

BrightLeaf Homes

McCormick Avenue
Brookfield, IL



BUILDER PROFILE

BrightLeaf Homes LLC, Brookfield, IL
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Rater: Insight Property Services
Joe Konopacki, joe@insightpsinc.com

FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: McCormick Avenue
- Location: Brookfield, IL
- Layout: 4 bedrooms, 3 baths, 2 floors, in-ground basement
- Conditioned Space: 2,880 ft²
- Climate Zone: IECC 5A, cold
- Completion: October 2014
- Category: Production

Modeled Performance Data:

- HERS Index: without PV 38
- Projected Annual Utility Costs: without PV \$1,362
- Projected Annual Energy Cost Savings (compared to a home built to the 2012 IECC): without PV \$1,314
- Builder's Added Cost Over 2012 IECC: without PV \$9,000
- Annual Energy Savings: without PV 4,307 kWh, 901 Therms

For Scott Sanders, a partner at BrightLeaf Homes in Brookfield, Illinois, it's all about the details. Sanders credits the attention to detail required by the U.S. Department of Energy's Zero Energy Ready Home program with helping BrightLeaf to achieve very low Home Energy Rating System (HERS) scores like the HERS 38 achieved on this two-story home built with common construction materials in the Chicago suburb of Brookfield.

Sanders founded BrightLeaf in 2012 after 2 years working for a large production builder in the Washington, DC, area, and built his first home to the DOE program criteria in 2013. BrightLeaf expects to complete 6 homes in 2015, 3 of them to the DOE Zero Energy Ready Home criteria, and hopes to construct 8 to 12 homes next year, all certified to the DOE program. The company describes their business model as custom home building with a production floor plan because they do scattered infill construction of primarily pre-sold homes with the same floor plan. Sanders appreciates the DOE program as a way to differentiate his product in the west Chicago suburbs.

Sanders also appreciates the DOE program for its low cost and simplicity. Because it is built on other familiar national programs like ENERGY STAR Certified Homes and the U.S. Environmental Protection Agency's Indoor airPLUS, Sanders has found a rater who will certify to it, whereas he has had difficulty finding raters who can certify to some other national programs, which he also considers to be costlier in terms of application fees. While there is some ambivalence in the local market about green programs, Sanders said he has had recent buyers who specifically sought out the company for zero energy construction. Sanders, who has a degree in construction management from Illinois State University, said the company has found ways to achieve high performance at an increased cost of only \$9,000 by following the criteria of the DOE Zero Energy Ready Home program.



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.

BrightLeaf Homes constructed this two-story home with basement in the Chicago suburb of Brookfield, Illinois, to the strict performance criteria of the U.S. Department of Energy's Zero Energy Ready Home program.



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

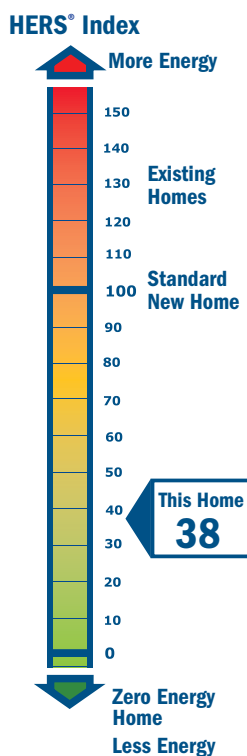
3 DUCT SYSTEM
located within the
home's thermal
boundary

**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.



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.

BrightLeaf's high-performance home starts with an 8-inch poured concrete basement foundation wall, with 4 feet of wall below grade and 4 feet above to allow for significant natural light through the 36-inch-tall basement windows. A sheet of 10-mil polyethylene vapor barrier separates the keyed footing from the foundation wall to minimize moisture transfer.

The foundation wall is fully insulated on the exterior with 3 inches of rigid XPS insulation installed in two 1.5-inch-thick layers with staggered seams to provide an extra protection against water infiltration to the foundation wall. The 4-inch-thick concrete basement slab has 2 inches of XPS insulation under it and extending over the top of the footing with taped seams. This rigid foam is installed on top of a crushed gravel base to promote drainage. On top of the foam insulation is a single continuous sheet of 10-mil polyethylene vapor barrier.

The primary water protection for the wall is a dimpled high-density polyethylene drainage mat. The material is continuous around the home's foundation from top to bottom except for two vertical seams that are overlapped 12 inches. The bottom of the drainage mat is sloped down over the top of the exposed edge of the footing to direct water to the drain tile located along the side of the footing instead of allowing the water to sit on top of the footing. The dimpled plastic extends up the wall above grade but is covered with 3 inches of rigid foam along the exterior wall, which was flashed to 6 inches below grade with metal flashing.

BrightLeaf puts ice-and-water shield over the top of the foundation wall and the top edge of the drainage mat before laying down the sill seal and sill plate. The ice-and-water shield stops any termites from coming up behind the drainage mat and reaching the sill plate.



Attention to detail, including very careful installation of house wrap, airtight drywall, thorough flashing, and a construction design that minimized penetrations through the ceiling, helped BrightLeaf achieve an airtightness of 0.94 ACH 50 on this production home. The garage was framed after the house was wrapped in house wrap to provide a seamless air barrier between the two. The home is solar ready with proper roof orientation and pitch and conduit and wiring in place. The garage is pre-piped for an electric vehicle charging station.

The exterior walls of this home utilized an assembly consisting of 2x6 top and bottom plates with 2x4s spaced every 8 inches but staggered to align with either the inside edge or the outside edge of the 2x6 plates, so that there is a stud aligned with the inside edge every 16 inches and a stud aligned with the outside edge every 16 inches. By aligning every stud with either the inside or outside edge of the wall, a space is left along one edge of the stud where insulation can be filled in to prevent thermal bridging, or heat transfer through the wall. BrightLeaf prefers to install these staggered studs every 12 inches for 24 inch spacing along each edge, but they were prohibited from doing so on this house by the local code official. The company used advanced framing techniques including two-stud corners on exterior walls, ladder blocking on interior partitions, right sized and insulated headers, reduced window opening framing, and layout of door and window king studs to match the 16-inch wall stud layout.

The wall cavities are filled with dense-packed cellulose insulation with an effective R-value of R-25. On the inside face, BrightLeaf installed $\frac{5}{8}$ -inch drywall using an airtight installation approach where all edges of each sheet are caulked to the studs. On the exterior, the builder installed $\frac{1}{2}$ -inch plywood sheathing, then house wrap. They pay attention to the details—following the manufacturers’ instructions for correct spacing of fasteners, correct flashing around the windows, sealing the house wrap with a tenacious tape at the top and bottom of the walls to prevent air infiltration behind the house wrap, and installing metal Z flashing above doors, windows, HVAC, electrical, and fan penetrations. On windows sills BrightLeaf installs what Sanders refers to as a poor man’s pan flashing—they place a 5.5-inch-wide cedar plank, which has a natural bevel, on the sill with the thicker edge toward the interior, then cover this with a flexible flashing tape to provide a sill that will drain out if any water gets behind the window. The builder has experimented with proprietary coated sheathing and rigid foam products, but felt they could get the same air sealing, thermal, and weather barrier results, at lower cost, from the staggered stud-plywood-house wrap assembly. Vinyl siding was installed that has a built-in air gap.

The home has a vented attic with the primary air barrier being the air-tight drywall ceiling of the second floor. Several small steps help to ensure this air-tight ceiling. All top plates of interior partition walls are sealed with one-part foam insulation before the 16 inches of R-60 loose blown cellulose attic insulation is installed. Raised heel energy trusses facilitate insulating over the exterior wall top plates with a full 16 inches of insulation. The plywood sheathing installed on the

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

EPA WaterSense

“This is an assembly that almost every contractor could build but very few can or will do it with the attention to detail that we perform. We have built wall assemblies with several proprietary products and have concluded that we can achieve remarkable levels of air tightness at a fraction of the cost with common house wrap and careful attention to detail.”

—Scott Sanders, owner, BrightLeaf 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.



Dimpled plastic carries water away from the foundation wall and down to the footing drains.

exterior walls is run up to the top of the raised energy heel trusses to provide a seamless air barrier. There are no recessed can lights in the second-floor ceiling and all smoke detectors on the second floor were installed on interior partition walls instead of in the ceiling. Wall sconces were used where possible and, where ceiling fans or other ceiling-mounted lights were necessary, the metal electrical junction boxes were completely taped and then further sealed with one-part spray foam.

The roof is a simple gable roof constructed with engineered roof trusses spaced at 16 inches on center. (The local building official prohibited 24-inch spacing.) A 1/2-inch plywood sheathing was installed as the roof deck. The trusses have extended rafter tails to allow for a full 24-inch overhang to protect the exterior walls from rain and provide solar shading for the second-floor windows. Ice-and-water shield was installed extending 4 feet in from the roof edge or 2 feet beyond the plane of the exterior wall. Penetrations in the roof are limited to a single plumbing vent stack, the radon vent, and two 6-inch bathroom exhaust vents. All of the penetrations are clustered together to facilitate the maximum amount of solar panels possible.

Balanced whole-house ventilation is provided with a fresh air intake duct that is ducted to the return side of the central air handler and has an electronically controlled damper connected to the variable-speed furnace motor.

Adding to energy and water savings are high-efficiency equipment including a 96% AFUE, 14 SEER gas furnace and air conditioner, a .97 EF tankless water heater, LEDs in 90% of the light fixtures, ENERGY STAR-rated appliances, and EPA WaterSense-labeled plumbing fixtures.

All of the attention to detail helped BrightLeaf to achieve a remarkable air tightness of 0.94 air changes per hour at 50 Pascals pressure difference (or 413 cfm 50) when tested with a blower door. “We are extremely proud of this number considering the fact that we are using common, commercially available building materials, U.S. made windows, and only a small amount of additional air sealing beyond the airtight drywall approach,” said Sanders.

Photos courtesy of BrightLeaf Homes

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 2x6 top and bottom plates, 2x4 studs staggered to inside or outside edge every 8 inches. Advanced framing. Dense-packed R-25 cellulose; 5/8" airtight drywall, 1/2" plywood sheathing, carefully air-sealed house wrap, vinyl siding; all openings tape flashed.
- **Roof:** 1/2" plywood sheathing; 30-lb felt, ice-and-water shield at eaves, 13" energy trusses; 24" overhang; ridge vent. Only 4 roof penetrations. ENERGY STAR asphalt shingles.
- **Attic:** Vented; all top plates sealed with one-part spray foam; 16" R-60 blown cellulose.
- **Foundation:** Poured concrete basement; 3" XPS on exterior foundation wall. 2" XPS insulation under slab over crushed gravel and 10-mil poly. Poly between footing and foundation wall, and foam and slab. Dimpled plastic over foundation wall.
- **Windows:** Vinyl-frame, triple-pane, argon-filled, low-e, U=0.18 to 0.22.
- **Air Sealing:** 0.94 ACH 50, 413 CFM 50.
- **Ventilation:** Controller-integrated fresh air intake, exhaust fan, and variable-speed furnace motor for balanced fresh air; bath fans.
- **HVAC:** 96% AFUE furnace, 14 SEER AC, dual-stage, variable-speed ECM, ductwork in conditioned space through open-web floor trusses.
- **Hot Water:** Tankless water heater, short runs.
- **Lighting:** 92% LED; ENERGY STAR ceiling fans.
- **Appliances:** ENERGY STAR dishwasher, refrigerator.
- **Solar:** PV ready.
- **Water Conservation:** 100% EPA WaterSense fixtures.
- **Other:** Low/no-VOC wood products and finishes. Garage wired for electric car charging.