines provide air to condition the crawlspace. The MERV 13 air filter is located in a central return box placed in a wall of the living space to provide ease of access for replacement. All systems are equipped with a wifi-enabled thermostat. Ventilation is provided by exhaust fans located in the bathrooms.

Given the longer shoulder seasons in the mixed-humid climate, space conditioning demands for sensible load may be minimal. Coupled with the high-performance windows, 6-inch exterior walls, and larger overhangs, the heating and cooling load is significantly reduced for a home of this size. With the space conditioning system not calling for heating or cooling, the homes are designed to have the central air handler fan (with an ECM motor) run in manual mode at 30% fan capacity for a set period each hour, between 15 and 45 minutes. Ceiling fans are installed in the central living spaces, including the living room, loft, morning room, and master bedroom. The periodic cycling of the air handler, coupled with the standard ceiling fans, can help to ensure mixing of the air throughout the home and prevent stratification from occurring when there is no demand for heating and cooling.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program - 100% Commitment

ENERGY STAR Certified Homes Version 3.1

National Green Building Standard EPA Indoor airPLUS

DOE Zero Energy Ready Home Quality Management Guidelines

"Insight Homes has committed to building all our homes to the DOE Zero Energy Ready Home designation, ENERGY STAR Certified Homes, and the National Green Building Standard."

Insight Homes

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.

A high-efficiency (97.5 AFUE) gas furnace, high-performance (9.3 HSPF, 18.8 SEER) central heat pump, and tankless gas water heater provide efficient space and water heating.

All of the home's lighting fixtures use LED light sources. The home's refrigerator, dishwasher, and tankless water heater are all ENERGY STAR rated.

The home's plumbing system consists of a central manifold with PEX piping. The homerun distribution system supply lines are sized for each specific end use, and shut-off valves are installed at each point of use. The fixtures are EPA WaterSense-labeled. Landscape irrigation was installed with weather sensors to prevent system operation during periods of rainy weather.

All homes certified through the DOE Zero Energy Ready Home program must meet the requirements of EPA Indoor airPLUS. Insight Homes uses low-VOC paints, construction adhesives, carpeting, and other materials that allow the home to achieve the gold level of certification under the National Green Building Standard.

In addition to meeting the DOE Zero Energy Ready Home designation, which includes ENERGY STAR and Indoor airPLUS certification, Insight Homes has also committed to building all its homes to be certified to the National Green Building Standard. These performance programs require third-party inspections, as well as performance testing at several stages of construction to ensure compliance with strict guidelines. In addition, Insight Homes' HVAC suppliers require system commissioning and air flow testing prior to occupancy.

"Insight Homes is the only home builder in the Mid-Atlantic region to dedicate the majority of their website and marketing literature to explaining the benefits of the building science that goes into our homes," said Brozyna. Insight also converted the garages of several of their model homes into building science education centers, which include mock-ups of their homes' building assemblies and interactive displays that explain the high-performance features that make their homes unique. "No other builder in this region dedicates the effort to educating the customers and explaining why they should be demanding high performance from their builder," said Brozyna. Insight uses only in-house sales staff that are specially trained in giving high-performance home tours and can explain the features and benefits of health and comfort that come from living in an Insight Home.

"Today, our homes are the healthiest and most energy-efficient homes in the Mid-Atlantic and are among the highest performing production homes in the nation. We ask homeowners to share their utility bills with us as testimonials to the actual performance observed and enjoyed in their homes. Their actual utility bills are posted on Insight Home's website for prospective buyers to review and for homeowners to brag about!" said Brozna. You can check them out at itsjustabetterhouse.com.

KEY FEATURES

- **Walls:** 2x6 framing at 24″ o.c. spacing, insulated headers, 2-stud corners, 7⁄16″ coated OSB sheathing, R-23 netted blown fiberglass in cavity, vinyl siding.
- **Roof:** 7⁄16″ OSB sheathing, 15# roofing paper, ice & water shield in valleys, double layer starter shingles, architectural shingles, 15″ overhangs, ENERGY STAR Cool Roof certified.
- **Attic:** Vented attic: 16.25″ R-49 blown fiberglass, 12″ R-38 batt fiberglass in cathedral ceilings. 18″ raised heel trusses.
- **Foundation:** Unvented crawlspace foundation: poured concrete walls, liquid water proofing on exterior, interior perimeter drain connected to sump pit, 4″ clean gravel, 10-mil fiber-reinforced poly vapor barrier, 2″ R-10 extruded polystyrene rigid foam board on interior of wall down to footer, R-19 open-cell polyurethane spray foam in band joist.
- **Windows:** Double-pane, argon-filled, low-e, vinyl double-hung frames, U=0.28, SHGC=0.19.
- **Air Sealing:** 1.9 ACH 50, two-stage air sealing of building envelope penetrations
- **Ventilation:** Exhaust-only. MERV 13 filters in returns.
- **HVAC:** Gas furnace heater, 97.5 AFUE. Central heat pump 9.3 HSPF, 18.8 SEER. Round metal trunk lines, flex branch ducts.
- **Hot Water:** Condensing tankless propane water heater, .97 UEF
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR refrigerator and dishwasher.
- **Solar:** N/A.
- **Water Conservation:** EPA WaterSense fixtures. Central manifold with PEX piping.
- **Energy Management System:** wi-fi connected T-Stats.
- **Other:** Low-VOC paints, construction adhesives, and carpeting.

Photos courtesy of Insight Homes

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