Award-Winning Coverage of Sustainable Construction, Products and Lifestyles

GREEN BUILDER®

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Building Science

MANY PATHS TO ZERO

Groundbreaking projects combine the best of new and old products and innovations to decarbonize the homes of the future

Net (very) positive. The United Way of Long Island's building information-modeled home is expected to save the homeowner more than $400 a month in utility costs.

CREDIT: UNITED WAY OF LONG ISLAND

Project Info

DESIGN: United Way of Long Island, Deer Park, New York, unitedwayli.org

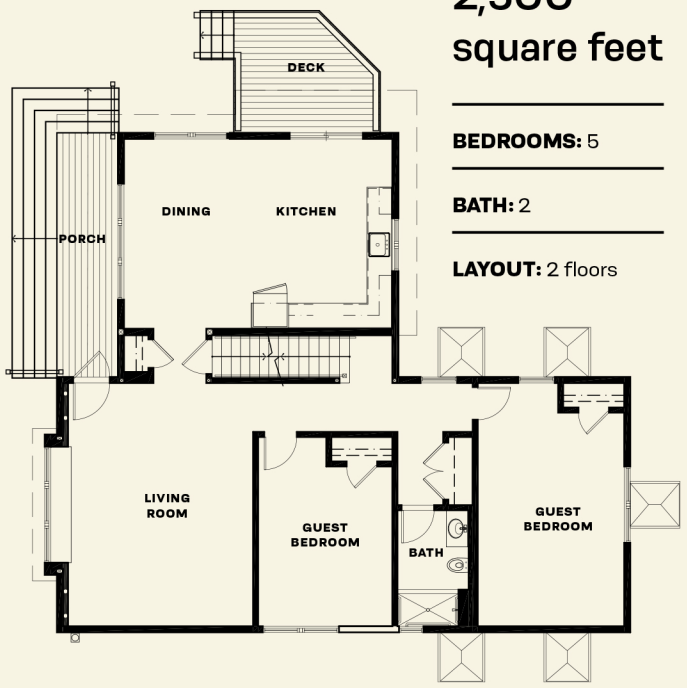
BUILDER: Rick Wertheim

COMPLETED: June 2020

CATEGORY: Affordable Multifamily

HERS Index: -2

Size: 2,500 square feet



BEDROOMS: 5

BATH: 2

LAYOUT: 2 floors

Data-Driven Performance

United Way's way of getting things done right? Getting help from professional data analysis of the projected design's performance.

THE CONCEPT of building information modeling (BIM) has been around since the 1970s. Nearly half a century later, it's coming into its own within the construction industry.

BIM produces integrated three-dimensional renderings of every aspect of a home, including framing, HVAC, plumbing and electrical. It allows a construction team to visualize how components fit together, giving team members a better understanding of the end product. They can see potential conflicts in sequencing of construction steps, and potential problem areas such as maintaining a continuous air and thermal barrier around a home's conditioned space.

United Way of Long Island, New York, used BIM to successfully visualize construction of its five-bedroom, two-bathroom, two-story home in Port Jefferson Station, New York. The 2,500-square-foot house earned a grand award in the U.S. Department of Energy (DOE) Zero Energy Ready Home (ZERH) 2020 Housing Innovation Awards (HIAs).

"This is the first project United Way has constructed using BIM," says Rick Wertheim, senior vice president of Housing and Green Initiatives for the United Way of Long Island Housing Development Corporation, a nonprofit organization that builds or renovates about six homes per year for its nonprofit partners. The agency has constructed 21 homes certified to DOE's ZERH program. It has won six HIAs and five grand awards in the affordable homes category since 2015.

The winning home achieved a Home Energy Rating System (HERS) score of 37 without photovoltaic (PV), or -2 with PV, enough to power the home and an electric vehicle. The home is expected to save about $5,300 a year in utility costs, which is critically important to the nonprofit agency that owns the home, according to Wertheim.

NOTHING BETTER THAN BIM

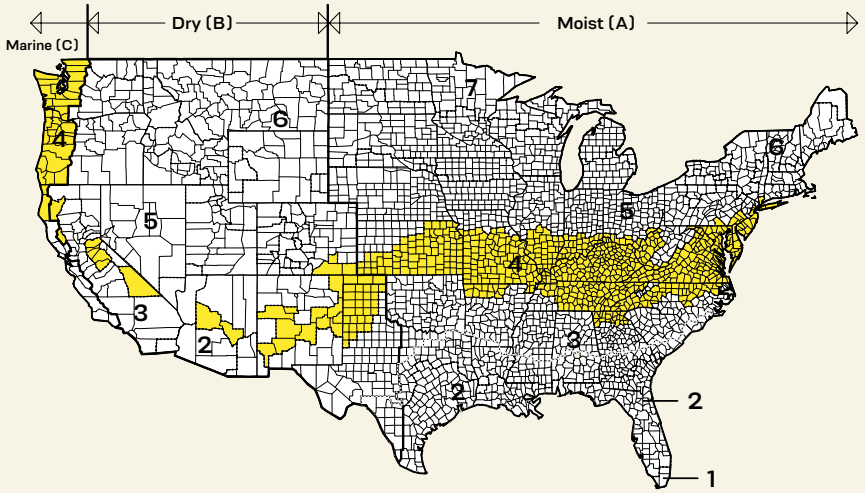
The design included a novel attic truss specifically crafted to accommodate a ducted mini-split heat pump tucked into

Average Monthly Energy Bill
$0
Calculated

Annual Savings
$5,250
Calculated versus typical new homes

Saved in the first 30 Years
$218,800
Includes fuel escalation rates, 2019 EIA Energy Outlook

Climate IECC,4A, mixed-humid



Key Features

AIR SEALING: 1.7 ACH 50.

APPLIANCES: ENERGY STAR refrigerator, dishwasher and clothes washer.

ATTIC: Vented attic: 14-inch R-50 blown-in fiberglass on flat ceiling; 18-inch R-65 blown-in fiberglass in vaulted roof; trusses incorporate mechanical chase insulated to R-50 with 3-inch spray foam and R-30 batt.

ENERGY MANAGEMENT SYSTEM: Smart thermostat is Wi-Fi and voice controlled.

FOUNDATION: Insulated basement: 8-inch concrete walls; elastomeric water proofing; 2-inch graphite EPS.

HVAC: Ducted and ductless mini-split heat pumps; 9.6 HSPF; 15.5 SEER.

HOT WATER: Heat pump water heater; UEF=3.7; 80-gallon central manifold and PEX piping.

LIGHTING: 100 percent LED with motion sensors; daylighting with interior windows.

ROOF: Truss gable roof: coated taped 5/8-inch OSB sheathing; ice and water shield fiberglass composite shingles; standing seam metal roof.

SOLAR: 9.2 kilowatt rooftop panels.

VENTILATION: ERV separately ducted; indoor air quality sensor; MERV 13 filters; dehumidifier.

WALLS: 2-by-6, 24-inch on center, R-33 total: closed cell spray foam plus blown fiberglass; 1-inch rigid EPS topped by 1/2-inch OSB; textured house wrap; spruce and engineered wood siding and trim.

WATER CONSERVATION: EPA WaterSense fixtures and toilets; drip irrigation; driveway.

WINDOWS: Thin triple-pane, argon-filled, low-e2, vinyl, casement style, U=0.18, SHGC=0.22.

OTHER: Accessibility features; all paint is low- or no-VOC; CARB compliant wood; walls are "flash" sealed with spray foam, which also seals the attic ventilation baffles to the top plates.

an insulated chase in the vented attic. Using the building information modeling tool was "very helpful for getting everyone on the same page" regarding schedule and sequencing of trades, and a great help in preparing for crucial pre-construction team meetings, Wertheim notes.

In addition to visualizations, BIM software can generate a bill of materials and a critical path schedule that allows labor productivity to be tracked at an activity and trade level. The software sends out an automated text message to each individual trade foreman with a simple question at the end of each workday (e.g., "Is the second floor interior framing 50 percent complete? Yes or No?). When they respond, the schedule is automatically updated. If the answer was "no," the follow-up question is "what percentage is complete?" followed by "what was the cause of the delay?"

Every step from that point is automated via a simple text-messaging interface. The builder and trade partners receive automated construction instructions, and can see updated schedules.

WALL TO WALL EFFICIENCY

A DOE Zero Energy Ready-certified all-electric home should be low maintenance, and this one is, according to Wertheim. The home's walls are sided with an easy-care engineered wood siding product. The walls are constructed of 2-by-6 studs installed at 24 inches on center. They incorporate advanced framing techniques to reduce the amount of lumber needed and to provide more room for insulation.

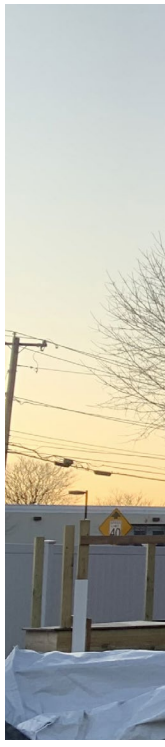
A 1.125-inch graphite-enhanced expanded polystyrene (EPS) rigid foam insulation board wraps the studs, and is covered with half-inch oriented strand board (OSB) sheathing that is installed with 3-inch construction screws for increased wind resistance in this high-wind-zone location. A coating of closed-cell spray foam is sprayed on the inside face of the EPS in every wall cavity. The rigid foam, spray foam and blown fiberglass in the wall cavities provide a total wall insulation value of R-33.

The builder achieved a low air leakage of 1.7 air changes per hour at 50 Pascals (ACH 50), with exceptional air sealing practices spray foaming the wall cavities, installing gaskets at the top and bottom plates, and installing rigid foam blocking between trusses at the eaves. All interior wall top plates were spray foamed after the ceiling gypsum board was installed. The floors were air-sealed at the rim joists with closed cell spray foam where the gasketed plates and floor joists meet the foundation wall, and all floor-to-floor penetrations and bypasses were gun foamed or fire caulked.

The exterior frame sits on 8-inch poured concrete foundation walls protected with a roll-on capillary break over the footings, and an elastomeric foundation water proofing on the exterior of the walls. These are then wrapped with two inches of EPS graphite-enhanced foam insulation. The above-grade portion of the EPS is protected with fiberglass-reinforced panels.

The main gable roof is topped with architectural asphalt shingles over a coated 5/8-inch OSB sheathing product that is taped at all seams; an ice-and-water shield provides additional protection at eaves and rakes. Two shed roof sections are topped with highly reflective standing-seam metal roofing over a full shield coverage. The shed roof tops a vaulted ceiling with 18-inch parallel chord roof trusses at 24 inches on center, along with 14 inches (R-50) of fiberglass loose-fill insulation. The gable roof has raised heel roof trusses to allow full coverage of the 18 inches (R-65) of blown fiberglass over the top plates in the vented attic.

This attic space lies over a flat ceiling in the second floor and has uniquely designed roof trusses that provide a 2-by-4-foot attic chase just large enough to house a ducted mini-split heat pump with short ducts that reach to the second-story bedrooms. The chase is made of 5/8-inch drywall and encased in 3 inches of closed-cell spray foam plus R-30 of batt insulation, for an R-50 insulated and air-sealed chase that is thermally connected to the living space of the home. A second ducted mini-split heat pump in the conditioned basement serves the main floor. Both heat pumps have a heating efficiency of 9.6 HSPF and cooling efficiency of 15.5 SEER.



SOMETHING (NOT) IN THE AIR

A whole house dehumidification system was installed for swing-season humidity control. The home's ventilation system includes an energy recovery ventilator and exhaust fans that are connected to each other and to sensors. It's the first time United Way-Long Island has used such a setup, Wertheim notes.

The energy recovery ventilator (ERV) is ducted separately from the HVAC. The whole house dehumidification is ducted separately as well and communicates via a controller. In addition, the two heat pump air handlers have MERV 13 filters in the return boxes of each blower unit.

All lighting is LED based and motion sensored. Well-placed triple-pane, U-0.18, SHGC-0.22 vinyl-framed windows with argon fill and two heat-blocking low emissivity coatings allow in plenty of daylight, which is conveyed to interior spaces through framed openings in interior walls.

The refrigerator, dishwasher and clothes washer are all ENERGY STAR qualifying. The home has a smart thermostat that is Wi-Fi, voice and smartphone controlled. Designated switches are Wi-Fi and smart home connected. **GB**

Splitting airs. The home features a pair of mini-split heat pumps—one in the attic, one in the basement—to improve overall internal temperature control. The two units combine for a heating efficiency of 9.6 HSPF and cooling efficiency of 15.5 SEER. CREDIT: UNITED WAY OF LONG ISLAND

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