



Healthy Communities

Today's New Living Experience at Walnut Farm Williamsburg, VA



BUILDER PROFILE

Healthy Communities
Williamsburg, VA
HealthyCommunitiesVA.com
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Project name: Today's New Living Experience at Walnut Farm
- Location: Williamsburg, VA
- Layout: 3 bdrm, 2 bath, 1 fl, 1,847 ft²
- Climate: IECC 4A, mixed-humid
- Completed: September 2022
- Category: Production

Modeled Performance Data:

- HERS INDEX: without PV 44; with PV 8
- Annual Energy Costs: without PV \$1,200; with PV \$300
- Annual Energy Cost Savings: without PV \$1,750; with PV \$2,650
- Annual Energy Savings: without PV 9,450 kWh; with PV 17,050 kWh
- Savings in the First 30 Years: without PV \$74,200; with PV \$110,750

For veteran home builder Jay Epstein, a lifetime of construction experience can be distilled into one phrase, the “simplicity of the build.” For Epstein, this philosophy consists of combining standard construction and quality installation with better materials and a few new technologies, added only where they make sense from a cost or performance perspective. It’s been a winning combination for Epstein, who recently crowned his 44-year career in the home building industry by earning a grand award in the “Off the Shelf” category in the U.S. Department of Energy’s 2023 Housing Innovation Awards competition.

As Epstein seeks to hand over the reigns of his Healthy Communities construction company in Williamsburg, Virginia, to his daughter, Morgan Epstein Wojciechowski, he reflects back on a career that’s seen the construction and certification of more than 95 homes to the DOE Zero Energy Ready Home criteria, with 90 more currently in the pipeline.

For Epstein, simplicity of the build means designing homes that contractors can easily put together without requiring a lot of new skills. For example, Epstein uses site-built stick-frame construction or factory-made exterior wall panels. But instead of 2x4 16-inch on-center, Epstein specifies 2x6 24-inch on-center framing with simple advanced framing adjustments like turned three-stud corners, insulated headers, and ladder blocking at intersecting walls so the walls can hold more insulation while using less lumber. Instead of wrapping the sheathing with house wrap, Epstein specifies 5/8-inch R-3 graphite-enhanced expanded polystyrene (GPS) rigid foam. “It’s light weight; it does not need to be structural due to the 1/2” plywood it’s attached to. Nine cap nails can hold a 4x8 sheet and we can nail the fiber cement siding right through to the studs,” said Epstein. With seams taped, the rigid foam serves triple-duty as a weather-resistant barrier, drainage plane, and thermal break to stop heat transfer through the studs.



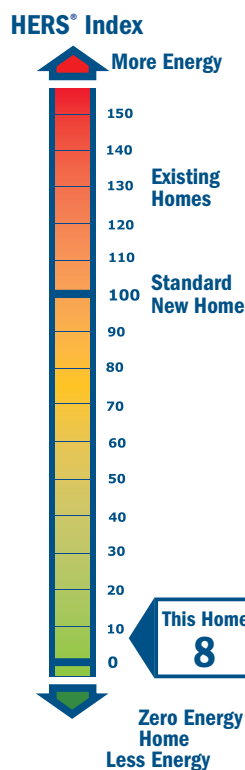
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE’s Zero Energy Ready Home program. Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0/3.1/3.2 for an energy-efficient home 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.

Healthy Communities built this 3-bedroom, 2-bath, 1-floor, 1,847-ft² home in Williamsburg, Virginia, to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. The highly efficient home should save its homeowners \$2,650 in annual utility bills thanks to its highly efficient building envelope and 6.32 kW of solar panels. The home is equipped with ENERGY STAR-labeled appliances, lighting, ceiling fans, and windows for energy savings and features low- or no-VOC cabinets, flooring, and finishes for better indoor air quality.



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.



“We are not really doing anything special. It’s not rocket science. We’re back to the basics, just with better tools,” said Epstein.

Epstein’s winning philosophy has paid off for the home owners too. When Epstein had the award-winning home performance tested and modeled by an energy rater, it achieved a Home Energy Rating System (HERS) index of 8. A typical new home would score around 80; a net zero energy home—one that produces as much energy as it consumes in a year—would score about 0. The owners of this home told Epstein they have yet to pay anything for power beyond the utility’s \$6 monthly demand charge.

Epstein said that energy independence is perhaps the most notable advantage of zero energy homes—their ability to free home owners from the uncertainties of rising energy costs. “With renewable energy sources on-site, homeowners can significantly reduce or even eliminate their reliance on the grid, resulting in considerable energy savings,” said Epstein. The owners of this home will have calculated annual energy savings of \$2,650 per year compared to the same home just built to code. They’ll also get the added benefits of improved comfort and better indoor air quality.

Every DOE Zero Energy Ready home is also certified to the criteria of ENERGY STAR Certified Homes Version 3.1 or 3.2 and the U.S. Environmental Protection Agency’s Indoor airPLUS program. Builders must also meet other efficiency requirements like the hot water distribution requirements of the EPA’s WaterSense program; the insulation requirements of the 2015 International Energy Conservation 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, homes are required to have photovoltaic (PV) panels installed or have the conduit and electrical panel space in place for future installation.

This home is located on a lot at Walnut Farms where the builder has already constructed 58 of a planned 75 DOE Zero Energy Ready certified homes. These semi-custom homes start with wall panels that are constructed in clean, dry conditions in a factory then shipped to the site, along with open-web floor joists and engineered roof trusses, for quick assembly, allowing the shell to be constructed in just three days and ready for windows, doors, shingles, and siding. “This panelized approach enables us to maintain control over pricing and material waste,” said Epstein.



The home is constructed of 2x6, 24-inch on-center wall panels that are built in a factory and shipped to the site for quick assembly, usually in 3 days. Healthy Communities uses a flash-and-batt approach installing one inch of closed-cell spray foam plus R-19 fiberglass batts to insulate and air seal the walls. Other air-sealing steps include caulking wood-to-wood seams and installing a 3.5-inch-wide foam gasket plus beads of expansive caulk beneath the sill plate of the 2x6 wall panels. This extensive air sealing helps to ensure airtight walls that keep in the conditioned air and keep out cold, heat, drafts, pests, pollen, dust, and humidity.

The wall panels are insulated on site with a flash-and-batt approach that includes spraying 1 inch of closed-cell foam into the wall cavities to seal the sheathing to the framing, then filling the remainder of the wall cavities with blown cellulose or fiberglass batt. The exterior is wrapped with a $\frac{5}{8}$ -inch R-3 layer of graphite-enhanced expanded polystyrene (GPS) that stops thermal bridging through the walls via the studs and brings the walls' total insulation value to R-24. The seams of the rigid foam are taped so it can serve as the weather-resistant barrier and drainage plane for the above-grade walls. The below-grade walls of the conditioned crawlspace are insulated along the interior with an R-10 layer of GPS and the rim band is filled with 5.5 inches (R-19.5) of open-cell spray foam. The interior level of the crawlspace floor is higher than the exterior grade around the home so no perimeter foundation drain pipe is needed.

Before filling the attic with R-49 of blown cellulose insulation, all of the top plates were sealed from the attic with 2 inches of open-cell spray foam. The attic access hatch was insulated and sealed with a gasket. The 24-inch on-center trusses of the gable roof align with the wall studs and included 14-inch raised-heel trusses to allow space over the exterior wall top plates for the full depth of attic insulation. The truss design was strengthened from 10 pounds to 15 pounds per square foot to accommodate the solar installation. A unique "storage cradle" or platform was designed into the trusses to provide desirable storage space that is elevated from the attic floor enough to allow a full R-49 of insulation underneath.

ENERGY STAR-rated double-pane windows with low-emissivity coatings complete the highly efficient building envelope. The windows have an insulation U-factor of 0.28 and a solar heat gain coefficient of 0.22. Epstein worked with the local window manufacturer who made several design changes to their windows to improve air tightness after visiting Healthy Communities' homes during blower door testing to see the impact leaky windows can have on a home's overall air tightness.

ENERGY STAR-rated appliances, a highly efficient heat pump water heater, and a push-button controlled recirculation pump on the hot water distribution system contribute to hot water and energy savings. The recirculation pump alone is estimated to save 9,125 gallons a year in water at an estimated homeowner savings of \$130/year.

With all of the air sealing measures implemented, Epstein's homes are able to achieve an air tightness of 1.94 air changes per hour at 50 Pascals pressure differential (ACH50), within the 2.5 ACH 50 needed to meet the program specifications for his climate zone.

HOME CERTIFICATIONS

ENERGY STAR Certified Homes
Version 3.1

EPA Indoor airPLUS

DOE Zero Energy Ready Home Program
- 100% Commitment

EPA WaterSense

Building integrated modeling is just one more facet of the "Simplicity of the Build" approach that allows Epstein to cost effectively build DOE Zero Energy Ready 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.



Fresh filtered outdoor air from the energy recovery ventilator is added to the return plenum of the variable-speed air handler, then distributed through ducts located in the conditioned crawl space.

“Employing a common-sense approach and taking the time to do it correctly makes the “Simplicity of the Build” easier,” said Epstein. “Collaborating with your insulation installer to complete the wall system seal is critical. It is also crucial to work closely with your third-party rater, as they are there to assist you in building a superior home rather than just to find problems.”

To ensure good air quality in the well-sealed homes, Epstein installs an energy recovery ventilator that brings in fresh filtered air and tempers it with outgoing conditioned air via a heat exchanger that transfers both heat and humidity to reduce the amount of humidity brought into the home. The incoming air passes through a MERV 8 or MERV 13 filter and is distributed throughout the home via the central air handler’s supply ducts. A central return draws stale air from the home. The ERV and HVAC can be remotely operated via an app. For spot

ventilation the bathrooms are equipped with ENERGY STAR quiet exhaust fans that have humidity sensors to increase fan speed during and after showers.

A central heat pump provides space heating with an efficiency of 9.6 HSPF and cooling with an efficiency of 18 SEER. The unit has a variable-speed air handler and multistage compressor that uses a network of sensors to monitor and optimize humidity and temperature in the home, adjusting compressor and fan speeds in real time to provide consistent temperature with maximum efficiency. The multistage system can adjust output to operate from 0.75 tons to 2 tons as needed. The system automatically adjusts the indoor unit’s fan speed at startup to draw more moisture from the air for better humidity control. All of the ducts are mastic sealed, insulated to R-8, and located in the insulated conditioned crawl space.

Epstein said one key to efficient HVAC performance is proper equipment sizing. Epstein noted he’s seen many HVAC contractors who still use old rules of thumb and end up oversizing equipment. Epstein has his energy rater perform heating and cooling load calculations to determine equipment sizing in accordance with the industry standard, Manual J, and Healthy Communities uses a compact duct layout following Manual D, both from ACCA (the Air Conditioning Contractors of America).

This home’s heat pump system was also equipped with an air cleaner that can remove 99.98% of allergens from the air. Like all DOE Zero Energy Ready Homes, this home was constructed to meet the U.S. Environmental Protection Agency’s Indoor airPLUS criteria. Indoor air quality is a critical element for Epstein who first got interested in home building when he was looking for a healthier home for his daughter who had asthma.

KEY FEATURES

- **Walls:** Panelized, 2x6, 24" o.c., R-25.5 total: advanced framed. In wall cavity: 1" closed-cell spray foam then 4.5" R-19 fiberglass batt compacted to R-16. Plywood sheathing; 1" R-5 graphite GPS; fiber-cement siding. 5.5" open-cell foam in rim joists.
- **Roof:** Gable truss roof, ½" plywood decking, synthetic underlayment, continuous ridge vent, 30-yr architectural shingles. Storage cradle built into trusses 14" raised heels.
- **Attic:** Vented attic, 14" R-49 blown cellulose. Attic hatch gasketed and insulated.
- **Foundation:** Unvented crawlspace, R-10 interior rigid foam, R-19.5 open-cell spray foam in rim joist. Raised dirt floor with 8-mil poly vapor barrier.
- **Windows:** Double-pane, U=0.28, SHGC=0.22. Low-e, argon fill, vinyl framed.
- **Air Sealing:** 1.94 ACH 50; 3.5" sill gasket plus expansive caulk at rim. All wall joints are caulked then sealed with 1" closed-cell spray foam to back of cavity wall. Top plates spray foamed.
- **Ventilation:** ERV integrated with central HVAC air handler. Uses HVAC supply and returns.
- **HVAC:** Air source heat pump, multi-stage compressor. 9.6 HSPF 18 SEER, variable speed.
- **Hot Water:** Heat pump water heater, 50-gallon, 3.35 COP, recirculation pump, compact plumbing.
- **Lighting and Appliances:** LED lighting, ENERGY STAR appliances.
- **Solar:** 6.32-kW PV panels. Electric hub installed for future electric vehicle charger, subpanel, and battery backup.
- **Energy Management System:** Web-enabled HVAC, diagnostics, locks, video surveillance, lights, shades, garage doors, and energy usage monitoring.
- **Other:** Building Integrated Modeling.

Photos courtesy of Healthy Communities